Clear For Takeoff? Investigating Military Spending and Unemployment in the Nazi Economy Using Evidence from the *Luftwaffe*

Lionel Chambon*

January 17, 2026

Abstract

Can rearmament boost employment? I estimate the causal effect of military spending on unemployment in Nazi Germany between 1932 and 1936, using novel archival data on the German Luftwaffe. Exploiting cross-district variation in exposure to rearmament, I construct a regional measure of defense spending based on the location of Luftwaffe suppliers. Linking firms to employment districts, I estimate the impact of military procurement on local labor market outcomes. I find that unemployment per capita declined by approximately 3 percentage points in districts with at least one Luftwaffe supplier, relative to districts without. These results are robust to various specifications and confirmed when using an appropriate DiD-estimator. I also show significant cross-district spillovers, indicating that my results likely underestimate the true effect of military spending.

(*JEL* C21, E62, H56, J63, N14, N44)

*lionel.chambon@sciencespo.fr I am grateful to my advisors, Paul Bouscasse and Moritz Schularick, for their invaluable guidance and support. I am indebted to Niccolò Battistini, Clément de Chaisemartin, Pierre-Philippe Combes, Stephanie Ettmeier, Paulo Gugelmo Cavalheiro Dias, Georgi Kocharkov, Kevin O'Rourke, Andrea Papadia, Nathanaël Soulage, Noémie Pinardon-Touati, and Jochen Streb for helpful comments and advice. I thank the Sciences Po School of Research for financially supporting this project. Parts of it have been completed during my traineeship at the European Central Bank (ECB). Naturally, this paper does not necessarily reflect the views of the ECB, the Eurosystem, or its staff. All remaining errors are my own.

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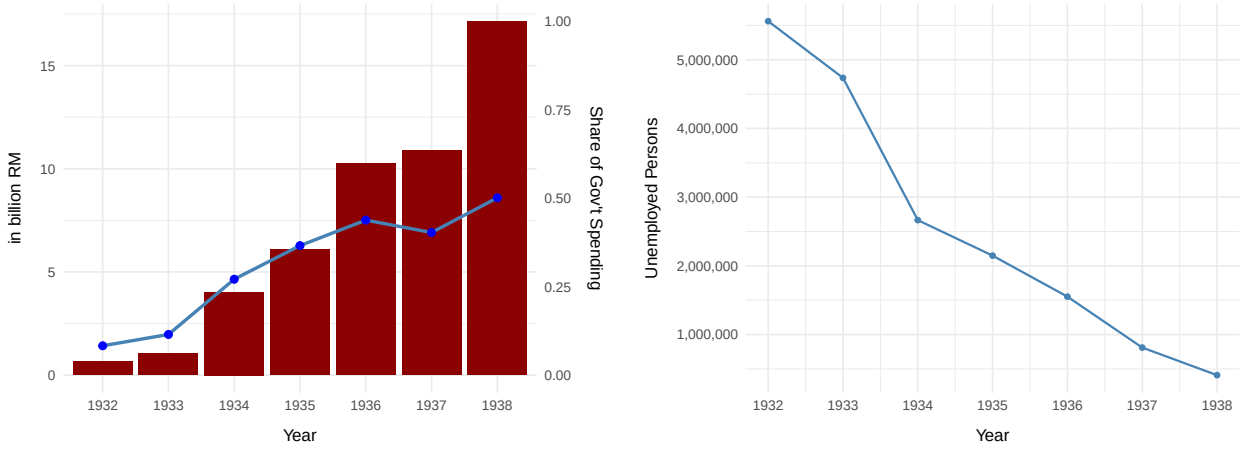
1 Introduction

> *National Socialism has rejected the liberal doctrine of the economy as an autonomous sphere governed by its own laws. It is an integral part of the National Socialist entity and must subordinate itself accordingly. Thus, German economic policy cannot be distinct from the overarching goals of the National Socialist state itself.*
>
> Hjalmar Schacht. President of the *Reichsbank*, 1933-1939[1]

From 1933 to 1939, the National Socialist state embarked on an unprecedented buildup of its armed forces, increasing military spending more than 25-fold between 1933 and 1938 (Oshima 1991). Moreover, the German economy, which had undergone a severe recession between 1929–1932, transitioned from mass unemployment to *full employment* by 1936 (Caesar and Hansmeyer 1976). The left panel of Figure 1 shows the evolution of military spending (red bars, left-hand scale) in billion *Reichsmark* (RM). The right panel shows the evolution of unemployed persons:



(a) Military Spending & Government Expenditure (Oshima 1991)

(b) Unemployed Persons Per Year (*Statistisches Jahrbuch*)

Figure 1: Military Spending and Unemployment, 1932–1938

The case of Nazi Germany is unique not only because of the speed with which the labor market recovered, but also due to the scale of military expenditure it undertook through deficit spending unprecedented for peacetime economies. Nazi economic policy

[1] Hjalmar Schacht. *Ziele deutscher Wirtschaftspolitik*. Deutsche Sparkassenzeitung, 1934. In: BA R2501/1760. Author's translation.

defined full employment as a policy priority to channel vast economic resources into its military buildup, and did so by gradually eliminating market-based principles and institutional frameworks (Barkai 1990, Boelcke 1992). Most importantly, the economy as a whole was subordinate to the Nazi administration, which executed its policies without any political or parliamentary constraints. The increase in public expenditure was paired with a strict supervision of prices and wages, as well as a rationing of private consumption. Private investment – or private economic activity in general – was subject to the authority of the Nazi state (Ritschl 1992).

This paper investigates the response of unemployment to variations in military spending in Nazi Germany. To assess how rearmament contributed to the rapid recovery of the German labor market, I combine existing historical and statistical sources with new archival data on the German air force, the *Luftwaffe*. I use a confidential list of Luftwaffe suppliers, which were recorded in a survey by the Reich Statistics Office (*Statistisches Reichsamt*, StRA) in 1933 and 1938. Exploiting their geographical distribution, I construct a regional military expenditure exposure variable, which I combine with district-level unemployment data from Ettmeier, Kriwoluzky, Papadia, et al. (2024). This allows me to identify the *relative* regional effect of military spending on unemployment between 1932 and 1936.[2] I argue that districts hosting a Luftwaffe supplier responded differently to changes in military expenditure compared to those without such exposure. Specifically, I find that districts exposed to the Luftwaffe experienced a statistically significant reduction in unemployment of approximately 3 percentage points relative to unexposed units. Overall, Nazi government spending may account for up to 36% of the observed decline in unemployment between 1932 and 1936, with military expenditure alone contributing around 11%.

These estimates are robust to the inclusion of several control variables and are confirmed when using a heterogeneity-robust difference-in-differences (DiD) estimator proposed by Chaisemartin and d'Haultfoeuille (2023). I find a statistically weighted average treatment effect of the treated (WATT) of around 8%. I also find statistically significant spillover effects into untreated districts, which suggest that these numbers are downward-biased.

Importantly, I demonstrate that my measure of Luftwaffe exposure is unlikely to be driven by pre-existing industrial characteristics at the regional level, which might other-

[2]Henceforth, *military spending* is used interchangeably to refer to my exposure variable constructed from data on Luftwaffe spending, which will be detailed below. *District* and *Employment District* will also be used synonymously.

wise suggest endogeneity if supplier locations were selected based on local economic conditions. Moreover, estimates obtained from an event-study regression indicate no presence of differential pre-trends. This supports the validity of my identification strategy, treating Luftwaffe supplier presence as an exogenous shock to government spending. Additionally, given that official unemployment figures during this period likely underreport true unemployment, my estimates should be interpreted as lower bounds.

This paper contributes to the existing literature by presenting a new data source, which allows for an identification of regional stimulus effects of defense spending, inspired by work from Nakamura and Steinsson (2014). Investigating economic effects of rearmament in Nazi Germany is notoriously difficult, as much archival material pertaining to its military expansion has likely been forcefully destroyed during or by the end of the war. Detailed accounts of German military production are available only starting in about 1938–1939 (see Wagenführ 1954, Tooze 2006). By exploiting the geographical distribution of Luftwaffe suppliers, I aim to estimate rearmament-related stimulus effects for the period *before* full employment had been reached by around 1936. I am, to the best of my knowledge, not aware of any previous papers that estimate regional defense spending effects on unemployment for the Nazi German case. In doing so, I contribute to the ongoing debate over the role of rearmament in Germanys economic recovery by providing causal evidence that military spending, instrumented through the Luftwaffe supplier network, significantly accelerated labor market improvements, and, in turn, contributed to the German upswing as a whole.

2 A Brief Overview of Nazi Economics

Nazi economic policy cannot be fully understood without reference to the severe recession Germany experienced between 1929 and 1933, which played a crucial role in creating the social and economic conditions that enabled the rise of the Nazi Party. Between 1929 and 1932, real national income shrank by about 25% (Albers 1976). Unemployment reached an estimated six to eight million at its peak (*Statistisches Jahrbuch*, Spoerer and Streb 2013). Moreover, the German economy had borrowed heavily from foreign creditors during previous years, which, after the Great Depression, led to a sudden and rapid reversal of capital inflows. This led to the collapse of the banking sector and prompted the introduction of capital controls in 1931 (Schnabel 2004). Public borrowing came to a near standstill, and domestic credit markets froze. As a result, economic activity contracted sharply, which reduced Germany's fiscal revenue, while the surge in unemployment precipitated higher welfare expenditures. The German government under chancellor Heinrich Brüning responded with a variety of austerity measures, cutting public spending and increasing taxes (Ettmeier, Kriwoluzky, Schularick, et al. 2024). A popular Nazi campaign slogan at the time was *"Arbeit und Brot"* – labor and bread.

Overall, Nazism did not elaborate a distinct economic ideology or theory. The key element was that the economy was subordinate to the objectives of the National Socialist state and the *Führer*. Many economic policymakers from the Weimar era continued to serve under the Nazi administration, including Hjalmar Schacht (Barkai 1990). It relied on stimulating public demand while simultaneously maintaining a strict control over economic processes to limit inflation risks (Albers 1976, Boelcke 1992). The contradictory nature of these two objectives was balanced by large-scale government control and interventionism. Thus, Nazi economic policy can be characterized by three pillars.

2.1 The End of Brüning's Austerity

The first is a vast expansion of *debt-financed* government spending: Figure 2 shows the evolution of Reich government debt by year.[3] Debt was oriented away from foreign creditors into medium- and long-term obligations held domestically (Stucken 1964, Banken 2020).

[3] *Statistisches Handbuch von Deutschland*, p. 555, *Reichshaushalt, Reichschsschuld und Notenumlauf.*

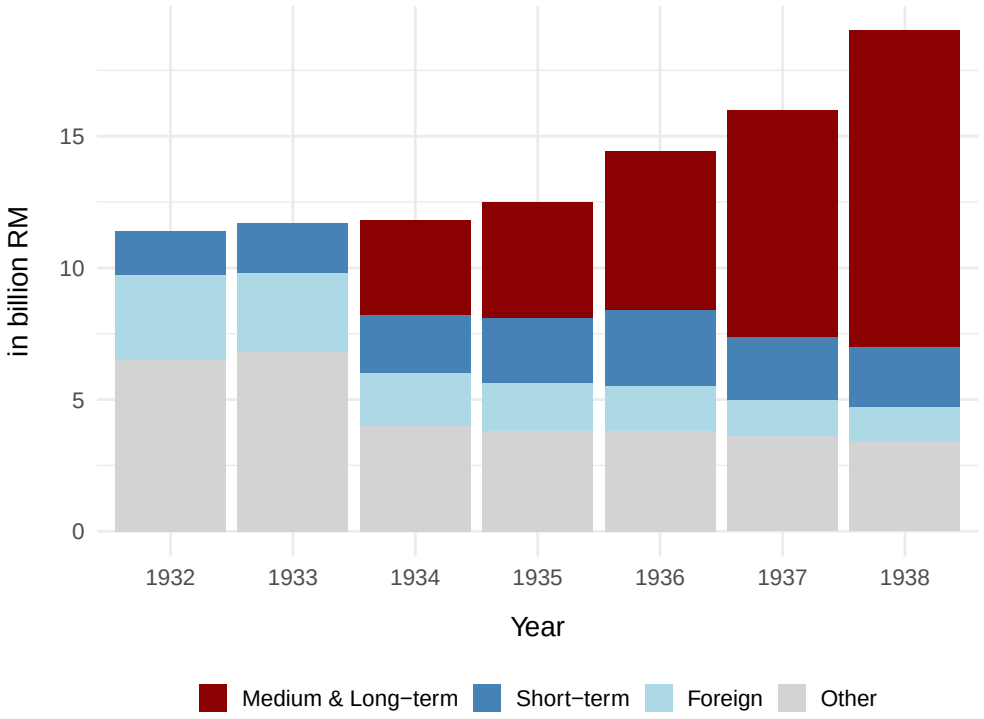
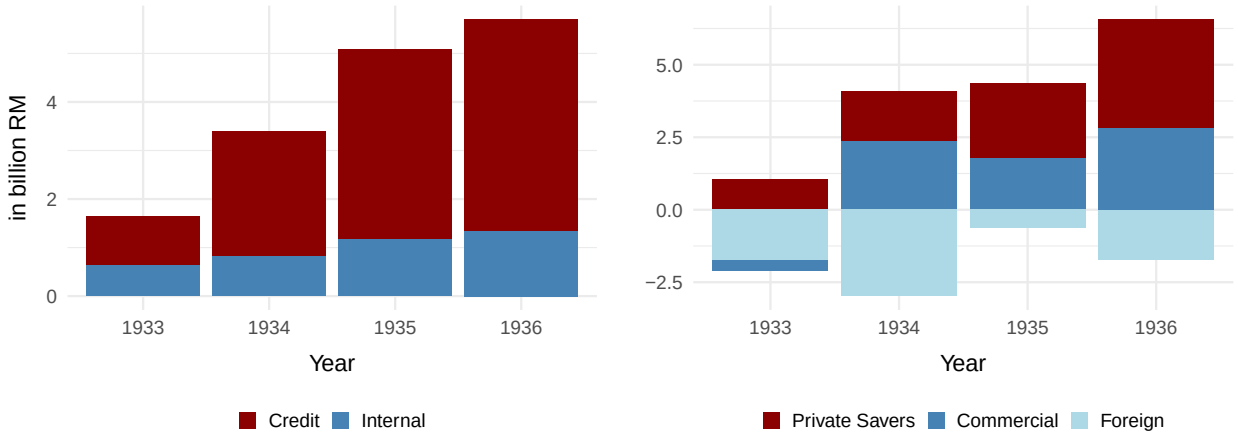


Figure 2: Components of Reich Public Debt

This is also illustrated in Figure 3, which decomposes the credit sources of public investment in the Nazi economy from 1933–1936, according to a confidential document by the StRA.[4] Not only was public investment predominantly financed by an expansion of credit (panel *a*), it was also directly linked to credit supplied by private domestic savers, that is, deposits and insurances (in red, panel *b*), while foreign credit experienced a sharp net outflow:

[4] *BA R 3102/2700*



(a) Sources of Public Investment

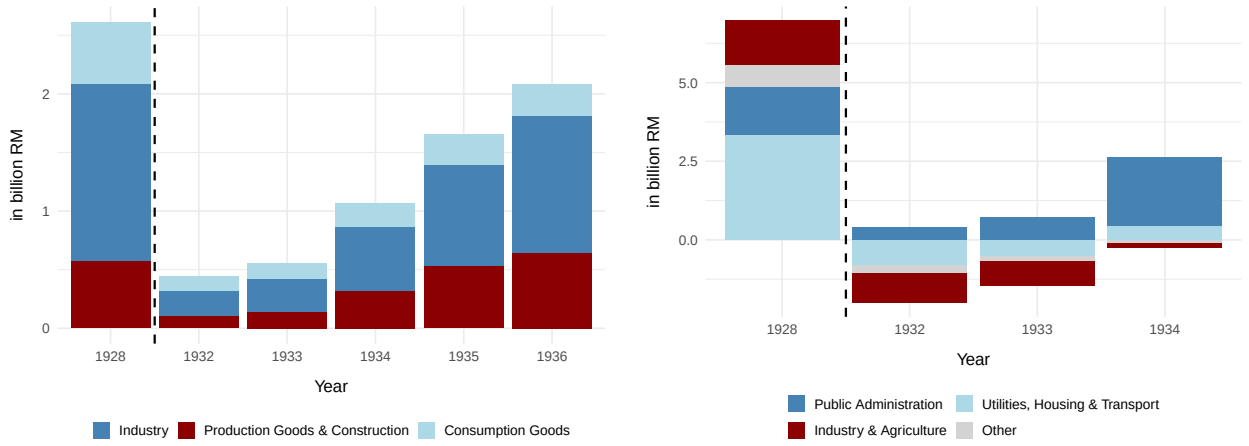
(b) Annual Changes in Credit Flows

Figure 3: The Financing of Economic Activity, 1933–1936

This was a direct consequence of the second pillar of Nazi economic policy, which was the gradual dismantling of market-based economic mechanisms to absorb purchasing power from the private sector and place it into government debt.

2.2 The End of the Market Economy

First, government intervention and regulation served to stimulate the economy while limiting the response of *private* demand and containing potential inflationary dynamics (Boelcke 1992). As soon as economic activity increased and unemployment fell, the government, particularly the Ministry for Economic Affairs (*Reichswirtschaftsministerium*), began strictly regulating prices, wages and private corporate management. Especially agricultural goods were subject to the oversight of a price commissioner, wages could no longer be negotiated autonomously as unions were effectively banned, firms could no longer decide whom to hire or fire, corporations could no longer pay dividends, and workers were no longer freely able to switch employers (Boelcke 1992, Ritschl 1992). This also had consequences on the levels and sources of investment in the economy, as illustrated in Figure 4:



(a) Decomposition by Sector

(b) Decomposition by Source, Net of Depreciation

Figure 4: Investment in the Nazi Economy

The left-hand side panel[5] shows the decomposition of *private* investment by sector. By 1936, aggregate private investment had still not reached levels before the Great Depression, shown by the numbers from 1928 for reference. Moreover, investment is mostly concentrated into industrial and production goods investment, at the expense of consumption goods, as investment therein remains well below 1928 levels. The right-hand side panel[6] shows the decomposition of aggregate investment *net of depreciation*. Unfortunately, this data series in the StJB is no longer published beyond 1934, but the growing importance of public investment is evident, while other sectors are still recovering from the downturn experienced following the Great Depression. This marked a clear policy departure from the previous Brüning administration.

Nevertheless, the economic rebound was so strong that, despite these measures, upward pressure on prices and wages nevertheless emerged, leading to shortages and the rise of black markets – underscoring the speed with which the German economy approached full employment (Caesar and Hansmeyer 1976). Similarly, foreign trade, which had been governed by strict capital controls and bilateral clearing agreements since the 1931 banking crisis, was reduced as efforts were made to relocate production of war-relevant goods and materials into Germany (Ritschl 1992). To maintain control over the price level and the *Reichsmark*, foreign currency circulation was placed under the direct supervision of the Reichsbank, as reserve levels were constantly and critically low and

[5] *StJB 1937*, p. 539, *Die volkswirtschaftlichen Investitionen.*
[6] *StJB 1937*, p. 540, *Die Anlageinvestitionen der deutschen Industrie.*

largely used for essential raw material imports (Stucken 1964).

Combined, this limited the growth of private consumption despite the economic upswing. Albers (1976) argues that increased employment did not result in higher real wages during the early 1930s, while consumption was depressed by rationing, taxation[7] or the deterioration of the quality of goods, thus having virtually no effect on living standards. According to Barkai (1990), between 1933 and 1936, public expenditure rose by 18.7% *per year*, while private consumption only rose by an annual 3.6%. Ritschl (1990) estimates that private consumption reached pre-Great Depression levels only in 1936. Figure 5, expressed in 1932 prices and levels, shows that despite sustained growth in real net national income, prices and real hourly wages grew by barely 5% by 1938. Real hourly wages returned to pre-Great Depression levels only between 1936 and 1937.[8]

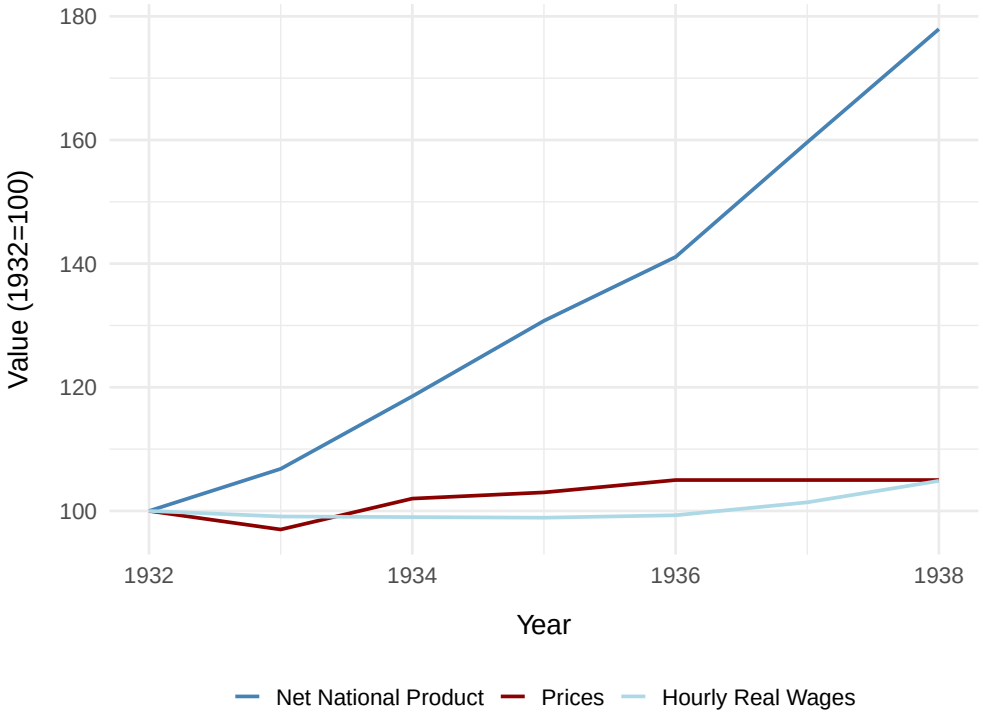


Figure 5: National Income, Prices, and Wages

Looking at national accounts paints a similar picture: Figure 6 shows a decomposition

[7]Indeed, the Nazi administration maintained most tax rates from the Brüning deflationary era. Some consumption and income tax rates were even increased (Ritschl 1992).

[8]NNP: Albers (1976). Prices and wages: *Statistisches Handbuch von Deutschland*, p. 463, *Reichsindexziffern für die Lebenshaltungskosten*, and p. 472, *Indexziffern der Arbeitsverdienste*.

of nominal national income.[9]

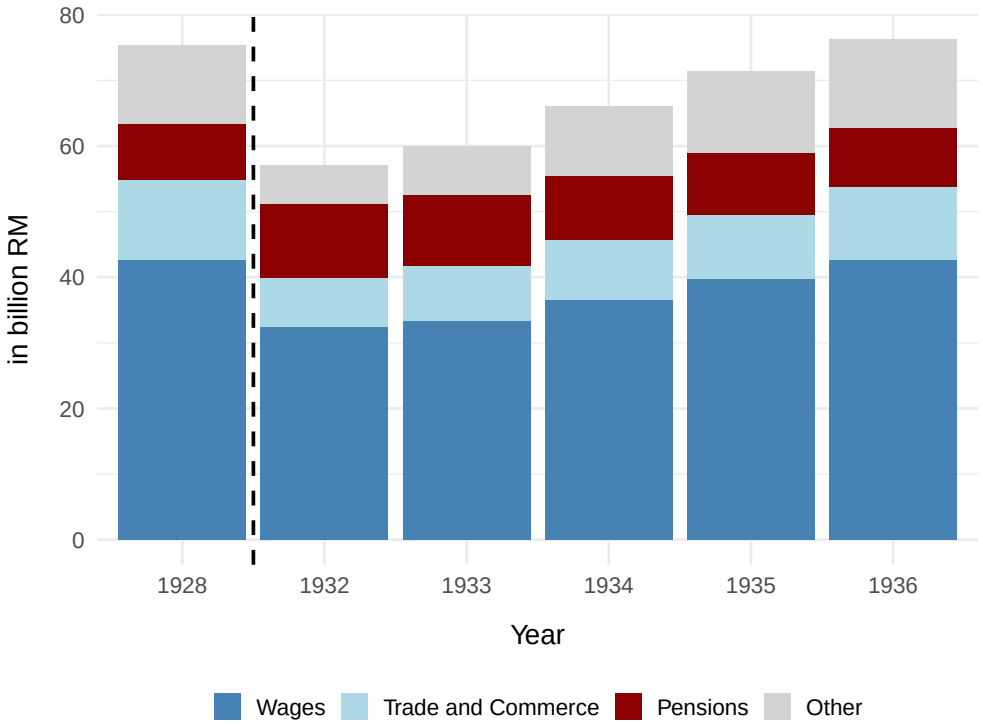


Figure 6: Decomposition of National Income

Taken together, these first two pillars served to generate *excess purchasing power*: stimulate the economy while containing public expenditure. Official Reichsbank documents lay out this economic policy by using the word *Kaufkraftabschöpfung*, which literally translates to *absorption of purchasing power*. This then fed into the third and final pillar.

2.3 The End of Financial Markets

Lastly, the Nazi state established an elaborate system of shadow banking to siphon purchasing power to finance work creation and rearmament by absorbing excess savings through the financial system.[10] As individuals had few opportunities to consume and corporations few opportunities to invest, savings were channeled into the remaining asset which the Reich was happy to supply in abundance: government debt (Oshima 2006).

[9] National income as per StJB 1938: *Volkswirtschaftliche Bilanzen, Das deutsche Volkseinkommen.*, p. 559.

[10] To quote an internal Reichsbank document: *"Every nation must save, and a nation with extraordinary tasks especially so."* BA R2501/7132, author's translation.

Through a framework called the *Geräuschlose Methode*, or *silent method*, the Nazi state created a closed credit cycle through which all private and non-state economic actors became, directly or indirectly, creditors of the Reich (Caesar and Hansmeyer 1976). This served to conceal the true nature of government (notably military) expenditure. While a comprehensive treatment of this opaque system lies beyond the scope of this paper, several key elements are necessary to grasp the full extent to which the Nazi state directed the economy to finance its military objectives. [11]

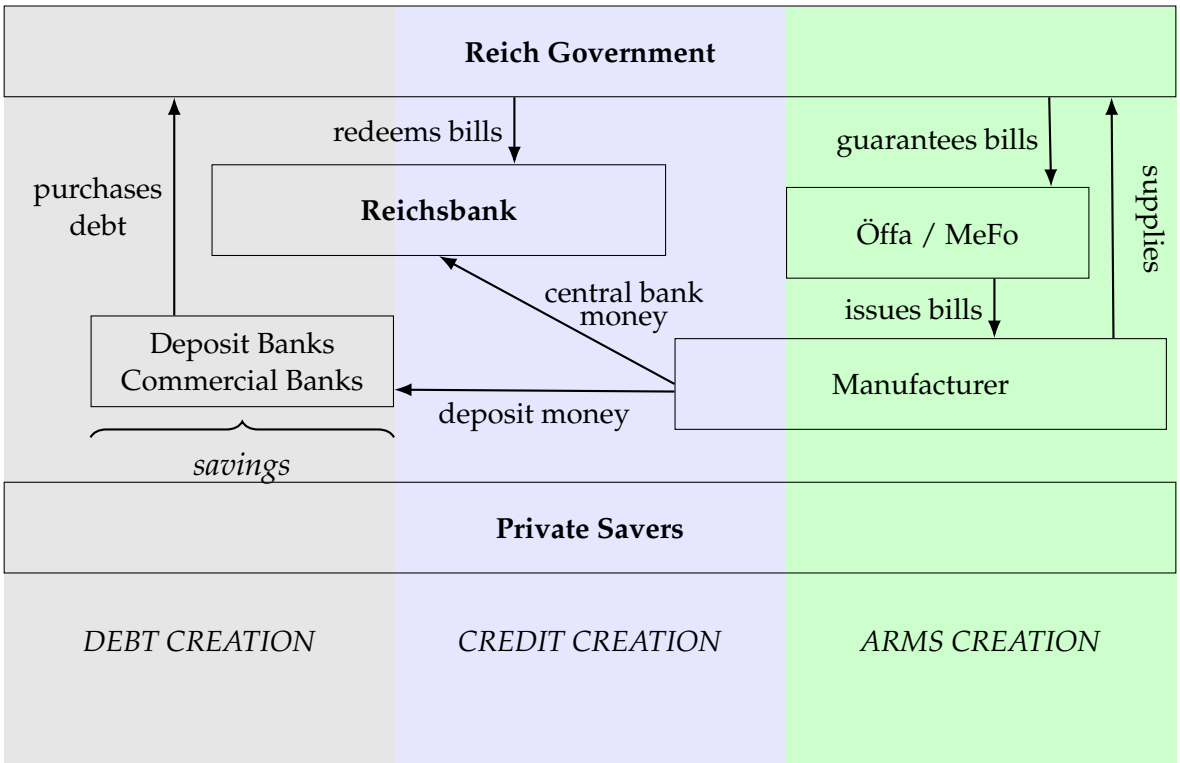


Figure 7: Shadow Credit in the Nazi Economy. Author's Illustration

A simplified illustration is provided in Figure 7. The key instruments used were specifically created bills, known as *Wechsel*, issued by shadow companies that only circulated in the financial system.

Between 1932 and 1937, the Nazi government invested into work creation programs by emitting work creation bills through various government subsidiaries, notably the

[11] This section is based on Grebler (1937), Stucken (1964), Caesar and Hansmeyer (1976), Oshima (1991), and Oshima (2006).

Deutsche Gesellschaft für Öffentliche Arbeiten, or *Öffa*. These bills were used by the *Öffa* to pay for work creation-related projects, such as construction or infrastructure. Importantly, these bills were guaranteed by the Reich, making them eligible for discounting at the Reichsbank. Hence, bills were stored by the Reichsbank or commercial banks as a liquid asset. [12] Oshima (1991) estimates that around 5 billion RM were invested in work creation programs, 37% of which was financed through work creation bills.[13]

The same principle was used to finance rearmament by creating a fictitious company, the *Metallurgische Forschungsgesellschaft mbH*, which emitted *Mefo-bills*. These bills had a three-month maturity, but were often extended up to five years.[14] An arms contractor would receive Mefo-bills as payment, which could then be discounted for cash at the Reichsbank or deposited at commercial banks. The Reich would then use revenue from emitting government debt to redeem those bills at the Reichsbank once matured. This meant that a large part of government expenditure was financed by shadow debt instruments outside official government accounts. Oshima (1991) estimates that *Mefo*-bills accounted for 60-70% of Wehrmacht expenditure between 1934 and 1937.

The Nazi economy was, thus, geared towards military conflict from the beginning. The initial focus on reducing unemployment was a strategic consideration to channel the productive forces of the German economy into the ultimate goal of rebuilding its military, to which full employment was both a practical and ideological *means*.[15] In one of his earliest cabinet meetings, Hitler himself stated that *"[t]he next five years must be devoted to the rearmament of the German people. Every public plan for the creation of jobs has to be judged from the point of view of whether it is necessary for the rearmament of the German people"*.[16] This was achieved by placing credit creation at the Reich's disposal. In the Nazi state, unemployment and rearmament went hand in hand.

[12] These instruments were, however, no Nazi invention, and many work creation programs had already been passed under the previous von Papen and von Schleicher governments by 1932. The Nazis did, however, use *Wechselfinanzierung* at an unprecedented scale with full cooperation of the Reichsbank.

[13] *Tabelle 15, ArbeitsbeschaffungsmaSSnahmen der Reichsregierung.*

[14] In theory, the Reich was supposed to use this system as a temporary instrument, and finance military expenditure through regular government revenue in the medium term. By 1939, billions worth of such bills were scheduled to be repaid by the Reich. Hitler, however, had no intention of doing so, which led to the resignation of the Reichsbank board the same year.

[15] This becomes abundantly clear from internal Reichsbank documents, for instance BA R2501/7132 or R3102/2482, which elaborate how the Reichsbank saw itself as an integral component to fulfilling the goals of the National Socialist state by catering the credit supply to its "needs". See also Barkai (1990) and Spoerer and Streb (2013), ch. 6.

[16] *Ministerialbesprechung vom 8. Februar 1933*, cited in Barkai (1990), p. 160.

3 Contribution to the Literature

This paper thus contributes to two strands of existing research.

The first is the study of fiscal multipliers using military spending as an exogenous government spending shock to estimate effects on GDP or unemployment. The empirical strategy I use is inspired by previous work from Nakamura and Steinsson (2014), who analyze data on US military procurement contracts to estimate regional multiplier effects of government spending. Their identifying assumption is that the United States did not embark on military buildups as an endogenous reaction to relative economic conditions between US states. I argue that the same assumption can be made about rearmament in Nazi Germany, and that the regional defense expenditure exposure variable I propose allows me to identify the effect of military spending on unemployment. This is particularly valuable given that the period of interest in the case of Nazi Germany spans only a few years, making it difficult to construct longer-term time series with multiple episodes of military buildups and drawdowns.

The second strand of literature is the economic study of Nazi Germany. For Nazi Germany, Erbe (1958) has previously estimated a fiscal multiplier of government spending of 1.6. He argues that this effect was far below what could have been observed had the Nazis aimed at stimulating the economy in a Keynesian sense – but by restricting income and consumption growth, the multiplier effect was muted as resources were channeled into rearmament (Erbe 1958). His reasoning was later corroborated by Ritschl (2002). On the other hand, Abelshauser (1999) suggests that Nazi deficit spending and Keynesian expansionary fiscal policy were what paved the way for Germany's recovery, which he claims was faster than what had been observed in other European countries, providing the economic foundation for Nazi Germany's rapid rearmament (Abelshauser 1999). This leads to the second strand of literature to which this paper contributes, which is how effective Nazi rearmament – and macroeconomic policy in general – was in lifting the German economy out of depression after 1933.[17].

In response to Abelshauser (1999), Buchheim (2001) and Buchheim (2008) instead argues that German economic recovery had started as early as 1932, before Hitler's rise to power, and that many work creation policies and programs that had contributed to the decrease in unemployment in 1933 had already been implemented under the previous

[17]Robinson (1972) famously said *"Hitler had already found how to cure unemployment before Keynes had finished explaining why it occurred."* Additionally, see Barkai (1990), Buchheim (2008), Spoerer (2005), Spoerer and Streb (2013) for more detailed discussions.

von Papen and Schleicher governments. According to Buchheim (2008), the recovery was primarily driven by a rebound in private investment, while public programs had a more limited impact, as they were largely financed through tax revenues – which depressed private demand – and, at best, served to stabilize existing employment rather than generate new jobs. Ritschl (2002) similarly suggests that recovery dynamics until 1936 were no different than what had been observed in Britain or the United States, and that the German upswing was more driven by a rebound effect than the Nazi's macroeconomic policies.

More recent research has since suggested a more active role of rearmament in stimulating employment. Fremdling and Stäglin (2015) find that the arms industry had created or induced more than five million jobs by 1935–1936, a number which increased to at least nine million shortly before the start of the war. Responding to Ritschl (2002), Fremdling and Stäglin (2015) claim that work creation and rearmament were at least "a sufficient condition" (Fremdling and Stäglin 2015, p. 22) for reaching full employment. There is little doubt that the Nazis knew well how to exploit the rapid decrease in unemployment for propaganda purposes. Voigtländer and Voth (2014) find that *Autobahn* construction significantly increased political support for the regime, showing that voting patterns were significantly more favorable to the Nazi party in districts exposed to road construction projects. Ettmeier, Kriwoluzky, Papadia, et al. (2024) investigate the effectiveness of Nazi fiscal policy through the lens of an expectations creation channel. Albers (1976) and Abelshauser (1999) argue that the overall economic upswing made the general public less sensitive to the slow growth of consumption and real wages, which the Nazi state absorbed to finance military spending.

Overall, this paper argues that military expansion presented a significant accelerating force, lending support to the arguments made by Fremdling and Stäglin (2015) while relying on a different identifying assumption. It is the first to estimate local, causal effects of military spending on unemployment for the Nazi economy, and my estimates suggest that the role of Nazi economic policy in stimulating the labor market was more active than suggested by previous research. Such labor market effects likely bolstered the Nazi regime in the eyes of the population, paving the way for continued popular support during its military buildup.

4 Data

4.1 *Luftwaffe* Suppliers

The objective of this paper is to identify regional effects of rearmament on unemployment. Military expenditure data for Nazi Germany is notoriously difficult to reconstruct, as much of it was likely deliberately destroyed by the regime before the end of the war in 1945. Detailed arms production data is available only starting around 1938 (Wagenführ 1954, Tooze 2006), which is outside the period of interest of this paper. Moreover, these sources capture military output on an aggregate level, and do not allow for a regional analysis.

To construct my regional measure of exposure to the arms industry, I rely on an archival file of the StRA.[18] In 1933 and 1938, the StRA sent surveys to firms that produced goods relevant to aircraft manufacturing, which contained questions on employment, production capacities, and raw material consumption. The file I analyze in this paper contains the list of – presumably – all suppliers these questions were sent to in both of those years, including the addresses. Importantly, this covers *plant locations*, as some firms have multiple entries in different cities. In my analysis, I consider all individual plants. This yields a geographical distribution of plants for 1933 and 1938.[19] In total, *R3102/3666* records 121 individual entries, the first 10 of which are shown in Figure 8. The list includes companies that remain well-known names today, such as *Daimler-Benz*, *BMW*, or *Junkers*.

[18] BA R3102/3666. *Statistisches Reichsamt. Reichsergebnisse der Produktionserhebungen. Band 2, Flugzeugindustrie.*

[19] Entries which are likely administrative headquarters are not considered. Plants in annexed Austria are also excluded.

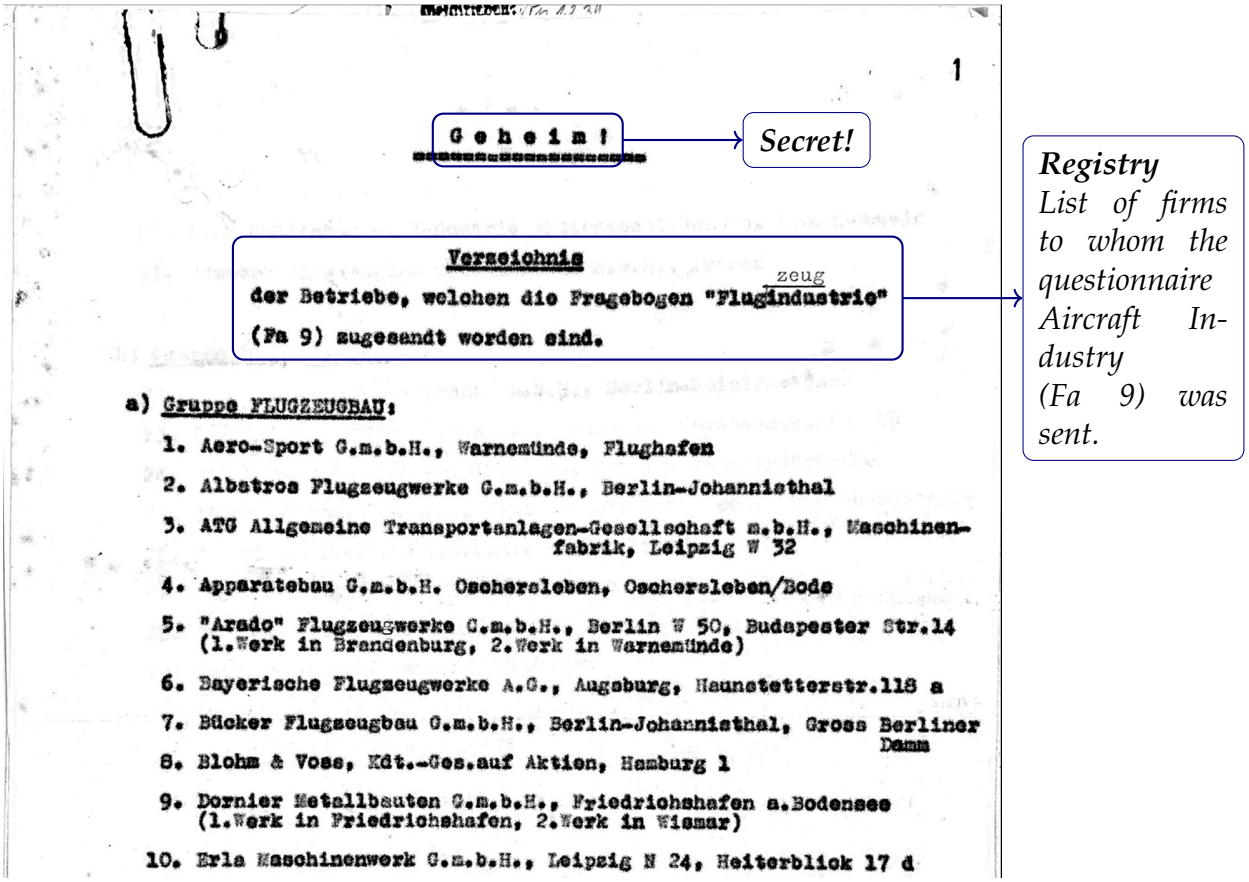


Figure 8: First Page of R3102/3666

Figure 9 shows the locations of plants for both years, illustrated as red dots.[20] In total, 30 plants are recorded in 1933, and 88 in 1938. Unfortunately, the data do not indicate when each individual plant started operating. Therefore, my main estimate is computed exploiting the location of suppliers in 1933 to limit endogeneity concerns. However, for illustration, I also report results using the distribution of firms in 1938.

[20] 1936 Borders. Map according to IPUMS.

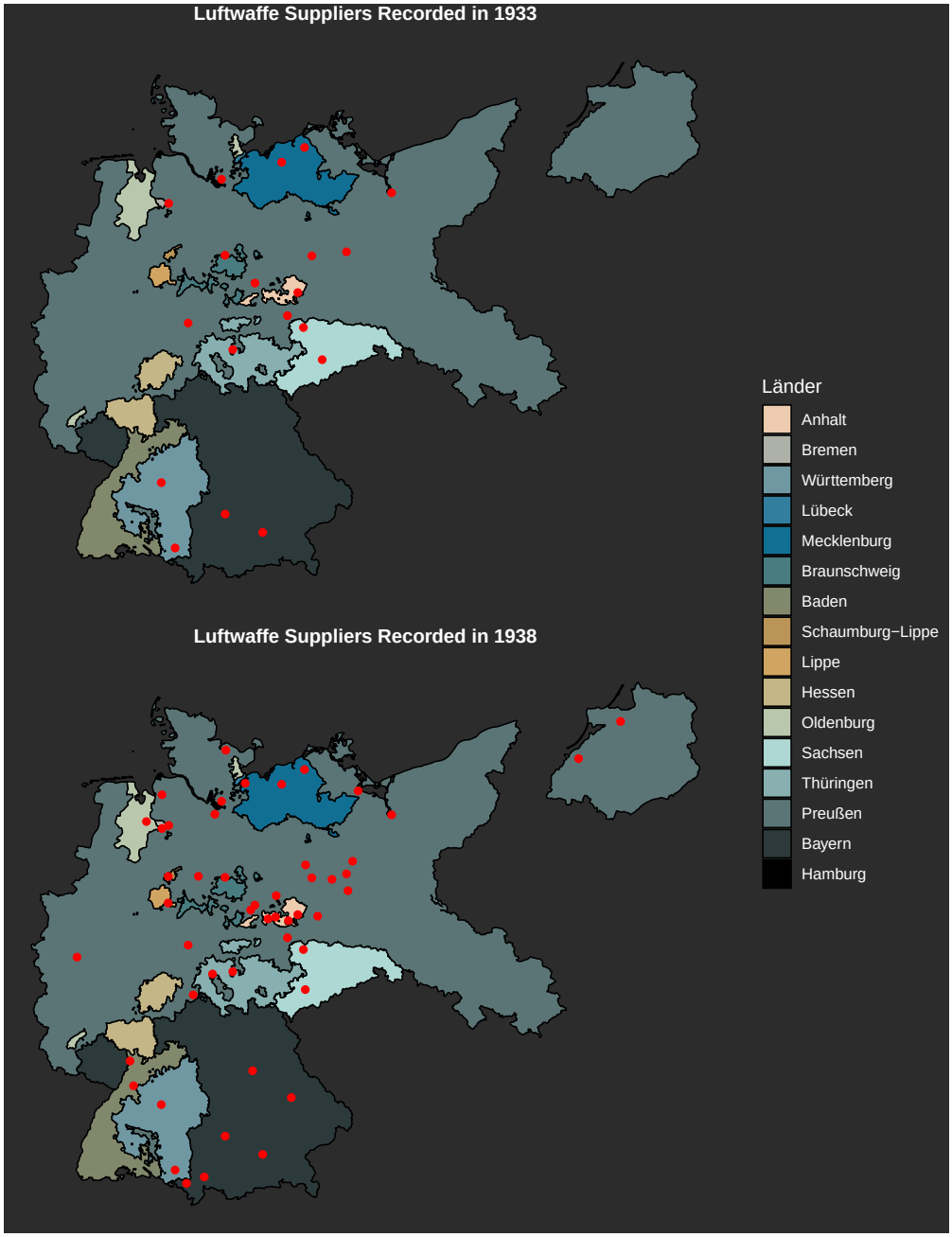
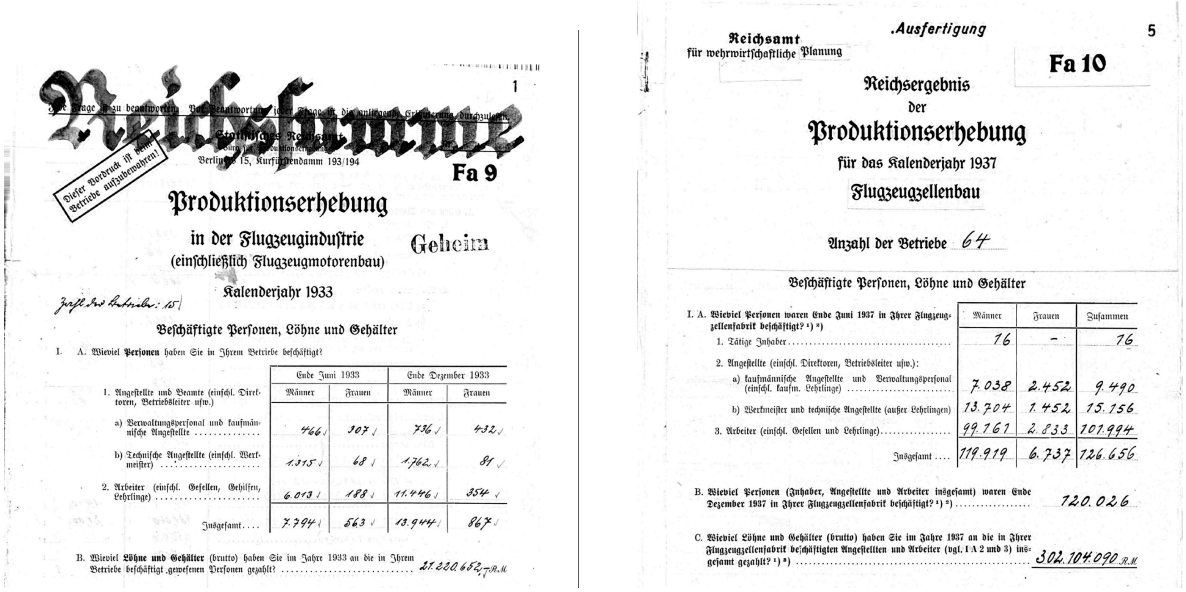


Figure 9: Distribution of Luftwaffe Suppliers

It could be of great interest to gather firm-level data for a richer analysis, but the returned individual questionnaires, if they still exist, are not in the StRA files. However, some aggregated data was collected, excerpts of which I show below in Figure 11. This document, which is likely a Reich Aggregate, tells us how many persons were employed and how much the firms spent on wages in the *Flugzeugindustrie*, or *aircraft sector*. Unfor-

tunately, I do not know which of the firms listed in Figure 8 are included in these totals, but they offer the following interesting observations.



(a) 1933 (b) 1937

Figure 10: StRA Survey Aggregates

According to these files, 8.357 people were employed by the end of June in 1933. By December of the same year, this number rose to 14.811. Since it is stated that total wage expenditure in 1933 totaled 21.220.652 RM, this yields a per-worker annual nominal wage of around 1430 RM in 1933. By the end of 1937, employment reached 126.656 workers across 64 plants, with each worker earning around 2.390 RM per year. To put these numbers into perspective, per-capita GDP was 713 RM in 1933, and 1046 RM in 1937. Notice also that the share of the female workforce decreased from about 10% in 1933 to 5% by the end of 1937. Table 1 summarizes descriptive statistics this source allows me to compute:

Table 1: *Flugzeugindustrie* Summary Statistics

Year	Firms	Employed Persons	Avg. Annual Wage	Per capita GDP
1933	15	14 811	1 430 RM	713 RM
1934	23	48 738	1 637 RM	804 RM
1937	64	126 656	2 390 RM	1 046 RM

Notes: BA R 3102/4151 & 5866. *Statistisches Reichsamt, Reichsergebnisse der Produktionserhebungen. Band 2, Flugzeugindustrie.* Wages and GDP in nominal terms reported in StJB 1938, ibid.

One limitation of these data is that many of these firms, especially carmakers, did not restrict their production to military goods. Hence, part of the observed economic activity may stem from civilian rather than military demand. While this is possible, I believe this to be a limited cause for concern. First, civilian demand in the Nazi economy was deliberately suppressed[21], and the fact that these firms were already recorded as early as 1933 suggests that they were at least preparing to engage in military production in the near future – likely outweighing any effects related to non-military output. Second, military-related data is inherently difficult to isolate, as military production cannot be neatly confined to a single industry, particularly when firms simultaneously produced both civilian and military goods (Streb 2023). In my data, firms are categorized into different groups according to what they produce, such as *aircraft engines* or *airframes*, which are unlikely to be of civilian use.[22]By focusing on a select group of firms with a clearly identifiable military purpose, this approach offers an advantage over relying on aggregated arms data or indices commonly used in the existing historical literature.

4.2 Military Expenditure

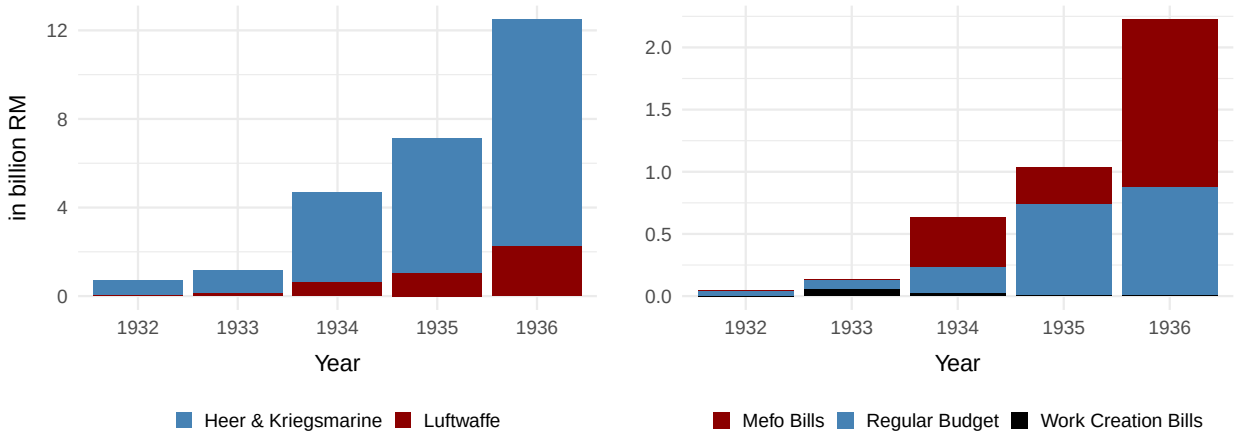
The second step in constructing my exposure variable is combining the geographical variation of suppliers with aggregate expenditure variations across years. I use Luftwaffe budget figures from Oshima (1991), which include both official government accounts and broader estimates that incorporate shadow budgets resulting from *Wechsel* circulation. I hereafter refer to these as the *official* and *estimated* budgets, respectively.[23]

Figure 11 shows the share of the Luftwaffe in estimated military expenditure as a whole (panel *a*), next to a decomposition of the Luftwaffe budget into its official and unofficial sources (panel *b*).

[21]According to Streb (2023), aircraft production in 1936 was 60% of what it was in September 1939.

[22]This could also imply that recorded plants were those that produced military equipment exclusively, if civilian goods were produced at separate locations and thus not concerned by this survey. However, my data do not allow me to verify this.

[23]Oshima (1991) provides a discussion of different sources used to construct military expenditure figures, which he argues were underestimated in the previous historical literature. I chose to use these estimates as they have been corroborated by later research (for instance Fremdling and Stäglin 2015) and provide clear archival documentation. For military expenditure: *Tabelle 10, Militärausgaben.*



(a) Luftwaffe Share, incl. Shadow Budgets

(b) Luftwaffe Budget Sources

Figure 11: Luftwaffe Expenditure, 1932–1936 (Oshima 1991)

Between 1932 and 1936, Luftwaffe expenditure increased from 43 million RM to about 2 *billion* RM in 1936, which represents an almost 50-fold increase. Nevertheless, this was only a small share relative to the amounts spent on the army, the *Reichsheer*, and the navy, the *Kriegsmarine* (Oshima 1991). Figure 11 also shows how important Mefo-bills were in turbocharging rearmament in the early 1930s, with about 60% of Luftwaffe spending being financed through these bills.[24] Therefore, I build my Luftwaffe exposure variable using both official and estimated expenditure figures for comparison, as the official statistics, by design, vastly underreport the true level.

4.3 District-Level Unemployment

Data on unemployment has kindly been provided by Ettmeier, Kriwoluzky, Papadia, et al. (2024), who collect unemployment data on the *employment district*-level, or *Arbeitsamtbezirk*, from the Federal Archives in Berlin. These data were recorded by the Reich Labor Office and published in the *Reichsarbeitsblatt* from 1930 to 1936. Their data set covers unemployment statistics for 358 of such districts, as well as district-level population, which allows for the calculation of district-level unemployment per capita.

Ettmeier, Kriwoluzky, Papadia, et al. (2024) record unemployment using three distinct categories: (1) individuals registered with unemployment insurance, (2) recipients of government crisis support transfers introduced during the Great Depression, and (3)

[24] Appendix B shows Figure 11 for 1932–1939.

recipients of general government welfare payments. Figure 12 illustrates the annual evolution of unemployed persons aggregated from employment districts (in bars) against the total unemployment estimate from the Statistical Yearbook (StJB):[25]. In this paper, I follow Ettmeier, Kriwoluzky, Papadia, et al. (2024) and focus on unemployment insurance and crisis relief. I then manually map each plant from the list of Luftwaffe suppliers to each district. In 1933, 30 plants were distributed across 18 out of 358 districts. In 1938, 88 plants were located in 42 individual districts.

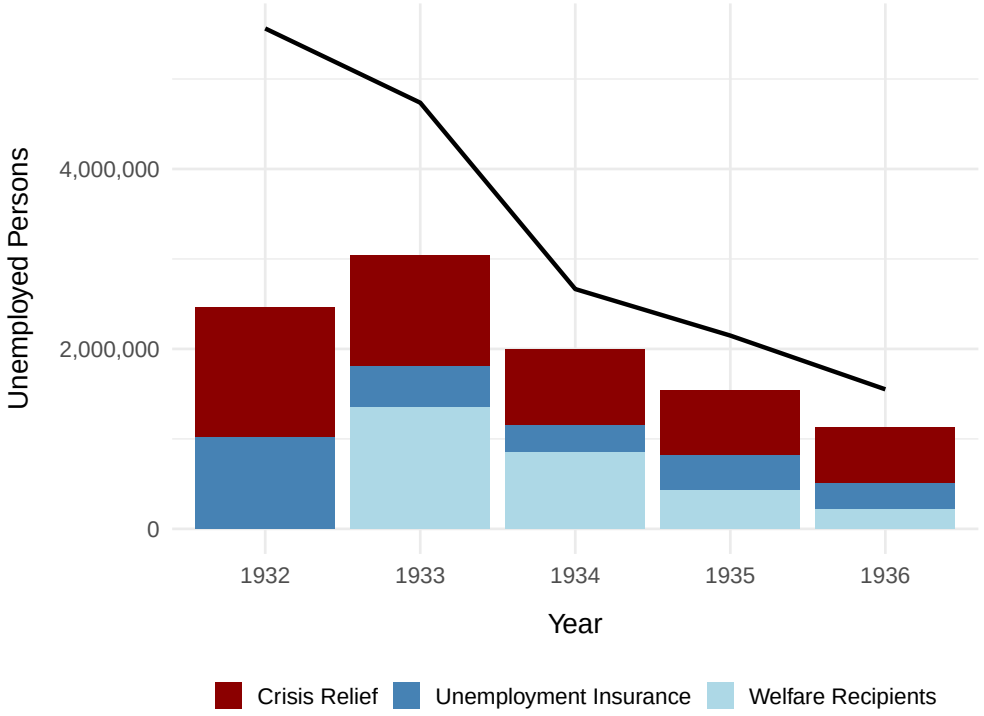


Figure 12: Unemployed Persons According to Ettmeier, Kriwoluzky, Papadia, et al. (2024) and StJB

[25]Both of these metrics likely underestimate the true level of unemployment, see Spoerer and Streb (2013) ch. 6 for a discussion.

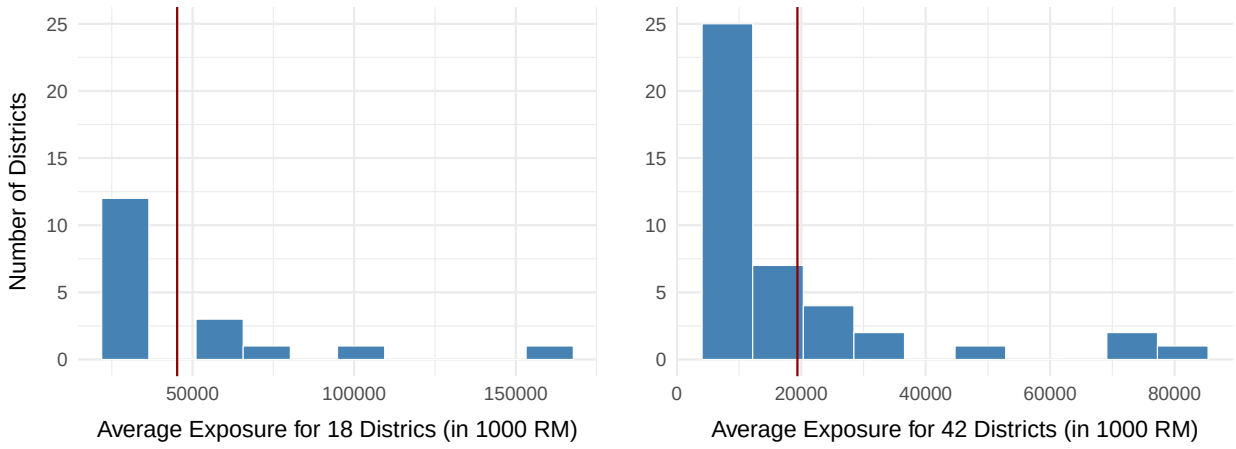
5 Empirical Analysis

5.1 Computing *Luftwaffe* Exposure

To map military spending to each district, I propose the following measure of *"Luftwaffe exposure"* for district d at time t, which I call LW_{dt}:

$$LW_{dt} = \underbrace{LW_{Reich,t}}_{\text{aggregate shift}} \times \underbrace{\frac{Plants_d}{Plants_{Reich}}}_{\text{geographical shift}}$$

I compute district-level exposure by weighting the total Luftwaffe budget $LW_{Reich,t}$, which varies across years t, according to the number of plants in each district as a share of all plants in the Reich, which varies across district d. This supposes that the total Luftwaffe budget is distributed evenly across firms. In total, this approach yields four exposure estimates, as I compute LW_{dt} using plant locations from both 1933 and 1938, combined with either the official or the estimated (i.e., including shadow budgets) aggregate Luftwaffe expenditure.



(a) Plants 1933

(b) Plants 1938

Figure 13: Luftwaffe Exposure by Districts, Average 1933–1936

Figure 13 plots average Luftwaffe exposure in 1000 RM from 1933 to 1936 across all non-zero districts and using the full estimated budgets. The mean across all districts is given by the red line. Districts with plants recorded in 1933 experienced an average annual exposure of about 45.2 million RM, with most plants being located in Berlin, Stuttgart, Rostock, and Dessau. For plants recorded in 1938, the average exposure per

year is about 19.3 million RM, and the most exposed districts are Berlin, Brandenburg, Leipzig, and München. This district-level exposure measure is next combined with unemployment and population data from Ettmeier, Kriwoluzky, Papadia, et al. (2024).

Figure 14 shows employment districts scattered according to unemployment and log Luftwaffe exposure for each year in the sample, both in per capita terms. Here, Luftwaffe exposure is computed using the 1933 firm distribution and estimated budget numbers[26]. Unemployment is constructed as the sum of persons in unemployment insurance and crisis relief. It shows an initially positive relationship that gradually reverts to a negative one by 1935.

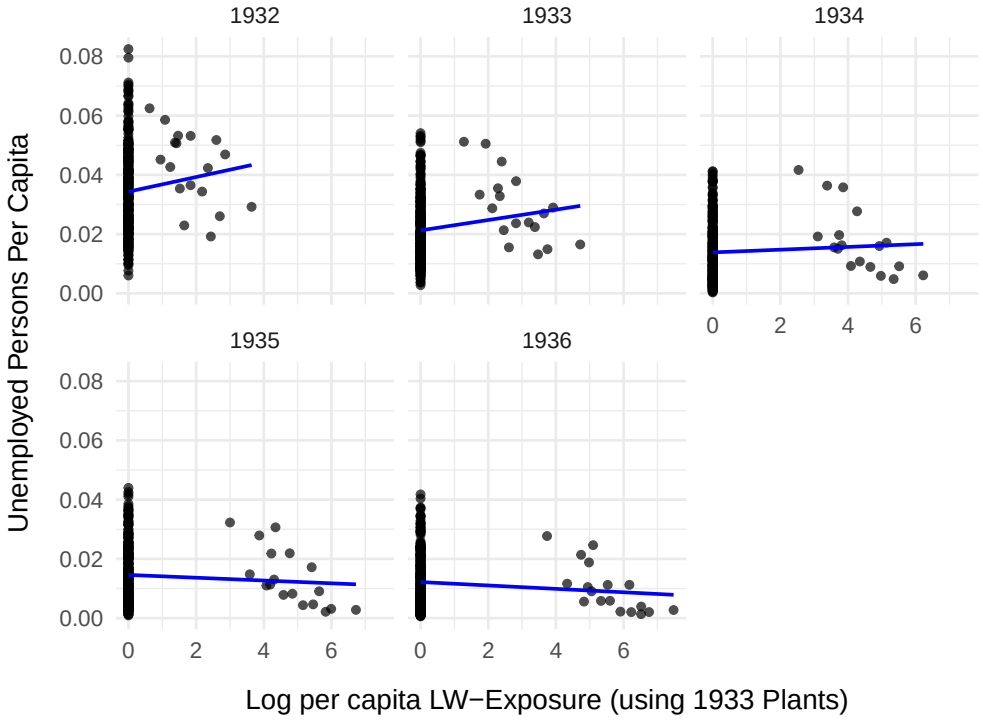


Figure 14: Per capita Unemployment and log Luftwaffe Exposure

The initial positive relationship could indicate that districts with a high level of initial exposure, such as Berlin or Stuttgart, were more traditionally more industrious and thus more affected by mass unemployment between 1929 and 1932. This endogeneity concern will be discussed further in Subsection 5.4.

It follows from Figure 14 that unemployment took about two years to respond to the

[26] Appendix B presents the same plot as in Figure 14, but with unemployed persons per capita relative to 1932 on the y-axis, revealing a persistent negative relationship.

Luftwaffe rearmament shock. Therefore, my main analysis will estimate the effect of Luftwaffe exposure on unemployment *relative* to 1932 as a base year to allow for a cumulative effect over time. [27].

5.2 Empirical Strategy

To estimate the effect of Luftwaffe exposure on unemployment, I make the following identifying assumption, which has previously been made by Nakamura and Steinsson (2014) in the context of military spending in US states. I assume that Nazi Germany did not undertake its military buildup in response to relative economic conditions between German regions. Therefore, regional – or, in my case district-level – variations in Luftwaffe exposure allow me to identify the causal effect of military spending on unemployment.

I then estimate the following equation:

$$\Delta U_{dt} = \gamma_t + \beta \frac{\Delta LW_{dt}}{\text{Pop}_{d,1932}} + \epsilon_{dt} \tag{1}$$

where

$$\Delta U_{dt} = \frac{\text{Unemployment}_{dt} - \text{Unemployment}_{d,1932}}{\text{Pop}_{d,1932}}$$

and

$$\Delta LW_{dt} = \frac{\text{Exposure}_{dt} - \text{Exposure}_{d,1932}}{\text{Pop}_{d,1932}}$$

γ_t represents time fixed effects, and LW_{dt} is expressed in 1000 RM. Both variables are divided by district-level population. ϵ_{dt} is an error term.

I estimate the equation using weighted least squares (WLS), with 1932 population levels serving as observation weights. By estimating the change in unemployed persons per capita relative to 1932, I allow for a cumulative effect of military spending over time.[28] By keeping population constant to 1932 levels in the denominator on the right-hand side, I control for potential population changes that might be driven by Luftwaffe exposure.

[27] I will show that my main result holds when estimating the baseline equation in levels as opposed to differences.

[28] I also estimated Equation 1 in levels, but including district-level fixed-effects. See Appendix C.

5.3 Baseline Result

Table 2 reports estimates for β from Equation 1 using the three different unemployment metrics from Ettmeier, Kriwoluzky, Papadia, et al. (2024). *Panel A* uses the exposure variable constructed from the plant distribution in 1933, while *Panel B* does so using the plant locations in 1938. The first three columns use official Luftwaffe expenditure for the total Reich Luftwaffe budget, while columns 4–6 include estimated shadow budgets. Standard errors are clustered at the district level.

Table 2: Unemployment Relative to 1932

	Official			Estimated[1]		
	Insured	Crisis	Ins. + Crisis	Insured	Crisis	Ins. + Crisis
Panel A: 1933 Plant Locations						
LW_{dt}	-0.0162*	-0.0389**	-0.0551**	-0.0069*	-0.0168**	-0.0237**
	(0.0094)	(0.0184)	(0.0273)	(0.0041)	(0.0080)	(0.0119)
Num. Obs.	1755	1755	1755	1755	1755	1755
R^2	0.604	0.494	0.597	0.604	0.493	0.596
R^2 Within	0.016	0.041	0.040	0.015	0.039	0.038
Std. Errors	District	District	District	District	District	District
Panel B: 1938 Plant Locations						
LW_{dt}	-0.0268***	-0.0856***	-0.1124***	-0.0115***	-0.0372***	-0.0487***
	(0.0063)	(0.0171)	(0.0209)	(0.0028)	(0.0075)	(0.0091)
Num. Obs.	1755	1755	1755	1755	1755	1755
R^2	0.605	0.518	0.610	0.605	0.516	0.609
R^2 Within	0.019	0.086	0.071	0.018	0.082	0.068
Std. Errors	District	District	District	District	District	District
Fixed Effects	✓	✓	✓	✓	✓	✓

[1] *This includes estimated shadow budgets resulting from* Wechsel-*circulation.*
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

I find statistically significant effects of Luftwaffe exposure on unemployment across all possible specifications. Reassuringly, these effects are present when looking at firm locations in 1933. Naturally, the effect is larger when using official Luftwaffe statistics compared to those including shadow budgets, which highlights how official government accounts from the Nazi era understate the true military spending that occurred during

this period. Therefore, my main result is the one obtained using the total budget figures interacted with the 1933 plant distributions. This is to limit endogeneity concerns related to plant location decisions, as areas that benefited from the Nazi economic boom could have attracted more suppliers. Hence, the remainder of the paper will reference the exposure measure obtained using 1933 plant locations and full Luftwaffe expenditure numbers unless otherwise stated.

Thus, my main result, the coefficient on my unemployment variable $Ins. + Crisis$, implies that a 1,000 RM per capita increase in Luftwaffe expenditure is associated with a 2.4 percentage point decline in unemployment – or, equivalently, a reduction of 24 unemployed persons per 1,000 inhabitants – relative to unexposed districts. The coefficient is statistically significant at the 5 % level. This evidence points to a substantial effect of rearmament in reducing unemployment, even during the early years of Nazi rule, lending support to the results by Fremdling and Stäglin (2015). Considering that the unemployment metric used is most likely downward biased (see Figure 12, Spoerer and Streb (2013)), my estimates should be considered as lower bounds.

5.4 Robustness

To assess the robustness of this result, I examine whether firms location choices may have been influenced by pre-existing regional characteristics, such as historical industrial structures or patterns of agglomeration. If the areas where plants were established were already more industrialized or productive prior to rearmament, the estimated effects could conflate the impact of military spending with a localized industrial rebound that would have occurred as part of the broader national recovery. If plant location was an endogenous choice, the estimates would not isolate the causal effect of defense expenditure.

Therefore, I repeat the estimation of Equation 1 including additional control variables. First, I control for the unemployment lag and the population level. Then, I construct an *industrial exposure* proxy analogous to my measure LW_{dt}. To do so, I construct:

$$\text{Ind. Exposure}_{lt} = \text{Production Index}_{Reich,t} \times \frac{\text{Ind. Employment}_{l,1933}}{\text{Pop}_{l,1933}}$$

using industrial employment data on the *Länder*-level by Hohls and Kaelble (1989) and national industrial production numbers from the League of Nations (1939). Länder-level data is much less detailed than district-level data, which makes it unsuitable for estimating military spending effects as before. However, I believe it is plausible that any

underlying endogeneity due to historical trends should be detectable beyond the district level, as those likely caused spillover effect over time. The available data allows me to compute this metric for 1933. Additionally, I use data from Hohls and Kaelble (1989) to compute *Länder*-level industrial employment per capita for 1925 and 1907. The results are presented in Table 3, where each column represents a different specification:

Table 3: Baseline Result incl. Controls

	(I)	(II)	(III)	(IV)
LW_{dt}	-0.0235**	-0.0219**	-0.0243**	-0.0253**
	(0.0109)	(0.0108)	(0.0115)	(0.0117)
Lagged Unemployment p.c.	-0.1581***			
	(0.0299)			
Population Level		-0.0000		
		(0.0000)		
Industrial Exposure			-0.0002	
			(0.0002)	
Industrial Employment p.c. in 1925				-0.0089
				(0.0088)
Industrial Employment p.c. in 1907				-0.0358**
				(0.0161)
Num. Obs.	1402	1754	1755	1690
R^2	0.299	0.606	0.599	0.611
R^2 Within	0.093	0.056	0.045	0.080
Std. Errors	District	District	District	District
Fixed Effects	✓	✓	✓	✓

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

My main result is robust to the inclusion of these controls, and the coefficient even increases when controlling for historical levels of industrial employment per capita. Overall, this support the hypotheses that the observed employment boom cannot merely be explained by aggregate trends or pre-existing economic conditions. To further reinforce this claim, I estimate a standard event-study regression to show pre-trends. I estimate the following equation:

$$\frac{U_{dt}}{Pop_{d,1932}} = \sum_{k \neq 1932} \beta_k \mathbb{1}_{\{t=k\}} \frac{LW_{d,1936-1932}}{\text{Pop}_{d,1932}} + \alpha_d + \gamma_t + \epsilon_{dt} \tag{2}$$

The resulting coefficients are illustrated in Figure 15. The pre-treatment coefficients are small and statistically indistinguishable from zero, providing no evidence of differential pre-trends prior to the treatment year. Consistent with the hypothesis of this paper, estimates turn negative and grow in magnitude starting in 1934:

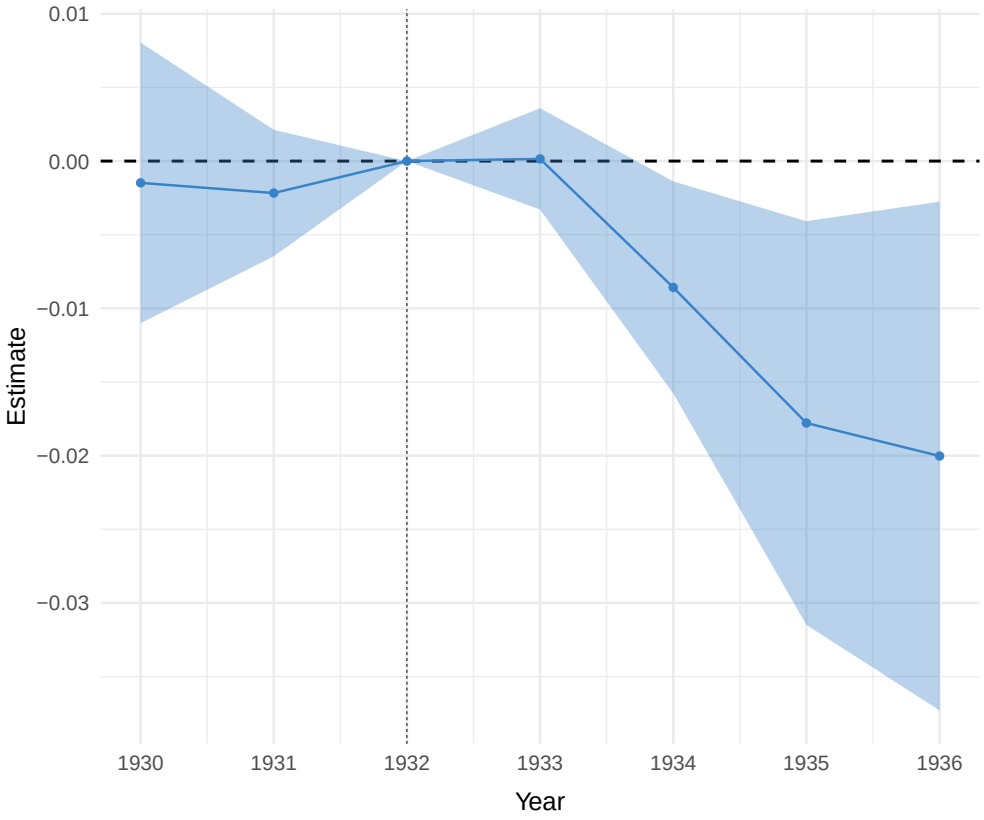


Figure 15: Event-Study Coefficients, 10% Confidence Band

I therefore argue that my local, Luftwaffe-based military spending proxy works well to identify relative rearmament effects on unemployment. The remaining subsections extend the analysis by introducing a heterogeneity-robust difference-in-differences (DiD) estimator and testing for spillover effects.

5.5 Estimation Using DiD

Following the recent DiD-literature, I use the estimator proposed by Chaisemartin and d'Haultfoeuille (2023) to account for heterogeneity in treatment timing and dose. Due to the large number of untreated units, Chaisemartin and d'Haultfoeuille (2023) show that the weighted average treatment effect on the treated (WATT) can be obtained through a 2SLS regression, in which the endogenous variable is regressed on a binary instrument in the first stage. Applying this framework on my Luftwaffe exposure and across all my specifications, I obtain the following results:

Table 4: DiD Estimator

	Official			Estimated[1]		
	Insured	Crisis	Ins. + Crisis	Insured	Crisis	Ins. + Crisis
Panel A: 1933 Plant Locations						
LW_{dt}	-0.0831**	-0.0889***	-0.1720***	-0.0372**	-0.0398***	-0.0770***
	(0.0359)	(0.0256)	(0.0470)	(0.0161)	(0.0114)	(0.0210)
Num. Obs.	1755	1755	1755	1755	1755	1755
R^2	1.000	1.000	1.000	1.000	1.000	1.000
R^2 Within	1.000	1.000	1.000	1.000	1.000	1.000
Std. Errors	District	District	District	District	District	District
Panel B: 1938 Plant Locations						
LW_{dt}	-0.0971**	-0.1647***	-0.2618***	-0.0435**	-0.0737***	-0.1172***
	(0.0430)	(0.0348)	(0.0638)	(0.0192)	(0.0156)	(0.0286)
Num. Obs.	1755	1755	1755	1755	1755	1755
R^2	1.000	1.000	1.000	1.000	1.000	1.000
R^2 Within	1.000	1.000	1.000	1.000	1.000	1.000
Std. Errors	District	District	District	District	District	District
Fixed Effects	✓	✓	✓	✓	✓	✓

[1] *This includes estimated shadow budgets resulting from* Wechsel-*circulation.*
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

These results indicate a substantial treatment effect on treated units, considerably larger than the average treatment effect obtained previously using OLS: whereas before, I obtained an unemployment reduction of around 2.4 percentage points on average, this effect grows to almost 8 percentage points for treated units, and is statistically significant

at the 1% level. This is further evidence in support of local, relative military spending effects.

5.6 Spillover Effects

As a final empirical exercise, I test for potential spillover effects. Given the strong local effects I find, it is natural to suppose that proximity to a Luftwaffe supplier could affect local unemployment even beyond district borders. To do so, I estimate an analogous version of Equation 1. Here, I define treatment not as a district hosting a Luftwaffe plant. Instead, I consider treated units as districts that share a border with a host district, and omit districts that are both hosts and neighbors simultaneously. Hence, I construct my local share not as the ratio of host districts, but of neighboring ones:

$$\Delta U_{dt} = \gamma_t + \beta \frac{\Delta \text{Neighbor Exposure}_{dt}}{\text{Pop}_{d,1932}} + \epsilon_{dt} \tag{3}$$

where, instead of using

$$LW_{dt} = LW_{Reich,t} \times \frac{Plants_d}{Plants_{Reich}}$$

I define:

$$\text{Neighbor Exposure}_{dt} = LW_{Reich,t} \times \frac{Neighbors_d}{Neighbors_{Reich}}$$

I do this for both my baseline OLS framework, but also using the same DiD-approach as for Table 4. The results are shown in Table 5 and suggest statistically significant unemployment effects if a district is neighboring a district that hosts a Luftwaffe supplier. The OLS estimate suggests that being a neighbor is associated with a 0.66 percentage point reduction in unemployment per capita. As before, the WATT is larger, indicating a 1.4 percentage point reduction of unemployment per capita among neighboring districts. This is a reassuring result, as it suggests that my baseline coefficients underestimate the true effects.

Table 5: Spillover Effects

	Insured	Crisis	Ins. + Crisis
OLS			
Neighbor Exposure	-0.0015*	-0.0051***	-0.0066***
	(0.0009)	(0.0014)	(0.0022)
Num. Obs.	1623	1623	1623
R^2	0.610	0.447	0.579
R^2 Within	0.002	0.012	0.009
Std. Errors	District	District	District
DiD			
Neighbor Exposure	-0.0028	-0.0109***	-0.0137**
	(0.0023)	(0.0038)	(0.0056)
Num. Obs.	1590	1590	1590
R^2	1.000	1.000	1.000
R^2 Within	1.000	1.000	1.000
Std. Errors	District	District	District
Fixed Effects	✓	✓	✓

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.7 Aggregate Effects (Alternative Paragraph: Appendix D)

This paper has, so far, made no claim about the nature of the aggregate effects of military spending in the Nazi economy. For *illustrative* purposes, I extrapolate the estimated effect of Luftwaffe exposure to broader categories of government spending. I do this in the absence of a structural model, as this would require future research into the politically enforced rigidities of the Nazi economic system, and would likely warrant a paper of its own. Extrapolating my headline estimate by multiplying it with a different aggregate shift will suffer from the missing intercept problem. Therefore, the numbers in the remainder of this section are to be treated with caution. Specifically, I calculate the predicted change in unemployment per capita using total military expenditure and total government expenditure per capita over the period 19321936. This is motivated by the fact that per capita Luftwaffe spending alone never approached 1,000 RM; therefore, I consider these broader aggregates as proxies for fiscal stimulus at scale. Thus, I approximate :

$$\text{Average Effect} \approx \beta \cdot \frac{\sum_{d,t=1932}^{1936} \text{Exposure}_{dt}}{\sum_d \text{Pop}_{d,1932}}$$

where β is either β_{1933}, that is, estimated using the 1933 plant distribution, or β_{1938}, equivalently obtained using the 1938 distribution.

The results are reported in Table 6. Column 1 displays spending per capita in Reichsmark. Column 2 shows the predicted response of unemployed persons per capita using β_{1933}, and column 3 shows the results from using β_{1938}.

Table 6: Predicted Reductions in Unemployment per capita

Spending Type	**Per Capita (RM)**	β_{1933} **(in pp)**	β_{1938} **(in pp)**
Luftwaffe	28.66	0.068	0.139
Military Total	333.33	0.789	1.623
Government Total	1,090.05	2.584	5.311

Notes: Coefficients are drawn from models reported in Table 2, column 6.

For comparison, from the German Statistical Yearbook, I compute a peak unemployed persons per capita rate of 9.4% in February 1932. By the end of 1936, it reached 2.2%.[29] β_{1933} in Table 6 implies that Nazi government spending could explain up to 36% of the decrease in unemployment between 1932 and 1936, 11% of which would be due to military spending.[30]

[29] *Statistisches Jahrbuch*. 1934: pp. 5 and 292. 1937: pp. 5 and 350.

[30] Approximated as $\frac{\beta}{9.4-2.2} \times 100$.

6 Concluding Remarks

This paper provides new empirical evidence on the effects of rearmament on unemployment in Nazi Germany. Using a newly assembled archival dataset that pinpoints the geographic distribution of firms supplying the German *Luftwaffe*, I build a regional measure of exposure to military expenditure. I show that districts hosting Luftwaffe-related production experienced a statistically significant decline in unemployment of 2.4 percentage points relative to districts that do not. This result is robust to various specifications including different control variables. Estimation using an appropriate DiD-estimator confirms large treatment effects on treatment units of around 8 percentage points. Additionally, I find evidence for statistically significant spillover effects, indicating that my results likely underestimate the true effect of military spending. My results suggest an active role of Nazi economic (or, perhaps more accurately, rearmament) policy in contributing to the German upswing of the early 1930s. This likely reinforced popular support for the regime and facilitated its transition to a war economy.

This result, and particularly this new data source, opens up numerous avenues for future research. It could be of interest to examine individual suppliers (or at least those with accessible archival records) to investigate the firm-level effects of the Nazi rearmament shock further. Another possible next step could be to extend the spatial aspects of this analysis by refining the estimation of spillovers. Moreover, the Nazi system of closed credit cycles and shadow budgets remains vastly understudied in the existing literature. A next paper could try to model these aspects more formally: this could not only allow for an improved discussion of aggregate effects, but invite the literature to reflect on how structural assumptions may change when operating under a politically controlled, and profoundly illiberal, economic framework. Such research could therefore shed light on how autocratic states maintain economic resilience in the context of military conflict an area of growing relevance as the economic consequences of geopolitical tensions and war unfortunately demand renewed scholarly attention.

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Appendix

A Discussion of Data Sources and Archival Material

With the exception of district-level data, which has been provided by Ettmeier, Kriwoluzky, Papadia, et al. (2024) and for which I am incredibly grateful, all data used in this research project has been hand collected from primary and secondary sources. I have done so at the *Bundesarchiv Berlin-Lichterfelde*, the library of the *Deutsches Institut für Wirtschaftsforschung* (DIW Berlin) and the *Bibliothèque nationale de France* in Paris, where I was able to discover various primary and secondary sources at various stages when researching this paper. I am indebted to the staff at all three of those institutions for their helpful suggestions and support, particularly Diana Fuenmayor, Katja Buro and Katharina Zschuppe.

A statistical source frequently cited in this project is the Statistical Yearbook of the German Empire (*Statistisches Jahrbuch für das Deutsche Reich*), which I accessed online using this link. At the DIW, I was able to look at the *Wochenberichte* and the *Konjunkturstatistische Handbücher*. I also consulted the editions of *Vierteljahreshefte zur Statistik des Deutschen Reichs*, the *Lageberichte der Deutschen Kreditgesellschaft AG* and *Wirtschaft und Statistik*, two recurring publications of the StRA, to construct time-series of additional outcome variables that I did not analyze further in this paper.

While in Berlin, my main focus were the archives of the Reichsbank, the StRA and the Reich Ministry of Finance. Archival files cited in this project are:

- **R 2501/1760.** *Berichte zur allgemeinen Konjunktur, Band 27.*
- **R 3102/2700.** *Wirtschaftsfinanzierung.*
- **R 3102/7132.** *Deutsche Kriegsfinanzierung und Wirtschaftspolitik.*
- **R 3102/2482.** *Arbeitsbeschaffung: Auswirkung und Finanzierung.*
- **R 3102/3666, 4151 & 5866.** *Reichsergebnisse der Produktionserhebungen, Band 2: Flugzeugindustrie.*

B Supplementary Figures

Total Military Spending

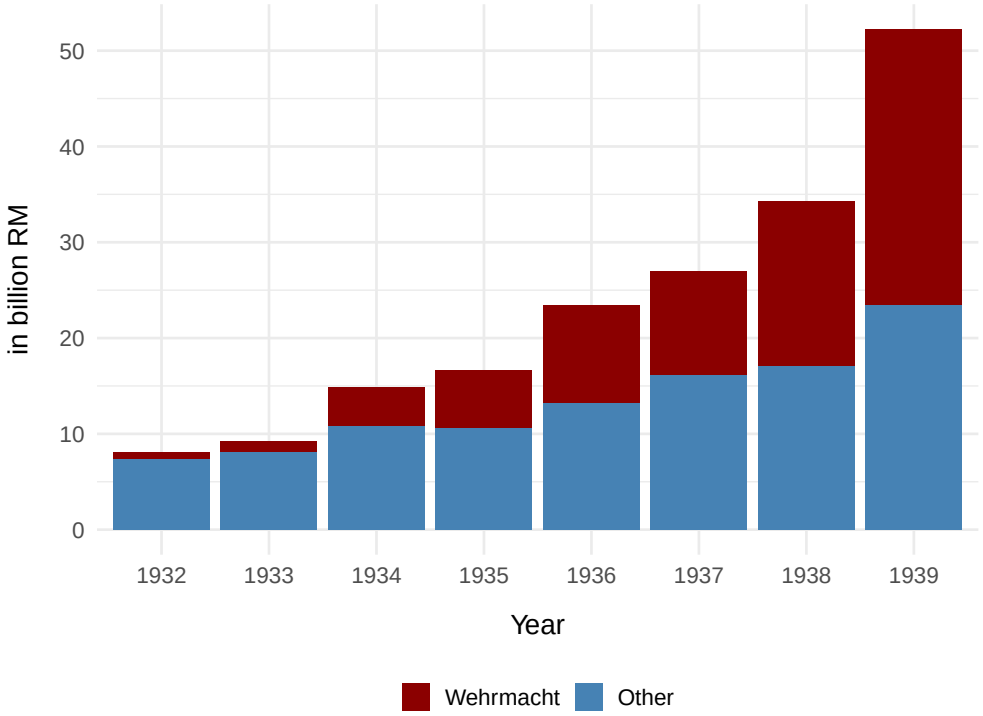
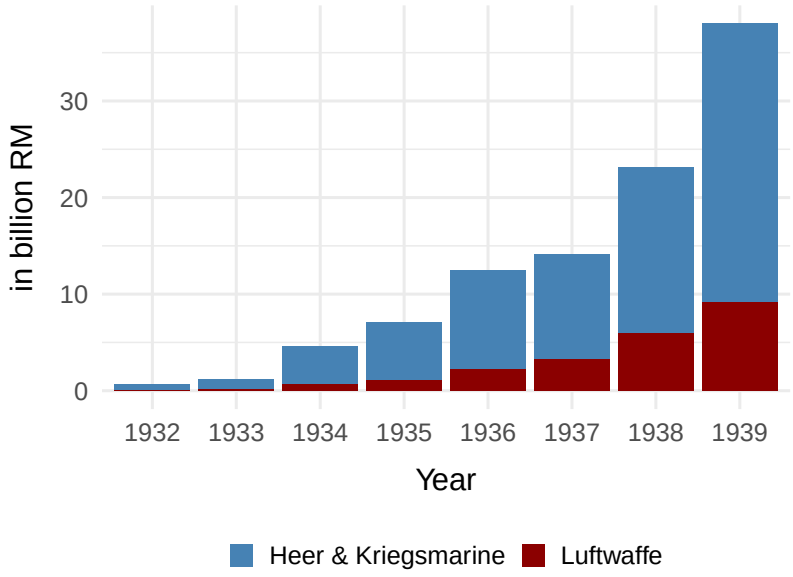
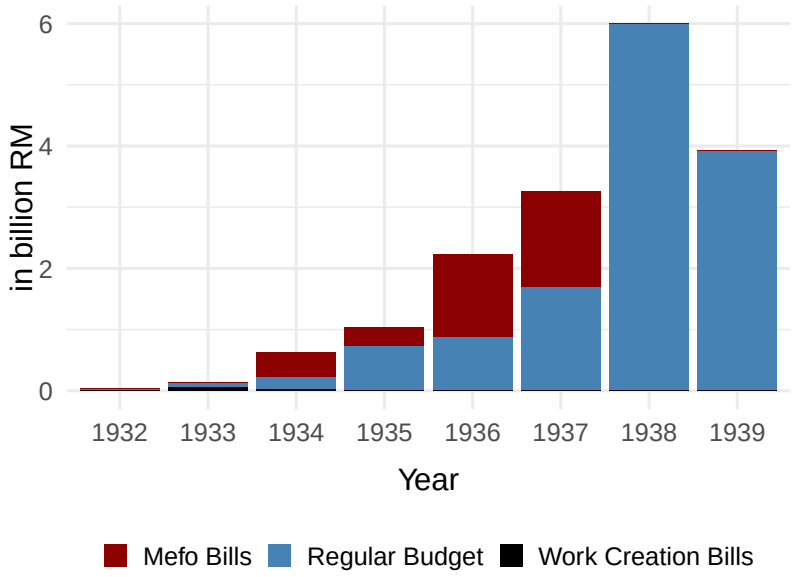


Figure A1: Military Expenditure as Share of Total Spending (continued)

Extended Luftwaffe Budget Decomposition



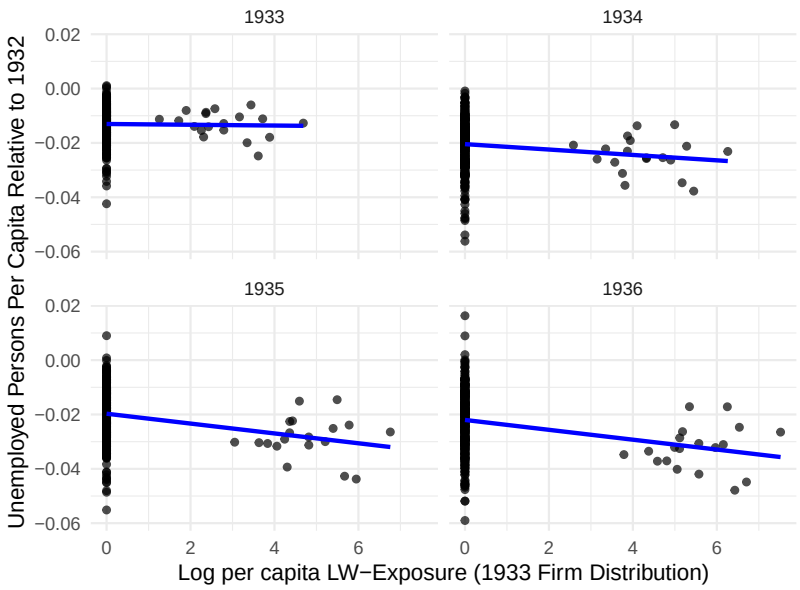
(a) Luftwaffe Share, incl. Shadow Budgets (cont'd)



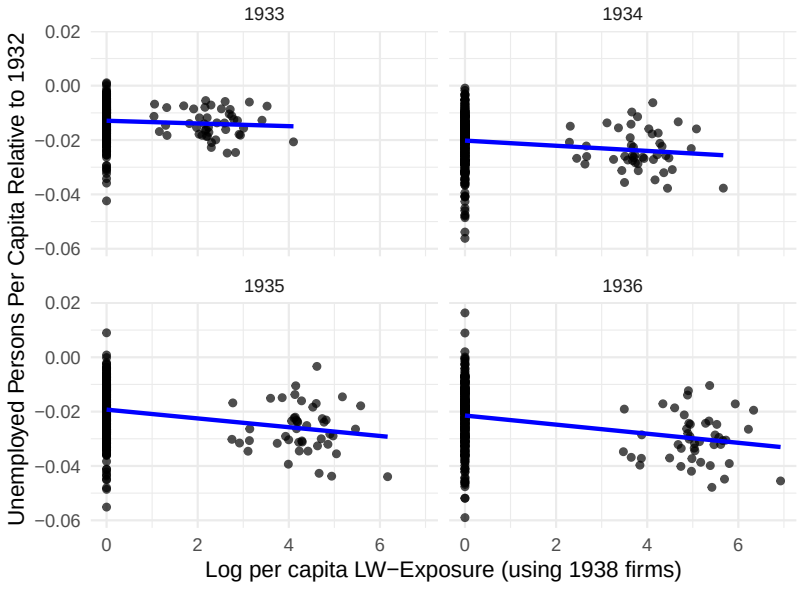
(b) Luftwaffe Budget Sources (cont'd)

Figure A2: Luftwaffe Expenditure, 1932–1939 (Oshima 1991)

Correlation Plots



(a) Plants 1933



(b) Plants 1938

Figure A3: Unemployment per capita Since 1932 and Luftwaffe Exposure

C Level Regression

As an additional robustness check, I re-estimate Equation 1 in levels, but including direict fixed-effects, that is:

$$\Delta U_{dt} = \alpha_d + \gamma_t + \beta \frac{LW_{dt}}{\text{Pop}_{d,1932}} + \epsilon_{dt}$$

This yields the following result:

Table 7: Estimating Equation 1 in Levels

	Official			Estimated[1]		
	Insured	Crisis	Ins. + Crisis	Insured	Crisis	Ins. + Crisis
Panel A: Plant Locations 1933						
LW_{dt}	-0.0179**	-0.0313**	-0.0493**	-0.0075**	-0.0136**	-0.0211**
	(0.0076)	(0.0154)	(0.0223)	(0.0033)	(0.0068)	(0.0098)
Num. Obs.	2459	2459	2459	2459	2459	2459
R^2	0.916	0.868	0.901	0.916	0.868	0.901
R^2 Within	0.009	0.024	0.026	0.008	0.023	0.023
Std. Errors	District	District	District	District	District	District
Panel B: Plant Locations 1938						
LW_{dt}	-0.0301***	-0.0651***	-0.0952***	-0.0128***	-0.0283***	-0.0411***
	(0.0070)	(0.0136)	(0.0179)	(0.0030)	(0.0059)	(0.0078)
Num. Obs.	2459	2459	2459	2459	2459	2459
R^2	0.917	0.871	0.903	0.917	0.870	0.902
R^2 Within	0.011	0.045	0.041	0.010	0.042	0.038
Std. Errors	District	District	District	District	District	District
Fixed Effects	✓	✓	✓	✓	✓	✓

[1] *This includes estimated shadow budgets resulting from* Wechsel-*circulation.*
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

D Bayesian Estimation of Aggregate Effects

This paper has, so far, made no claim about the nature of the aggregate effects of military spending in the Nazi economy. Identifying from such effects is difficult from Nazi-era macrodata, given the low number of observations. Conversely, while my empirical approach identifies local, relative effects, extrapolating aggregate effects from them would suffer from the missing intercept problem. In the absence of a structural model, I use an alternative methodology proposed by Matthes, Nagasaka, and Schwartzman (2025). The authors propose a framework in which aggregate effects can be identified by jointly estimating the local cross-sectional and aggregate time-series effect in a Bayesian model. Their additional identifying assumption is that "the comovement across units in the panel data are well captured by a factor model, with, in the example, one of the factors representing an aggregate government spending shock" (Matthes, Nagasaka, and Schwartzman (2025), p. 3). In my case, this would require that the local Luftwaffe effect is informative enough about the aggregate military spending shock. Then, I can use the local effect to inform the aggregate relationship in a Bayesian model as follows.

Suppose the local OLS estimate is a noisy measurement of the military spending estimand:

$$\hat{\beta} \mid \beta \sim \mathcal{N}(\beta, \widehat{se}^2)$$

Then, I can estimate the aggregate effect from time-series data using a flexible time-series likelihood:

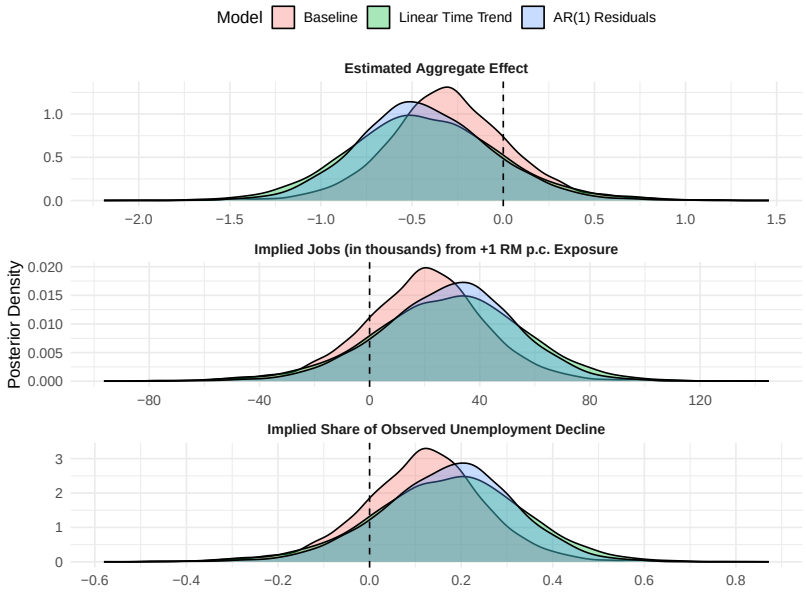
$$\Delta \overline{U}_{t-1932} = \delta \Delta \overline{Exposure}_{t-1932} + e_t$$

where δ is the aggregate effect. The missing intercept is thus $\theta = \delta - \beta$. Standardizing variables allows me to use weakly informative priors for both δ and β.[31]

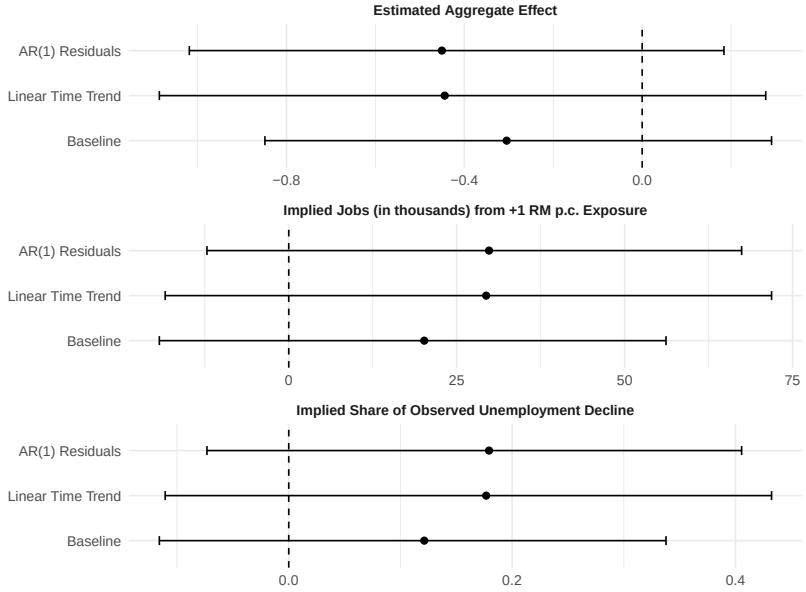
In other words, the Bayesian model estimates the aggregate effect while using by baseline OLS estimator to inform itself on how much of the global variation could be explained by local effects. This remains a challenging exercise, as the number of aggregate time-series observations is low. To address this, I estimate two additional specifications of this Bayesian model: first, I include linear time trends to absorb aggregate movements in unemployment not related to military spending. Second, I use AR(1) residuals to allow a

[31] The results do not change when imposing $\mathcal{N}(0,1)$ or $\mathcal{N}(0,2)$ on both parameters.

persistence of the aggregate shock. The results are reported in Figure A4:



(a) Density Plot



(b) Alternative Plot

Figure A4: Distribution of Posteriors

These results reveal several interesting things. First, due to the low number of aggregate observations, posteriors are widely distributed, and identification is weak. However, when looking at the posterior medians, they suggest sizable aggregate effects, or equiva-

lently, a large missing intercept. Concretely, the estimated aggregate effect, shown in the top-most panel, ranges from about 0.3 to 0.5 - much larger than the local, relative effects identified previously. Assuming that the local relative Luftwaffe effect can capture the effect of military spending as a whole, these numbers imply that an additional Reichsmark per capita spent on the armed forces is associated with the creation of 20-40 thousand jobs, representing somewhere between 10-20 % of the observed reduction in unemployment between 1932 and 1936. Given that per capita Luftwaffe spending was around 28 RM, this could imply a range of 800.000 - 1.000.000 jobs. For comparison, Fremdling and Stäglin (2015) estimate rearmament-induced jobs by 1935 at somewhere between 1.9-2.5 million jobs. Additionally, multiplying this effect with total per capita military spending, estimated job creation would exceed nine million - this improbable result could hint at non-linearities of military spending effects, suggesting decreasing returns to scale.