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Multipliers of unexpected increases in defense spending: An empirical investigation

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ABSTRACT

We show that unexpected increases in defense spending increase total factor productivity (TFP) and output and decrease investment in US quarterly data. Yet, the output multiplier is zero when the TFP response is shut down. We examine various explanations for this phenomenon and find that the rise in TFP is due to the presence of measurement error in quarterly data. Using artificial data generated from an RBC model with measurement error, we demonstrate the suitability of our identification approach for recovering the true output multiplier in the presence of measurement error.

1. Introduction

According to conventional wisdom, and many textbook analyses, fiscal policy is mostly stimulating demand. Since Keynes advocated a fiscal stimulus during the Great Depression, many governments have implemented fiscal expansions during recessions as a means of stimulating demand. On the other hand, standard business cycle models, both of the Keynesian or the RBC tradition, offer little support for significant demand stimulus from fiscal policy and a lot of recent research aims at developing models that increase the size of the fiscal multiplier (see, e.g., Gali et al., 2007; Christiano et al., 2011, and Erceg and Linde, 2014 among others). Hence, understanding the propagation mechanism and effects of fiscal expansions is crucial for both academic and policy analysis.

In this paper we investigate the macroeconomic implications of unexpected defense spending shocks. Following the work of Ramey (2011) most researchers would agree that large increases in defense spending are anticipated several quarters before they actually occur. Still, the traditional unanticipated fiscal shock can be potentially important, and, most importantly, the majority of the theoretical models in the literature study the effects of unexpected rather than expected increases in fiscal policy. For that reason, we focus on unexpected changes in defense spending, identifying these shocks as innovations in defense spending within a VAR that includes various real and nominal macroeconomic variables as well as the Ramey (2011) news series.

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We show that unexpected increases in defense spending increase total factor productivity (TFP) and output and decrease investment on impact. Since unexpected increases in defense spending increase TFP, the positive output effect of the fiscal shock might be due to the positive responses of the TFP. Indeed, when we force the fiscal shocks to be orthogonal contemporaneously to TFP movements, we find that the output multiplier is zero, with investment declining more strongly and with the consumption response becoming significantly negative as opposed to being insignificant in the unrestricted case. Thus, our analysis confirms the results of Ramey and Shapiro (1998): unexpected increases in defense spending do not seem to generate any significant demand effects.

What is the mechanism that makes unexpected increases in defense spending increase TFP? We argue that correlated measurement errors present in aggregate quarterly data on defense spending, TFP, and output are driving the positive TFP-defense shock relation.[1] We base our argument on three facts. First, the positive correlation between TFP and the unanticipated defense shock only holds for quarterly data and is entirely eliminated when using a TFP measure that is constructed from annual data. Second, when we use the measurement-error free GDP measure put forward by Aruoba et al. (2013) we also find a zero multiplier in response to the unanticipated defense shock, consistent with our measurement-error based interpretation of the results. This suggests that the positive TFP-defense shock relation is spurious and orthogonalizing the defense shock with respect to TFP essentially strips away the measurement error component from the defense shock. Third, we provide some direct evidence on there being a correlation between the measurement error in defense spending, output, and TFP by showing that the unanticipated defense spending shock significantly raises on impact the "statistical discrepancy", which is the difference between Gross Domestic Product (GDP) and Gross Domestic Income (GDI).[2] This effect, however, is halved once the TFP response is shut down. Moreover, since our TFP measure is constructed from business sector output data that is based on data sources that are also used for constructing GDP, it is reasonable to ascertain that TFP is also contaminated by this output measurement error; consistent with this assessment, we found a correlation of 0.37 between TFP growth and the first difference of the ratio of the statistical discrepancy variable to GDP.

We also provide evidence that rules out other plausible economic explanations for the TFP-defense shock relation. First, as conjectured by Nekarda and Ramey (2011), a fiscal shock may raise aggregate productivity by increasing factor inputs in durable goods industries more that in non-durable ones. This, coupled with the observation that returns to scale are higher in durable goods industries than in non-durable industries (see, e.g., Basu and Fernald, 1997 and Nekarda and Ramey, 2011), can generate a rise in TFP in response to a fiscal shock. Nevertheless, we provide evidence against this conjecture by showing that TFP positively responds not only to defense investment shocks but also to defense consumption shocks. To examine if other plausible economic explanations can account for the evidence, we have investigated whether the TFP-defense shock relation can be accounted for by (a) increases in public capital; (b) changes in consumers' confidence; and (c) changes in R&D. None of these other explanations seems to account for the responses we obtain. Hence, it seems that the effects of unanticipated defense spending shocks are solely triggered by measurement errors.

To show that our identification approach is capable of picking up the true output multiplier in the presence of measurement error in quarterly data, we simulate data from an RBC model that includes a common measurement error in TFP, defense spending, and output, and employ our proposed identification scheme on the simulated data. The evidence from this Monte Carlo exercise indicates that our methodology works considerably well. The orthogonalization restriction with respect to TFP enables the proper identification of the true effects of the defense shock on output and the other macroeconomic variables.

Contrary to the effects of unexpected increases in defense spending, anticipated defense spending shocks have sizeable demand effects as shown in Ben Zeev and Pappa (2013) when they are identified as shocks that best explain future movements in defense spending over a five-year horizon and are orthogonal to current defense spending. However, we show that the identified anticipated defense spending shocks do not suffer from the presence of measurement error in quarterly data. Our results suggest that the predictions of the standard RBC model reasonably describe the responses of the US economy to unexpected increases in government spending. Yet, more theory is needed to jointly explain the behavior of the economy after expected and unexpected changes in defense spending.

The remainder of the paper is organized as follows. Section 2 describes the econometric framework. Section 3 presents the main empirical results and in Section 4 we present the Monte Carlo exercise. Section 5 examines the sensitivity of our results to changes in the model's specification. In Section 6 we test different economic explanations for the responses of TFP to unexpected defense shocks and in Section 7 we present evidence on the effects of anticipated defense spending shocks. Section 8 concludes.

2. Identifying unanticipated defense shocks

Let y_t be a kx1 vector of observables and let the VAR in the observables be given by

$$y_t = B_1 y_{t-1} + B_2 y_{t-2} + \cdots + B_p y_{t-p} + B_c + u_t \tag{1}$$

[1] The notion of a common measurement error in aggregate quarterly data is not new; both Ireland (2004) and Malley and Woitek (2010) have formalized this notion by incorporating correlated measurement errors in macroeconomic aggregates in a standard DSGE model.

[2] The statistical discrepancy represents the net sum of all of the measurement errors in estimating the respective components of GDP and GDI. See Rassier (2012) for details on the sources of this measurement error.