When Does Government Spending Matter? It's All in the Measurement

Edoardo Briganti[1] **Gillian Brunet**[2] **Victor Sellemi**[3]

[1]Bank of Canada

[2]Smith College

[3]UC San Diego & Meta Platforms

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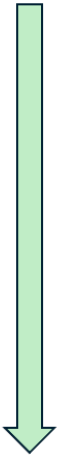
Outline

Government Spending is a Slow and Complex Process



Appropriations ≈ Authorizations

- Congress passes an authorization and then an appropriations act
- that *confers budget authority* on the Department of Defense (DoD).

Obligations

- *DoD signs a contract* (e.g., for a batch of F-35 fighters).
- The signature legally *obligates* the Treasury to pay once conditions are met.

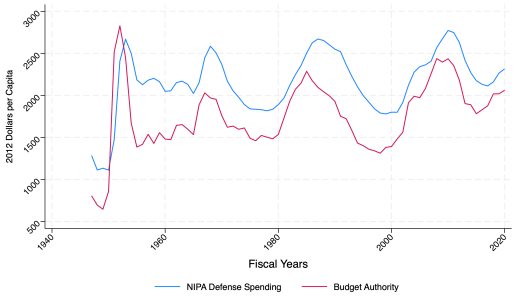
Production

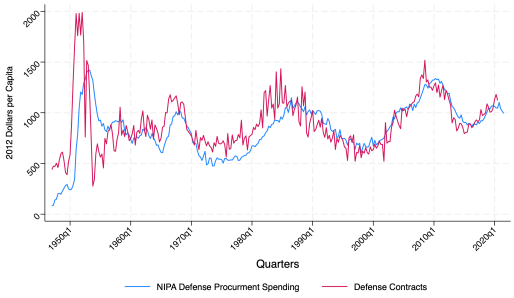
- The contractor hires workers and orders parts;
- the activity shows up in NIPA as *inventory* investment.

Delivery And Payment

- Product (e.g., aircraft) is delivered;
- Treasury disburses funds.

NIPA is not the Only Measure of Government Spending!





→ NIPA measures of government spending lag behind:

- Budget Authority
- Obligations (i.e., contracts)

Research Question and Findings

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  - For the "anticipation effect" of government spending:
  - → GDP moves faster than G because NIPA uses inventories to capture the work-in-progress of military contractors.
  - → Resemblance of fiscal foresight (i.e., negative wealth effects).

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  - For estimating fiscal multipliers:

  → Fiscal multipliers estimated with NIPA are biased downward.

Contribution Literature

1. We construct three novel, timely measures of government spending:
   - *Budget Authority*: FY:1938–FY:2020
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IV. Anticipation effects:
   - We show that inventories play a central role in transmitting government-spending shocks.
   - We offer a straightforward, accounting-based (i.e., non-Ricardian) explanation for the faster response of GDP relative to government spending.

Outline

Three New Measures of Government Spending

- (Defense) Budget Authority
  - Data Sources
  - Series and Delay

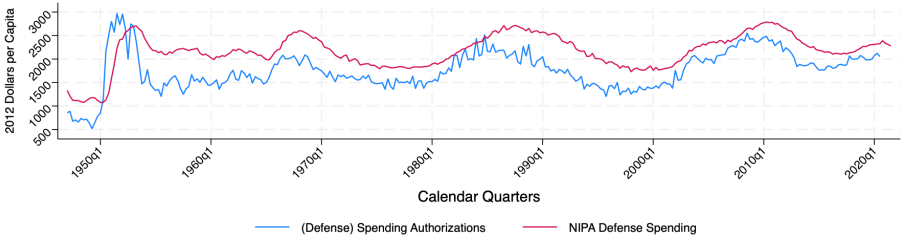
  → Lead NIPA Defense Spending by 1 fiscal year.

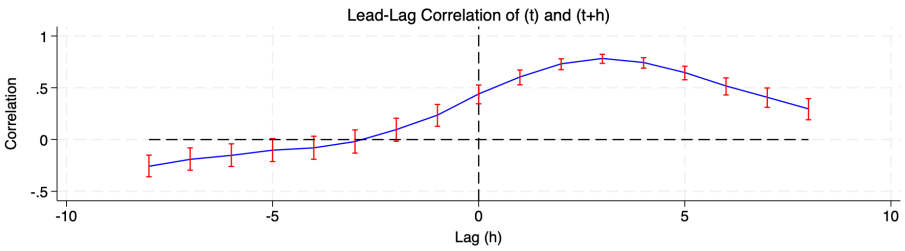
- (Defense) Contracts
  - Data Sources
  - Measures of Defense Contracts
  - Series and Delay

  → Lead NIPA Defense Procurement Spending by 3-4 Quarters.

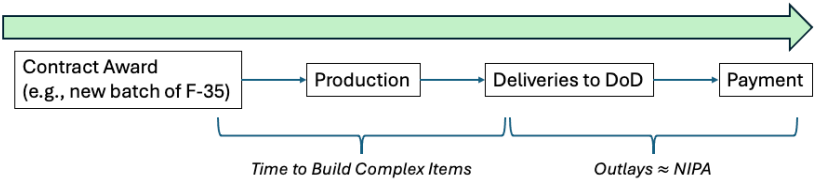
- Spending Authorizations
  - Interpolation

Spending Authorizations





Time to Build as one Source of Delay



"The largest timing difference is for national defense gross investment for relatively long-term production items, such as aircraft and missiles, for which the work in progress is considered part of business inventories until the item is completed and delivered to the Government." (BEA Government Transaction Methodology Paper, p. II-11)

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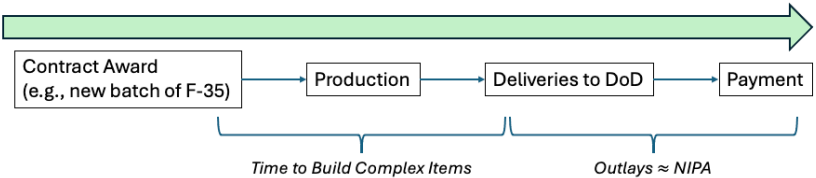

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"A general principle underlying NIPA accounting is that production should be recorded at the time it occurs. [...] The recording of movements of goods in inventory [...] and from inventories to final sales provides the means to allocate production to the period in which it occurred." (Chapter 7 of NIPA's Handbook)

Hickman and the Evidence from the Korean War

"It is apparent that a defense mobilization will provide a stimulus to economic expansion if government expenditures increase the aggregate demand for goods and services. However, the expansion need not await the actual growth of government expenditures. In the first place, some government expenditures for defense will lag behind the placement of orders. For some time, the increase in production that follows orders will be reflected in private inventory investment rather than in government expenditures."
(Hickman, 1955, January)

Outline

Identification

- Spending Authorizations meet the conditions for a macroeconomic shock (Ramey, 2016):

  1. *Exogeneity 1*: uncorrelated with contemporaneous and lagged values of endogenous variables;
  → control for lags + recursive assumption (e.g., SVAR with Cholesky).

  2. *Exogeneity 2*: uncorrelated with other shocks (e.g., monetary policy shocks);
  → Focus on defense spending.

  3. *Unpredictability*: unanticipated.
  → Spending authorizations lead NIPA G! Granger Causality Test

Do Not Use NIPA, Use Spending Authorizations!

- We use spending authorizations as an internal instrument for government spending:
  - (Lag-Augmented) Local Projections:

$$\frac{Y_{t+h} - Y_{t-1}}{\text{GDP}_{t-1}} = \beta^h \cdot \frac{\text{SA}_t - \text{SA}_{t-1}}{\text{GDP}_{t-1}} + (\text{Lagged Controls}) + \varepsilon_{t+h}$$

  - Recursive SVAR (order spending authorizations first):

$$\boldsymbol{Y}_t = A(L) \cdot \begin{bmatrix} \text{SA}_t \\ \text{G}_t \\ \vdots \end{bmatrix} + \varepsilon_t$$

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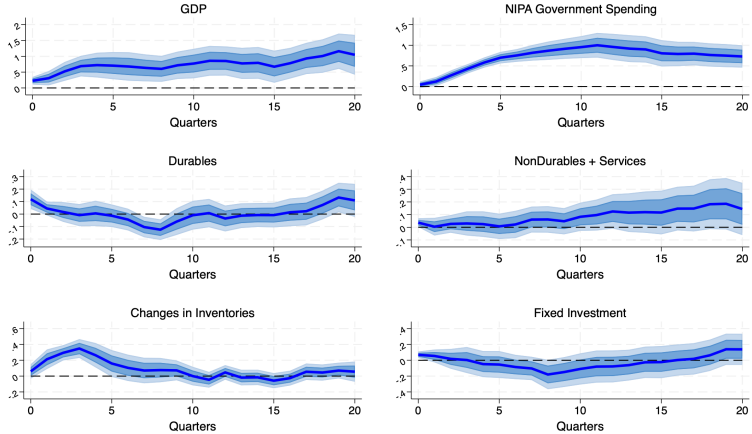
- Baseline analysis:
  - *Variables*: spending authorizations, NIPA G, GDP, TB3, R&R10 Exogenous Tax Shocks.
  - *Sample*: 1947:1 - 2007:4.

Inventories Drive the Early Response of GDP!



Notes: Responses are normalized by the peak response of the IRF of G. Confidence bands represent 68% and 90%. Standard errors are heteroskedasticity-robust (Montiel Olea and Plagborg-Møller, 2021). Sample: 1947:1 to 2007:4.

Robust to Methodology and/or Sample

	1947:1 - 2007:4	1951:1 - 2007:4	1947:1 - 2019:4
LP	Baseline	LP - 1951-07	LP - 1947-19
SVAR	VAR - 1947-07	VAR - 1951-07	VAR - 1947-19

→ Inventories drive early response of GDP.

→ Non-Durable+Service ($\approx$ 82% of C) delayed positive response.

Outline

Estimate Multiplier via LP-IV

- Follow Ramey (2016), Stock and Watson (2018), and Plagborg-Møller and Wolf (2021).
- We estimate the following equation:

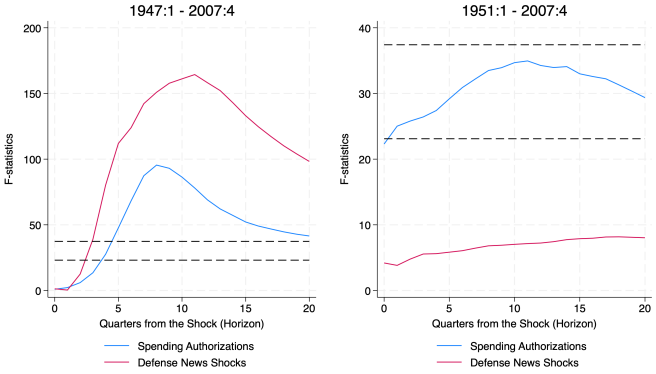
$$\sum_{h=0}^{H} \frac{\text{GDP}_{t+h} - \text{GDP}_{t-1}}{\text{GDP}_{t-1}} = \mathcal{M}_H \cdot \underbrace{\sum_{h=0}^{H} \frac{\text{G}_{t+h} - \text{G}_{t-1}}{\text{GDP}_{t-1}}}_{\text{Instrument with } Z_t} + \text{lags} + \nu_t \tag{1}$$

where

  - lags include four lags of the variables from our baseline LP equation.
  - The cumulative change in G is instrumented with:

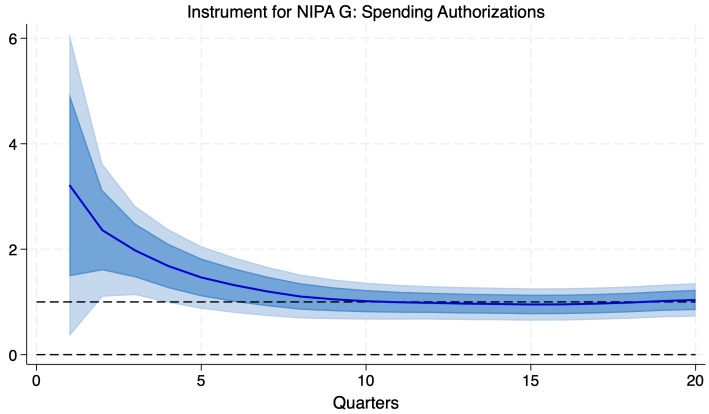
$$Z_t := \frac{\text{SA}_t - \text{SA}_{t-1}}{\text{GDP}_{t-1}}.$$

First Stage: High Statistical Power!



Notes: F-statistics are obtained using either `ivreg2` (Kleibergen and Paap, 2006) or using `weakivtest` in Stata, which produces the Montiel Olea and Pflueger (2013)'s effective F statistics. When there is a single endogenous variable and a single instrument, the two statistics are identical. Black dash lines represent the 5% and 10% weak instruments thresholds (i.e. 37 and 23) calculated by Montiel Olea and Pflueger (2013).

Multipliers go from 5 (Impact) to 1 (5 Years)



Notes: Estimates of the LP-IV multipliers are obtained using the `ivreg2` command in Stata. Confidence bands represent 68% and 90% confidence intervals, calculated with heteroskedasticity-robust standard errors (Montiel Olea and Plagborg-Møller, 2021).

NIPA Underestimates the Multiplier!

- According to our narrative:

→ NIPA underestimates the multiplier.

- Empirical Test:
  - Estimate multipliers using NIPA defense spending (mimic the Blanchard and Perotti (2002) approach).
  - In practice, use NIPA defense spending as an instrument for the cumulative change in NIPA G, in the LP-IV equation:

$$Z_t := \frac{G_t^{def} - G_{t-1}^{def}}{\text{GDP}_{t-1}}.$$

  → Compare multipliers with spending authorizations.

NIPA Underestimates the Multiplier!

	1947:1–2007:4				1951:1–2007:4			
	Spending Authorizations		NIPA Defense Spending		Spending Authorizations		NIPA Defense Spending	
	Multiplier	*Effective F*	*Multiplier*	*Effective F*	*Multiplier*	*Effective F*	*Multiplier*	*Effective F*
Impact	5.12	0.87	0.80	462.26	2.12	15.24	1.08	348.73
	(4.92)		(0.21)		(0.85)		(0.21)	
1-Year	1.68	31.11	0.60	107.73	1.53	19.28	0.70	83.14
	(0.42)		(0.22)		(0.61)		(0.34)	
2-Year	1.10	98.42	0.48	69.48	0.82	21.61	0.23	50.75
	(0.25)		(0.19)		(0.47)		(0.37)	
3-Year	0.98	66.69	0.55	56.28	0.64	23.45	0.25	39.57
	(0.19)		(0.18)		(0.44)		(0.41)	
4-Year	0.95	47.11	0.61	49.33	0.75	23.83	0.35	31.23
	(0.19)		(0.19)		(0.44)		(0.46)	
5-Year	1.04	40.15	0.75	45.21	0.89	22.86	0.46	25.35
	(0.19)		(0.20)		(0.47)		(0.51)	

Notes: Robust standard errors in parentheses. Effective-F calculated with `weakivtest` on Stata (Montiel Olea and Pflueger (2013)).

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  - Suggests DSGE models should emphasize firm behavior over household tax anticipation.
- **Take-away**: measuring *commitments*, not *payments*, restores the true speed and size of fiscal stimulus.

Thank You

Related Literature BACK

- The paper reconciles differences of two main papers:
  - Blanchard and Perotti (2002): recursive SVAR with NIPA G ordered first.
  - Ramey (2011): recursive SVAR with *defense news shocks* ordered first.

- Literature on identification of government spending shocks:
  - **Time Series**: Ramey and Shapiro (1998) (war dates), Mountford and Uhlig (2009) (sign restrictions) Barro and Redlick (2011), Auerbach and Gorodnichenko (2012) (news augmented SVAR), Fisher and Peters (2010) (stock market), Ben Zeev and Pappa (2017) (medium-run restrictions), Ramey and Zubairy (2018).
  - **Panel**: Nekarda and Ramey (2011) (industry level), Nakamura and Steinsson (2014)+Dupor and Guerrero (2017)(state-level), Auerbach, Gorodnichenko, and Murphy (2020) (MSA+Industry level), Miyamoto et al. (2019)+Born et al. (2023) (country level), Guajardo et al. (2014)+Alesina et al. (2015) (fiscal consolidations)
  - **Measurement Delays**: Leduc and Wilson (2013) (highway construction).

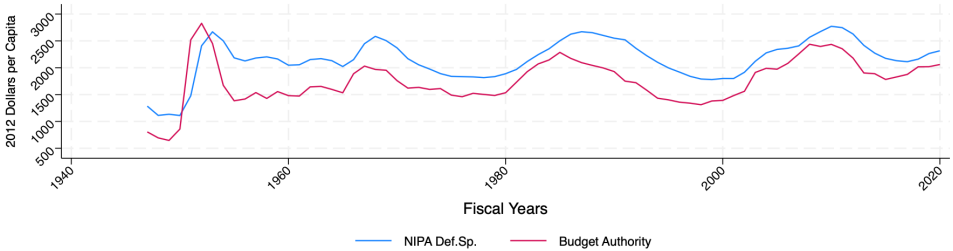
Construction of Budget Authority

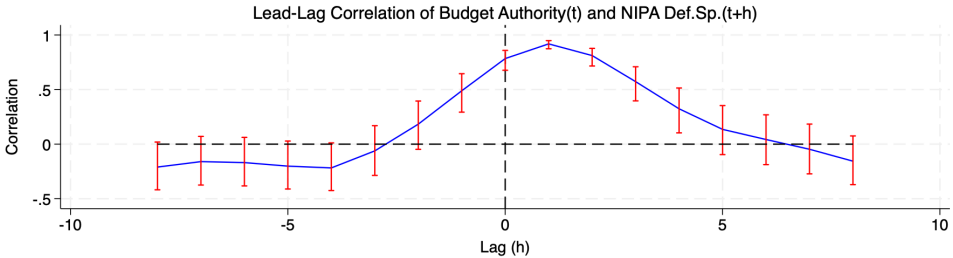
Back

- Data Sources:
  - 1938-1975: *Budget of the United States*.
  - 1976-Onward: Annual budget authority available from *Office of Management Budget* (OMB).
- (Defense) Budget Authority.
  - Pros: most comprehensive measure of spending authorizations.
  - Cons: annual frequency

Budget Authority Leads NIPA Defense Spending

Back





Construction of Defense Contracts Back

- Data Sources:
  - 1940-1945: universe of contracts from *War Production Board* (WPB)
  - 1946: no data (i.e. linear interpolation)
  - 1947-1950: no data (extrapolation from other available series) Extrapolation
  - 1951-1988: monthly data (Ramey (1989)); sourced from *Business Condition Digest* (BCD).
  - 1981-2003: quarterly data from *Federal Procurement Summary Reports* (FPSR).
  - 2000-Onward: universe of contracts from *Federal Procurement Data System* (FPDS).

(Defense) Contracts.

- Pros: quarterly/monthly frequency
- Cons: less complete measure (e.g., no personnel cost).

Defense Contracts Data

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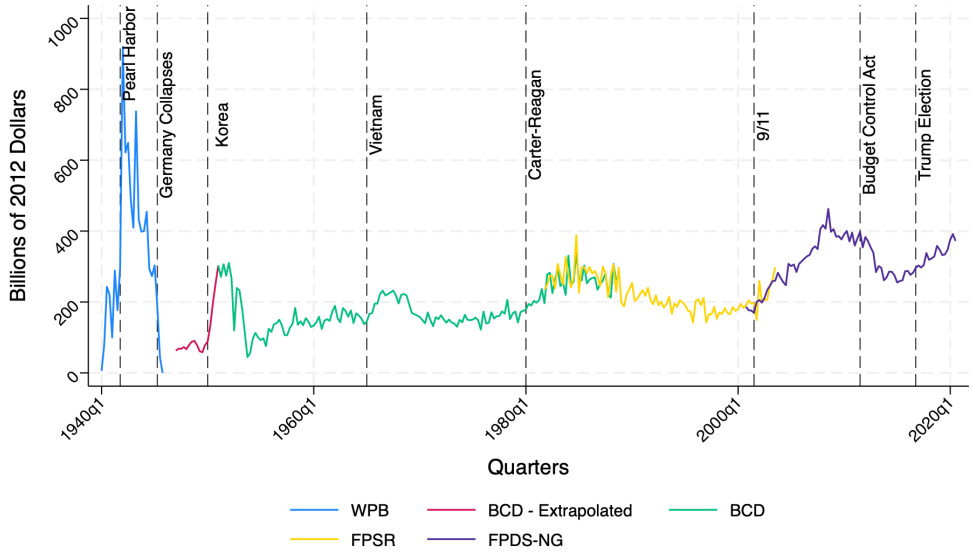
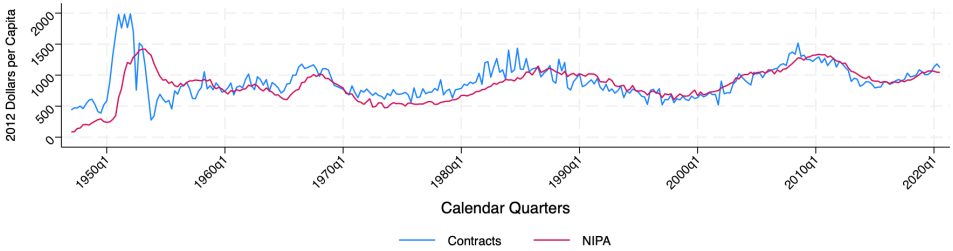
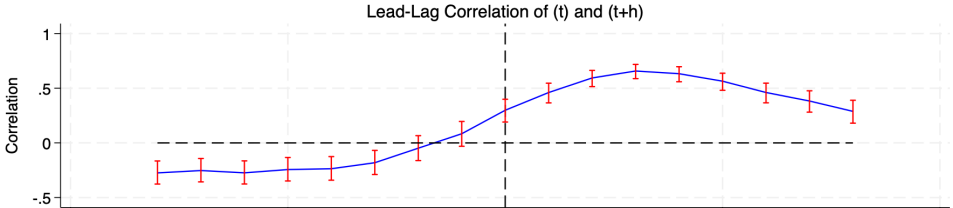


Def. Contracts Lead NIPA Def. Procurement Spending





Combine Budget Authority and Contracts

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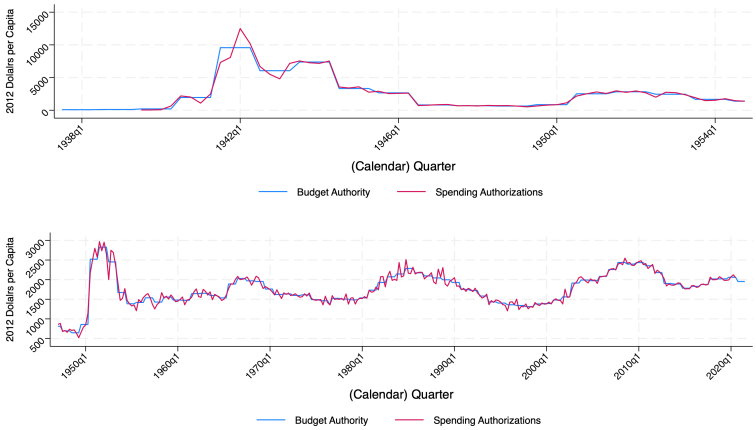

- Interpolate annual values of budget authority with quarterly variation in defense contracts.

Extrapolation

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We estimate the following equation via OLS, spanning from 1951:1 to 1980:4:

$$\text{MPC}_t = \kappa + \beta \cdot (\text{Avg.Hours Aircraft})_t + \sum_{h=0}^{4} \psi_h \cdot \text{NIPA}_{t+h} + \varepsilon_t$$

Table: Predicting Military Contracts - 1947:1-1950:4

Dependent: Military Contracts	*Coefficient*	*Std. err.*	*t*	*P>|t|*	*[95% conf.*	*interval]*
Avg. Weekly Hours (Aircraft)	51.646	23.745	2.175	.032	4.585	98.707
NIPA						
–.	-1.277	.38	-3.361	.001	-2.029	-.525
F1.	.172	.578	.298	.766	-.973	1.317
F2.	.923	.59	1.564	.121	-.247	2.093
F3.	.877	.593	1.479	.142	-.299	2.053
F4.	-.065	.431	-.151	.88	-.919	.79
R^2 64.84%						
T 116						

Notes: Constant is not reported in the output-table. NIPA refers to real defense procurement spending per capita. Price deflator is the GDP price deflator. Average weekly hours of production workers in Aircraft manufacturing are available monthly from 1947 from the discontinued database of the Bureau of Labor Statistics.

Spending Authorizations Predict NIPA! Back

Spending Authorizations vs. NIPA Defense Spending

Predicted	*Predictor*	*Sample*	*F Statistic*	*pvalue*
NIPA Defense Spending	Spending Authorizations	1947:1 - 2019:4	13.916	0
NIPA Defense Spending	Spending Authorizations	1951:1 - 2019:4	12.145	0
NIPA Government Spending	Spending Authorizations	1940:1 - 2019:4	15.806	0
Spending Authorizations	NIPA Defense Spending	1947:1 - 2019:4	1.678	.104
Spending Authorizations	NIPA Defense Spending	1951:1 - 2019:4	.852	.558
Spending Authorizations	NIPA Government Spending	1940:1 - 2019:4	2.059	.04

Cholesky Shocks to NIPA Government Spending vs. Cholesky Shocks to Spending Authorizations

Predicted	*Predictor*	*Sample*	*F Statistic*	*pvalue*
NIPA Government Spending	Spending Authorizations	1947:1 - 2019:4	8.688	0
NIPA Government Spending	Spending Authorizations	1951:1 - 2019:4	8.782	0
Spending Authorizations	NIPA Government Spending	1947:1 - 2019:4	1.182	.311
Spending Authorizations	NIPA Government Spending	1951:1 - 2019:4	1.186	.308

Notes: Granger causality tests are conducted using Stata's `vargranger` post-estimation command from the `var` command, which estimates a bivariate VAR model for the predicted variable and the predictor with p lags. The VAR configuration employs the `dfk` and `small` options of the `var` command to adjust the F statistics for small-sample bias. The testing procedure involves (i) running an OLS regression of the predicted variable on p lags of itself along with p lags of the predictor, and (ii) conducting a Wald test to assess the null hypothesis that the p lags of the predictor are jointly non-significant. The lag p is set to *eight*. Variables are in real per capita values. We use the GDP price deflator (2012=100).

Contracts Budget Authority Defense News Shocks

Granger Causality: Contracts

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Predicted	*Predictor*	*Sample*	*Frequency*	F	*p value*
NIPA Def. Proc. Spending	Military Prime Contracts	1947:1 - 2019:4	Cal. Quarter	10.571	0
NIPA Def. Proc. Spending	Military Prime Contracts	1951:1 - 2019:4	Cal. Quarter	9.758	0
Military Prime Contracts	NIPA Def. Proc. Spending	1947:1 - 2019:4	Cal. Quarter	1.308	.24
Military Prime Contracts	NIPA Def. Proc. Spending	1951:1 - 2019:4	Cal. Quarter	1.634	.115
		Budget Authority - Contracts			
Budget Authority	Military Prime Contracts	1940 - 2019	Fiscal Year	33.123	0
Budget Authority	Military Prime Contracts	1947 - 2019	Fiscal Year	13.865	0
Budget Authority	Military Prime Contracts	1951 - 2019	Fiscal Year	1.452	.242
Military Prime Contracts	Budget Authority	1940 - 2019	Fiscal Year	5.508	.006
Military Prime Contracts	Budget Authority	1947 - 2019	Fiscal Year	4.632	.013
Military Prime Contracts	Budget Authority	1951 - 2019	Fiscal Year	1.482	.235

Notes: Granger causality tests are conducted using Stata's `vargranger` post-estimation command from the `var` command, which estimates a bivariate VAR model for the predicted variable and the predictor with p lags. The VAR configuration employs the `dfk` and `small` options of the `var` command to adjust the F statistics for small-sample bias. The testing procedure involves (i) running an OLS regression of the predicted variable on p lags of itself along with p lags of the predictor, and (ii) conducting a Wald test to assess the null hypothesis that the p lags of the predictor are jointly non-significant. The lag p is set to *four* for quarterly data and to *two* for annual data. Variables are in real per capita values. Price deflator is the GDP price deflator (2012=100).

Granger Causality: Budget Authority

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Predicted	*Predictor*	*Sample*	*Frequency*	F	*p value*
NIPA Def. Spending	Budget Authority	1947 - 2019	Fiscal Year	61.364	0
NIPA Def. Spending	Budget Authority	1951 - 2019	Fiscal Year	52.407	0
Budget Authority	NIPA Def. Spending	1947 - 2019	Fiscal Year	.247	.782
Budget Authority	NIPA Def. Spending	1951 - 2019	Fiscal Year	.738	.482
Budget Authority - Defense Outlays					
Def. Outlays	Budget Authority	1940 - 2019	Fiscal Year	168.37	0
Def. Outlays	Budget Authority	1947 - 2019	Fiscal Year	9.815	0
Def. Outlays	Budget Authority	1951 - 2019	Fiscal Year	52.407	0
Budget Authority	Def. Outlays	1940 - 2019	Fiscal Year	9.917	0
Budget Authority	Def. Outlays	1947 - 2019	Fiscal Year	9.817	0
Budget Authority	Def. Outlays	1951 - 2019	Fiscal Year	.167	.847

Notes: Granger causality tests are conducted using Stata's `vargranger` post-estimation command from the `var` command, which estimates a bivariate VAR model for the predicted variable and the predictor with p lags. The VAR configuration employs the `dfk` and `small` options of the `var` command to adjust the F statistics for small-sample bias. The testing procedure involves (i) running an OLS regression of the predicted variable on p lags of itself along with p lags of the predictor, and (ii) conducting a Wald test to assess the null hypothesis that the p lags of the predictor are jointly non-significant. The lag p is set to *four* for quarterly data and to *two* for annual data. Variables are in real per capita values. Price deflator is the GDP price deflator (2012=100).

Granger Causality: Defense News Shocks

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Predicted	*Predictor*	*Sample*	*Frequency*	F	*p value*
Spending Authorizations	Defense News Shocks	1940:1 - 2019:4	Cal. Quarter	14.319	0
Spending Authorizations	Defense News Shocks	1947:1 - 2020:4	Cal. Quarter	4.683	0
Spending Authorizations	Defense News Shocks	1951:1 - 2020	Fiscal Year	4.843	0
Defense News Shocks	Spending Authorizations	1940:1 - 2020:4	Cal. Quarter	7.705	0
Defense News Shocks	Spending Authorizations	1947:1 - 2020:4	Cal. Quarter	2.988	.003
Defense News Shocks	Spending Authorizations	1951:1 - 2020:4	Cal. Quarter	2.745	.006

Notes: Granger causality tests are conducted using Stata's `vargranger` post-estimation command from the `var` command, which estimates a bivariate VAR model for the predicted variable and the predictor with p lags. The VAR configuration employs the `dfk` and `small` options of the `var` command to adjust the F statistics for small-sample bias. The testing procedure involves (i) running an OLS regression of the predicted variable on p lags of itself along with p lags of the predictor, and (ii) conducting a Wald test to assess the null hypothesis that the p lags of the predictor are jointly non-significant. The lag p is set to *four* for quarterly data and to *two* for annual data. Variables are in real per capita values. Price deflator is the GDP price deflator (2012=100).