# Anticipation Effects and Fiscal Multipliers: Evidence from WWII*

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**Abstract**

Correctly estimating fiscal multipliers depends on correctly recording when news of future spending breaks. The leading approach from Ramey (2011) deals with this issue by constructing fiscal shocks using news articles on defense spending. As an alternative, we construct a new measure of excess returns on military contractors over 1936-1947. Excess returns systematically lead the defense news series and produce more persistent dynamic responses of output and government spending. We estimate a long-run fiscal multiplier of 0.7. We consider two explanations for these discrepancies in the context of WWII: slow-moving changes in public expectations and private, pre-war coordination between defense-related firms and the government. For the first, we show that controlling for pre-war expectations of future spending renders both the news series and excess returns poor predictors of government spending. For the second, lagging (leading) the excess returns (defense news) series can approximately reproduce the impulse responses generated by the other, suggesting that firms' returns are measuring the same eventual spending as the defense news series but are responding earlier in time.

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# 1 Introduction

With their overwhelming statistical power in identifying government spending shocks and their plausible exogeneity, large wars have played a critical role in aggregate fiscal multiplier literature. For example, Hall 2009 concludes that essentially all the identifying power in estimating government purchase multipliers from 1930 to 2008 comes from large movements during World War II and the Korean War. That being said, the scale of the fiscal multipliers during major war episodes themselves is often estimated to be small. This is especially the case during WWII, which is widely viewed as the quintessential example of fiscal stimulus. Indeed, numerous studies in the literature using varied approaches in identifying government spending shocks have observed a limited and below-unity fiscal multiplier associated with WWII.

In considering this finding, it is important to note that mismeasurement of the timing of spending shocks can bias estimated fiscal multipliers. This factor can be quantitatively important because large changes in government spending are often expected by the public ahead of actual purchases, which gives households and firms opportunity to respond in anticipation. One leading solution to this problem is to estimate the timing and size of military spending shocks via the news media, as in V. A. Ramey 2011. However, in the run-up to a major war this approach may not succeed because news shocks may not accurately capture when economic actors change the expectations of future spending. For example, while the exact timing of the attack on Pearl Harbor was a surprise, many expected that the U.S. would have to enter the war at some point. Additionally, the pre-WW2 period was characterized by extensive non-public coordination between private firms and government, which could have lead to information leaking ahead of public reporting in a manner similar to what Dube, Kaplan, and Naidu 2011 find in the Cold War era.

In this study, we contend that excess returns on military contractors during WWII correctly capture the timing of military spending shocks and therefore when expectations about future spending changed. The basic intuition is that changes in expected military spending should move expected cash flows for military contractors and therefore excess returns on those firms compared to the whole market. In reasonably functioning financial markets, these excess returns should occur as information is released and their size should capture appropriately discounted expected future changes in military spending.

Essential to this approach is knowing *who* these military contractors are. Fisher and Peters 2010, who pioneered this approach on the post-Korean-War era, relied on a set of large, public, specialized defense contractors. However, such firms did not exist during our period. To

address this challenge, we turn our attention a 1946 congressional report that meticulously documents the economic activities of each industry sector in the U.S. by SIC code both before and during the war. The report also includes valuable information on the distribution of the U.S. government purchases over the same period among industries and among the leading companies within each industry. Based on the 1946 report, together with other historical evidence, we classify aircraft manufacturing and shipbuilding companies as the WWII equivalent to the defense sector used in Fisher and Peters. We also present evidence from the stock market that the excess returns of the aircraft and shipbuilding companies as a group were indeed driven by shocks in the expected government military purchases during our sample period of 1936–1948. For the other companies that also received substantial military contracts at the same time, we find their excess returns were confounded by idiosyncratic shocks related to the movements in the civilian economy. Lastly, we show that there was private coordination between business leaders, who are often major shareholders in their own firms, and the government in the run up to the war.

With our definition of the defense sector, we then estimate the fiscal multiplier associated with WWII. We use our measure of excess returns as an external instrument in a VAR with government spending and output over the time frame 1936–1947, incorporating the important late-30s period in which the public came to expect a large war. We estimate a fiscal multiplier of about 0.7 using the peak impulse response of output relative to the peak response of government spending following an excess returns shock. Our point estimate is similar to that reported by Fisher and Peters 2010 in the post-Korean-War period and the defense-news-based WWII multiplier estimated by V. A. Ramey 2011. In addition, the shape of our government spending and output responses to an excess returns shock is of similar persistence to those observed in Fisher and Peters 2010 and are more persistent than those generated by the defense news series.

We then provide evidence that expectations of future military spending formed prior to the beginning of WWII are key when estimating multipliers using either defense news or excess returns. We start by restricting our sample to 1939-1947 and controlling for 4-5 quarterly lags in our VAR as in V. A. Ramey 2011 This choice means that all expectations about the upcoming war from before 1940 will either be excluded from the estimation or enter the regressions as controls. However, the bulk of actual government spending on WWII occurs after 1940 and so is included in this sample. We calculate very similar point estimates of the fiscal multiplier using either the defense news series or our excess returns series. However, the output and government spending responses to either the news shock or the excess returns shock are insignificant under this specification with short-run responses at (for news shocks) or below (for excess returns)

zero. These results suggest that the bulk of both series' explanatory power comes from pre-war observations and therefore from expectations of spending formed far ahead of spending actually occurring.

Finally, we argue that expectations effects can impact the persistence with and lag at which government spending is estimated to impact output. First, we estimate that the excess returns series leads the Ramey news series by several months. Second, we show that re-estimating our VAR using forwarded defense news shocks — in essence replicating the timing of the excess returns series — yields estimated government spending dynamics that match the original excess returns results. Conversely, using lagged excess returns gives similar estimated dynamics as the original defense news results. This exercise suggests that excess returns are measuring the same eventual change in government spending as the defense news series, except earlier in time. Lastly, the greater persistence of output in response to an excess returns-instrumented government spending shock suggests that there are early expectations-driven adjustments occurring that the defense news series does not capture.

This paper connects to the large literature on fiscal multipliers and military spending. One secction of the literature estimates spending shocks using a contemporaneous-timing restriction. This includes the work of Blanchard and Perotti 2002, Berndt, Lustig, and Yeltekin 2009, Fatas and Mihov 2001, Gali, Lopez-Salido, and Valles 2007, Mountford and Uhlig 2009, Perotti 2005 and Perotti, Reis, and Ramey 2007, etc. They directly impose a timing restriction on government expenditures in a vector autoregression (VAR) where the government spending is ordered first. Among other similar studies using this approach, Hall 2009 finds that a lower bound for the GDP multiplier during 1930–2008 is around 0.5 with a similar point estimate for the 1939-1948 period. An important and common critique of this approach, however, is that imposing such a restriction assumes that the economy will not respond ahead of time via expectation effects.

To account for the possibility that news of exogenous government spending shocks arrives prior to spending itself, the second main method implemented by the literature employs a narrative approach and uses historical records to construct a measure of government spending news. Works that follow this line of the literature include Ramey and Shapiro 1998, Edelberg, Eichenbaum, and Fisher 1999, Burnside, Eichenbaum, and Fisher 2004, Cavallo 2005, Eichenbaum and Fisher 2005, and V. A. Ramey 2011. In the most relevant example, V. A. Ramey 2011 creates a series of defense news based on both historical news records, such as those from *Business Week*, and professional forecasts to control for the expected government spending. She estimates a slightly above-unity output multiplier (1.1) for the full sample of 1939–2008,

but the multiplier drops to 0.7 for 1939–1949.[1] We view this approach, and especially Ramey's implementation, as the most relevant comparison point for our work here.

As an alternative to news shocks, Fisher and Peters 2010 develop a novel asset-pricing-based approach to estimating fiscal multipliers using government spending. They use statistical innovations in the excess returns of the top U.S. military contractors in the stock market to identify government spending shocks and estimate an output multiplier of about 1.5 over a horizon of five years for the post-Korean War period (1958–2007). They report a multiplier with a much stronger size and persistence compared to estimates in the previously discussed literatures. Unfortunately, however, their implicit first stage is shown by V. Ramey 2016 to be insignificant, largely mirroring her own findings that her defense news series is unpredictive during the bulk of the Cold War.

Lastly, related work has used military contract-level data to estimate multipliers using cross-sectional variation to estimate multipliers. Work from Nakamura and Steinsson 2014 and Auerbach and Gorodnichenko 2012 apply this approach to post-Vietnam periods. Brunet 2018 focuses on WWII and uses a state-level panel with detailed war supply contracts issued by the U.S. government during 1940–1945 to estimate an open economy relative multiplier. She finds a relative fiscal multiplier of around 0.25, which implies an aggregate multiplier of around 0.3, a result consistent with the finding from Hall 2009 using the sample of 1939–1944. Dupor and Guerrero 2015 extend the Nakamura and Steinsson state-level military contract series back through the Korean War and estimate relative multipliers that are less than 1.

The remainder of the article proceeds as follows. Section 2 presents and argues for our definition of the defense sector using historical evidence. Section 3 discusses the construction of our excess returns series and compares them to returns on other plausible definitions of the defense sector. Section 4 presents our main estimates of the fiscal multiplier. Section 5 compares our excess returns series and the defense news series. Section 6 offers concluding remarks.

## 2 Defining the Defense Sector

The key to applying the stock market-based approach from Fisher and Peters 2010 is locating a well-defined defense sector. Ideally, the excess returns of the defense sector relative to overall market returns should be driven predominantly by the market expectations regarding government military expenditures. During a major war, changes in government military spending

1. The output multiplier for the post-WWII sample is estimated to be around 0.6 to 0.8, though the data source of Ramey's defense news series switches from historical news to professional forecasts during the post-Korean War period, when the historical news lose explanatory power and become not informative.

should be based primarily on the war effort instead of economic concerns. Thus, the exogenous shocks in government purchases can be captured by the defense sector's excess returns if the market is sufficiently efficient.

However, an empirical challenge in implementing the stock market-based approach during the Second World War is that the modern defense industry in the U.S. was largely non-existent. In fact, the entire U.S. economic environment during the war was characterized by several unique conditions that are not seen during peacetime. Thus, in order to find an appropriately classified defense sector, it is therefore necessary to understand the wartime environment that characterized the U.S. economy during the WWII era.

### 2.1 The Unique Economic Environment of WWII

The first important characteristic of the U.S. economy during the WWII is the enormous increase in government defense spending. While today we consider the military buildup during the Cold War and the spending for the Iraq War to be huge expenditures, figure 1 demonstrates that these numbers are dwarfed by the increase in military expenditures during WWII. This drastic surge in government purchases makes WWII the quintessential example of fiscal stimulus.

The second key feature of the wartime economy is that, despite the massive upswing in military spending, there was not a well-developed defense industry specialized in producing for the military demand. In fact, before Pearl Harbor in December 1941, the U.S. defense industry was largely non-existent, and was certainly not prepared for a total war Nelson 1946. As a result, the U.S. government had to rely upon converting a significant portion of the civilian economy to produce for the war effort. One of the most notable examples is the total conversion of the automobile industry: in early February 1942, the civilian purchases of automobiles were banned through a consumption rationing order[2]. The entire industry was then converted to military production, and normal production for civilian sales did not resume until near the end of the war in the summer of 1945 Mansfield 1948.

The fact that the wartime production conversion was critical for the war effort can also be seen from President Eisenhower's farewell address on January 17, 1961:

> Our military organization today bears little relation to that known by any of our predecessors in peacetime, or indeed by the fighting men of World War II or Korea. Until the latest of our world conflicts, the United States had no armaments industry.

2. The Rationing Order No.2 (OPA, 1942).

> American makers of plowshares could, with time and as required, make swords as well.

As will be discussed in the next section, wartime production conversion of civilian industry was intense and widespread; almost all areas of the U.S. economy were involved in contributing to the war effort.

In addition to these two main characteristics, there are also several other conditions that distinguish the behavior of the U.S. economy during WWII from the peacetime era. These conditions can be summarized as follows: 1) An extensive sequence of consumption rationing orders with a strict price and wage control. 2) A near ZLB interest rate environment combined with an expansionary fiscal policy, along with rising inflation that was intentionally created as a coordinated move for the war effort. 3) A high corporate and individual income tax environment despite the fact that the war was primarily financed through debt issuance. 4) A strong saving boom in the form of war bond purchases fueled by patriotism and economic constraints.

Together, these unique wartime economic environment factors may suggest a depressed fiscal multiplier during the days when the U.S. actively engaged in the conflict; that is, from December 7th, 1941 (Pearl Harbor) to September 2nd, 1945 (V-J Day). As a demonstration, we can use the textbook New Keynesian multiplier $1/(1 - MPC)$. During the war, a large chunk of the government expenditures need to be on wartime production conversion and the eventual reconversion to civilian production when the war ended. This spending would not be used to directly generate output, which means that the numerator of the multiplier would be smaller than 1. Meanwhile, the marginal propensity to consume for civilian populations is constrained by consumption rationing orders, high inflation and the tax environment, a strong Ricardian motive associated with the surge in public debts, and other factors, all of which would increase the denominator. Combining both considerations, the fiscal multiplier during WWII would be severely constrained, as argued by Brunet 2018, Fishback and Cullen 2013, Gordon and Krenn 2010, among others. Given that the stock market-based approach tends to yield a well above-unity multiplier during the post-Korean War period, it is interesting to see if the same approach can provide a consistent estimate compared to the figure reported by the existing literature when applied back to the sample of WWII.

However, the unique economic conditions of the wartime period also pose two serious concerns. The first concern is that if there was not a true defense sector, and all companies who produce for the war effort were converted from civilian production, then the excess returns of the "defense sector," especially during the period before the war, will almost certainly have

components related with the general economic environment and forecasts about future civilian spending. These components will directly render the identified government spending shocks endogenous. Secondly, if the "defense sector" contains almost all producers in the market, then the sector's stock returns would simply track the overall market performance and there would be no variation in the excess returns with which to identify the government spending shocks.

On the other hand, if we can find an appropriate defense sector that meets the requirement of the stock market-based approach, then the unique economic environment of WWII becomes an opportunity. Since many standard margins of adjustment such as prices and wages were fixed by law, the period provides a potentially cleaner setting for evaluating the direct effects of increased government spending on output. Additionally, strictly implemented consumption rationing orders can help address common worries about contamination of defense sector excess with changes in sales to civilians. Given the importance of finding the correct defense sectors, we spend the next three sections explaining our classification procedure.

### 2.2 Identifying the Defense Sector through War Supply Contracts

To address the challenge of locating an appropriate defense sector, we turn our attention to a 1946 congressional report, titled *Economic Concentration and World War II*. This report was prepared by the Smaller War Plants Corporation for the Senate Small Business Committee to examine the economic concentration and activities of the U.S. before and during the Second World War. It meticulously documents the economic activities of each industry line in the U.S. by SIC code and includes valuable information on the distribution of the U.S. government purchases during the WWII era. This information on the distribution of the government purchases is of particular importance, as it records the defense related procurement from all branches of the government among all industries as well as the leading companies within each industry both before and during the war.[3]

The first piece of information we obtain from the report is that, during the war, the U.S. economy can be generally divided into war and nonwar industries. The war industries, such as iron and steel, machinery, aircraft and shipbuilding, petroleum and coal, etc., include the manufacturing of products that are directly related with military actions. The nonwar industries, such as food and related products, tobacco, textiles and apparel, lumber and furniture, etc., are outputs that can either indirectly support military actions or are not closely related with

3. From the report perspective, the U.S. joined the war on December 7th, 1941. The majority of the information covered by the report goes back to 1939 or 1935. The report also contains statistics for output, employment, and merger movements of certain industries back to 1909 or 1919.

the war effort.[4]

The second piece of information we learn is that both war and nonwar industries received a substantial amount of supply contracts from different government procurement agencies during the conflict. For war industries most, if not all, of the government purchases came from war supply contracts issued by the War Production Board. For the nonwar industries, government procurement generally took the form of various types of supply contracts issued by the Quartermaster Corps of the War Department. For example, at the same time General Motors was awarded war supply contracts to build tanks and bomb shells, textile manufacturers also received procurement arrangements and employed a primary allocation of strategic agricultural resources, such as cotton, to supply the army with uniforms. According to the report, the Quartermaster Corps was the largest procurement agency during the war.

What makes war and non-war industries different is that, compared with the supply contracts distributed by the Quartermaster Corps, the issuance of the war supply contracts within war industries was much more heavily concentrated and usually took place after an extensive period of negotiation for a guaranteed profit. From June 1940 through September 1944, around $175 billion worth of prime supply contracts were issued to 18,539 corporations by the War Production Board.[5] Among the $175 billion worth of the contracts, around 62% were awarded to the top 100 corporations. More than 51% of the worth of the contracts went to the top 33 companies, each of which received awards totaling $1 billion or more. Around 30.1% worth of the contracts were issued to the top 10 firms, around 20.3% were issued to top 5 firms, and General Motors, the top contractor, received around 8% worth of the total awards. Among the top 5 corporations, three are aircraft companies (Curtiss-Wright Corp., Consolidated Vultee Aircraft Corp., and Douglas Aircraft Co.) and two are automobile manufacturers (General Motors and Ford Motor Co.). The top 10 contractors cover the aircraft, shipbuilding, and automobile manufacturing industries.[6] In addition, the report finds no significant change in the

4. The complete list of the war industries highlighted by the report includes iron and steel and their products, metal products (electrical machinery, machinery excepts electrical, transportation equipment excluding aircraft and shipbuilding, aircraft and shipbuilding), products of petroleum and coal, rubber products and synthetic rubber, and chemicals and allied products. The complete list of the nonwar industries highlighted by the report includes food and allied products, tobacco, textiles and apparel, leather and leather products, paper and paper products, printing and publishing, lumber and furniture, and stone clay, and glass products.

5. The figures relating to the awards of the prime war supply contracts are based upon prime awards of $50,000 and over reported to the WPB by the Army, Navy, Maritime Commission, Treasury Procurement Division, and purchasing missions of foreign governments. Lend-lease and defense aid contracts awarded by the above agencies are included. Treasury awards include only such contracts. The record does not include contracts for gas, light, heat, power, and similar utility services, contracts for food or food processing, and contracts for construction or expansion of production facilities.

6. The top 10 contractors, ranked by the value of the awarded contracts, are General Motors, Curtiss-Wright, Ford Motor, Consolidated Vultee Aircraft, Douglas Aircraft, United Aircraft, Bethlehem Steel (shipbuilding),

concentration of the contract awards between 1941 and 1944.

The fact that a detailed negotiation for profits usually precedes the issuance of the war supply contracts is also shown in historical records regarding the situation back in 1940. Holley 1964, for instance, summarizes the demands faced by the Army Air Force in 1940 during its materiel procurement:

> They [businessmen] wanted escalator clauses to protect them against unanticipated increases in the cost of labor and materials; they refused to sign liquidated damage clauses that would penalize them for belated deliveries; and, they were reluctant to include the usual option clauses granting the government the right to procure further increments of aircraft in the future at stated prices.

In contrast, though a large amount, the procurement arrangements made by the Quartermaster Corps were significantly less concentrated, potentially due to the more diverse nature of the nonwar industries. Based on the data provided by the congressional report, in 1944, the top 7 cotton textile manufacturers only received a grand total of around $128.79 million worth of the supply contracts. This is a relatively small number, particularly considering that 1944 was the peak year for government expenditures during WWII. Additionally, the cotton industry is one of the more concentrated nonwar industry lines, so the top 7 capture the majority of this industry.

As a result, if we classify the defense sector using any industry that had ever received government military purchases or was influenced by consumption rationing orders during the war, it is more than likely that our defense sector would include the majority of the firms in the market. As mentioned earlier, this would fail to meet the identification requirements for the stock market-based approach. On the other hand, the top contractors from the aircraft, shipbuilding, and automobile industries seem to offer a promising definition for the defense sector. With the staggering degree of concentration of prime war supply contracts and the extensive negotiations prior to the contract awards, it is likely that the excess returns of this group of firms were heavily affected by expected government military spending during the war.

However, a high concentration of prime contract awards may mask the distribution of profits among firms within the same production network. A strong influence of expected military

Chrysler, General Electric, Lockheed Aircraft. In addition, the top 50 contractors include most of the important shipyards or ship manufacturers, such as Kaiser, Henry J. Co, Newport News Shipbuilding & Drydock Co., Todd Shipyards Corp., Aviation Corp. (New York Shipbuilding Corp.), California Shipbuilding Corp, Bath Iron Works, etc.

purchases in excess returns may coexist with significant components related to the performance of the civilian economy. These concerns will be addressed in the subsequent sections.

### 2.3 Do Subcontractors Matter?

To examine whether the profits generated from prime supply contracts were shared by producers in the same production network, we examine the subcontracting activities within the war production effort. Under the system of procurement adopted at the very beginning of the war effort, prime contractors were given complete autonomy to obtain the materials, components, and parts needed to produce the final output for which they had been awarded the prime contract. This means, of course, that the figures on the prime contract awards could overstate the concentration of the war production, since a portion of these prime contracts was passed down to other firms in the form of subcontracts.

To evaluate the magnitude of these subcontracting activities, we turn to a survey conducted by the Smaller War Plants Corporation in 1943, which was documented in the congressional report. This survey contains the prime and subcontracting records of 252 of the largest corporations in the U.S. that received the bulk of the prime contract awards. The survey finds that these companies subcontracted 34% of the value of their prime contracts, but also that three-fourths of the value of these subcontracts went to other large companies (firms with over 500 employees by the standard of the report) in the relevant production lines. The large company subcontractors, in turn, passed along 13% of their subcontract business to further subcontractors. 56% of these lower-tier subcontracts were received by other relevant large firms. Overall, the survey concludes that the majority value of the prime contracts awarded to the large companies in fact stayed within a group of similarly large firms. In addition, there existed substantial subcontracting activities among the large companies within the same production network.

The evidence so far suggests that a high concentration of government purchases occurred and remained within the scope of public aircraft, shipbuilding, and automobile companies during WWII, rather than being subcontracted away to other smaller firms. Meanwhile, the entire industry as a group, rather than only the top contractors, felt the heavy influence of the government spending due to both the concentrated prime contract awards and the significant subcontracting activities within the relevant production lines. This point can be further reinforced by the fact that the U.S. government was the dominant, if not the only, customer of the aircraft, shipbuilding, and automobile industries during the conflict, given the strict consumption rationing orders effectively preventing civilian sales.[7] Therefore, to better capture

7. The automobile industry was completely converted to war productions under the Rationing Order No.2.

the expectation effects on government military expenditures, it is reasonable for us to take the excess returns of the public companies in the aircraft, shipbuilding, and automobile industries as a group into consideration.

### 2.4 Other Historical Evidence

Now that we have proposed the public aircraft, shipbuilding, and automobile companies as the potential candidates for the defense sector, it is important to check if their excess returns were primarily driven by the expected government military expenditures without confounding factors, especially during the periods before and around the end of the war. In this section, we consult evidence from other historical sources to show that the excess returns of the aircraft and shipbuilding companies can in fact meet the identification requirements of the stock market-based approach. The returns from the automobile industry, however, are confounded by factors related with the performance of the overall economy.

For the aircraft and shipbuilding industry, we first turn to event studies that investigate the profitability of U.S. defense contractors prior to and during WWII. Kaen 2012 and Ciccone and Kaen 2016 point out that, because civilian demand was not yet recovered after the Great Depression, stock returns of the aircraft and shipbuilding sector were weak through the recession of 1937–1938. However, the period from March 1935 to March 1938 marked a change in the attitude of the market from pacifism to war anxiety, and after this the returns of the aircraft and shipbuilding sector began to be driven by the anticipation of the upcoming war and the potential arrival of large defense sales. In particular, the returns of the aircraft manufacturers were driven by export sales in 1939; these had reached $194.2 million and accounted for around 44% of the year's total sales Vander Meulen 1991. Export sales are an important concern when using excess returns to identify government spending shocks, since these sales are driven by foreign demand instead of the U.S. government. However, export sales collapsed one year later after the fall of France. From then on, the majority of the foreign sales took the form of lend-lease, which was counted towards U.S. government expenditures. Thus, although the existence of foreign sales introduces a confounding factor, these sales were not driven by economic concerns in the U.S, which preserves the usefulness of this approach. Furthermore, the degree of concern is mostly mitigated by the record-breaking U.S. military spending during the war and the short-lived nature of these prewar foreign exports.

Interestingly, upon the U.S. actually joining the war in 1941 the aircraft and shipbuilding

The civilian sales in the aircraft and shipbuilding industry were almost impossible during the war, because all strategic resources needed to build or use the output, such as iron, steel, tin, fuel oils, etc., were under strict rationing and generally could not be accessed for any civilian purpose.

industry's stock returns began to decline as the expected issuance of the supply contracts materialized. However, this downturn in returns occurred while most of the aircraft and shipbuilding companies enjoyed an improved accounting profit. Ciccone and Kaen 2016 posit that this phenomenon is caused by the expectation of the temporary nature of the government military expenditures, as investors believed that civilian demand would not continue at wartime levels after the war.

The belief that the civilian demand of the aircraft and shipbuilding sector would not increase to match wartime levels after the war, despite a recovering economy, agrees with the literature about the U.S. post-war reconversion experience. As Rhode 2003 documents, employment in the manufacturing sector on the U.S. West Coast fell sharply in 1945, but almost all of the contraction was from the aircraft and shipbuilding sector. Many of the other war industries, such as chemicals, petroleum, rubber tires, and automobile manufacturing recovered quickly after their initial cutback in the wartime military demand. The aircraft industry on the West Coast suffered a severe contraction between 1945 and 1947, but activities soon stabilized at a level above pre-war production due to the resumption of military orders in 1948. The shipbuilding sector, however, virtually collapsed. For several years after mid-1947, the industry received no orders for new ships and performed only repair work.

The experiences from the U.S. West Coast, which may not be identical to the situation in the entire U.S., can at least provide some evidence that the nature of the aircraft and shipbuilding industry during the WWII era had a fundamental connection to government military demand. Given that the aircraft and shipbuilding sector were heavily concentrated on the West Coast before the war and many of their factories were constructed as the conflict raged (Rhode, 2003), we can have further confidence in this evidence.

Finally, the last piece of evidence for using the aircraft and shipbuilding companies as our defense sector comes from the definition of the modern defense sector used by Fisher and Peters 2010. Upon replicating the stock market sample for the list of SIC codes they deem to have a clear military focus from 1958–2007, we find that the top 5 subsectors of the SIC codes are: Aircraft and Parts (SIC 3720), Aircraft Parts and Auxiliary Equipment (SIC 3728), Aircraft (SIC 3721), Aircraft Engines and Engine Parts (SIC 3724), and Ship And Boat Building (SIC 3730). Together, these sectors form 77.57% of the sample for the modern defense sector.

The returns from automobile manufactures paint a quite different picture, however. To begin with, it was well-documented that the auto industry suffered substantial losses during the recession of 1937–1938 due to a loss in auto sales and a general decrease in durable consumption.

Kaen 2012 documents that the returns of the automobile sector recovered in 1938 upon the end of the recession, before starting to decline again in the final days leading to the Pearl Harbor. During this period, there was a widespread concern in the market fueled by rising anxiety over losing sales upon entering an all-out war. The returns of the auto industry started to bounce up again when the industry was converted to the war effort that replaced the loss of wartime civilian sales with a guaranteed profit from the supply contracts. As shown in Kaen 2012, this rise continued till the end of the war, as investors expected a boom in the economy due to pent-up wartime consumption demand.

Considering this, the existing event studies make a solid case that the excess returns of the automobile companies likely include components significantly correlated with the expected performance of the civilian economy. These concerns make it likely that the identified government spending shocks would be endogenous. Meanwhile, for the aircraft and shipbuilding sector WWII, in a sense, acts as a natural experiment. The sector's excess returns were predominately driven by the drastic swings in defense expenditures during the WWII era. The effects of civilian demand were not influential before the war due to the Great Depression, and civilian sales were also not expected to catch up after the war because the defense purchases during the war were so high.

Based on the evidence presented in this section, we conclude it is reasonable to consider that the excess returns of the public aircraft and shipbuilding companies during the periods associated with WWII were dominantly driven by the expected government military expenditures. Thus, they can be used to identify the exogenous government spending shocks. We provide direct supports in the next section by examining the stock market returns of the relevant sectors.

# 3 Excess Returns on the Defense Sector

In this section we discuss the construction of our excess returns series and examine the excess returns of large firms, firms seriously involved in war contracting, the automobile industry, and of top military contractors to provide further evidence that the excess returns on shipbuilding and aircraft companies best capture exogenous government spending changes and not domestic economic factors.

## 3.1 Returns Data and Construction

The stock market data used in this analysis comes from the complete monthly records of CRSP that covers all public companies from January 1936 to January 1950. We choose to start our

sample in 1936, since it is early enough to cover the transition period from 1935 to 1938 and the recession of 1937-1938. As documented by Kaen 2012 and Ciccone and Kaen 2016, the period between 1935 and 1938 witnesses a change in attitude from pacifism to war anxiety both in the U.S. economy and in the stock market. If the excess returns of a section were driven by expected defense sales, we should expect an increase at least after this period. The recession of 1937-1938, on the other hand, can serve as an useful check point to see if the excess returns were heavily influenced by economic concerns.

The sample of the market return plots ends in January 1950 to allow us observe the market responses after the War Scare of 1948. As Rhode 2003 and Ciccone and Kaen 2016 point out, the aircraft and shipbuilding industry experienced a severe decline soon after the end of the conflict upon realizing the loss of demand. The depressed industry was saved in 1948, at least for the aircraft manufactures, after Truman and his associates arguing for the need to contain Soviet expansion and inaugurating a military buildup.[8] If the excess returns were dominated by the expected government purchases, this event should mark a turning point in their performance. At the same time, since the War Scare of 1948 was more related to the Cold War buildup, we stopped our regression sample in December 1947 to focus on the expectation effects during the WWII era.

Following Fisher and Peters 2010, the stock market returns used in this paper are calculated as follows. For any group of firms, the monthly returns of the group are calculated as the market-value-weighted sum of the total holding period returns of the individual stocks in the group during any given month. The total monthly holding period return of any individual stock is fully adjusted for splits, dividends, and inflation. We use the market value at the beginning of the month to weight the monthly holding period returns of the individual stocks. The overall market returns are computed similarly as the market-value-weighted sum of the monthly returns of all publicly traded companies in the market. For any given month, the excess return of a given group of firms is defined as the difference between the monthly holding period return of the group and that of the market. Since the excess returns are often noisy and can mask important low frequency movements, we focus on the accumulated excess returns in our analysis consistent with the practice of Fisher and Peters 2010.[9] For the remainder of this paper, the accumulated excess returns are normalized to 1 in the first period of observation of any given sample for ease of comparison.

8. As a related note, the Berlin Airlift began in June 1948 and lasted till May 1949.

9. The accumulated excess returns are calculated by accumulating the excess returns over each month, where each excess returns are computed based on the corresponding monthly holding period returns.

### 3.2 Returns of Historical Dow Firms

To start the analysis, figure 2 plots the accumulated monthly holding period returns and the accumulated excess returns of the historical Dow firms.[10] We choose to start our analysis with the Dow firms because doing so can help us understand the baseline performance of the large companies as a whole during this period.

As shown by figure 2, panel A, the performance of the Dow firms in fact tracks the overall market returns in a very close manner, suggesting the size of the firms did not play a critical role in driving the returns during the sample. In addition, we can see that the market performance reflects the economic conditions during this era. In particular, the market experienced a significant downturn during the recession of 1937-1938, before bouncing back in mid-1938. Then there was a general decline following the Fall of France in 1940 till around the first quarter of 1942, indicating a spread of concerns about the performance of the economy during an all out war. Once the majority of the supply contracts started to flow from the government, however, the market entered a stage of "war boom" and continued to rise until after the end of the war, fueled by the expectations on a post-war economic recovery and the release of the pent-up consumption demand. The rapid growth in the market was put to an end in 1946, when regulators increased stock market margin requirements in to 100% from 75%. In order to meet those new requirements, many investors were forced to sell their shares, which contributed to the market going into a short-term tailspin. The market returns stayed relatively stabilized, before starting to rise into the booms of the 1950s. Compared with the overall market returns, if anything, the Dow firms as a group did not beat the market over this period. figure 2, panel B shows that for a dollar invested in the Dow firms in 1936:m1, one would get approximately 5 cents less either by the end of the war or by 1948:m1, compared to investing the same dollar into the overall market portfolio after adjusting for inflation.

### 3.3 Returns of War Sector Firms

To investigate if the industries heavily affected by the war behaved systematically differently from the rest of the economy, we define a group of rationed sectors using the 3-digit SIC codes lie within the scope of the consumption rationing orders issued during WWII.[11] The information on

10. The Dow firms include the historical components of the Dow Jones Industrial Average from 1936 to 1957.

11. Our current list of the rationed sectors include Metal Mining (SIC 100), Coal Mining (SIC 120), Oil and Gas Extraction (SIC 131, 138), Building Construction (SIC 150), Textile Mill Products (SIC 221, 225, 227), Lumber and Logging (SIC 241), Chemicals (SIC 283, 289), Petroleum Refining (SIC 291, 299), Rubber and Plastics (SIC 301, 309), Footwear (SIC 314), Primary Metal (SIC 331, 335), Transportation (SIC 371, 372, 373, 374, 379), Passenger Transportation (SIC 411, 419), Motor Freight, Storage, and Warehousing (SIC 422), Water

the consumption rationing orders comes from various historical records detailing the wartime activities of the Office of Price Administration and the War Production Board (OPA, 1942; WPB, 1945; Mansfield, 1948). We also classify the war and nonwar industries documented in the 1946 congressional report by their 3-digit SIC codes.[12]

The stock market performance of the rationed sectors and the war and nonwar industries are displayed in figures 3, 4, and 5 respectively. Upon examining the monthly returns of each group of the industries, as demonstrated by panels A of the figures, one can find that there is almost no difference between the returns of the group and the overall market returns. This is consistent with the narrative evidence that the influences of the war were profound and widespread in the U.S. economy. In a sense, almost all areas of the economy were involved to contribute for the war effort.

This finding also supports the argument that one should not use the industries that had ever received government military purchases or were impacted by the consumption rationing orders during the war to form the defense sector. Doing so will likely place an overwhelming number of firms in the market to the defense sector such that the excess returns would offer little variation. Furthermore, by applying an overgenerous definition, one would risk invalidating the identification requirements by introducing confounding factors correlated with the economic concerns into the defense group. As have mentioned earlier, the stock market performance during this era indeed reflects the general economic environment.

panel B of the figures examines these excess returns in more detail. Though the overall variations are small, we can still observe that the rationed sectors and the war industries performed differently with the nonwar industries in an expected way. Specifically, both the rationed sectors (figure 3, panel B) and the war industries (figure 4, panel B) tend to outperform the market by around 10% during the war, while the nonwar industries (figure 5, panel B) suffered an approximately 10% loss in the excess returns. However, the nonwar sector quickly bounced back at the end of the war.

A notable feature from panels B of figures 4 and 5 is that the excess returns of the war industries started to rise both before WWII and soon after the War Scare of 1948, while the excess returns of the nonwar industries generally declined at the same time. This behavior indicates, even though the return variations are small, the excess returns of the two industries can still pick up influences from the expected military expenditures.

Transportation (SIC 440), General Merchandise Stores (SIC 531, 532, 533, 534), and Automotive Dealers and Gasoline Services (SIC 533).

12. See footnote 6 for the definitions of the war and nonwar industries.

### 3.4 Returns on Aircraft and Shipbuilding Industries vs. the Automobile Industry

Figures 6 and 7 plot the stock market performance of the aircraft and shipbuilding companies vs. that of the automobile firms. As can be seen from panels A of the two figures, compared with the monthly accumulated returns of the previous groups, the stock returns of these two sectors now display significant differences compared to the overall market returns. Contrasting their excess returns in details, one can observe several important differences.

The first distinct feature, as shown by panels B of figures 6 and 7, is the auto sector suffered a much significant drop during the recession of 1937-1938 compared to that of the aircraft and shipbuilding companies. This is consistent with the narrative evidence that the automobile industry experienced a considerable loss in civilian sales during the recession, while the civilian demand for the aircraft and shipbuilding sector was weak throughout the later years of the Great Depression.

The second notable point is that the excess returns of the aircraft and shipbuilding industry were driven by almost all influential events signalling an outbreak of hostile actions, including, among others, Germany annexing Austria in March 1938, Germany taking over Czechoslovakia in September 1938, the invasion of Poland in September 1939, the military buildup in the U.S. after 1940, and the War Scare of 1948 (See figure 6, panel B). In comparison, upon recovering from the recession in 1948, although the excess returns of the automobile industry displayed similar positive responses around 1939 and 1940, their returns declined seriously during the U.S. military buildup period beginning in mid-1940. In addition, the industry's returns dropped after the War Scare of 1948 (See figure 7, panel B). These movements make it hard to argue that automobile industry returns were in fact orthogonal to domestic economic conditions. In fact, according to Kaen 2012, the decline in excess returns before Pearl Harbor reflects the concerns over a loss in auto sales upon the outbreak of a total war.

In addition to the above characteristics, we can observe that the returns of the aircraft and shipbuilding sector indeed declined during the war, which is consistent with the observation made by Ciccone and Kaen 2016 that, upon realizing the arrival of the supply contracts in 1942, investors started to foresee the temporary nature of the government purchases as the civilian demand was not strong enough to begin with to replace the wartime military demand. This point is further reinforced by the decline of the returns soon after the end of the conflict until the Cold War buildup initiated in January 1948.

As for the automobile sector, the excess returns jumped upon the conversion to war production as the supply contract awards with a guaranteed profit effectively removed the concern

about the loss in civilian sales. Furthermore, though with an initial set back after the end of the war, the sector's excess returns recovered almost one year earlier than those of the aircraft and shipbuilding industry, consistent with the narrative evidence documented in Rhode 2003.

In the end, a curious phenomenon recorded by figure 6, panel B is that the excess returns of the aircraft and shipbuilding firms increased since mid- or late-1944 till around the end of the war, despite the fact a final victory was well-expected during this period. This late-war bump in the excess returns can be explained by two reasons according to Ciccone and Kaen 2016. The first explanation is that there was in fact a renewed arrival of the supply contracts due to the large scale operations involved in the the Normandy Landings. In addition, there were a sequence of unexpected setbacks towards the end of the war, notably, Operation Market Garden, that created an impression that the war would last longer. The market, and the army, was also uncertain about the prospects of a landing in Japan as well as the scope of military spending needed in maintaining peace in the post-war Europe. However, as the uncertainty soon cleared and it was certain that there would be no more supply contracts, the returns of the industry collapsed, as what we have seen from the post-war period. This occurrence can provide an example that we could identify uncertain expectations that never materializes by using the stock market-based approach.

### 3.5 Returns of Top Contractors

The last set of figures document the stock market returns of the top 5 and 10 war supply contractors reported by the 1946 congressional report. As can be seen from figures 8 and 9, the monthly holding period returns and the excess returns of the top contractors resemble features strikingly close to those of the automobile manufacturers. This is perhaps not surprising considering that large automobile companies dominate the top 5 and 10 contractors with GM along received 8% of the $175 billion worth of the war supply contracts. In unreported results, we show that the excess returns of top contractors were in fact driven by the returns of GM. After dropping GM from the sample, the returns of the top 5 contractors look remarkably close to the return patterns of the aircraft and shipbuilding firms.

However, as argued before, due to the intensive subcontracting activities and the endogeneity concerns associated with the excess returns of the automobile manufacturers, it is more appropriate to use the aircraft and shipbuilding companies as the defense sector to identify exogenous government spending shocks using excess returns.

# 4 Estimation of the Fiscal Multiplier

This section discusses the mapping from excess returns shocks to government spending shocks in greater detail and then estimates fiscal multipliers using these shocks. Our main analysis starts at the the monthly level to take advantage of the high frequency of stock market data. We estimate a fiscal that is largely in line with the existing literature but with a substantial lag between when the shock occurs and when government spending and output respond.

## 4.1 Identification of Government Spending Shocks using Excess Returns

The key assumptions of the stock market-based approach are that innovations to government spending can be identified by innovations to the excess returns of the defense sector and that these shocks are orthogonal to the current state of the economy. With these assumptions, the fiscal multiplier can be estimated via a VAR including the necessary macroeconomic variables representing the state of the economy together with the excess returns, where the excess return variable is ordered first with a timing restriction.

Because wartime spending was done with military and not domestic economic goals in mind, these government spending shocks can be considered as exogenous. As we have established that excess returns of the aircraft and shipbuilding companies during this era were dominantly driven by expected government expenditures, the exogenous government spending shocks can be identified by the excess returns of the defense sector, assuming the market is sufficiently efficient.

Of course, the stock returns of the aircraft and shipbuilding firms can be driven by a wide range of factors other than government defense spending. The performance of these companies can be impacted by the state of the economy through the cost of inputs and civilian sales. The stock returns of an individual firm are affected by idiosyncratic shocks unique to the company. These issues, however, can be addressed by the focus on the excess returns relative to the overall market performance, which should capture the influence of macroeconomic fluctuations. We also consider the combined returns of the aircraft and shipbuilding companies as a group. This should alleviate the concerns over firm-level idiosyncratic determinants that are not related to the expected government expenditures. In fact, as we have shown, the civilian demand of the aircraft and shipbuilding industry was not strong to begin with, and the nature of the industry had a deep connection to the expected defense sales during the WWII era.

Since the focus of our analysis is the aircraft and shipbuilding industry, it is possible that the industry as a whole was influenced by factors correlated with the government expenditures. For

example, the production technology of the industry may evolve at a higher trajectory compared to the rest of the economy due to the vast amount resources the government poured in for the relevant research and development. It may also very well be the case that the industry enjoyed a higher markup, given the awarded supply contracts often include a guaranteed profit. The potentially high markup can also result from the industry's capital-intensive production. Since the relative price of the capital could be falling during the war due to a heavy government subsidy and a shortage of labors, the markup of the industry could be increasing.

To account for the concern that the excess returns of the industry may have an upward trend during the study period, we further include a linear trend term in our VAR analysis, which is also the practice of Fisher and Peters 2010. The argument is, by controlling for the trend term, the remaining variations in the excess returns of the defense sector are overwhelmingly dominated by the exogenous shocks in the government military demand.

### 4.2 Monthly Data

The sample of our monthly estimation lasts from January 1936 to December 1947. The beginning of the sample is early enough to include the relevant expectation formation regards the upcoming of the war. As mentioned before, the period around 1936 witnesses an important change in attitude of the market from pacifism to war anxiety. At the same time, our sample ends before the War Scare of 1948, which can be considered as the start of the Cold War military buildup. Doing so would therefore allow us to better focus on the expected government purchases associated with WWII.

We use three main data series: our shock series, real output, real government spending. Our real output series is the monthly, seasonally adjusted industrial production index (IPI) from FRED and the nominal federal budget expenditures from the NBER Macrohistory Database[13]. We then convert the nominal federal budget expenditures to a real measure by the CPI for all urban consumers from FRED. The choice of using these variables is primarily based on the concern of data availability, as the selection of historical monthly sequences back to the mid-1930s is rather limited. Admittedly, the IPI is different with real GDP and the federal budget expenditures are not identical to total government spending. Yet, upon taking quarterly averages and comparing our series with the corresponding variables from V. A. Ramey 2011 during the overlapping period, we find a correlation of 0.92 between the IPI and Ramey's real GDP measure and a correlation of 0.98 between the real federal budget expenditures and the

13. The nominal federal budget expenditure series is not seasonally adjusted. However, the regression coefficients are all statistically insignificant upon regressing this variable on the twelve monthly dummies, which suggests that seasonality is not a strong concern.

constructed total government spending sequence from V. A. Ramey 2011.

As demonstrated by figure 10, panels A and B, the macroeconomic data we use in fact track Ramey's variables in general.[14] A major discrepancy is that the FRED IPI experiences a deeper drop towards the end of the war. This can explained by the fact that the IPI is a more direct representation of the manufactured goods sponsored by the government purchases, which, of course, will result in a different interpretation of the fiscal multiplier by definition. The estimate of the IPI multiplier from the stock market-based approach and estimate of the GDP multiplier based on Ramey's defense news nevertheless largely agree with each other, as documented later on.

### 4.3 Comparison with Prime Contract Awards

We also compare our shock series with prime contract awards using the monthly awarded and open contract data from Brunet 2018. The awarded contracts document the aggregated nominal value of the prime contract awards at their issuance date, while the open contracts uniformly distribute the awarded values over the period when a contract is active. Brunet 2018 uses the open contract variable to approximate the effects of the contract awards on the associated economic activities.

Figure 10, panels C–F visualize the contract and macroeconomic variables vs. the excess returns. panel C shows that the war supply contracts were indeed issued in a concentrated manner upon the U.S. entering the war. The excess returns also displayed positive responses before the hike in the contract awards in 1943. Consistent with the narrative records, the excess returns started to increase after the resumption of the contract issuance associated with the Normandy Landings, when the market began to speculate if the military demand of the war was higher than what had been expected.

panels C–F also demonstrate that the excess returns before, or at the early stage of, the war can be viewed as a leading indicator of the contract awards. The arrival of the contracts then leads the industrial production, which peaks before the government expenditures.[15] This feature is consistent with Ramey's argument that the economy would response before government purchases either through anticipations or the mechanical reason that government spending is

14. Note that the real federal budget expenditures from NBER and the real total government spending series from V. A. Ramey 2011 are plotted in figure 10, panel B on their individual scales. This does not mean that the federal expenditures can be higher than the total government spending. The point of the figure is to show the patterns of each series trace each other, not to compare their actual scales. It should also be noted that V. A. Ramey 2011 relies on a combination of deflators in computing the real GDP and its components.

15. The jump in federal spending in 1936 is caused by the government bonus payment to WWI veterans, which is not related to the aspects of WWII.

recorded at the deliverance of a supply contract.

It is also worth noting that excess returns may not always lead contract awards if expectations turn out to be incorrect. In this case, we could still see some real economic responses that go uncaptured by the defense news series since those are typically much more certain and closer in time to the actual spending.

### 4.4 Monthly Specification and Results

We use a trivariate VAR in levels that includes our government spending shock series, real output, and real government expenditures. Our specification is similar to that of V. A. Ramey 2011. We follow Fisher and Peters 2010 and V. A. Ramey 2011 and employ 15 monthly lags. The results remain similar if we change the lag order to 12 or 18.[16] The same holds true when we adjust the excess returns by the three-month treasury rate or not adjust the returns by inflation at all.[17] Note that our sample is small compared to the full estimation periods of Fisher and Peters 2010 and V. A. Ramey 2011[18].

The impulse responses to a one-standard-deviation innovation to the accumulated excess return variable are presented in figure 11, panels A and B. The dashed lines demarcate the 95% confidence intervals based on the bootstrapped standard errors with 500 replications for the remaining of the paper. Government spending and industrial production only rise notably after about 15 months with both spending peaking about 4 years out and production at about 2 years. This difference is consistent with the argument that output tends to respond before government expenditures due to anticipatory adjustments. These peaks are about 0.08 and 0.02 log points, respectively and give an output elasticity to government spending of about 0.275. In unreported results, we find these results hold generally under an "integral" spending specification as well. The magnitude and persistence of these responses are remarkably similar to existing findings looking at the post-Korean-War period.

The about 15 month delay before either output or government spending responds to an excess returns shock is reasonable given the historical context and the time series behavior of the various series plotted in figure 10. In particular, much of the market's expectations about future U.S. involvement in the war appear to have been formed by 1939, about one to two years

16. The highest optimal lag selected via Akaike's (AIC), Schwarz's Bayesian (SBIC), and the Hannan and Quinn information criterion (HQIC) is around 14.

17. The concern on the effects of monetary policy on government spending can be further mitigated by the intentionally created near-ZLB environment during WWII.

18. The estimation sample used in Fisher and Peters 2010 goes from 1958 to 2007, while the full sample used in V. A. Ramey 2011 covers 1939–2008.

before purchases began to slowly ramp up in 1940 and 1941. This can be seen by comparing the time series of excess returns to those of prime contract awards or federal spending. During this period of lag, the responses of the government spending are relatively small and could be further confounded by the short-lived boom in foreign sales before the Fall of France in 1940. In any event, the much larger rises in contract awards and spending post U.S. entry into the war swamp these early changes in magnitude and are likely responsible for the much more significant and decidedly positive longer-horizon responses we see.

With this output elasticity in hand we can then calculate the fiscal multiplier as the percentage change in output per a percentage in government spending divided by the ratio of government spending over output. We estimate the government's nominal share of output to be around 38.2% over our sample using the annual historical statistics from the Census. This long-run government spending share is the average of annual spending shares over our sample weighted by annual nominal government spending to reflect the concentration of government purchases during the war years. With this estimate, the WWII industrial output multiplier can be computed as $(0.275/0.382) = 0.72$, which is in turn consistent with the 0.7 output multiplier estimated by V. A. Ramey 2011 over the 1939-1949 sample and, more remarkably, with the findings from Fisher and Peters 2010 in the post-Korean-War era.

## 5 Comparison with Defense News Shocks

In this section we compare the performance of the excess return shocks with that of the defense news innovations and find substantive difference in our sample period. We then provide evidence suggesting that expectations effects can explain this difference.

### 5.1 Quarterly Results for Excess Returns

Since Ramey's estimates are based on data with a quarterly frequency, we convert our monthly sample to a quarterly one for comparability. We do so by calculating the quarterly excess returns following the procedure laid out by Fisher and Peters 2010[19] and taking the quarterly averages for our monthly macro sequences. The quarterly IRFs based on a corresponding VAR in levels with 5 lags are reported in figure 12, panels A and B. As can be seen, the shape and persistence of the spending and output responses largely remain the same and statistically

19. For each given group of firms, the quarterly holding period returns are calculated by first computing the average monthly holding period returns weighted by the market value of the firms at the beginning of each quarter. For each given quarter, the three monthly returns are then accumulated to form the quarterly return of the group. The excess returns are the differences between the quarterly returns of the group and that of the market.

significant positive responses can still be picked up at the 95% confidence interval, but overall statistical significance is reduced compared to the monthly specification.

The response of industrial production reaches its peak after 14 quarters at around 0.098. The response of the government spending reaches its peak after 9 quarters at around 0.034. These imply an output elasticity of $(0.034/0.098) = 0.34$, which leads to a fiscal multiplier of $(0.34/0.382) = 0.89$. Similar to the situation of the monthly estimation, the output elasticity based on the integral under the IRFs is qualitatively similar. Changing to 4 or 6 lags, adjusting the excess returns by the three-month treasury rate, or not adjusting the returns by inflation all give similar results.[20]

### 5.2 Results for Defense News Shocks

We estimate now the fiscal multiplier using the defense news series in a similar quarterly VAR setup. Unfortunately, the defense news series only begins in 1939. Therefore, this VAR contains the defense news, the log of the total government spending, and the log of the real GDP, in that order, with a timing restriction, a linear trend term, and 4 lags for the 1939-1947 period. The IRFs are reported in figure 15, panels A and B[21]. For the new sample, the response of the real GDP reaches its peaks after 4-5 quarters at around 0.0133. The response of the government spending reaches its peak after 5 quarters at around 0.0631. The resulting output elasticity is therefore $(0.0133/0.0631) = 0.21$, which is slightly lower than, but still very close to, the 0.3 output elasticity estimated from our 1936-1947 sample. The output elasticity based on the integral under the IRFs is qualitatively the same. The implied fiscal multiplier is then around 0.6. The estimation results are robust to changing the lag order to 3, 5, and 6 lags[22].

In sum, the fiscal multipliers implied by both the defense news and the excess returns series are reasonably similar over this period. Indeed, we would not reject that the two approaches give the same output elasticity, and therefore fiscal multiplier, given the relatively large uncertainty in our estimates. The difference between the two approaches, however, lies in the persistence of the responses. In particular, the excess return shocks seem to systematically pick up a more persistent response in both government spending and output, whereas the responses from the defense new shocks tend to revert more quickly. We examine this issue in more detail in the

20. The highest optimal lag suggested by AIC, SBIC, and HQIC is around 2, however, we choose to use a higher lag following Fisher and Peters 2010 and V. A. Ramey 2011.

21. We also report VAR results for Ramey's larger VAR specification over 1939-2008 in figure 13 and for this smaller VAR specification over the 1939-1949 period in figure 14. These two specifications directly replicate the ones in her paper and give fiscal multipliers of about 1.1 and 0.7, respectively.

22. Similar to the situation of the quarterly estimation over the 1936-1947 sample, the highest optimal lag suggested by AIC, SBIC, and HQIC is around 2.

next section.

### 5.3 Do Expectations Explain the Difference in Results?

For full comparability with the defense news results presented previously, we re-estimate the excess returns VAR for the 1939-1947 period and report the IRFs in figure 16. As shown by the figure, once estimated over the reduced sample, the responses of the government spending and real GDP seem to be shifted down from the responses obtained from the full quarterly 1936-1947 sample, which are displayed in figure 12. The positive responses of the spending and real output now become much weaker, without much of the persistence and statistical significance. At the same time, there are substantial negative responses during the initial periods. In terms of real GDP, the negative responses at around the third quarter are even statistical significant at the 95% level.[23]

What could be the cause of such considerable changes? One potential explanation is that, by focusing on the 1939-1947 sample with 4 lags, the regressions effectively start in 1940:Q1. This means the important expectations formed in the market around or before 1939 about the upcoming conflict would not be appropriately accounted for. They would either be excluded from the regressions or enter the VAR as controls, instead of being directly used to estimate the spending and output responses. As a result, the IRFs could be biased downward to potentially below zero.

To examine whether the control of the timing of the relatively long-term expectations can be a source of explanation, one would ideally extend the defense news sample back to 1936 to include the early observations in the estimation. However, since the beginning of Ramey's defense news is 1939:Q1, we follow a strategy proposed by V. A. Ramey 2011 and conduct a test within the 1939-1947 sample. Specifically, V. A. Ramey 2011 argues that, if the expectation effects are driving the difference, delaying the timing of the Ramey-Shapiro dates should result in the VAR-type Keynesian results. Similarly, if the changes in the performance of the excess return shocks are caused by the timing of the additional long-term expectations, lagging the excess return series should make the responses look closer to the estimates obtained from the

23. The estimation results behave in a similar manner when using the quarterly IPI and federal budget expenditure series. The estimation results also do not change significantly when using 3, 5, or 6 lags, though decreasing the lag order tends to lead to an improvement. With the current estimates, as shown in figure 16, panels A and B, the response of the real GDP reaches its peak after 16 quarters at around 0.0054. The response of the government spending reaches its peak after 14 quarters at around 0.0258. Therefore, the peak estimates result in an output elasticity of $(0.0054/0.0258) = 0.21$, which, perhaps surprisingly, is almost identical to the elasticity given by the defense news. Of course, due to the obvious reason, the same can not be said for the elasticity evaluated using the integral under the IRFs.

defense news shocks. Meanwhile, forwarding the defense news sequence should generate an outcome resembling the IRFs described by figure 16.

We start the analysis by plotting the accumulated excess returns against the defense news in the original 1939-1947 sample. As figure 17, panel A indicates, at least before the U.S. joining the war at the end of the 1941, the reactions of the market tend to lead the arrival of the defense news. This is especially the case at the outbreak of the war in 1939:Q3, where the excess returns of the defense firms surged drastically, while there seems to be no information update regards the future U.S. government purchases from the defense news, even though the Naval Act of 1938 had been passed to expedite the U.S. military buildup and Roosevelt had announced his plan in 1938 to prepare the U.S. army by purchasing 50,000 airplanes.

In order to simulate the scenario where the concentrated arrival of the defense news since 1941:Q2 were in fact expected by the market in 1939, we forwarded Ramey's defense news series by 7 quarters. The forwarded defense news vs. the original excess returns series are shown in figure 17, panel B. The estimation results using the updated news series without changing the remaining of the trivariate VAR specification are reported in figure 18, panels A and B.[24] As the figure suggests, the forwarded defense news shocks indeed yield IRFs similar to those obtained from the original excess return series (figure 16, panels A and B). In addition, without having further fluctuations as those of the excess returns, the shifted news sequence indicates an even more significant drop in both the spending and output responses in the early periods with almost nonexistent positive responses during the later phase.

Based on the performance of the forwarded news series, we then allow the market expectations in 1939 to estimate the IRFs by lagging the excess returns by 4 quarters. This is equivalent in assuming the market was systematically delayed in a way that the information would had been available in 1939:Q1 arrived in 1940:Q1.[25] The shifted returns series vs. the original defense news are presented in figure 17, panel C. The estimation results using the same VAR but the lagged returns are displayed in figure 19, panels A and B. As the panels demonstrate, by including the early information in the estimation, instead of using them as controls, the positive responses of the government spending and real GDP both become substantially stronger and statistically significant. The shape of the responses is almost comparable to the findings from the complete sample of V. A. Ramey 2011 (figure 19, panels A and B). Instead of having a temporary increase, the shifted excess returns also give much more persistent responses in the

24. For the remaining of this analysis, the estimation results are robust when using 3, 5, and 6 lags.

25. The lag is performed by using the excess return series from the complete 1936-1947 sample at the quarterly level. Lagging the returns by 7 quarters in consistent with the shift in the defense news generates almost identical, if not improved, results.

later periods for both the output and government spending measures.

Admittedly, the shifted series are not identical to the reality. Yet, given the data constraint, this exercise can at least provide evidence that the timing of the additional expectation effects matters. Failing to appropriately account for the complete expectation effects in the sample can result in an underestimation, along with potential negative responses, when using the stock market-based approach. Perhaps more importantly, it seems the additional expectation effects captured by the excess return shocks contribute to the persistence of the economic responses. This can be used to support the importance of the expectation effects that yet to be captured by the main approaches of the literature.

## 6 Conclusion

In this paper, we use stock returns to estimate the fiscal multiplier during the WWII era by classifying public aircraft and shipbuilding companies as the defense sector of the U.S. stock market. Using innovations in the excess returns of the aircraft and shipbuilding firms to identify exogenous government spending shocks, we compare the performance of this stock market-based approach, a relatively novel strategy in estimating the fiscal multiplier developed by Fisher and Peters 2010, with the existing findings from the main approaches of the literature. Based on a monthly sample from 1936 to 1947, we find that the output elasticity with regards to total government spending is around 0.276 during WWII, which is very close to the 0.3 output elasticity reported by Fisher and Peters 2010 from their post-Korean War sample. In addition, we observe persistent responses in government spending and real output to innovations in the excess returns of defense sector, a feature consistent with the findings of Fisher and Peters 2010 and suggesting the existence of additional expectation effects at a longer horizon that has yet to be accounted for by the main approaches of the literature. The 0.276 output elasticity implies a fiscal multiplier of around 0.72, which is in turn consistent with the 0.7 output multiplier computed by V. A. Ramey 2011 using defense news and a narrative approach. The below-unity fiscal multiplier associated with WWII further agrees with the observations from Hall 2009 and Brunet 2018, among others.

Upon comparing the performance of the stock market-based approach with the results of the defense news on an overlapping sample, we present evidence that expectations effects are key for explaining the difference in results given by our excess returns measure and Ramey's defense news series. In fact, we find that by forwarding Ramey's defense news and lagging the excess return sequence within the overlapping sample, the shape of the responses from the two methods can replicate each other. Future work that expands this approach to cover the Korean

War and onwards or further back in time to cover WWI would be valuable and could provide additional evidence on the extent of and importance of these expectations effects.

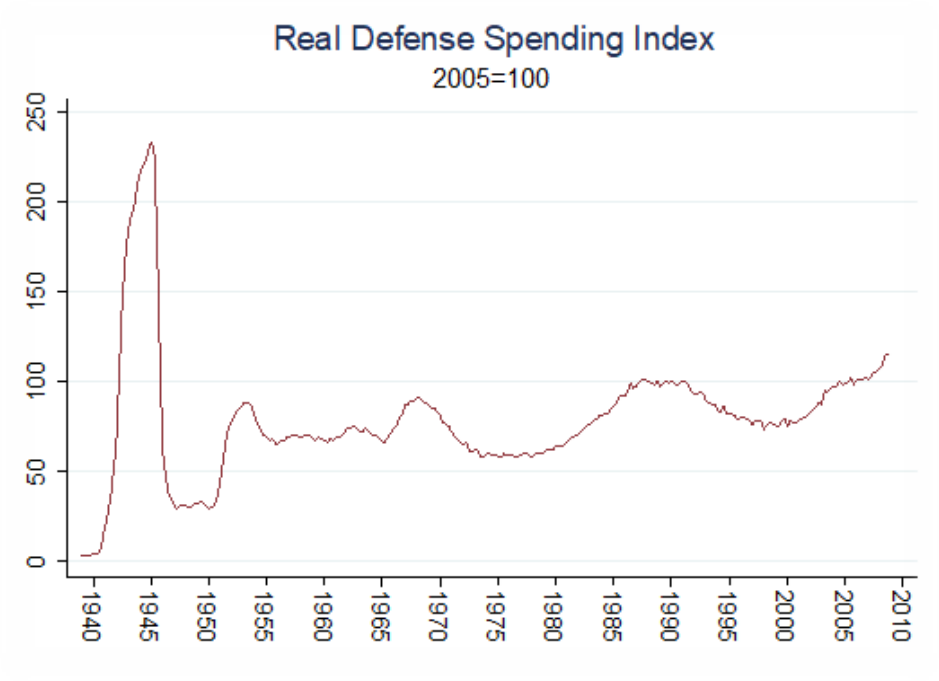


Figure 1: Real Defense Spending Index, 1939-2008
Notes: This figure plots the real defense spending index developed in V. A. Ramey 2011 available from 1939 to 2008. The index is at the quarterly frequency and equals 100 in 2005.

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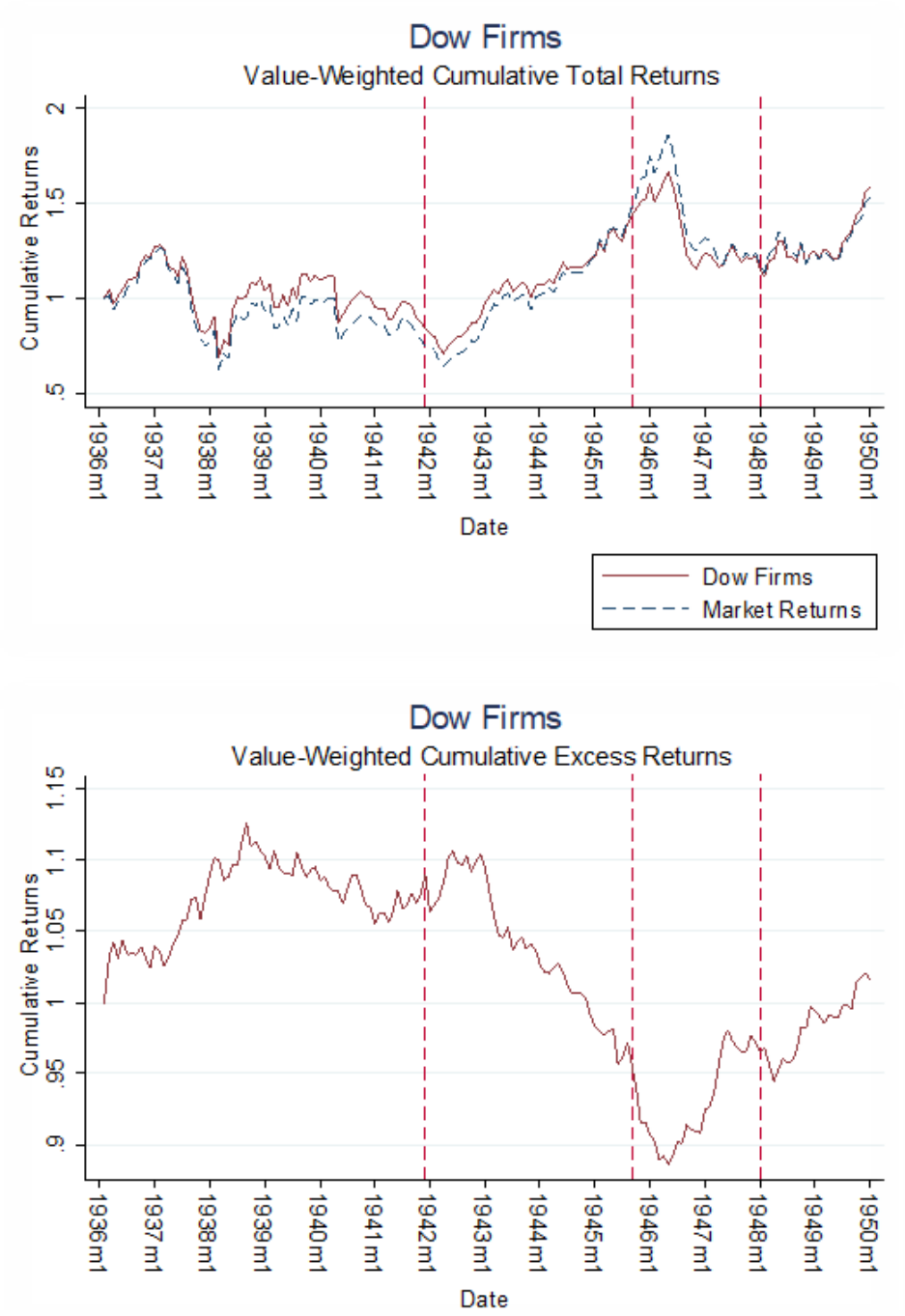


Figure 2: Stock Market Returns of the Historical Dow Firms

Notes: This figure plots the accumulated monthly holding period returns and the accumulated excess returns of the historical Dow firms from 1936:M1 to 1950:M1. The Dow firms include the historical components of the Dow Jones Industrial Average from 1936 to 1957. The first red dashed line indicates Pearl Harbor (1941:M12), the second red dashed line indicates the V-J Day (1945:M9), and the third red dashed line marks the War Scare of 1948 (1948:M1). The returns are normalized to 1 in the first period of observation.

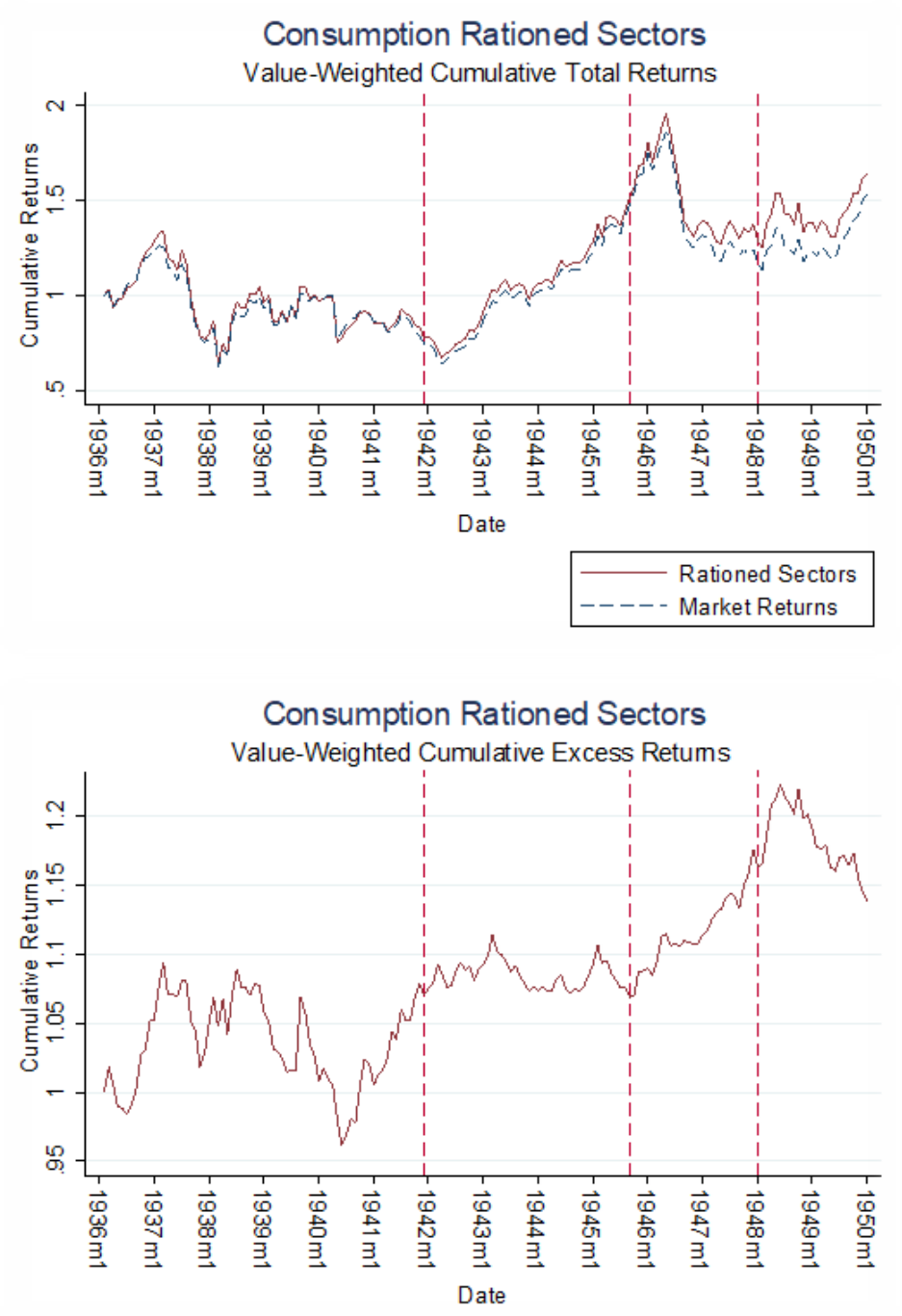


Figure 3: Stock Market Returns of the Rationed Sectors

Notes: This figure plots the accumulated monthly holding period returns and the accumulated excess returns of the consumption rationed sectors based on the 3-digit SIC codes from 1936:M1 to 1950:M1. The first red dashed line indicates Pearl Harbor (1941:M12), the second red dashed line indicates the V-J Day (1945:M9), and the third red dashed line marks the War Scare of 1948 (1948:M1). The returns are normalized to 1 in the first period of observation.

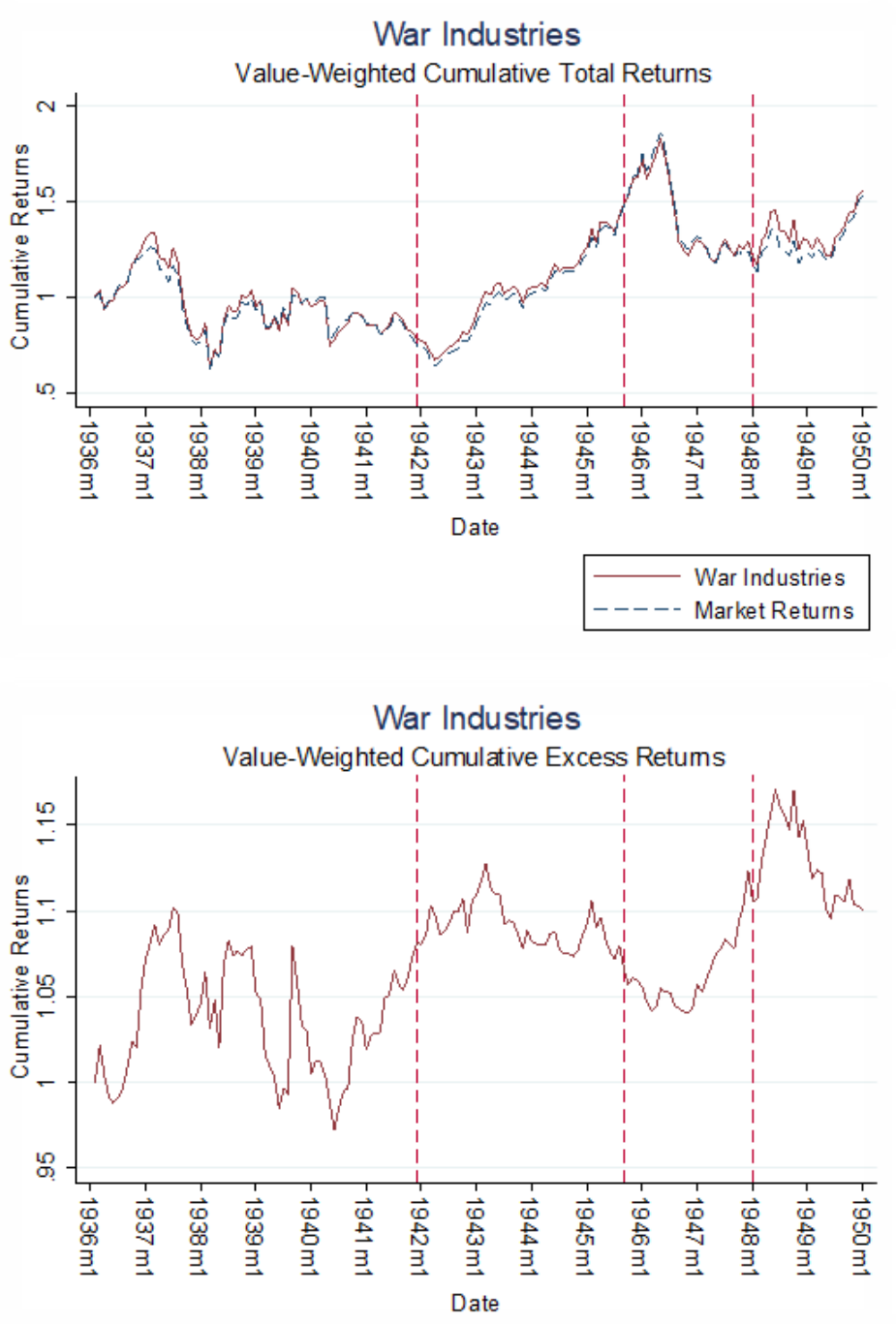


Figure 4: Stock Market Returns of the War Industries

Notes: This figure plots the accumulated monthly holding period returns and the accumulated excess returns of the war industries highlighted in the 1946 congressional report based on the 3-digit SIC codes from 1936:M1 to 1950:M1. The first red dashed line indicates Pearl Harbor (1941:M12), the second red dashed line indicates the V-J Day (1945:M9), and the third red dashed line marks the War Scare of 1948 (1948:M1). The returns are normalized to 1 in the first period of observation.

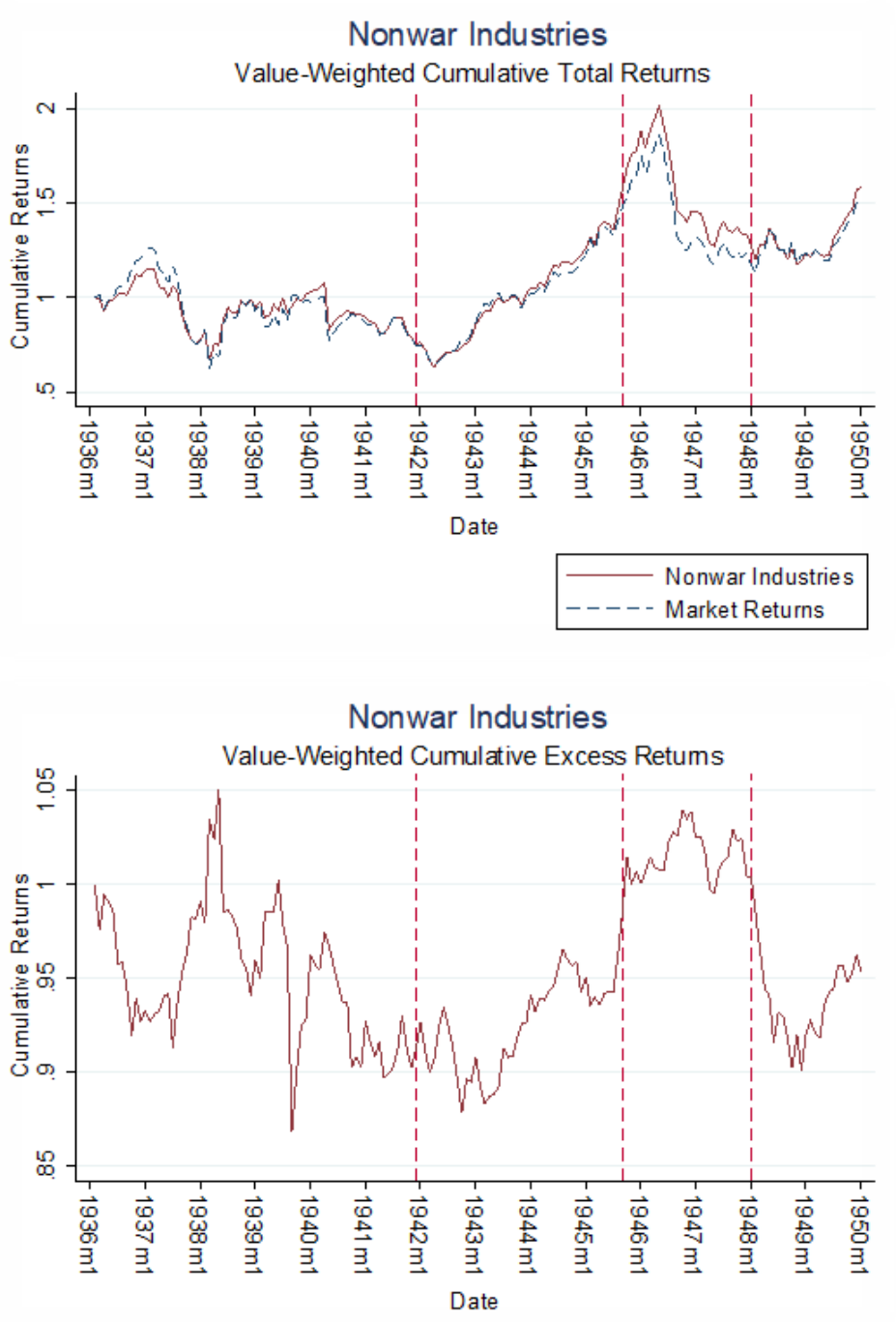


Figure 5: Stock Market Returns of the Nonwar Industries

Notes: This figure plots the accumulated monthly holding period returns and the accumulated excess returns of the nonwar industries highlighted in the 1946 congressional report based on the 3-digit SIC codes from 1936:M1 to 1950:M1. The first red dashed line indicates Pearl Harbor (1941:M12), the second red dashed line indicates the V-J Day (1945:M9), and the third red dashed line marks the War Scare of 1948 (1948:M1). The returns are normalized to 1 in the first period of observation.

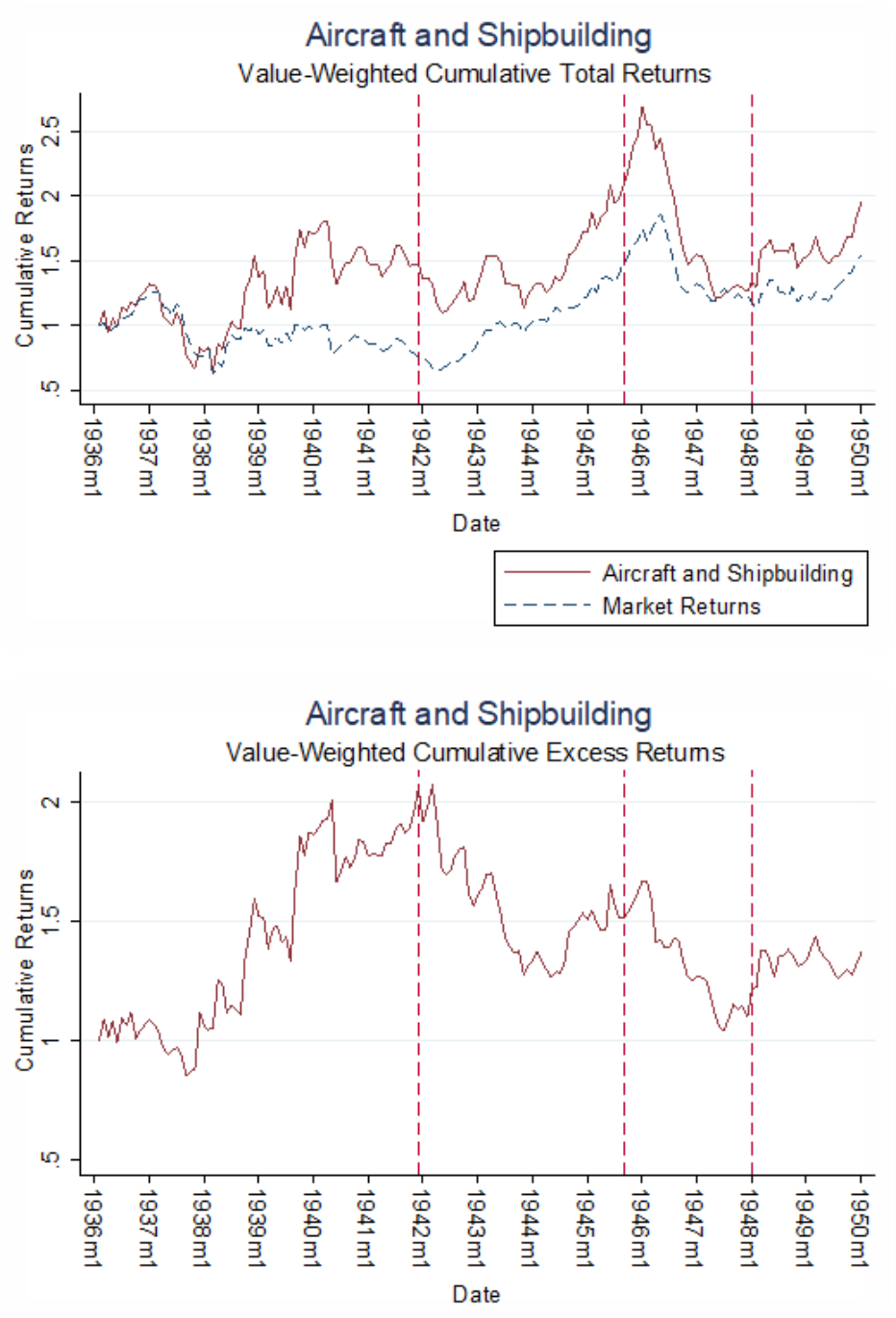


Figure 6: Stock Market Returns of the Aircraft and Shipbuilding Industries

Notes: This figure plots the accumulated monthly holding period returns and the accumulated excess returns of the public aircraft and shipbuilding companies from 1936:M1 to 1950:M1. The first red dashed line indicates Pearl Harbor (1941:M12), the second red dashed line indicates the V-J Day (1945:M9), and the third red dashed line marks the War Scare of 1948 (1948:M1). The returns are normalized to 1 in the first period of observation.

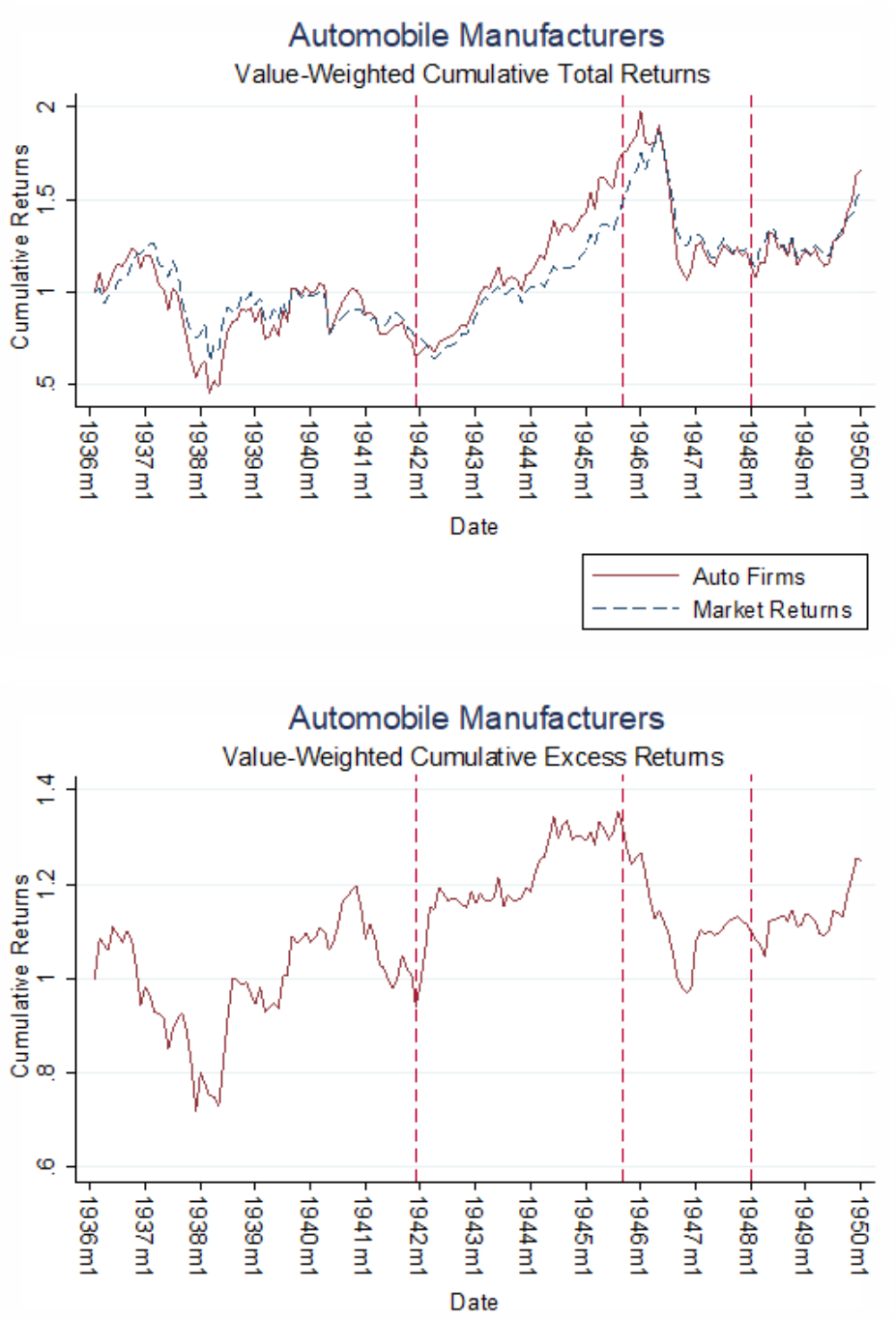


Figure 7: Stock Market Returns of the Aircraft and Shipbuilding Industries

Notes: This figure plots the accumulated monthly holding period returns and the accumulated excess returns of the public automobile companies from 1936:M1 to 1950:M1. The first red dashed line indicates Pearl Harbor (1941:M12), the second red dashed line indicates the V-J Day (1945:M9), and the third red dashed line marks the War Scare of 1948 (1948:M1). The returns are normalized to 1 in the first period of observation.

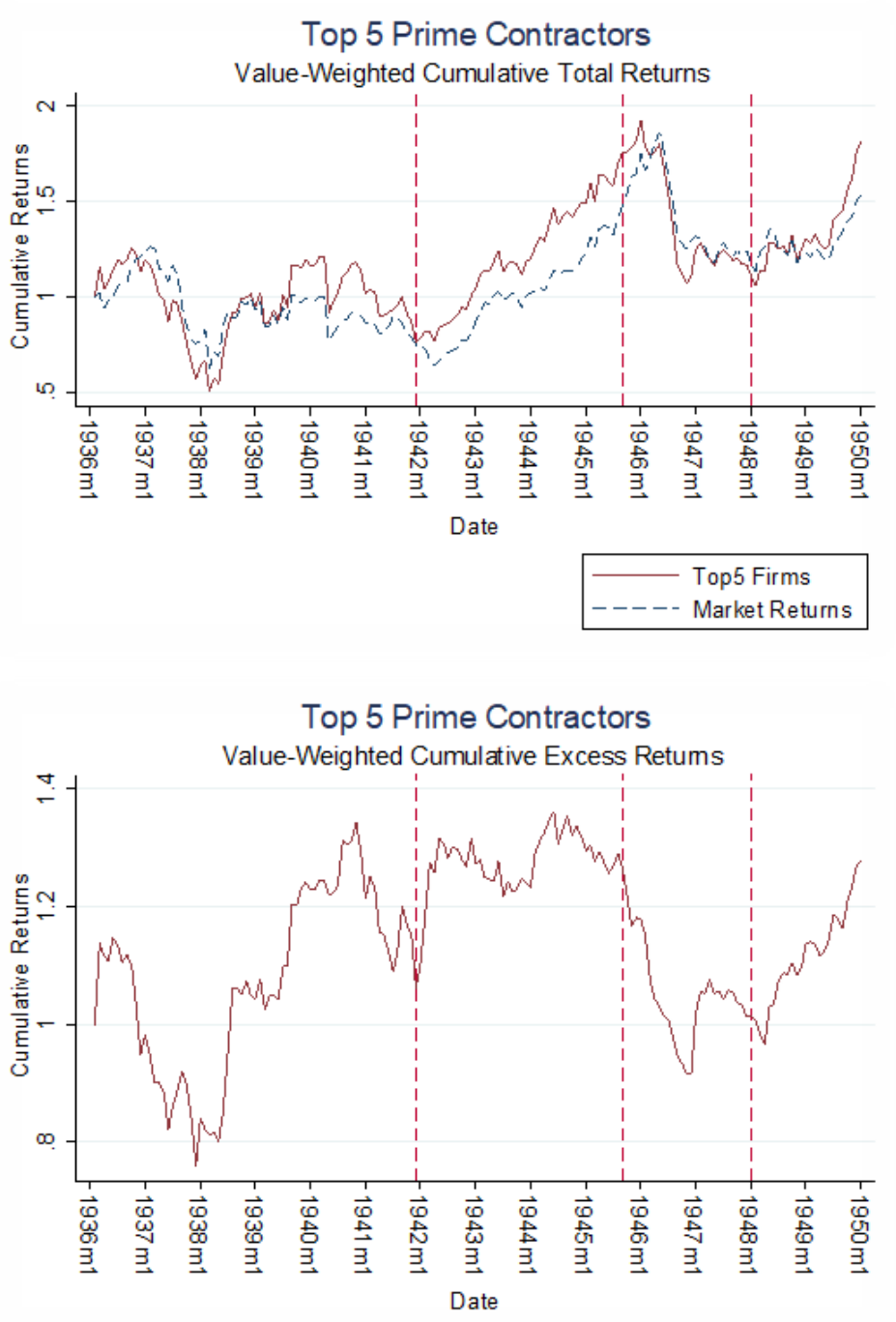


Figure 8: Stock Market Returns of the Top 5 Prime Contractors

Notes: This figure plots the accumulated monthly holding period returns and the accumulated excess returns of the top 5 prime contractors documented in the 1946 congressional report from 1936:M1 to 1950:M1. The first red dashed line indicates Pearl Harbor (1941:M12), the second red dashed line indicates the V-J Day (1945:M9), and the third red dashed line marks the War Scare of 1948 (1948:M1). The returns are normalized to 1 in the first period of observation.

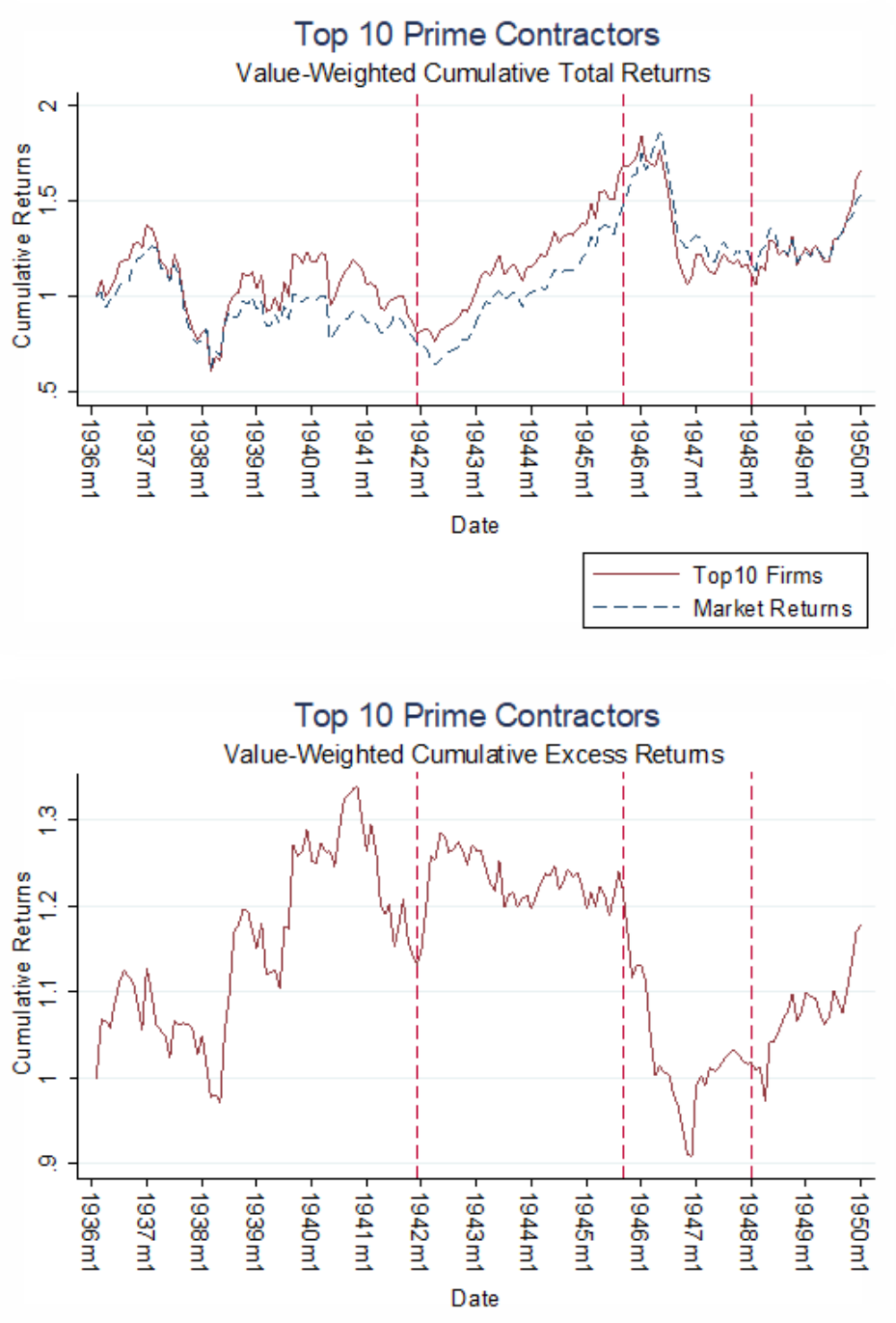


Figure 9: Stock Market Returns of the Top 10 Prime Contractors

Notes: This figure plots the accumulated monthly holding period returns and the accumulated excess returns of the top 10 prime contractors documented in the 1946 congressional report from 1936:M1 to 1950:M1. The first red dashed line indicates Pearl Harbor (1941:M12), the second red dashed line indicates the V-J Day (1945:M9), and the third red dashed line marks the War Scare of 1948 (1948:M1). The returns are normalized to 1 in the first period of observation.

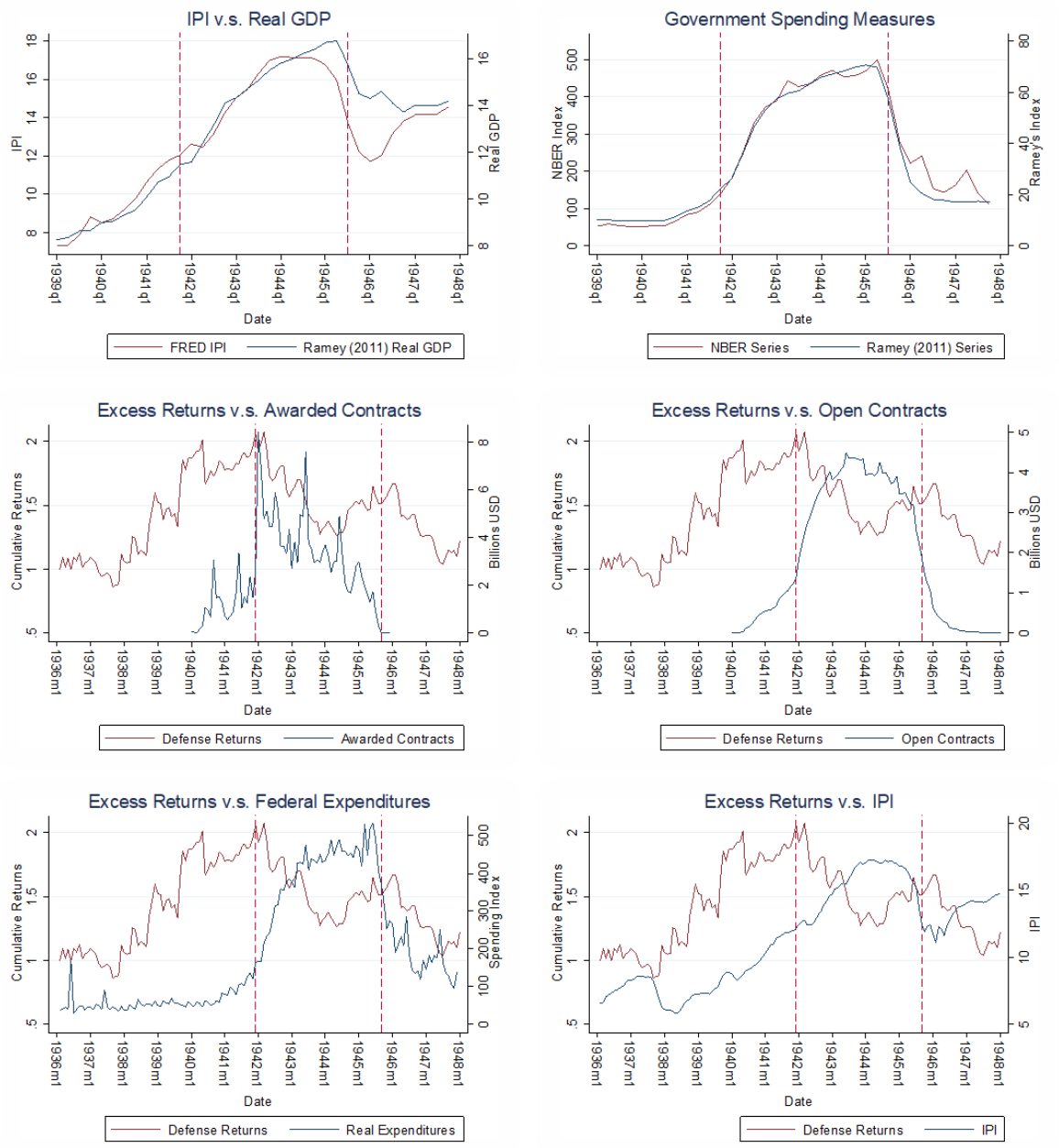


Figure 10: Macroeconomic Data

Notes: This figure displays the macroeconomic data we use in the monthly analysis. The sample spans 1936:M1 to 1947:M12. IPI is the industrial production index, the "NBER Series" government spending measure comes from the NBER Macrohistory Database, and the open and awarded contract data is from Brunet 2018. The first red dashed line indicates Pearl Harbor (1941:M12) and the second red dashed line indicates the V-J Day (1945:M9).

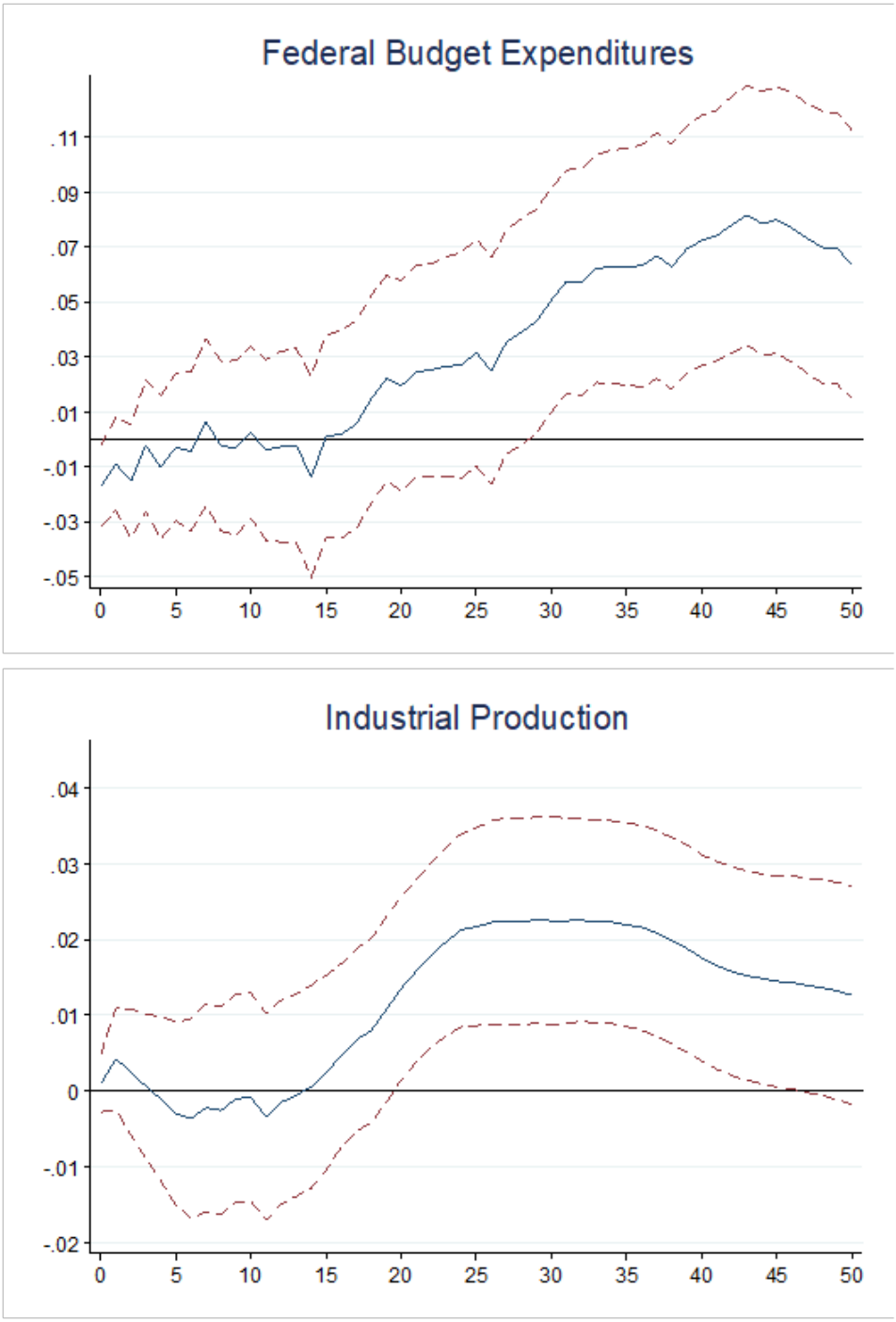


Figure 11: Impulse Responses for a Excess Returns Shock, Monthly VAR

Notes: This figure presents the 50 steps impulse responses to a one-standard-deviation innovation to the accumulated excess returns of the defense sector. The monthly VAR is evaluated over the sample of 1936:M1 to 1947:M12 with 15 lags. The VAR includes the excess returns of the aircraft and shipbuilding companies, the log of the federal budget expenditures, and the log of the IPI, in that order, with a timing restriction and a linear trend term. The dashed lines demarcate the 95% confidence intervals based on the bootstrapped standard errors with 500 replications.

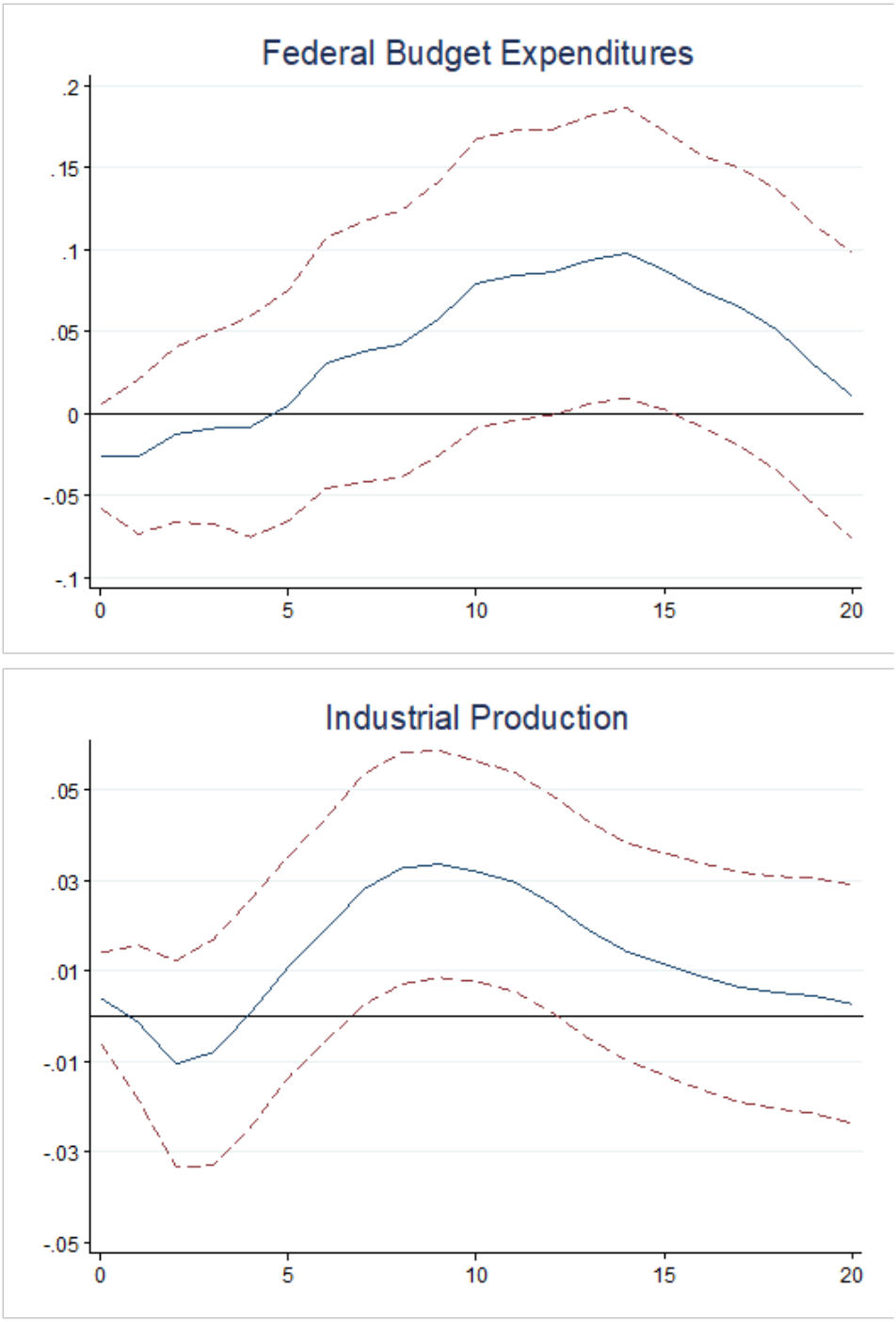


Figure 12: Impulse Responses for a Excess Returns Shock, Quarterly VAR

Notes: This figure presents the 20 steps impulse responses to a one-standard-deviation innovation to the accumulated excess returns of the defense sector. The quarterly VAR is evaluated over the sample of 1936:Q1 to 1947:Q4 with 5 lags. The VAR includes the excess returns of the aircraft and shipbuilding companies, the log of the federal budget expenditures, and the log of the IPI, in that order, with a timing restriction and a linear trend term. The dashed lines demarcate the 95% confidence intervals based on the bootstrapped standard errors with 500 replications.

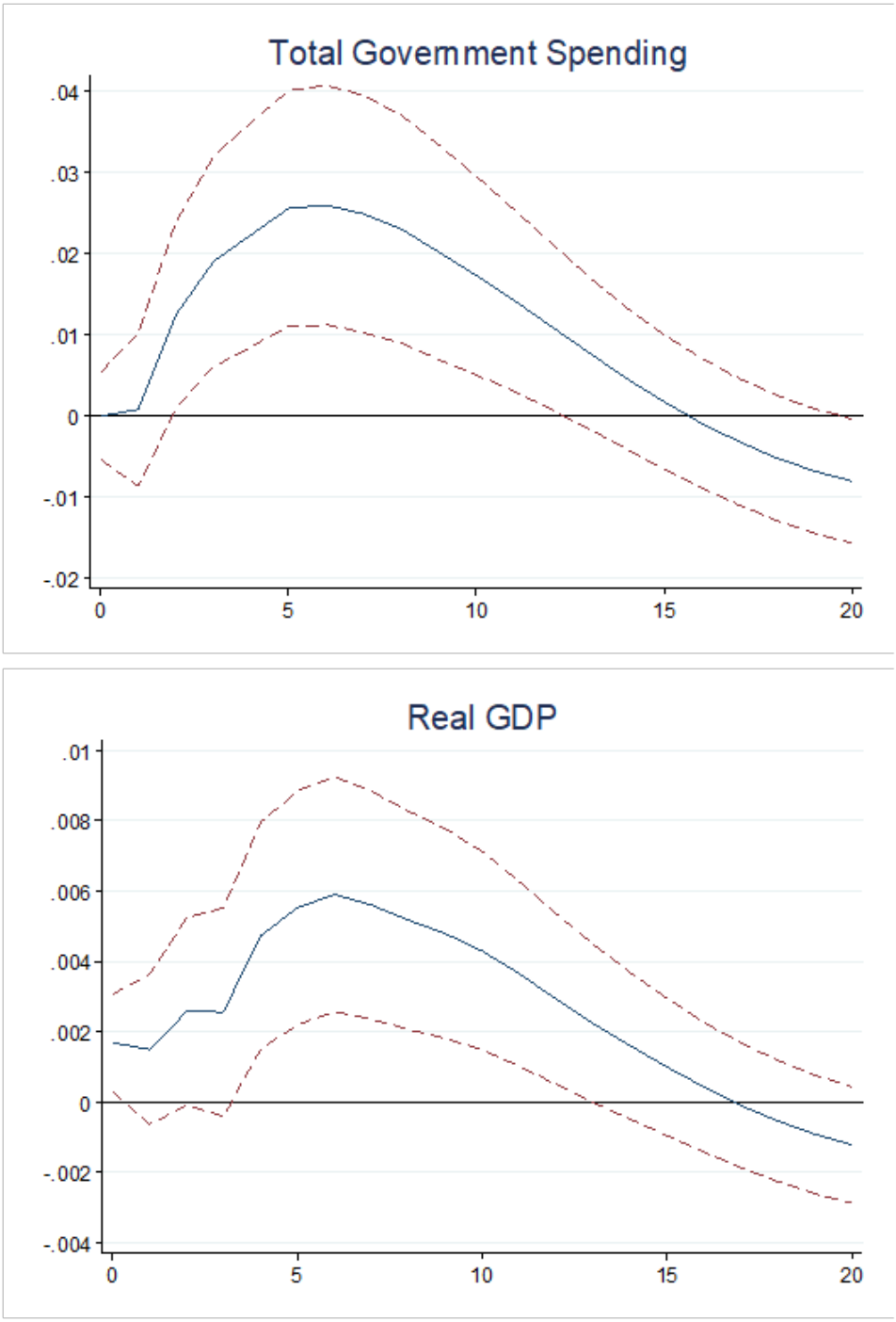


Figure 13: Impulse Responses for a Defense News Shock, 1939-2008

Notes: This figure presents the 20 steps impulse responses to a one-standard-deviation innovation to the defense news. The quarterly VAR is evaluated over the sample of 1939:Q1 to 2008:Q4 with 4 lags. The VAR includes the defense news, the log of total government spending, the log of real GDP, the three-month treasury rate, the Barro-Redlick average marginal income tax rate, and the log of total hours, in that order, with a timing restriction as well as a linear and a quartic trend. The dashed lines demarcate the 95% confidence intervals based on the bootstrapped standard errors with 500 replications.

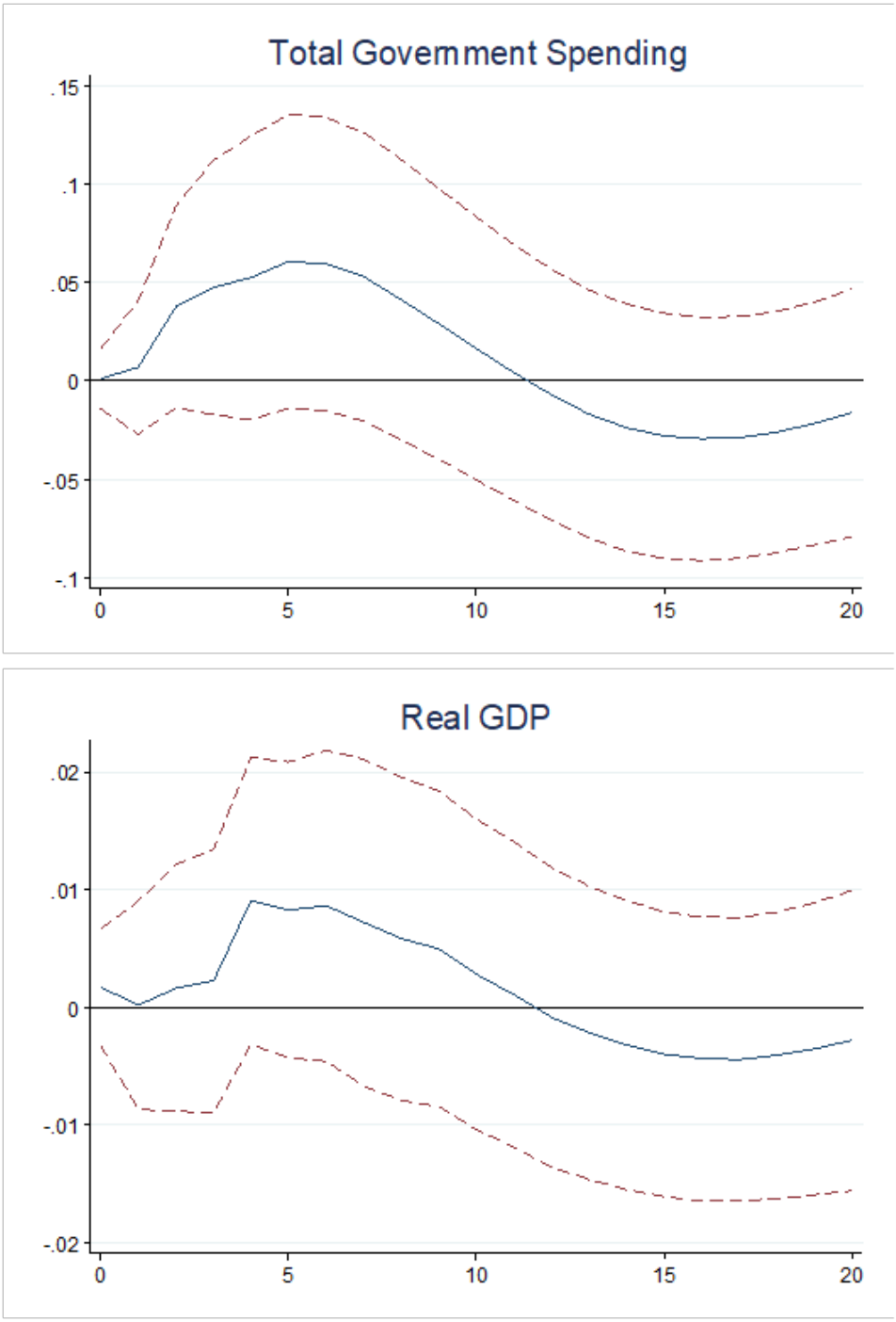


Figure 14: Impulse Responses for a Defense News Shock, 1939-1949

Notes: This figure presents the 20 steps impulse responses to a one-standard-deviation innovation to the defense news. The quarterly VAR is evaluated over the sample of 1939:Q1 to 1949:Q4 with 4 lags. The VAR includes the defense news, the log of total government spending, the log of real GDP, the three-month treasury rate, the Barro-Redlick average marginal income tax rate, and the log of total hours, in that order, with a timing restriction as well as a linear and a quartic trend. The dashed lines demarcate the 95% confidence intervals based on the bootstrapped standard errors with 500 replications.

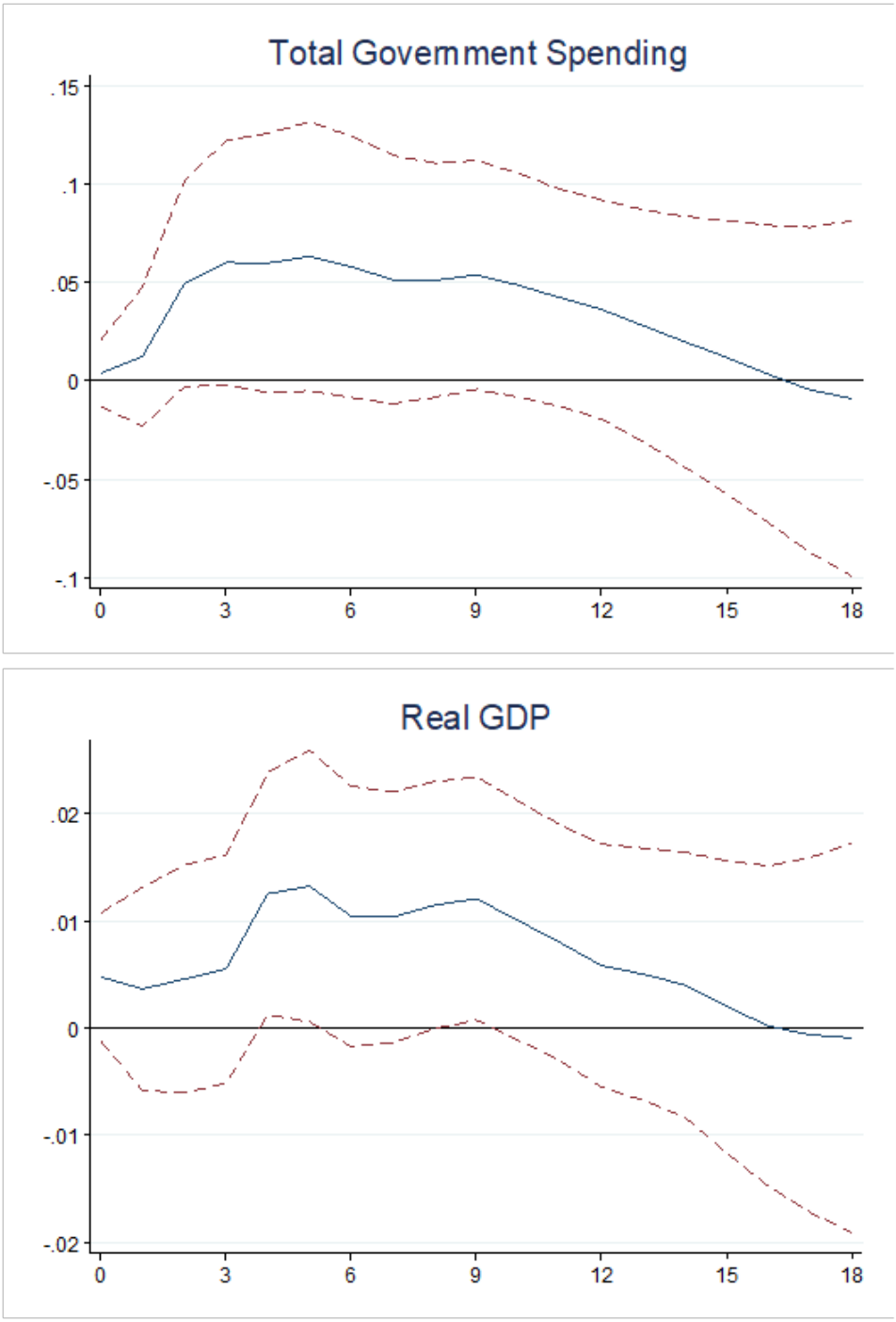


Figure 15: Impulse Responses for a Defense News Shock, 1939-1947

Notes: This figure presents the 20 steps impulse responses to a one-standard-deviation innovation to the defense news. The quarterly VAR is evaluated over the sample of 1939:Q1 to 1947:Q4 with 4 lags. The VAR includes the defense news, the log of total government spending, the log of real GDP, the three-month treasury rate, the Barro-Redlick average marginal income tax rate, and the log of total hours, in that order, with a timing restriction as well as a linear and a quartic trend. The dashed lines demarcate the 95% confidence intervals based on the bootstrapped standard errors with 500 replications.

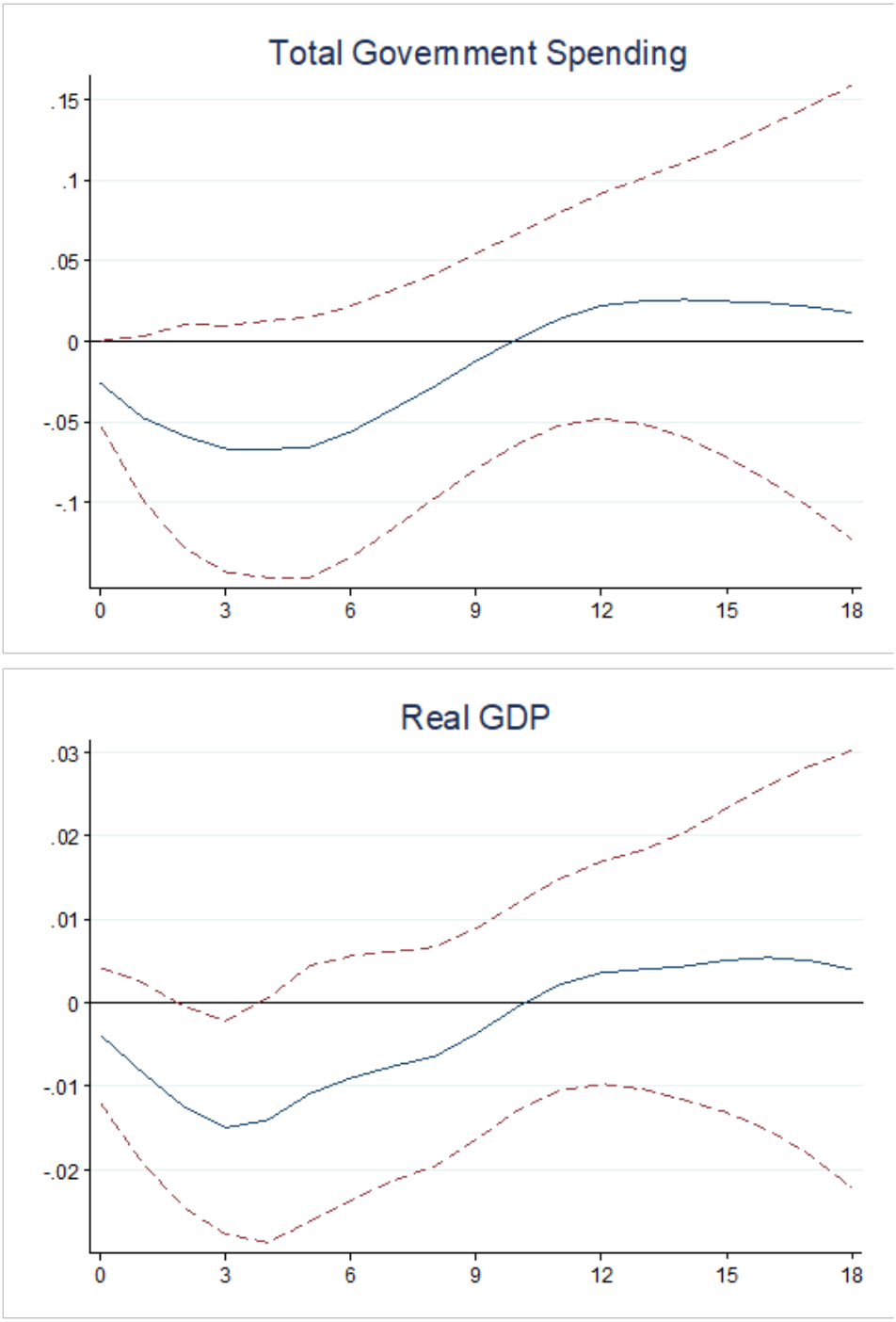


Figure 16: Impulse Responses for an Excess Returns Shock, 1939-1947

Notes: This figure presents the 18 steps impulse responses to a one-standard-deviation innovation to the accumulated excess returns of the defense sector. The quarterly VAR is evaluated over the sample of 1939:Q1 to 1947:Q4 with 4 lags. The VAR includes the excess returns of the aircraft and shipbuilding companies, the log of total government spending, and the log of real GDP, in that order, with a timing restriction and a linear trend term. The dashed lines demarcate the 95% confidence intervals based on the bootstrapped standard errors with 500 replications.

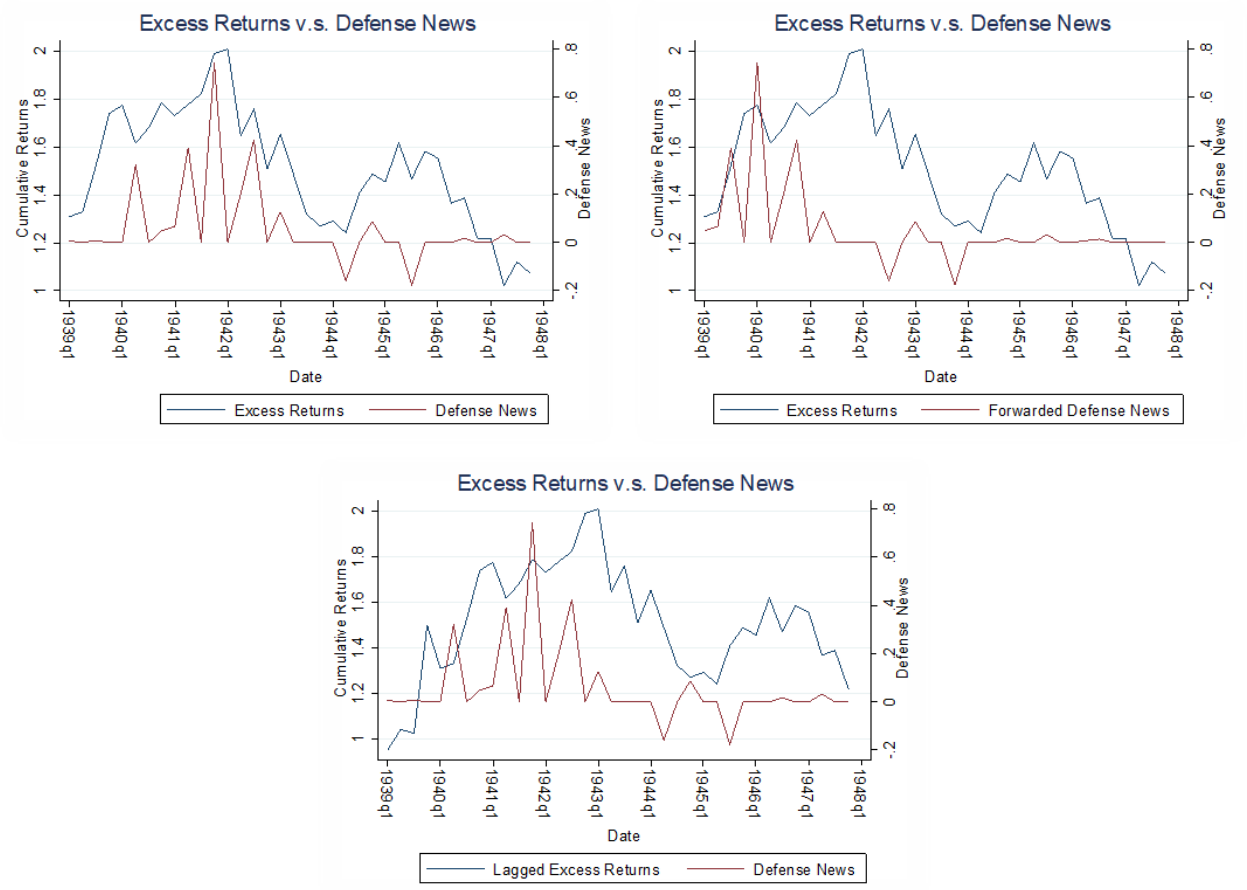


Figure 17: Excess Returns and Defense News

Notes: This figure describes the accumulated excess returns of the aircraft and shipbuilding companies vs. the defense news over the quarterly sample of 1939:Q1 to 1947:Q4. Panel A plots the original series. Panel B plots the original excess returns and the defense news forwarded by 7 quarters. Panel C plots the excess returns lagged by 4 quarters and the original defense news.

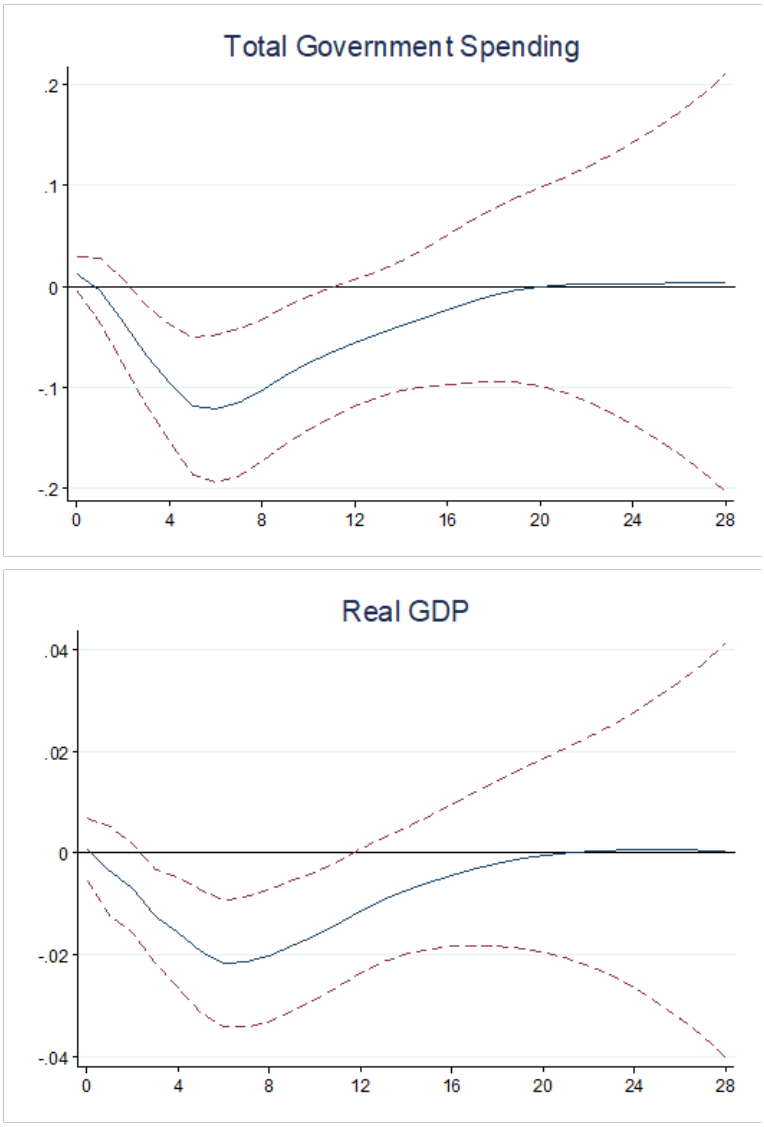


Figure 18: Impulse Responses for a Forwarded Defense News Shock, 1939-1947
Notes: This figure presents the 28 steps impulse responses to a one-standard-deviation innovation to the forwarded defense news. The quarterly VAR is evaluated over the sample of 1939:Q1 to 1947:Q4 with 4 lags. The VAR includes the forwarded defense news, the log of total government spending, and the log of real GDP, in that order, with a timing restriction and a linear trend term. The dashed lines demarcate the 95% confidence intervals based on the bootstrapped standard errors with 500 replications.

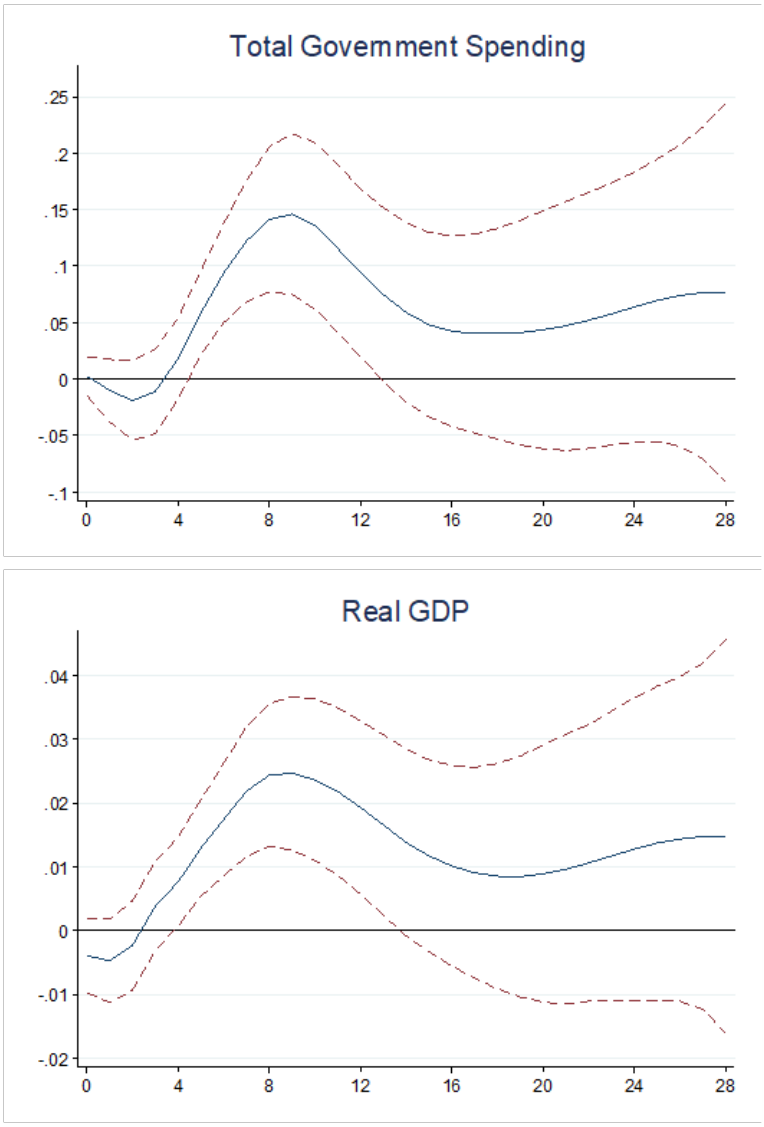


Figure 19: Impulse Responses for a Lagged Excess Returns Shock, 1939-1947

Notes: This figure presents the 28 steps impulse responses to a one-standard-deviation innovation to the lagged accumulated excess returns of the defense sector. The quarterly VAR is evaluated over the sample of 1939:Q1 to 1947:Q4 with 4 lags. The VAR includes the lagged excess returns of the aircraft and shipbuilding companies, the log of total government spending, and the log of real GDP, in that order, with a timing restriction and a linear trend term. The dashed lines demarcate the 95% confidence intervals based on the bootstrapped standard errors with 500 replications.