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Spending Shocks and
Multipliers in Korea

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Identifying Government Spending Shocks and Multipliers in Korea

Accurately estimating the government spending multiplier is important so that fiscal policies can be used appropriately when recessions hit the economy. To fill the gap between the frontier research of calculating the government spending multiplier and current Korean research, and to estimate a more accurate multiplier in Korea, we construct a government spending news series in Korea based on Fisher and Peters (2010) by exploiting a market-weighted sum of excess stock returns of military contractors in Korea. We then use this military spending news series and estimate a structural VAR model to evaluate the effects of government spending. As a result, GDP and government spending show statistically significant responses to military spending news shocks. The accumulated government spending multiplier peaks after four quarters, and the five-year cumulative multiplier is calculated as 1.27. For a robustness check, different types of VAR models are tested and results are qualitatively similar.

Keywords: Fiscal policy, Multiplier

JEL Classification Numbers: C32, E62

I . Introduction

How does the real economy react to an increase in government spending? To answer this question, there has been a lot of research in the literature on estimating the government spending multiplier.¹⁾ While conclusions are still divided, the methodologies employed for identifying multipliers have been sharpened.

Identifying government spending shocks has become of utmost importance for researchers to quantify the government spending multiplier, as it is necessary to identify exogenous shifts in government spendings in order to accurately calculate the spending multiplier. After structural vector autoregressions became a standard method for studying the effects of fiscal policies, imposing contemporaneous relationships among variables, such as a Choleski decomposition or the Blanchard and Perotti (2002) method, has been utilized to identify government spending shocks.²⁾ However, as Ramey (2011a) explained, these methods are prone to misspecification that arises due to advance information (or news) regarding government spending.³⁾ That is, real activity reacts to news about future government purchases, not to actual purchases in the future. Private agents adjust their consumption or investment decisions to fiscal news before the government actually spends its expenses. For this reason, estimating government spending multipliers based on actual government expenses might be inappropriate. Ramey (2011a) circumvents this problem by accounting for information flows based on the narrative approach, while constructing a measure of military spending, which is exogenous to economic developments, by calculating the present discounted values of military spendings announced in news articles. After Ramey's seminal work, researchers have incorporated additional variables that can capture information flows regarding future changes in fiscal activities into structural

1) See Ramey (2011b, 2016) for surveys of the literature.

2) One early exception was Ramey and Shapiro (1997) in which war dates are used to identify exogenous shifts in government spendings.

3) See Leeper et al. (2013) for a detailed theoretical study about the role of information flow in fiscal analyses.

econometric models (Mertens and Ravn, 2010; Ricco, 2014; Caggiano et al., 2015; Ellahie and Ricco, 2017, among others), or have imposed a medium-run restriction to identify the government spending news shock (Ben Zeev and Pappa, 2015).⁴⁾

However, it seems that research on government spending multipliers in Korea has remained unaffected by advances in the methodologies mentioned above. Imposing contemporaneous relations among variables and using actual government expenses data is still the prevailing way of identifying government spending shocks. There are a couple of reasons on this stream of research in Korea. Firstly, it might be attributed to the institutional differences in budgetary systems between the United States and Korea. Unlike in the US, in which government spending activities are regulated by laws, it is somewhat difficult and tricky to identify each specific spending act in Korea, and it prevents the implementation of a narrative approach similar to Ramey's construction concerning military spending. Second, there is no data available for tracking shifts in private expectations of government spending activities. In the US, the Survey of Professional Forecasters distributed by the Philadelphia Fed contains private forecasts for government spending growth, which can be easily used to detect shifts in private expectations concerning government spending.

As the size of the government spending multiplier is an extremely important subject when crafting fiscal policy, and as policymakers have a keen interest in this, it is necessary to fill the gap between the frontier research and the current computation of the multiplier in Korea. For this purpose, we build a government spending shock in Korea based on Fisher and Peters (2010). This series conveys information about future military spendings in Korea. This is achieved by constructing a market-weighted sum of excess stock returns of publicly traded military contractors in Korea. As stock prices of military contractors theoretically reflect current and future government military spending, which is generally exogenous to

4) There has also been previous research, Ramey and Zubairy (2018) among others, in which semi-parametric methods, such as local projections, have been employed by using externally identified government spending shocks based on information flows.

economic fluctuations, the market-weighted sum of excess stock returns can be an ideal candidate for capturing exogenous shifts in government spending.

Even though the identified government spending shock as explained above is not perfectly matched with the total fiscal expenditure shock, it is the most convenient and accurate one to analyze discretionary and exogenous shifts of government spending among different categories of fiscal expenditure. For this reason, previous literature (Hall, 1980; Hall, 1986; Barro, 1981; Barro and Redick, 2010; Hall, 2009; Ramey, 2011a; Ramey and Shapiro, 1998, among others) has used military spending to evaluate the effects of fiscal policy. To the best of our knowledge, this is the first paper that accounts for information flows regarding government spending through the lens of military spending news while estimating the government spending multiplier in Korea.

One additional contribution to this research is that it can provide an external instrument for the government spending shock in Korea. As there are no survey data that can measure shifts in fiscal expectations in Korea, methods for identifying government spending shocks that are immune to fiscal foresight are limited. We believe that the government spending news shock series constructed in this paper has an advantage in being used in other research as an external instrument compared to the other possible method based on Ben Zeev and Pappa (2015), as the current method is independent of the model specifications.

We incorporate the military spending series constructed above into an otherwise ordinary structural VAR model and calculate the government spending multiplier in Korea. The baseline results show that GDP increases statistically significantly for a couple of quarters. Although most previous research on fiscal multipliers in Korea found it difficult to show a statistically significant response of output with a high level of confidence, we observe a significant response under a 90% confidence level. This outcome hints at the importance of adequately identifying the information flow of government policy that is neglected in the literature for Korean

cases so far. It also turned out that the spending multiplier over a five-year horizon after a military spending news shock is released is estimated at above 1. Therefore, the results can support calls for active fiscal policy during times of depression.

We check the robustness of the results in some dimensions. In particular, we change the lag length, the VAR ordering and the construction of news shocks. While the estimates of spending multipliers vary across specifications, the qualitative responses of macro variables to a military spending news shock are unchanged and all resulting multipliers are located within the range that the previous literature documented.

This paper is organized as follows. Section 2 introduces previous literature regarding the government spending multiplier in Korea. The methodology we employ in this research to identify the government spending shocks are explained in Section 3. Section 4 contains the econometric model used in the analysis. Section 5 presents the results of this paper. Section 6 provides evidence of the robustness of the results. Finally, Section 7 concludes.

II. Related Literature

This paper is closely related to previous studies of fiscal multipliers in Korea. There has been literature studying the government spending multiplier in Korea, but the results are quite different from each other and there is no consensus yet on the effectiveness of fiscal policies. Many of them apply the Blanchard and Perotti (2002) method, using a structural vector autoregression(SVAR). Kim (2007) follows Blanchard and Perotti (2002) and finds that government expenditure shocks decrease output, but tax reduction shocks increase output, concluding that tax reduction policy seems more effective in stimulating the economy compared to government spending expansion policy. Hur (2007) also uses the Blanchard and Perotti (2002) method, but finds that both fiscal expenditure and taxation policy

have insignificant effects on GDP, or else the effects decay quickly. Baek and Seo's (2010) results show that fiscal policy has a statistically significant effect: an expansionary government spending increases output, whereas an increase in tax rate contracts output. Moreover, they conclude that a tax rate reduction may be more effective in increasing output rather than a government spending expansion. Kim (2011) uses an SVAR to estimate the effects of government expenditures and finds that the size of the effect is much bigger than that found in previous studies. The effects of tax cuts using tax revenue data in an SVAR is small, but exploiting historical tax rate data, instead of revenue, reveals that the effects of tax rate changes have more pronounced effects.

There also exists literature that uses methods other than typical SVAR methods. Kim (2012) examines dynamic changes in macro variables according to a temporary increase in fiscal expenditure and tax reductions by constructing a macro-econometric model. It estimates that the expansionary fiscal policy in 2009 increased the real GDP growth rate by 1.9%p in total, consisting of a fiscal expenditure increase of 1.1%p and a tax reduction increase of 0.8%p. Choi and Son (2013) apply a time-varying parameter VAR approach and they estimate government spending multipliers over time from 1986 to 2011. Their results show that after an expansion of government spending, the GDP growth rate increases significantly for three to four quarters, but the trend of effects from government spending decreased gradually after 2000. Son and Lee (2014) use a threshold vector autoregression model (TVAR) to estimate the nonlinear effects of government spending on output. They find asymmetric effects of the fiscal policy. They find that government spending shocks have a larger impact on output during recessionary periods when output is below the potential output compared to expansionary periods, and the degree of asymmetry in Korea is larger compared to those of other advanced economies from the previous studies. Lee and Hur (2017) also point out that using SVAR to estimate fiscal multipliers might have caused different results in previous literature.

Alternatively, they use a Bayesian VAR approach with an interval value constraint on the parameters and find that both tax cuts and government spending expansions have significant stimulus effects on GDP, and government spending expansions have a bigger effect than tax cuts.

We contribute to this important strand of literature by accounting for fiscal foresight caused by advance information and by focusing on military spending, which seems to be exogenous to macroeconomic developments, to clearly identify the effects of exogenous shifts in government spending policy. To our knowledge, this paper is the first attempt to expand research on government spending multipliers in Korea in these directions.

III. Identifying Government Spending Shocks

In this paper, we identify exogenous shifts in government spending activities based on military purchases following Fisher and Peters (2010). The identification strategy based on a Blanchard and Perotti (2002) and Choleski decomposition has been widely used to estimate the government spending multiplier in Korea, as discussed in the previous section. However, this method has a critical drawback as it cannot account for the anticipation of future government spending and it might give the wrong conclusion regarding the effects of government purchases as shown in Ramey (2011a). On the other hand, it is also difficult to implement the narrative approach suggested by Ramey or to use survey data on expectations of future changes in government spending to take account of the fiscal foresight of private agents in Korea, due to either institutional difference in the budgetary system or a lack of reliable data.

As explained in Fisher and Peters (2010), using the market-weighted sum of excess stock returns of military contractors can alleviate the shortcomings found in two major approaches, the narrative and Choleski methods. First, unlike in the narrative approach of Ramey, it is not necessary to assume that spending is known for sure. Moreover, this method is not vulnerable to the subjectiveness of the choice of dates. In

addition, this method can avoid the foresight problem, as stock prices are supposed to reflect future profitability of military contractors whenever new information, which is an anticipation of future military spending, in this case, becomes public.

In this section, we first explain the way military spending news shocks, which measure exogenous shifts in government military spending, are constructed. Then we examine whether this shock captures in any way developments of military spending and government spending in order to justify using the newly created measure.⁵⁾

1. Constructing military spending news shocks originated from military purchases

In this subsection, we explain how military spending news shocks are constructed. We follow a couple of steps to build the measure. First, the list of military contractors, which can be used to build military spending news shocks, is specified. We rely on the list of firms indicated as official military contractors on the Korea Defense Industry Association website, which is originally based on the Defense Acquisition Program Act. Second, firms that are not traded publicly on the stock market are removed from the list.⁶⁾ Table 1 contains the full list of these remaining firms in the first column.

Then, we calculate market excess returns for these firms between February 1980 and November 2018.⁷⁾ Using excess returns allows us to remove any economy-wide variations in equity returns, such as fluctuations due to business cycles, and allows us to isolate solely military-related

5) “Military spending” should take a meaningful portion of government spending to be used as an indicator variable for government spending. From 2000 to 2018, military purchases accounted for 5% of total government spending, which is similar to the defense spending-to-government spending ratio in the United States.

6) Although we lose a lot of firms by dropping non-public companies, their impact would be limited as they are much smaller than publicly traded firms.

7) Market excess returns are calculated by subtracting the monthly KOSPI index growth rate from the monthly returns of each firm.

changes, which, we expect, include shifts in military spending.⁸⁾ Then, we accumulate excess returns for each firm to avoid volatile swings in the resulting variables, following Fisher and Peters (2010).

$$news_t = \sum_i S_{it} m_{it} er_{it} \quad (1)$$

Finally, a military spending news shock series is constructed by the market-weighted sum of accumulated excess returns of military contractors. Specifically, the military spending news shock at time t is calculated as shown in Equation 1. i is the index for each military contractor. S_{it} , m_{it} and er_{it} are the market share, revenue share of the military part within each firm i , and the accumulated excess return of firm i at time t . We take additional firms into account whenever they become available (second column, Table 1).

Two different weighting schemes are used. First, we simply put weights on each firm based on the market share of the firm among military contractors. That is, m_{it} is set to one for all firms (M1). However, this measure might contain very noisy information about military spending, as the list includes firms that also operate in the private sector. For example, Korean Air is the largest company in the airline industry in Korea, and Hyundai Heavy Industries and Daewoo Shipbuilding & Marine Engineering are world-leading shipbuilders. This is a distinctive feature of this construction compared to Fisher and Peters (2010), as they only use returns of the top three military contractors in each year, while excluding firms that operate heavily in the private sector, such as Boeing. It is not

8) It is questionable whether this news shock is vulnerable to industry-specific shocks. For instance, the list contains a lot of heavy industry companies, so the news shock might be affected by the market environment for this industry. However, this is not problematic for two reasons. First, the list includes various industries, such as car components, metals, chemicals, machinery, shipbuilding, airlines, aerospace, etc. Therefore, industry-specific shocks should not affect the news shock significantly as they will be averaged out. Second, for the M2 measure, each firm makes up only a small portion while computing the measure as shown in the last column of Table 1, except for firms that focus mainly on military manufacturing ($m_{it} > 0.5$). Therefore, industry-specific shocks originated from the various industries will not affect the measure.

Table 1. List of Firms

Name	Starting Date	Military Sales	Share of Military Sales	Total Share of M2 (Nov. 2018)
Hyundai Wia	2011/03	Yes	0.1700	0.0232
S&T Motiv	2002/04	Yes	0.1850	0.0111
S&T Dynamics	1985/02	Yes	0.8925	0.0316
Poongsan	2008/08	Yes	0.3675	0.0445
Hanwha	1985/02	Yes	0.3150	0.1088
Kia Motors	1985/02	Yes	≈ 0	0.0000
Doosan Infracore	2001/03	No	0.0800	0.0217
Doosan	1980/02	No	0.1350	0.0460
Doosan Heavy Industry and Construction	2000/11	No	–	0.0000
Hyundai Rotem	2013/11	Yes	0.2050	0.0726
STX Engine	2004/06	Yes	0.4925	0.0122
Korean Air	1985/02	Yes	0.0700	0.0325
Korea Aerospace Industries	2011/07	Yes	0.6025	0.2860
Hanwha Aerospace	1987/06	Yes	0.7125	0.1849
LIG nex1	2015/11	Yes	1.0000	0.1249
Daewoo Shipbuilding and Marine Engineering (DSME)	2001/03	No	–	0.0000
Hanjin Heavy Industries and Construction	2007/09	No	–	0.0000
Hyundai Heavy Industries	1997/02	No	–	0.0000

possible to pursue this strategy in Korea, as there are few companies that solely operate in the military sector in Korea, and military contractors are relatively smaller compared to those in the US.

For this reason, we build a second measure (M2) based on both market share and the proportion of revenues that the military part of the company generates for each firm. Specifically, we search the annual reports of firms listed in Table 1. The third column in Table 1 shows whether the annual report of each firm announces the revenue share of its military division, and the fourth column presents the revenue share of

the military division in each company, if available.⁹⁾

While computing the second measure, M2, we only include firms that announce their military share of revenue, where the fourth column is a positive number. The value of m_{it} is set to zero for firms for which we could not obtain the revenue share of its military division. Then, the cumulated sum of excess returns, which are multiplied by the military share of revenue m_{it} and the market share S_{it} , are used as the second measure of the military spending news series.

Note that this construction naturally ignores overseas military purchases, as they do not affect profits of domestic military contractors. This is an appealing feature of this measure, as overseas purchases do not have stimulus effects on real domestic activities.

2. Further analyses of military spending news shocks

In this subsection, we examine whether the military spending news shocks constructed above are valid variables in the sense that they capture shifts in military spending and government spending.

First, correlations between defense improvement spending¹⁰⁾ and military news shocks are computed during the 2000 to 2018 period.¹¹⁾ Figure 1 depicts graphs of these three series and Table 2 presents the correlation structure, with lags and leads, between military spending news series and defense improvement spending. Two military spending news shocks move similarly, as shown in Figure 1. However, it is not quite clear from the figure whether the news shocks and the defense

9) Revenue share may vary considerably as it takes a long time to deliver contracts and to make actual payments for large military contracts. For this reason, we take the average of the revenue share of the military division between 2014 and 2017, which is the longest span for the majority of firms listed in Table 1. One exception is Doosan Infracore, which only reports its share from 2016.

10) Total government military spending consists of two parts, operational costs that cover wages and the maintenance of equipment & facilities, and then defense improvement spendings that are purchases of military equipment, such as arms, vehicles, airplanes and ships.

11) We de-trended defense improvement spendings through an HP filter to focus on the cyclical component.

Figure 1. Military Spending News Shocks & Defense Improvement Spending

Note: The solid red line represents defense improvement spending (right). The dashed grey and dotted blue lines are government spending news shocks without/with consideration of revenue shares of firms' military divisions (left).

Table 2. Correlation Between Defense Improvement Spending and News Shocks

Correlation	With DIS (-2)	With DIS (-1)	With DIS (0)	With DIS (+1)	With DIS (+2)
All firms included	-0.15	0.12	0.13	0.16	0.16
Military proportion considered	-0.13	0.11	0.09	0.26	0.57

Note: DIS=Defense Improvement Spending

improvement spending are related. Table 2 shows that both shocks are reasonably correlated with defense improvement spendings. Specifically, both show a strong positive relationship with contemporaneous and future defense improvement spendings. Because the stock market reflects all available information regarding future developments in the industry, the news shocks contain future available information about government military spending. For this reason, both news shocks are more strongly correlated with future defense improvement spending.

In addition, the second measure, M2, which includes information about the revenue of the military division in each firm, is more strongly correlated with future defense improvement spendings. This suggests that reflecting the portion of military-related activities while calculating the military spending news shock can alleviate noise that is not related to government military spending. Based on these results, we use the second measure of M2 as the benchmark case in our main analyses.¹²⁾

Second, it is necessary to check whether increases in defense improvement spendings lead to hikes in military spending. It might seem trivial, as defense improvement spending is a component of overall military spending. However, as the military spending-to-GDP ratio is very stable in Korea, increases in defense improvement spending might crowd out other components of military spending and military spending may remain unchanged. To resolve this concern, we assess the co-movement of two variables by computing correlations both in levels and in cyclical components. It turns out that the correlation in levels is 0.98 and that in cyclical components is 0.69. Therefore, we can dismiss the concern raised above based on the high level of co-movement between the two variables.

Lastly, we test whether the news shocks are valid for identifying government spending shocks by computing explanatory powers following Ramey (2011a) and Fisher and Peters (2010). In particular, we regress government spending on current and lagged values of the news shocks.¹³⁾

Table 3. Explanatory Power of News Shocks

News Shock	All Firms Included	Military Proportion Considered
R^2	0.10	0.16

Table 3 shows the explanatory power of the news shocks. As anticipated, the second measure has better explanatory power than the

12) The benchmark government spending news shock series is available on the corresponding authors' websites.

13) The HP-filtered cycle of seasonally adjusted real government spending per capita is used in the regression. Following Fisher and Peters (2010), six lags of the news shocks are included.

first measure, as the second measure contains less “noisy” information regarding current and future military spendings. Compared to the news shock constructed in Fisher and Peters (2010), our news shocks have similar or better explanatory powers. Hence, we can conclude that the news shocks are valid for identifying shocks to government spending.

IV. Econometric Model

1. Data

We use quarterly GDP, government spending, tax revenue and 91-day CD rates¹⁴⁾ from 2000 Q1 to 2018 Q3 in the analyses below. GDP, government spending and tax revenue are log real variables, which are first divided by population. Real GDP and 91-day CD rate are obtained from the Bank of Korea. Government spending and tax revenue are from consolidated central government balance statistics provided by the Ministry of Economy and Finance. Since they are nominal raw data, we first convert them to real variables by scaling them by a GDP deflator. Then, they are seasonally adjusted by the X-13 ARIMA procedure. Finally, we divide them by population and take logs as in GDP.¹⁵⁾

2. VAR model

We estimate the following VAR model:

$$y_t = Ax_t + \sum_{i=1}^n B_i y_{t-i} + e_t \quad (2)$$

14) We used 91-day CD rates following Ramey (2011a), Fisher and Peters (2010), and Ben Zeev and Pappa (2015), which used 3 month T-bill rate as the benchmark interest rate. We also tried 5-year Treasury bill rate for a robustness check and found that the fiscal multiplier is only marginally different in the second place below the decimal point.

15) All variables, excluding the CD rate, are turned into per capita terms by dividing by population provided by Statistics Korea.

where y , x and e are endogenous variables, exogenous variables, including the constant term, and the reduced form error term with variance Ω . A and B_i are coefficient matrices to be estimated.

The baseline VAR includes five endogenous variables: military news shock, GDP, government spending, tax revenue and the 91-day CD rate. The military news shock is ordered first, as this variable is supposed to be the most exogenous. Four lags are included as the baseline, while some lag tests, such as the SIC, prefer shorter lags following the usual practice in the literature using quarterly VAR models. However, the results are robust under shorter lag specifications, as will be shown later. We also include linear and quadratic time trends in the VAR, following Ramey (2011a). We evaluate the effects of shifts in exogenous government spending with the Choleski innovation to military spending news shock, following Fisher and Peters (2010). That is, we identify structural shocks to endogenous variables by imposing restrictions to contemporaneous matrix C in the following equation

$$Cy_t = \bar{A}x_t + \sum_{i=1}^n \bar{B}_i y_{t-i} + \varepsilon_t \quad (3)$$

where $A = C^{-1}\bar{A}$, $B_i = C^{-1}\bar{B}_i$ and ε is a structural shock with a diagonal variance matrix Σ . C is a lower triangular matrix that satisfies $C^{-1}\Sigma(C^{-1})^T = \Omega$.

V. Results

1. Baseline model

Figure 2 displays responses to a one standard deviation military spending news shock¹⁶⁾ of GDP, government spending, tax revenue and

16) The standard deviation of structural disturbances to military spending news shock is about 0.3. Hence, a one standard deviation military spending news shock can be interpreted as an announcement of increases

the 3-month interest rate. A shock to the military spending news shock is associated with hump-shaped positive GDP responses, peaking after two quarters. The peak response of GDP is about 0.005% and the effect fades away smoothly. The response remains statistically significant for three quarters after the impact, with a 90% confidence level. This result is remarkable given that many previous studies of the Korean economy show marginally significant output effects from government purchases with lower confidence levels. The magnitude is also economically significant given that defense improvement spending only makes up a small portion of total government spending.¹⁷⁾

Figure 2. Responses to a Military Spending News Shock

in military purchases, which can boost the market weighted sum of excess returns among military contractors by 0.3%p quarterly.

17) Defense improvement spending in the 2017 fiscal year was approximately KRW 12 trillion which is about 3% of the total budget (approx. KRW 400 trillion) in fiscal year 2017.

As is expected, government spending also presents a statistically significant positive response with delay to a one standard deviation from the military spending news shock.¹⁸⁾ Since the news shock delivers information that the government will increase its military purchases, it is anticipated to have a positive effect on government spending. This result, combined with the reaction of output, suggests that the military spending news shock that we constructed above is appropriately identified. The response peaks after six quarters and the effects dissipate over time.

Interestingly, the response of government spending is not significant during the first year after the news shock arrives. This is a reasonable outcome as military spending news shocks convey prior information about future military spending. They do not signal actual government spending. It takes a number of quarters to settle actual payments after an announcement of a military purchase. This is also in line with the correlation structure discussed in the previous section.

Responses to tax revenue dissipate slowly over about six quarters, and the interest rate shows a hump-shaped reaction, peaking after two quarters with the size of 0.18%p. This statistically significant effect of a news shock to the interest rate implies that the crowding-out effect may undermine the stimulating impacts of government purchases.

Table 4. Government Spending Multiplier

Impact Multiplier	After 6 Quarters (1.5 years)	After 20 Quarters (5 years)
1.09	1.68	1.27

Table 4 shows fiscal multipliers that are calculated by dividing the cumulative effect of GDP to the news shock over the cumulative effect of government spending to the same shock, following Ramey (2011a) and Ramey and Zubairy (2018).¹⁹⁾ The effects used here to calculate the fiscal

18) Ramey and Zubairy (2018) and Ben Zeev and Pappa (2015), among others, also report similar hump-shaped and delayed responses of government spending to a military news shock.

multipliers are accumulated, which means the sum of the effects of each period up to a certain point in time. Therefore, the h -period cumulative spending multiplier can be computed as below:

$$h\text{-period cumulative spending multiplier} = \frac{\sum_{j=0}^h y_j}{\sum_{j=0}^h g_j}, \quad h = 1, 2, 3, 4, \dots \quad (4)$$

where y_j and g_j are responses of GDP and government spending in j periods after the impact.²⁰⁾

The cumulative government spending multiplier up to 6 and 20 quarters are estimated as 1.68 and 1.27, respectively. Additionally, the impact government spending multiplier, which is calculated by dividing the impact effect of GDP to the news shock over the impact effect of government spending to the same shock, is estimated at 1.09.

Multipliers tend to be much larger for shorter horizons. This is a natural outcome given that actual government spending increases with delay while GDP starts to respond immediately after military spending news arrives. Then, the multiplier drops significantly in the five-to-11 quarters horizon as government purchases actually realize. In the analyses below, we will focus on a medium-run cumulative multiplier in the five-year horizon for better comparison, following Ramey (2011b, 2016).

As mentioned before, some of related literature in Korea report an insignificant effect of government spending on output. Among other literature, which reports significant responses of macroeconomic variables to government spending shocks, Kim (2011) calculates a government spending multiplier that is comparable with our research. The size of the multiplier for the 20-quarter horizon is similar: ours is calculated at 1.27

19) Similarly, present value multipliers, which discount future effects by real interest rates, are widely used in the literature, for instance in Leeper, Traum and Walker (2017).

20) Specifically, the multipliers are computed as the ratios of integrals under the impulse response functions of GDP over government spending multiplied by the average government spending-to-GDP ratio over the past 10 years (2008-2018), which is 0.22.

and Kim (2011) reports 1.516.

The estimated multipliers are also comparable with those calculated for the US economy. Fisher and Peters (2010), who employ a similar identification strategy used in this paper, report that the five-year accumulated effects of an increase in military spending are 10% and 3% hikes for government spending and output. This is equivalent to the five-year multiplier of 1.5, which is similar to our result of 1.27. Ramey (2011a) also reports the five-year multiplier of 1.2, which is close to ours. Moreover, these results lie in the range of estimated multipliers in the literature, around 0.6 to 1.8, as summarized in Ramey (2011b, 2016).

This suggests that increases in government spending have significant effects on boosting real activity for a prolonged period, as the cumulative spending multiplier is bigger than one for more than five years. The result concludes that increasing government spending is a valid and effective countercyclical policy option in Korea. In particular, government spending multipliers estimated in Table 4 reveal that temporary hikes in government spending can front-load resources from expansion periods to recession periods. This can be beneficial when increasing incomes during recessions are preferred to sacrifice the same amount of incomes during expansions.

2. Keynesian vs. Neoclassical Effects

As discussed in Blanchard and Perotti (2002) and Ramey (2016), among others, Keynesian and Neoclassical models give opposite predictions regarding the effects of government spending on private consumption and real wage. Specifically, Keynesian models predict that an increase in government spending leads to a hike in private consumption and real wage, whereas Neoclassical models predict the opposite. Therefore, analyzing the responses of private consumption and real wages empirically might shed some light on future research regarding which type of model is more appropriate to study the effects of fiscal policies.

To this end, we enlarge the baseline model and include private consumption and real wages as additional endogenous variables. Included variables are ordered as follows: spending news, GDP, private consumption, government spending, tax revenue, real wages and short-term nominal interest rates.

Figure 3. Responses of Private Consumption and Real Wages

Notes: The solid dark blue lines are point estimates of responses to a military spending news shock. The dashed light blue lines show the 68% probability regions and the dashed red lines show the 90% probability regions.

Figure 3 shows the impulse responses of private consumption and real wages to a positive government military spending news shock. Private consumption presents a similar response to that of GDP. Private consumption increases as government military spending rises, and this reaction is statistically significant at the 90% confidence level. This result favors Keynesian models over Neoclassical models. However, the response of real wages indicates somewhat mixed results. Specifically, real wages do not show a significant reaction to the military spending shock, so it is not possible to assess which model real wages prefer based on these results.

To summarize, the above evidence weakly supports the Keynesian view point, as does a large amount of the literature that analyzes the consequences of fiscal policy, especially research that uses the Blanchard-Perotti method, as documented in Ramey (2016). This is also in line with the results reported by Fisher and Peters (2010), which uses a similar identification scheme for the US economy.

3. Comparison with Choleski Decomposition and Blanchard–Perotti Method

We illustrate how inclusion of a news variable improves fiscal analysis by comparing our results with those obtained by other identification strategies, such as a simple Choleski decomposition or the Blanchard–Perotti method. First, we simply apply a Choleski decomposition to a VAR model consisting of the four variables used in the baseline model: GDP, government spending, tax revenue and nominal interest rates. Two orderings are considered. In the first case, government spending is ordered after GDP. The impulse response in Figure 4 shows that GDP does not respond to a government spending innovation in a statistically significant way. The right panel in Figure 4 presents the response of GDP to a government spending innovation when government spending is ordered first. Basically, it shows a similar reaction regardless of the specific ordering of the VAR model.

Figure 4. GDP Responses in Choleski Decomposition

Notes: The solid dark blue lines are point estimates of responses to a government spending shock. The dashed light blue lines show the 68% probability regions and the dashed red lines show the 90% probability regions.

Next, we identify structural innovations using the Blanchard–Perotti method. We have to estimate or restrict matrices A and B to recover structural shocks from the reduced form disturbances shown below.

$$Au_t = B\varepsilon_t \quad (5)$$

$u_t = [t_t \ g_t \ x_t]'$ and $\varepsilon_t = [e_t^t \ e_t^g \ e_t^x]'$ are reduced form residuals and structural shocks. t , g and x denote their association with tax revenue, government spending and the GDP equation, respectively. A and B can be expressed explicitly as

$$A = \begin{pmatrix} 1 & 0 & -a_1 \\ 0 & 1 & -b_1 \\ -c_1 - c_2 & 1 & 1 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & a_2 & 0 \\ b_2 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}. \quad (6)$$

As we focus on the impact of the government spending shock on GDP, it is suffice to impose restrictions for a_1 , a_2 , b_1 and b_2 . Following Kim (2011), we impose the following restrictions:²¹⁾

$$a_1 = 2.067, \ b_1 = -0.139, \ a_2 = 0, \ b_2 = 0.$$

Figure 5 shows the impulse responses of government spending and GDP to a government spending shock. The qualitative results are quite similar to those obtained by a Choleski decomposition, and a positive response of GDP is not statistically significant in this case. As a consequence, the implied government spending multiplier is subsequently smaller compared to the baseline result. Indeed, the cumulative multiplier on the five-year horizon is only 0.22, which is about one-sixth of the baseline result.

21) Other specifications reported in Kim (2011) are also considered. For instance, the $a_1 = 2.706$, $b_1 = -0.197$ case and the $a_2 = 0.016$, $b_2 = 0$ case are tested, but these specifications do not significantly change the results.

Figure 5. Blanchard-Perotti Method

Notes: The solid dark blue lines are point estimates of responses to a government spending shock. The dashed light blue lines show 68% probability regions and the dashed red lines show 90% probability regions.

Table 5. Government Spending Multiplier From B-P Method

Impact multiplier	After 6 Quarters (1.5 years)	After 20 Quarters (5 years)
0,22	0,45	0,22

In sum, both a Choleski decomposition and the Blanchard-Perotti method produce insignificant output responses to a government spending shock. This suggests that the conclusions made in previous studies that government spending is not effective in stimulating real activities might be caused by neglecting fiscal foresight.

VI. Robustness Checks

In this section, we check the robustness of our results by changing the empirical model specifications in some dimensions. First, we estimate the VAR model with shorter lags. Since some lag order criteria, e.g., SIC and Hannan-Quinn, prefer shorter lags, the same VAR model with two lags is estimated. The top panel in Figure 6 shows that the government spending news shock can stimulate GDP and the response is statistically significant for the next one year at a 90% confidence level. A primary difference

from the baseline result is the response of government spending. While government spending shows a significant reaction to the news shock in the baseline above, it is muted under this specification. This might be caused by simpler dynamics due to the smaller number of lags. As a result, government spending multipliers are bigger than the baseline estimates, as shown in Table 6. In particular, the cumulative multiplier is higher than three at the five-year horizon.

Secondly, a specification with different ordering of the VAR variables is also considered. In particular, we order the news shock last in the VAR model and assume that the news shock can affect the other variables with some lag. In this case, the results are also intact: an increase in military spending news stimulates GDP in a significant way and drives up actual government spending with lags, as in the baseline specification. Therefore, we can conclude that the main results are robust under different specifications of the estimated model and that the military spending news shocks constructed in this paper are a useful proxy variable to study fiscal policy, as they can result in robust responses of output and government spending.

Finally, an alternative military spending news shock that does not consider the portion of the military division's operations within each military contractor (M1) is used instead of our primary measure of military spending news shock (M2) to show that the results are not driven by the somewhat adhoc choices of the list of military contractors used in constructing the news shock. It turns out that the results are still robust with an alternative choice of military spending news shocks. The response of output is hump-shaped and statistically significant, while government spending responds to the news shock with a delay, as in the baseline case. However, the five-year cumulative multiplier turns out to be smaller than in the baseline case (1.13). In addition, the response by government spending is less significant in this measure. This suggests that accounting for the share of the military-related division within each firm helps to identify government military spending.

Figure 6. Responses to a Military Spending News Shock With Different Specifications

Figure 6. Responses to a Military Spending News Shock With Different Specifications - *Continued*

Notes: The solid dark blue lines are point estimates of responses to a military spending news shock. The dashed light blue lines show the 68% probability regions and the dashed red lines show the 90% probability regions.

Table 6. Five-year Cumulative Government Spending Multipliers

2 Lags	Different Ordering	Military Proportion not Considered (M1)
2.00	2.16	0.86

In sum, these results confirm that government spending can be considered to be an effective policy option to stimulate real economic activities, at least in the medium-run. However, the possible range for the magnitude of the boost measured by cumulative multipliers is quite large so that a quantitative evaluation of government spending policy is still ambiguous.

VII. Conclusion

Accurately estimating the government spending multiplier is important for policymakers and economists, since it gives a hint as to how to use fiscal policy when economic recession hits the economy. In Korea, even though there is a lot of research estimating the government spending multiplier based on structural vector autoregression methods, there's no consensus yet as to the effects of government spending on output. In this paper, we try to fill the gap between frontier research and current Korean research by accounting for fiscal foresight and strive to get a more accurate government spending multiplier. To this end, we construct a government spending news series in Korea based on Fisher and Peters (2010) by exploiting the market-weighted sum of excess stock returns of military contractors. Identifying the government spending shock with stock returns of the military contractors not only has the advantage of containing information about current and future military spending, but it can also capture any exogenous movements in government spending.

The baseline result shows that a positive military spending shock immediately raises GDP even before actual government spending is carried out. In addition, government spending responds to the military spending news shock with a one- to two-year delay, as expected from the construction of the news shock. We calculate the accumulated fiscal multipliers and it turns out that the peak appears after four quarters and decreases slowly afterward. The baseline five-year cumulative multiplier is calculated at 1.27 and this result suggests that government spending is an effective option for stimulating real economic activity.

Unlike previous research, we find a statistically significant reaction of real GDP to government purchasing activities. Combined with the results obtained from a Choleski decomposition and the Blanchard-Perotti method, this hints that incorporating fiscal foresight is important when trying to evaluate the effects of fiscal policy.

For a robustness check, we estimate other versions of the baseline

model by imposing shorter lags, shuffling the order of variables in the VAR, and using different types of military spending news series. Although the quantitative size of fiscal multipliers is somewhat different in each, qualitative movements of the responses to the news shocks seem to be similar in general regardless of the specifications.

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<Abstract in Korean>

새로운 재정지출 식별방법을 이용한 우리나라의 정부지출 승수효과 추정

박광용*, 이은경**

정부지출승수를 정확하게 추정하는 일은 경제가 침체기에 도입했을 때 재정정책을 적절히 활용하기 위해서 중요한 일이다. 정부지출승수 추정의 최신 기법을 도입하고 좀 더 정확한 추정치를 구하기 위해, 본 논문은 Fisher and Peters (2010)의 방법론을 기반으로 한국의 방산 업체의 초과주식 수익률을 활용하여 재정충격을 식별하였다. VAR 모형 분석 결과, GDP와 정부지출은 군수사업체의 재정충격에 통계적으로 유의한 반응을 보였으며, 축적된 정부지출 재정승수는 4분기 이후에 최댓값을 나타냈으며 그 이후로는 서서히 감소하는 추세를 보였다. 또한 충격 이후 5년간의 누적 재정승수는 1.27로 나타났다. 강건성 검사를 위하여 다른 유형의 VAR 모형도 추정하였으며, 그 결과 전반적으로 재정충격에 의한 거시 변수의 움직임이 비슷함을 확인하였다.

핵심 주제어: 재정정책, 재정승수

JEL Classification: C32, E62

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3	Who Improves or Worsens Liquidity in the Korean Treasury Bond Market?	Jieun Lee

제2018-4	Establishment Size and Wage Inequality: The Roles of Performance Pay and Rent Sharing	Sang-yoon Song
5	가계대출 부도요인 및 금융업권별 금융취약성: 자영업 차주를 중심으로	정호성
6	직업훈련이 청년취업률 제고에 미치는 영향	최충 · 김남주 · 최광성
7	재고투자와 경기변동에 대한 동학적 분석	서병선 · 장근호
8	Rare Disasters and Exchange Rates: An Empirical Investigation of Korean Exchange Rates under Tension between the Two Koreas	Cheolbeom Park · Suyeon Park
9	통화정책과 기업 설비투자 - 자산가격경로와 대차대조표경로 분석 -	박상준 · 육승환
10	Upgrading Product Quality: The Impact of Tariffs and Standards	Jihyun Eum
11	북한이탈주민의 신용행태에 관한 연구	정승호 · 민병기 · 김주원
12	Uncertainty Shocks and Asymmetric Dynamics in Korea: A Nonlinear Approach	Kevin Larcher · Jaebeom Kim · Youngju Kim
13	북한경제의 대외개방에 따른 경제적 후생 변화 분석	정혁 · 최창용 · 최지영
14	Central Bank Reputation and Inflation-Unemployment Performance: Empirical Evidence from an Executive Survey of 62 Countries	In Do Hwang
15	Reserve Accumulation and Bank Lending: Evidence from Korea	Youngjin Yun
16	The Banks' Swansong: Banking and the Financial Markets under Asymmetric Information	Jungu Yang

제2018-17	E-money: Legal Restrictions Theory and Monetary Policy	Ohik Kwon · Jaevin Park
18	글로벌 금융위기 전·후 외국인의 채권투자 결정요인 변화 분석: 한국의 사례	유복근
19	설비자본재 기술진보가 근로유형별 임금 및 고용에 미치는 영향	김남주
20	Fixed-Rate Loans and the Effectiveness of Monetary Policy	Sung Ho Park
21	Leverage, Hand-to-Mouth Households, and MPC Heterogeneity: Evidence from Korea	Sang-yoon Song
22	선진국 수입수요가 우리나라 수출에 미치는 영향	최문정 · 김경근
23	Cross-Border Bank Flows through Foreign Branches: Evidence from Korea	Youngjin Yun
24	Accounting for the Sources of the Recent Decline in Korea's Exports to China	Moon Jung Choi · Kei-Mu Yi
25	The Effects of Export Diversification on Macroeconomic Stabilization: Evidence from Korea	Jinsoo Lee · Bok-Keun Yu
26	Identifying Uncertainty Shocks due to Geopolitical Swings in Korea	Seohyun Lee · Inhwan So · Jongrim Ha
27	Monetary Policy and Income Inequality in Korea	Jongwook Park
28	How the Financial Market Can Dampen the Effects of Commodity Price Shocks	Myunghyun Kim
29	Which External Shock Matters in Small Open Economies? US Economic Policy Uncertainty vs. Global Risk Aversion	Youngju Kim · Hyunjoon Lim
30	Do Korean Exports Have Different Patterns over Different Regimes?: New Evidence from STAR-VECM	Sei-Wan Kim · Moon Jung Choi
31	기술진보와 청년고용	심명규 · 양희승 · 이서현

제2018-32	북한지역 장기주택수요 및 연관 주택건설투자 추정	이주영
33	기업규모간 임금격차 원인 분석	송상윤
34	우리나라 고용구조의 특징과 과제	장근호
35	창업의 장기 고용효과: 시군구 자료 분석	조성철 · 김기호
36	수출입과 기업의 노동수요	음지현 · 박진호 · 최문정
37	청년실업의 이력현상 분석	김남주
38	노동시장 이중구조와 노동생산성: OECD 국가를 중심으로	최충 · 최광성 · 이지은
39	한국과 일본의 청년실업 비교분석 및 시사점	박상준 · 김남주 · 장근호
40	노동시장의 이중구조와 정책대응: 해외사례 및 시사점	전병유 · 황인도 · 박광용
41	최저임금이 고용구조에 미치는 영향	송헌재 · 임현준 · 신우리
42	최저임금과 생산성: 우리나라 제조업의 사례	김규일 · 육승환
43	Transmission of U.S. Monetary Policy to Commodity Exporters and Importers	Myunghyun Kim
44	Determinants of Capital Flows in the Korean Bond Market	Soohyon Kim
45	Central Bank Credibility and Monetary Policy	Kwangyong Park
46	통화정책이 자본유출입에 미치는 영향: 행태방정식 분석	이명수 · 송승주

제2018 -47	Commodities and International Business Cycles	Myunghyun Kim
제2019 -1	Deciphering Monetary Policy Board Minutes through Text Mining Approach: The Case of Korea	Ki Young Park · Youngjoon Lee · Soohyon Kim
2	The Impacts of Macroeconomic News Announcements on Intraday Implied Volatility	Jieun Lee · Doojin Ryu
3	Taking a Bigger Slice of the Global Value Chain Pie: An Industry-level Analysis	Chong-Sup Kim · Seungho Lee · Jihyun Eum
4	Trend Growth Shocks and Asset Prices	Nam Gang Lee
5	Uncertainty, Attention Allocation and Monetary Policy Asymmetry	Kwangyong Park
6	Central Bank Digital Currency and Financial Stability	Young Sik Kim · Ohik Kwon
7	은행의 수익 및 자산구조를 반영한 통화정책 위험선호경로	김익진 · 정호성
8	혁신기업에 대한 산업금융 지원: 이론모형 분석	강경훈 · 양준구
9	가계부채 제약하의 통화정책: 2주체 거시모형(TANK)에서의 정량적 분석	정용승 · 송승주
10	Alchemy of Financial Innovation: Securitization, Liquidity and Optimal Monetary Policy	Jungu Yang
11	Measuring Monetary Policy Surprises Using Text Mining: The Case of Korea	Youngjoon Lee · Soohyon Kim · Ki Young Park
12	Tracking Uncertainty through the Relative Sentiment Shift Series	Seohyun Lee · Rickard Nyman
13	Intra-firm and Arm's Length Trade during the Global Financial Crisis: Evidence from Korean Manufacturing Firms	Moon Jung Choi · Ji Hyun Eum

제2019-14	특허자료를 이용한 우리나라 지식전파의 지역화 분석	이지홍 · 남윤미
15	Overhead Labour and Skill-Biased Technological Change: The Role of Product Diversification	Choong Hyun Nam
16	Does the Number of Countries in an International Business Cycle Model Matter?	Myunghyun Kim
17	High-Frequency Credit Spread Information and Macroeconomic Forecast Revision	Bruno Deschamps · Christos Ioannidis · Kook Ka
18	경제 분석을 위한 텍스트 마이닝	김수현 · 이영준 · 신진영 · 박기영
19	Takeover, Distress, and Equity Issuance: Evidence from Korea	Euna Cho
20	The Cash-Flow Channel of Monetary Policy: Evidence from Mortgage Borrowers	Sang-yoon Song
21	부의 효과의 분위 추정: 분위 정준 공적분회귀를 중심으로	김기호
22	Identifying Government Spending Shocks and Multipliers in Korea	Kwangyong Park · Eun Kyung Lee