

Fiscal Multipliers: A Meta-Analysis of the Literature*

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Abstract. Since the fiscal expansion during the Great Recession 2008-2009 and the current European consolidation and austerity measures, the analysis of fiscal multiplier effects is back on the scientific agenda. The number of empirical studies is growing fast, tackling the issue with manifold model classes, identification strategies, and specifications. While plurality of methods seems to be a good idea to address a complicated issue, the results are far off consensus. We apply meta regression analysis to a set of 89 studies on multiplier effects in order to provide a systematic overview of the different approaches, to derive stylized facts and to separate structural from method-specific effects. We classify studies with respect to type of fiscal impulse, model class, multiplier calculation method and further control variables. Moreover, we analyse subsamples of the model classes in order to evaluate the effects of model-class-specific properties, currently discussed in the literature, such as the influence of central bank reaction functions and liquidity constrained households. As a major result, we find that the reported size of the fiscal multiplier crucially depends on the setting and method chosen. Thus, economic policy consulting based on a certain multiplier study should lay open by how much specification affects the results. Our meta-analysis may provide guidance concerning influential factors.

Keywords. multiplier effects; fiscal policy; meta-analysis

JEL classification. E27, E62, H30

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1 Introduction

The discussion on the scale of fiscal multipliers has lasted for decades and still economists struggle on the value of the multiplier. Stimulus packages facing the Great Recession and the current consolidation and austerity measures have brought the matter back on the scientific agenda. Especially the question of effects of the US stimulus packages under Bush jun. and Obama administrations were a permanent source of economic discussion. Turning to European countries, currently the effects of fiscal contractions are a central issue that is also closely related to multiplier evaluations. In theoretical approaches several effects have been discussed that eventually turn the balance of the multiplier below or above unity. Roughly summing up, the discussion is about crowding in vs. crowding out effects in private consumption, investment and net exports.

The empirical literature on the size of the multiplier is growing fast, tackling the issue with manifold model classes, identification strategies, and specifications. While plurality of methods seems to be a good idea to address a complicated issue, unsurprisingly the results are far off consensus.

The vast majority of different model approaches and assumptions makes the case for a systematic literature review. Several papers that try to summarize the literature take a descriptive approach or come up with a list of reported multipliers and characteristics of the reporting studies. However, since reported multiplier values in the literature are quantifiable, it should be possible to review the literature with statistical criteria. Meta regression analysis is a suitable tool to tackle the issue. According to Stanley and Jarrell (2005: 301), ‘Meta-analysis is the analysis of empirical analyses that attempts to integrate and explain the literature about some specific important parameter.’ We apply meta regression analysis to a set of 89 studies on multiplier effects in order to provide a systematic overview of the different approaches, to derive stylized facts and to separate structural from method-specific effects.

It should be stressed that our method is not suitable to find *the true multiplier value*, because even if our sample is an unbiased representation of the whole literature on multiplier effects, it is not clear whether or not this whole literature provides an unbiased picture of actual multiplier effects. Moreover, as Carroll (2009: 246) points out, ‘asking what *the* government spending multiplier is, [...] is like asking what *the* temperature is. Both vary over time and space.’ However, our meta-analysis helps to filter out the systematic influence of certain study characteristics on the reported multiplier value. We are able to separate methodic distinctions among studies from structural distinctions of the fiscal policy settings these studies evaluate.

We classify studies with respect to type of fiscal impulse, model class, multiplier calculation method and some further control variables. The type of fiscal impulse is our central structural characteristic by which we try to identify the relative effectiveness of different fiscal measures. The model class is our central method-specific parameter by which we try to analyse the goodness of fit of results from certain model classes in comparison to other model classes. Moreover, we analyse subsamples of the model classes in order to evaluate the effects of model-class-specific properties currently discussed in the literature, such as the influence of central bank reaction functions, liquidity constrained

households or the sample period on which the studies base their calculations.

Our main results go in line with theoretical reasoning: first, reported multipliers largely depend on model classes, with RBC models standing out of the rest of approaches by reporting significantly lower multipliers. Second, direct public demand tends to have higher multipliers than tax cuts and transfers. Especially public investment seems to be the most effective fiscal impulse. Third, reported multipliers strongly depend on the method and horizon of calculating them. Thus, a simple listing of multiplier values without additional information on how they were computed could show a biased picture. Fourth, longer time series tend to imply higher multipliers in our sample, time series that end in more recent years tend to imply lower multipliers. One should, however, be aware that even the most recent time series in our sample do not cover a reasonable part of the effects of the stimulus packages in response to the Great Recession. Fifth, the more open the import channel of an economy, the lower seems to be the multiplier. Sixth, in model based approaches the interest rate reaction function is a key parameter to the reported multiplier value. Multiplier effects are highest, when the central bank accommodates fiscal policy or is bound to a zero interest rate. Moreover, an increasing share of Keynesian agents, for whom Ricardian equivalence is broken, significantly increases multiplier values. Both an accommodating monetary policy and liquidity constrained households correspond to the current macroeconomic setting which could imply a higher effectiveness of fiscal policy in times of the current crisis.

To sum up, reported multipliers very much depend on the setting and method chosen, thus, economic policy consulting based on a certain multiplier study should lay open by how much specification affects the results. Our meta-analysis may provide guidance concerning such influential specifications.

The paper is organized as follows: In the next section we provide a conventional literature review on related multiplier surveys, meta-analyses as well as on the topics discussed in the fiscal multiplier literature. Section three gives an overview of the data collection. Section four shows some descriptive statistics. Section five explains and discusses the meta regression method. Section six provides the findings of our meta regression, including various robustness checks. The final section concludes.

2 Literature Review

2.1 Other Meta-Analyses and Multiplier Literature Reviews

The growing interest in the effects of fiscal policy measures has recently provoked several overview articles that descriptively sum up the findings in the literature by extracting some stylized facts and influences of the economic setting and study characteristics (Ramey 2011; Parker 2011; Hebous 2011; Bouthevillain et al. 2009; Spilimbergo et al. 2009; van Brusselen 2009; Fatás and Mihov 2009; Hasset 2009). While at least some of these studies provide tables of study results and study characteristics to categorize the existing literature, there is a lack of a systematic quantitative analysis, which makes the case for a meta regression analysis.

Meta-analysis is becoming a more and more accepted tool in economics. Ebscohost

shows more than 250 entries with the phrase “meta analysis” in the title of the publication by the end of 2011. To our knowledge, our study is the first application of meta regression analysis to the growing literature on fiscal multipliers. There are some similar studies on other macroeconomic policy evaluations. De Grauwe and Costa Storti (2004) meta-analyse the effects of monetary policy on growth and prices. They draw on 43 empirical studies that use VAR models and structural econometric models. Rusnák et al. (2011) reveal study specific influences, sufficient to explain the price puzzle in a sample of 70 papers on price effects of monetary policy. Another meta-analysis by Nijkamp and Poot (2004) surveys 93 studies on fiscal policy, but focuses on long-run growth effects of fiscal policies, and does not take into account short-run multiplier effects. Card et al. (2010) analyse 97 studies on active labor market policies and evaluate the effectiveness of certain kinds of programs. The famous meta-analysis of Card and Krueger (1995) provided insights of the reported effects of minimum wages depending on the study specification. An overview on some further meta studies in economics can be found in Stanley (2001: 134).

2.2 Overview of included studies

Our survey includes model-based studies as well as empirical investigations. We discriminate between New Classical RBC (or D(S)GE) models, New Keynesian DSGE models, structural macroeconometric models, VAR models, and all kinds of single equation estimation techniques (OLS, IV, ML, GMM, ECM, ...).

Basic RBC models entail a utility maximizing, representative household for whom Ricardian equivalence holds. Additionally, they feature fully competitive labor and goods markets. These models imply full crowding out of private consumption. Expansionary fiscal policy does not increase GDP via a Keynesian demand effect, but via a neoclassical negative wealth effect that results in increased labor supply (Baxter and King 1993). The multiplier effect of public spending is usually in a range of $0 < k < 1$, with the precise value depending on the elasticities of demand for labor and the elasticity of substitution of consumption and leisure (Woodford 2011). Some modifications to the household’s utility function, such as complementarity of consumption and labor supply, complementarity of public and private consumption or allowing for productivity enhancing effects of public spending, may raise the multiplier to values larger than one (Linnemann 2006; Mazraani 2010). Negative multipliers in these models may come with public employment lowering private labour supply and with distortional effects of taxation (Ardagna 2001; Fatás and Mihov 2001).

Most contemporary studies on fiscal multipliers use New Keynesian DSGE models (henceforth: DSGE-NK), extending the standard RBC model with monopolistic competition and sticky prices or wages. These New Keynesian amendments allow for an output gap in the short run and possible demand side effects of fiscal policy, even if Ricardian equivalence holds. Multiplier effects in these models, however, largely depend on the reaction function of the monetary authority, or more precisely on the reaction of the real interest rate. The usual setting of an inflation target or some sort of Taylor rule implies a counteraction to a decreasing output gap leading to a partial interest rate

crowding out of investment and/or consumption. Depending on calibration and/or estimation of the parameters, the multiplier effects in these models vary slightly, but they typically find multipliers of public spending in a range of $0 < k < 1$. However, current developments in the related literature tend to broaden the spectrum of possible multipliers in both directions. On the one hand, the multiplier may be $k < 0$ when including so-called non-Keynesian effects due to distortionary taxation, a wage-level increasing effect of public employment, or risk premia on interest rates for high government debt. The modifications possibly indicate expansionary effects of fiscal contractions in these models (Briotti 2005: 10-11). On the other hand, introducing a share of non-Ricardian consumers (Galí et al. 2007; Cwik and Wieland 2011), or a central bank that operates at the zero lower bound (ZLB) (Woodford 2011; Freedman et al. 2010), DSGE-NK models yield higher multiplier values, comparable to those of structural macroeconomic models. Ricardian equivalence is broken by assuming high individual discount rates or liquidity constraints for some households. There are many synonyms in the literature, e. g. non-Ricardian agents, hand-to-mouth consumers, myopic agents, rule-of-thumbers, liquidity constrained households, etc. They are subsumed under the heading of *Keynesian agents* here, as they share the attribute of aligning their spending with current income. The ZLB effect constitutes a non-linearity to the central bank reaction function in situations with a big output gap and low inflation. At the ZLB the nominal interest rate is fixed, and thus expansionary fiscal policy lowers the expected real rate of interest due to increasing inflation expectations, i. e. a Fisher effect.

A third type of models are structural macroeconomic models (henceforth: MACRO), still in use for political consulting despite the dominance of micro-founded models in academia. Macroeconomic models typically do not incorporate utility maximising households, but estimate macroeconomic consumption and investment functions. Most of these models combine Keynesian reactions in the short-run with neoclassical features in the long run. Due to the short-term nature of fiscal multiplier measures their Keynesian features are core here, which usually leads to multipliers larger than one due to crowding in of private consumption or investment, depending on the monetary and foreign trade regime.

Another strand of the literature applies VAR models and measures impulse-responses of fiscal shocks. Estimated multiplier values vary widely, which may be due to divergent data bases, kinds of fiscal shock, and the method of identification of exogenous fiscal shocks. There are five established approaches for identification, two of which rely on additional historical information, and three of which try to identify exogenous fiscal shocks directly from the time series. See (Caldara and Kamps 2008) for a comprehensive explanation of most of the methods. (1) The war episodes approach focuses on a few periods of extraordinary US military spending hikes, which are deemed to be orthogonal to business cycle fluctuations (Ramey and Shapiro 1998). (2) The so-called narrative record, established by Romer and Romer (2010), follows a similar idea, but employs real time information such as government announcements and economic forecasts. (3) The recursive VAR approach (Fatás and Mihov 2001) uses a Choleski decomposition with imposed zero restrictions to implement a causal order of the VAR variables and to rule out contemporaneous reactions of the fiscal variable to business cycle variations. (4) The

Blanchard and Perotti (2002) SVAR approach builds on the recursive VAR approach, but additionally allows for non-zero restrictions such as imposing estimated elasticities of automatic stabilizers.⁽⁵⁾ The sign restricted VAR approach (Mountford and Uhlig 2009) identifies exogenous fiscal shocks by imposing sign restrictions to the impulse-response functions of the fiscal shocks and then distinguishing them from a business cycle shock. Some VAR studies additionally distinguish multiple regimes in order to separate effects of fiscal policy in upturns and downturns, pointing out the relevance of downturn regimes when it comes to evaluating fiscal stimuli (Auerbach and Gorodnichenko 2012).

Our data set also includes a group of various single equation estimations (henceforth: SEE), such as OLS, IV, ML, GMM, and ECM approaches. Just like VAR studies, this group reports a wider range of multiplier values than the more model based approaches. The multiplier in single equation estimations usually appears in the coefficients of the (lagged) fiscal variables, which may impose a problem to compare these multipliers with those of the other approaches.

Besides their model class, papers differ concerning the types of fiscal impulses, they try to evaluate. One can distinguish at least six expansionary fiscal measures, namely public consumption, public investment, military spending, direct public employment, transfers to households and tax cuts, notwithstanding more detailed classifications. Many studies do not even distinguish public consumption, investment and military spending, but simply refer to public spending.

3 Data and Variables

Our data set includes empirical and (semi-)calibrated papers on short-term output effects of discretionary fiscal policy measures. It takes into account 89 papers from 1992 to 2012, providing a sample of 749 observations of multiplier values. We counted 278 observations from DSGE-NK models, 55 from RBC models, 94 from MACRO models, 260 from VARs and 62 from SEE. The majority of papers in our sample has been published from 2007 onwards. This is due to the fact that fiscal policy is back on the political agenda since the Great Recession.

In order to search for papers we used BusinessSearch and repec as well as established working paper series (NBER, CEPR, IMF, Fed, ECB) and Google Scholar. As a necessary precondition papers must provide calculations of multiplier effects or at least provide enough information such that we were able to calculate multiplier effects on our own. For example, some papers provided elasticities of output with respect to government spending. If these papers also provided the share of government spending to GDP, multiplier calculations were possible.

The 749 reported multiplier values come along with specific characteristics. We developed a set of characteristics that should explain the variability in the reported multiplier values. To this end, we focussed on typical characteristics that gave rise to discussions in the literature. However, some characteristics do not apply to every model class. For example, it is not possible to discriminate agent behavior in VAR studies. Thus, for the total sample we only included characteristics that fit to all model classes. In subsamples that focus on special model classes we were able to check the influence of further

characteristics.

Most characteristics, such as the model class itself, are measurable on a nominal scale only, i. e. there is no possible ranking order. We group these characteristics, since they are exclusive. A reported multiplier value can exclusively belong to one value in the group ‘model class’, which comprehends the values (RBC, DSGE-NK, MACRO, VAR, SEE). For example, an observation that stems from a VAR has dummies (RBC=0, DSGE-NK=0, MACRO=0, VAR=1, SEE=0).

For the total sample we focus on the influence of model classes and the type of fiscal impulse (SPEND, CONS, INVEST, MILIT, TRANS, EMPLOY, TAX), which is recorded on a nominal scale, too. Again, an observation must belong to exclusively one value in this group. The value ‘SPEND’ applies, when the paper reports the effect of public spending without specifying whether it is public consumption (CONS), public investment (INVEST) or military spending (MILIT). Other impulses could be transfers to households (TRANS), public employment (EMPLOY) or lowering taxation (TAX).¹ For robustness checks, we also set up a variable for spending in general (GSPEND), comprising all observations from (SPEND, CONS, INVEST, MILIT), as opposed to the other types of impulses.

Moreover, we include some control variables. In line with Spilimbergo et al. (2009: 2) we found several calculation methods of the multiplier in the data set. DSGE, RBC and VAR models usually provide impulse response functions of standardized fiscal policy shocks; macroeconometric models report deviations of a fiscal shock scenario from a baseline scenario. Multipliers are calculated either as the peak response of GDP with respect to the initial fiscal impulse

$$k = \frac{\max_n \Delta Y_{t+n}}{\Delta G_t} \quad (1)$$

or as the integral of the response function of GDP divided by the integral of the fiscal impulse function

$$k = \frac{\sum_n \Delta Y_{t+n}}{\sum_n \Delta G_{t+n}}. \quad (2)$$

Since peaks are usually the maxima of response functions, we would expect peak multipliers to exceed integral multipliers. However, sharply declining fiscal impulse functions combined with long-lasting GDP responses can produce integral multipliers exceeding peak multipliers. For single equation estimations multiplier effects show up in the coefficients of fiscal variables. We therefore recorded the group of multiplier calculation methods with the variables (PEAK, INTEGRAL, COEFF) on a nominal scale.²

Multiplier calculations also differ concerning the time horizon of measurement (Brückner and Tuladhar 2010: 16), so we list the number of quarters after the shock (HORIZON) on which the multiplier calculation is based. By collecting both the calculation

¹We do not distinguish the various types of taxation. Moreover, some included papers deal with multipliers from tax increases. They are treated symmetrically to multipliers from lowered taxes.

²As COEFF belongs to only one model class (SEE) and *vice versa*, COEFF is omitted from the regression due to exact collinearity.

method and the horizon, we can account for the effect that peak multipliers are usually recorded on a shorter horizon than integral multipliers. Thus, the pure method specific effect is separated from the timing effect. Moreover, by this combination impact multipliers, listed by Spilimbergo et al. (2009: 2) as yet another calculation method, simply fall into the category of integral multipliers with horizon 1.

Some models largely rely on calibrated parameters, while others largely base their parameter values on estimations. A potential bias with respect to this distinction of methods is controlled for by a dummy (CALIB, ESTIM) for models that are estimated to a large part. The difference only applies to DSGE-NK and RBC models, while the other model classes are estimated by nature.

Another issue that should be controlled for is the leakage of fiscal impulses through the import channel as a country-specific effect. Using the World Bank World Development Indicators data set, we recorded the average import quota (M/GDP) of the time series and country (or group of countries) that the reported multiplier relates to. With respect to calibrated models that are not based on a certain time series, we referred to the whole available time series of the country(-group) to which the model is calibrated.

Meta-analyses in economics often test for a possible publication bias in their data set (Stanley and Doucouliagos 2010; Card et al. 2010; Card and Krueger 1995), i.e. a preference for statistically significant results in submission processes. In line with Card et al. (2010) we tackle this issue by using a dummy variable for journal publications as opposed to working papers and books, which are consolidated (JOUR, WP/BOOK).

Concerning subsamples, more detailed characteristics can be taken into consideration. We build five subsamples with respect to model classes. Subsample #I, comprising DSGE-NK, RBC and MACRO models, distinguishes the characteristics mentioned above, and additionally looks for agent behavior, the modeling of the interest rate reaction, and whether the model is an open-economy model. The very same characteristics are taken into account for subsample #II that focuses on DSGE-NK and RBC models only. As for agent behavior, we record the share of Keynesian agents (KEYNES), for whom Ricardian equivalence is broken. The higher the share of Keynesian agents, the higher should be the reported multiplier. The modeling of the interest rate can take one of four values on a nominal scale (LOANABLE, INFLATION, FIXED, ZLB), namely, on the basis of a loanable funds market, an inflation target central bank reaction function, including Taylor rules, a fixed real interest rate, and a zero lower bound setting with a fixed nominal interest rate for the central bank, where expansionary fiscal policy may lower the expected real rate of interest via a Fisher effect. Fixed real rates of interest or a ZLB regime should come with higher multipliers than the other two regimes, where crowding out via interest rates is more likely. In order to control for the disparity of open-economy models and closed-economy models, we use a dummy variable (OPEN, CLOSED). We expect closed-economy models to report higher multipliers.

Subsample #III, as a complement to subsample #II, contains all observations from MACRO, VAR and SEE approaches. Due to diversity of the model classes, there are no additional variables compared to total sample. However, subsample #IV, which is the complement to subsample #I, only includes the related VAR and SEE approaches, and thus allows for more characteristics. We record some properties of the time series that the

studies draw upon. We included a normalised value of the last year of the respective time series (END), the length of the time series measured in years (LENGTH) and a dummy for annual vs. quarterly data (ANNUAL, QUARTER). LENGTH and QUARTER could be proxies for the quality of the study since they contain information on the sample size. END could provide information whether more recent time series tend to have lower multipliers, as discussed in van Brusselen (2009); Bilbiie et al. (2008); Bénassy-Quéré and Cimadomo (2006); Perotti (2005).

Subsample #V applies the same characteristics as subsample #IV, but refers to VAR models only. As pointed out, there is a specific discussion in the VAR literature on identification strategies of discretionary fiscal impulses, and there are five established approaches (war episodes, narrative record, recursive VAR, structural VAR and sign restricted VAR). As with model classes for the total sample, we record the various approaches on a nominal scale, with dummies (WAREPI, NARRATIVE, RECURSIVE, STRUCTURAL, SIGNRES), where each observation belongs to exactly one approach.

4 Descriptive Statistics

This section provides a short overview on reported multiplier values. We corrected for some outliers that would have otherwise distorted the distribution. As the mean of reported multipliers is around 0.8, we excluded all observations outside the interval $[-2.2; 4]$, which is about $\mu \pm 3\sigma$. Six observations were dropped from the total sample—one on the lower end and five on the upper end of the distribution.

Table 1 reports mean and median values of reported multipliers with respect to model classes and kinds of fiscal impulse. From this mono-characteristic view, multiplier values vary widely among model classes and fiscal impulses (first rows of the table). Macro models seem to report highest multipliers, while those from RBC models seem to be lowest. Means are in a range of 0.5 to 1.0, however, one should be aware that they comprise all kinds of fiscal impulses. This is important because impulses themselves also seem to come along with very different multipliers (mid-rows). The means of reported multipliers from general public spending and public employment seem to be approximately twice as high as those from tax cuts and transfers. Splitting the group of general spending into public consumption, investment, military spending and nonspecific spending is suggestive of higher multipliers for public investment (bottom rows).

It should be stressed again that these statistics should not be (mis-)interpreted as true multiplier values, even if they stem from a comprehensive literature survey. Multiplier calculations may all be biased in some direction and several significant influences are unaccounted for at this point. Properties of the distribution should advise caution as well. Even though means are relatively close to medians for each model class and impulse, Figures 1 and 2 show that multipliers for the subgroups are by and large not normally distributed, which is confirmed by Jarque-Bera probabilities. Multimodal distributions point to additional influential factors. Of course, obvious distortional factors are model classes interfering the distributions of fiscal impulses and *vice versa*, but also the other variables, introduced in the former section should be tested. This is why we perform a meta-analysis on our sample. The aim is to separate the influences of model classes and

Table 1: Descriptive statistics of reported multiplier values for model classes and fiscal impulses

	TOTAL	DSGE-NK	RBC	MACRO	SEE	VAR
N	743	278	54	94	62	255
Mean	0.8	0.8	0.5	1.0	0.6	0.9
Median	0.8	0.8	0.5	1.0	0.6	0.8
Std. Dev.	0.8	0.7	0.8	0.5	0.7	0.9
Jarque-Bera p	0.00	0.00	0.55	0.03	0.00	0.00
	GSPEND	TRANS	TAX	EMPLOY		
N	525	58	147	13		
Mean	1.0	0.4	0.6	0.8		
Median	1.0	0.3	0.5	0.9		
Std. Dev.	0.8	0.5	0.7	0.9		
Jarque-Bera p	0.00	0.00	0.00	0.36		
	SPEND	CONS	INVEST	MILIT		
N	319	95	86	25		
Mean	0.9	0.9	1.2	1.1		
Median	0.9	1.0	1.1	0.9		
Std. Dev.	0.8	0.6	0.8	0.8		
Jarque-Bera p	0.00	0.12	0.00	0.01		

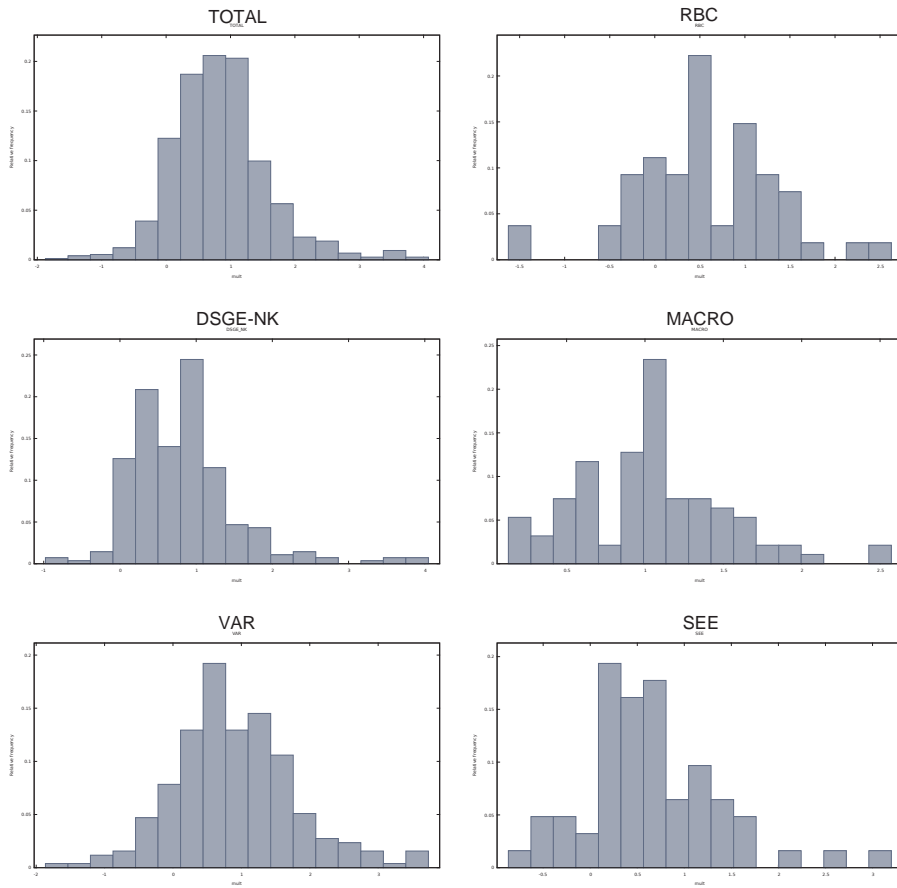


Figure 1: Histograms of reported multiplier values for various model classes

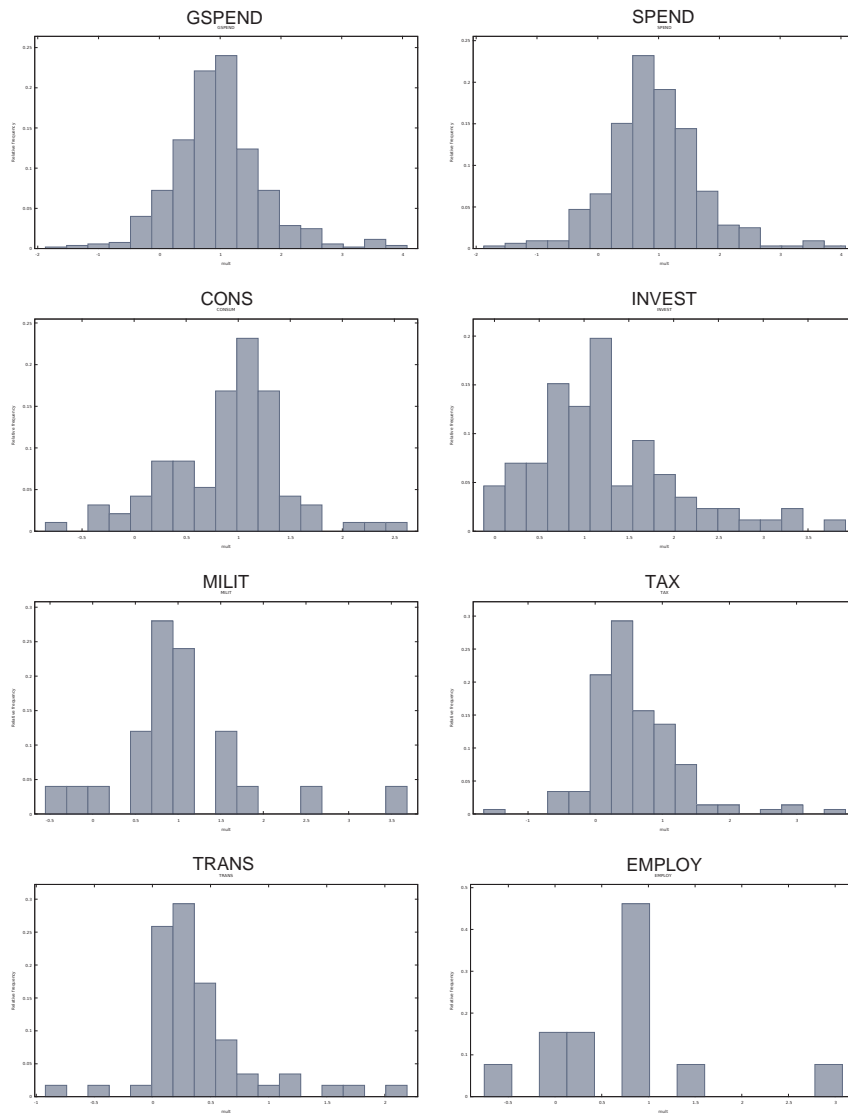


Figure 2: Histograms of reported multiplier values for various fiscal impulses

types of impulses and to check for additional significant influences.

5 Meta Regression Analysis – Method

For the proposed meta-analysis we stick to Stanley and Jarrell (2005: 302). In general, our model reads

$$k_j = \kappa + Z_j\alpha + e_j \quad j = 1, \dots, N \quad (3)$$

with

- k_j multiplier value of observation j
- κ “underlying” or “reference” multiplier value
- Z_j vector of characteristics (“moderator variables”) of observation j
- α vector of systematic effects of Z_j on k_j

We use heteroscedasticity-robust estimators and include dummies for each paper in order to control for paper-specific intercepts. However, to keep track of the main results we do not display the dummies in regression tables. Some further methodical questions need to be addressed. Meta studies often use normalisation tools to construct the effect size. To end up with a dimensionless scale, the average outcome of a treatment group is subtracted by the average outcome of the control group divided by standard deviation of the control group (Stanley 2001: 135). Normalisation is not an issue for our purpose, because the multiplier is already dimensionless. On the other hand, as mentioned above, multiplier values are not measured in a standardised manner. We control for the multiplier calculation method and the time horizon to extract comparable multiplier values, but it should be pointed out that this may only be a second best solution. However, there is no established method to translate, for example, peak multipliers into integral multipliers, or a multiplier for a horizon of ten quarters into a multiplier for five quarters.

According to Goldfarb and Stekler (2002), a general problem is double counting when several meta-studies use the same data base (for instance US quarterly data from 1970-2005). Meta-analysis should include only distinct and separate observations and not clones or reiterations of existing studies. However, for our purpose the same data set does not imply the same study setup. One data set can be used with different methods and model classes. These different approaches help to discriminate between specifications and should thus be included entirely.

A different question is whether to include multiple observations from one study, e.g. when the authors deal with various models, countries or types of fiscal impulse. Stanley (2001: 138) suggests to use only one observation per study or to take the average in order to control for undue weight of a single study. While this is a reasonable claim, there are some important counter-arguments. First, there is a clear trade-off with variability and degrees of freedom. Second, when picking only one observation per study, the meta-analysers must take a tough decision, which one to include. Third, taking the average

value may be possible for the reported multipliers, yet this technique is not valid for study characteristics of a nominal (categorical) scale type, such as the type of fiscal impulse. Fourth, taking only one observation from a comprehensive study may likewise give an undue weight to less-comprehensive studies. We and also other authors (De Grauwe and Costa Storti 2004; Nijkamp and Poot 2004; Card et al. 2010; Rusnák et al. 2011) therefore prefer including more than one observation per study. By using dummies for each paper, the specialty of a study is controlled for to a certain degree.

Nevertheless, we are aware of the problem of over-weighting, and thus check the robustness of our results in several ways. First, we exclude single papers with many observations ($N \geq 30$) from our sample. Second, for the total sample, we perform a robustness check by taking only one observation per study into account, namely the median value. Third, for each (sub-)sample we set up a weighted sample, by weighting each observation of a paper by the number of observations in the paper; that is, given a paper reports five different multiplier estimates, we include every estimate weighted by 1/5. The same technique applies to the study characteristics. In total every study is equally weighted. By doing so, we strike a balance between proportional influence of single studies versus degrees of freedom and variability in our survey.

Other meta studies differentiate the quality of included studies. Stanley (1998), for example, checks for quality on the basis of degrees of freedom, number of robustness tests and thus the number of different specifications of an included study; a higher number of degrees of freedom and different specifications should hint at a better diagnosis. De Grauwe and Costa Storti (2004) use the sample size as a quality-weight. We do not perform quality selections for our total sample, as the above mentioned criteria are not suitable for model-based approaches. However, for the subsamples on VAR and SEE the length of the time series and whether it is based on annual or quarterly data could provide information on quality.

6 Meta Regression Analysis – Results

In this section we present and discuss our results. For convenience, Table 2 summarizes the list of characteristics we tested for.

First, we regress reported multipliers of the total sample on characteristics as shown in Table 3. Groups of variables measured on a nominal scale, such as model class or type of impulse, are necessarily multicollinear because any observation must belong to exactly one value in this group. That is why one variable of a closed group is omitted. The influence of these omitted variables is reflected in the constant (κ), which is thus called *reference value*. It now becomes clear that κ should not be interpreted as the *true multiplier* because it depends on the reference specification. The reference for the prime estimation in column (1) is an average multiplier value calculated as an integral response to an unspecified public spending impulse, stemming from a largely estimated RBC model in a study that was published as a working paper or in a book. Such an observation on average reports a multiplier of -0.1678 when controlling for other influences, which is not significantly different from zero.

The next rows show the influences of other model classes, which are all significantly

Table 2: List of variables for meta regression

group	variable	explanation	scale
<i>model class</i>			
	RBC	RBC model	dummy
	DSGE-NK	New Keynesian DSGE model	dummy
	MACRO	structural macroeconometric model	dummy
	VAR	VAR model	dummy
	SEE	single equation estimation approach	dummy
<i>VAR model class</i>			
	WAREPI	war episodes approach	dummy
	NARRATIVE	narrative record approach	dummy
	RECURSIVE	recursive VAR approach	dummy
	STRUCTURAL	structural VAR approach	dummy
	SIGNRES	sign restricted VAR approach	dummy
<i>fiscal impulse</i>			
	SPEND	unspecified public spending	dummy
	CONS	public consumption	dummy
	INVEST	public investment	dummy
	MILIT	public military spending	dummy
	GSPEND	SPEND+CONS+INVEST+MILIT	dummy
	TRANS	transfers to private sector	dummy
	EMPLOY	direct public employment	dummy
<i>publication bias</i>			
	JOUR	study published in a journal	dummy
	WP/BOOK	study published as a working paper or book	dummy
<i>calibration or estimation</i>			
	ESTIM	model more estimated than calibrated	dummy
	CALIB	model more calibrated than estimated	dummy
<i>multiplier calculation method</i>			
	PEAK	calculated as peak multiplier	dummy
	INTEGRAL	calculated as integral multiplier	dummy
	COEFF	calculated from coefficient of fiscal impulse	dummy
	HORIZON	horizon of the multiplier calculation	quarters after shock
<i>open economy leakage</i>			
	M/GDP	import quota of the surveyed country sample	percentage
	OPEN	open economy model	dummy
	CLOSED	closed economy model	dummy
<i>share of Ricardian vs. Keynesian agents</i>			
	KEYNES	share of Keynesian agents	percentage
<i>modeling of interest rate reaction</i>			
	LOANABLE	loanable funds market	dummy
	INFLATION	fixed real interest rate	dummy
	ZLB	zero lower bound / fixed nominal interest rate	dummy
<i>properties of time series</i>			
	END	normalized end of the series	percentage
	LENGTH	length of the series	years
	QUARTER	quarterly data	dummy
	ANNUAL	annual data	dummy

Table 3: Total sample (Dep. Var.: multiplier)

	(1) prime ^a	(2) plain ^b	(3) macro-ref ^c	(4) gspend-ref ^d
κ	-0.1678 (0.4181)	0.3815* (0.2129)	1.0142*** (0.3431)	0.03689 (0.3762)
<i>model class</i>				
RBC			-1.182*** (0.2484)	
DSGE-NK	0.7662*** (0.2327)	0.6983*** (0.2324)	-0.4159*** (0.1067)	0.7904*** (0.2357)
MACRO	1.182*** (0.2484)	1.142*** (0.2428)		1.197*** (0.2472)
SEE	0.9393*** (0.2442)	0.3112 (0.1913)	-0.2428 (0.2624)	0.8603*** (0.2421)
VAR	0.8154*** (0.2591)	0.6420*** (0.2411)	-0.3667 (0.2778)	0.7796*** (0.2544)
<i>fiscal impulse</i>				
CONS	0.2655** (0.1157)	0.2682** (0.1194)	0.2655** (0.1157)	
INVEST	0.5843*** (0.1260)	0.5485*** (0.1290)	0.5843*** (0.1260)	
MILIT	-0.1898 (0.3168)	-0.2196 (0.3237)	-0.1898 (0.3168)	
TRANS	-0.3468*** (0.09694)	-0.3465*** (0.09810)	-0.3468*** (0.09694)	-0.6240*** (0.07597)
TAX	-0.3019*** (0.08131)	-0.3086*** (0.08438)	-0.3019*** (0.08131)	-0.4562*** (0.06949)
EMPLOY	0.2221 (0.2534)	0.2130 (0.2708)	0.2221 (0.2534)	-0.03012 (0.2373)
<i>control variables</i>				
JOUR	-0.04406 (0.3701)		-0.04406 (0.3701)	-0.2670 (0.3073)
CALIB	0.2156* (0.1134)		0.2156* (0.1134)	0.2062* (0.1138)
PEAK	0.4377*** (0.1162)		0.4377*** (0.1162)	0.3995*** (0.1165)
HORIZON	0.0175*** (0.0062)		0.0175*** (0.0062)	0.0152** (0.0060)
M/GDP	-1.328*** (0.3222)		-1.328*** (0.3222)	-1.335*** (0.3277)
N	743	743	743	743
$Adj.R^2$	0.3707	0.3389	0.3707	0.3404
ℓ	-615.7	-636.4	-615.7	-634.9

^a reference: RBC, SPEND, WP/BOOK, ESTIM, INTEGRAL

^b reference: RBC, SPEND

^c reference: MACRO, SPEND, WP/BOOK, ESTIM, INTEGRAL

^d reference: RBC, GSPEND, WP/BOOK, ESTIM, INTEGRAL

*, **, *** indicate significance at the 10, 5, 1 percent level respectively
Standard errors in parentheses

higher than for the RBC specification. Of the four alternative model classes, DSGE-NK models tend to report the lowest multipliers, while MACRO models are on the upper end of the scale.

Fiscal impulses also differ significantly concerning their influence on the multiplier. Especially public investment produces higher multiplier values in our data set, while tax cuts and transfers have a significantly lower impact compared to direct public spending. For military spending and public employment there is only an insignificant difference to unspecified public spending.

Attention should be given to control variables. The regression does not show a significant difference between journal publications and working papers or books, so our prime specification does not point to a publication bias, even if the coefficient is slightly negative. Calibrated models tend to report higher multipliers than estimated ones. Estimated models were chosen as reference in order to better compare the estimated variants of DSGE and RBC models to MACRO, VAR and SEE approaches, which are estimated by nature. Peak multipliers are, as expected, significantly higher than integral multipliers. However, a longer horizon of measurement relates to higher multipliers. Import quotas are highly significant with a negative impact on reported multipliers.

To do some first robustness checks, we estimated some variants of the regression in column (1). Column (2) shows a plain model without control variables. Results of our prime model are reconfirmed by and large. However, excluding control variables makes the reference specification significantly positive and renders the difference between RBC and SEE approaches insignificant. A stepwise exclusion of controls does not affect the other controls except for HORIZON that becomes insignificant when excluding PEAK. This effect is coherent with our reasoning that peak multipliers are usually recorded on a shorter horizon than integral multipliers. Ignoring the heterogeneity of peak and integral multipliers obscures the specific information of HORIZON.

The regression model in column (3) tests the impact of exchanging the reference model class. Using observations from MACRO models as reference merely effects the constant and the model class group. The test reveals that DSGE-NK and RBC models report significantly lower multipliers, while VAR and SEE do not. When DSGE-NK models serve as reference, VAR and SEE coefficients are also insignificant, while the coefficient for RBC is significantly lower and the one for MACRO models is significantly higher (results not shown). That is, RBC models negatively stand out of the model classes tested.

Column (4) shows that our results are robust to a different reference fiscal impulse (GSPEND), where we do not distinguish public spending, consumption, investment and military spending. Coefficients and significance levels only alter very slightly in comparison to column (1).

We now turn to subsamples in order to perform some additional robustness tests and to control for characteristics that apply to specific model classes only. We start with subsample #I, comprising observations from model based approaches (DSGE-NK, RBC, MACRO). Regression results are shown in Table 4, which provides the prime regression for this subsample as well as some simple robustness checks akin to the ones in Table 3.

Most results of the total sample are reaffirmed with subsample #I. The reference value

Table 4: subsample #I (Dep. Var.: multiplier)

	(1) prime ^a	(2) plain1 ^b	(3) plain2 ^c	(4) dsge-ref ^d	(5) intfix-ref ^e
κ	0.1319 (0.3901)	0.1996 (0.1778)	0.2873 (0.1797)	0.8468** (0.3389)	0.5271 (0.4034)
<i>model class</i>					
RBC				-0.7149*** (0.2032)	
DSGE-NK	0.7149*** (0.2032)	0.7214*** (0.1926)	0.8833*** (0.1898)		0.7149*** (0.2032)
MACRO	1.463*** (0.2354)	1.476*** (0.2226)	1.353*** (0.2078)	0.7481*** (0.1397)	1.463*** (0.2354)
<i>fiscal impulse</i>					
CONS	0.07406 (0.1011)	0.06691 (0.1023)	0.1104 (0.1009)	0.07406 (0.1011)	0.07406 (0.1011)
INVEST	0.2522** (0.1220)	0.2337* (0.1234)	0.2360* (0.1270)	0.2522** (0.1220)	0.2522** (0.1220)
MILIT	1.003*** (0.2277)	0.8954*** (0.1828)	0.8077*** (0.1846)	1.003*** (0.2277)	1.003*** (0.2277)
TRANS	-0.6024*** (0.1047)	-0.6087*** (0.1061)	-0.6042*** (0.1080)	-0.6024*** (0.1047)	-0.6024*** (0.1047)
TAX	-0.5324*** (0.07616)	-0.5436*** (0.07820)	-0.5204*** (0.08157)	-0.5324*** (0.07616)	-0.5324*** (0.07616)
EMPLOY	-0.004832 (0.1602)	-0.01681 (0.1680)	-0.05924 (0.1585)	-0.004832 (0.1602)	-0.004832 (0.1602)
<i>additional characteristics</i>					
KEYNES	0.6544** (0.3184)	0.6493** (0.3141)		0.6544** (0.3184)	0.6544** (0.3184)
LOANABLE					-0.3951*** (0.1036)
INFLATION	0.3173*** (0.09164)	0.2855*** (0.08683)		0.3173*** (0.09164)	-0.07782 (0.1044)
FIXED	0.3951*** (0.1036)	0.3190*** (0.1175)		0.3951*** (0.1036)	
ZLB	0.8400*** (0.1196)	0.8010*** (0.1150)		0.8400*** (0.1196)	0.4449*** (0.1305)
OPEN	-0.3299* (0.1805)	-0.3298** (0.1617)		-0.3299* (0.1805)	-0.3299* (0.1805)
<i>control variables</i>					
JOUR	-0.2243 (0.3084)			-0.2243 (0.3084)	-0.2243 (0.3084)
CALIB	0.1421 (0.1101)			0.1421 (0.1101)	0.1421 (0.1101)
PEAK	0.2113 (0.1518)			0.2113 (0.1518)	0.2113 (0.1518)
HORIZON	0.002891 (0.005891)			0.002891 (0.005891)	0.002891 (0.005891)
M/GDP	-0.7339*** (0.2638)			-0.7339*** (0.2638)	-0.7339*** (0.2638)
N	426	426	426	426	426
$Adj.R^2$	0.5396	0.5299	0.4483	0.5396	0.5396
ℓ	-226.7	-233.5	-270.5	-226.7	-226.7

^a reference: RBC, SPEND, WP/BOOK, ESTIM, INTEGRAL, LOANABLE, CLOSED

^b reference: RBC, SPEND, LOANABLE, CLOSED

^c reference: RBC, SPEND

^d reference: DSGE-NK, SPEND, WP/BOOK, ESTIM, INTEGRAL, LOANABLE, CLOSED

^e reference: RBC, GSPEND, WP/BOOK, ESTIM, INTEGRAL, FIXED, CLOSED

*, **, *** indicate significance at the 10, 5, 1 percent level respectively

Standard errors in parentheses

is not significantly different from zero. Model classes differ significantly with highest value for MACRO models. Exchanging the reference model class, as done in column (4), where a DSGE-NK models serves as reference instead of a RBC model, does not alter the results.

Concerning fiscal impulses, public investment still significantly increases the reported multiplier, while tax cuts and transfers decrease it. Unlike the total sample, in subsample #I military spending comes along with highest multipliers.

The additional characteristics concerning agent behavior, interest rate reaction and openness to trade are all significant. The higher the share of Keynesian agents, the higher the reported multiplier. Models with a loanable funds specification of the interest rate, which is our reference here, tend to have the lowest multipliers. Including a central bank reaction function with an inflation target significantly increases the multiplier. This is pretty much the same for models with a fixed real rate of interest. The highest multipliers result from models with a zero lower bound specification. When a model with a fixed real rate of interest serves as reference (column (5)), it can be shown that models with inflation targeting do not significantly differ, while the ZLB specification is still significantly higher. Other regression coefficients are unaffected by this modification. Open-economy models point to lower multipliers than closed-economy models.

The other control variables have the same algebraic sign as compared to the total sample. However, they are not significant, except for the import quota. Setting up plain regressions without control variables and additional characteristics (columns (3) and (4)) does not alter the results qualitatively.

Meta regression results for subsample #II, which is akin to subsample #I, but focuses on RBC and DSGE-NK models only, are displayed in Table 5. Subsample #II is actually a mere robustness check to #I because the same characteristics are tested. It is no use to test for other reference models since there are only two possible model classes. Concerning the interest rate reaction function, there is no observation with a fixed real rate of interest for this sample, thus, the variable is dropped. Table 5 by and large reproduces the results from Table 4, except for the inflation target specification, which is now insignificantly different from a loanable funds specification. However, models with a zero lower bound setting still produce significantly higher multipliers. The high effect of military spending compared to spending in general seems to be a special characteristic of model based approaches, since this is not confirmed by the total sample and the following subsamples.

With subsample #III, which takes into account observations from MACRO, VAR and SEE approaches, the complement to subsample #II is tested. Results are shown in Table 6. Due to heterogeneity of the model classes, we simply test for the broad characteristics of the total sample, omitting the calibration vs. estimation dummy that does not apply for this group. Regression results in all four columns are qualitatively similar to those of the total sample: the three model classes do not produce significantly different multipliers. Public investment seems to be the most effective fiscal impulse in our sample. Indirect impulses, such as taxes and transfers, seem to be less effective, although results are less significant, probably due to the smaller sample size. Military spending turns insignificant again.

Table 5: subsample #II (Dep. Var.: multiplier)

	(1) prime ^a	(2) plain1 ^b	(3) plain2 ^c
κ	0.03285 (0.3695)	0.2590* (0.1493)	0.2873 (0.1804)
<i>model class</i>			
DSGE-NK	0.7612*** (0.1974)	0.7615*** (0.1887)	0.8833*** (0.1905)
<i>fiscal impulse</i>			
CONS	0.2254* (0.1318)	0.2070 (0.1355)	0.2548* (0.1321)
INVEST	0.3517** (0.1514)	0.3184** (0.1565)	0.3168** (0.1599)
MILIT	0.8826*** (0.2166)	0.8360*** (0.1552)	0.8077*** (0.1853)
TRANS	-0.5626*** (0.1257)	-0.5811*** (0.1308)	-0.5755*** (0.1319)
TAX	-0.5624*** (0.1021)	-0.5837*** (0.1074)	-0.5557*** (0.1083)
EMPLOY	0.05129 (0.1843)	0.02801 (0.1939)	-0.01318 (0.1836)
<i>additional characteristics</i>			
KEYNES	0.6335* (0.3237)	0.6314** (0.3185)	
INFLATION	0.05055 (0.1342)	0.05511 (0.1349)	
ZLB	0.5786*** (0.1349)	0.5739*** (0.1352)	
OPEN	-0.3367* (0.1796)	-0.3461** (0.1580)	
<i>control variables</i>			
JOUR	-0.1067 (0.2448)		
CALIB	0.1419 (0.1102)		
PEAK	0.2430 (0.1557)		
HORIZON	0.005032 (0.006497)		
M/GDP	-0.5694* (0.3148)		
N	332	332	332
$Adj.R^2$	0.5455	0.5375	0.4469
ℓ	-189.6	-194.9	-227

^a reference: RBC, SPEND, WP/BOOK, ESTIM, INTEGRAL, LOANABLE, CLOSED

^b reference: RBC, SPEND, LOANABLE, CLOSED

^c reference: RBC, SPEND

*, **, *** indicate significance at the 10, 5, 1 percent level respectively

Standard errors in parentheses

Table 6: subsample #III (Dep. Var.: multiplier)

	(1) prime ^a	(2) plain ^b	(3) see-ref ^c	(4) gspend-ref ^d
κ	0.1679 (0.6417)	0.7302 (0.5807)	0.6668 (0.4673)	0.3062 (0.5850)
<i>model class</i>				
MACRO	0.3156 (0.3455)	0.1292 (0.3403)	-0.1833 (0.1213)	0.3504 (0.3107)
REGR	0.4989 (0.3769)	-0.1708 (0.3403)		0.5080 (0.3424)
VAR			-0.4989 (0.3769)	
<i>fiscal impulse</i>				
CONS	0.1194 (0.1728)	0.1491 (0.1777)	0.1194 (0.1728)	
INVEST	0.6525*** (0.1955)	0.6003*** (0.1941)	0.6525*** (0.1955)	
MILIT	-0.1174 (0.4278)	-0.1760 (0.4370)	-0.1174 (0.4278)	
TRANS	-0.1388 (0.1690)	-0.1096 (0.1570)	-0.1388 (0.1690)	-0.2542 (0.1575)
TAX	-0.2288** (0.1077)	-0.2397** (0.1110)	-0.2288** (0.1077)	-0.3021*** (0.09759)
EMPLOY	0.3891 (0.9967)	0.4126 (1.101)	0.3891 (0.9967)	0.1311 (0.9459)
<i>control variables</i>				
JOUR	-0.1045 (0.6102)		-0.1045 (0.6102)	-0.3584 (0.4167)
PEAK	0.6706*** (0.1584)		0.6706*** (0.1584)	0.6233*** (0.1572)
HORIZON	0.03121*** (0.009974)		0.03121*** (0.009974)	0.02761*** (0.009613)
M/GDP	-1.864*** (0.4959)		-1.864*** (0.4959)	-1.830*** (0.5021)
N	411	411	411	411
$Adj.R^2$	0.3375	0.2734	0.3375	0.2992
ℓ	-364.6	-385.4	-364.6	-378

^a reference: VAR, SPEND, WP/BOOK, INTEGRAL

^b reference: VAR, SPEND

^c reference: SEE, SPEND, WP/BOOK, INTEGRAL

^d reference: VAR, GSPEND, WP/BOOK, INTEGRAL

*, **, *** indicate significance at the 10, 5, 1 percent level

respectively

Standard errors in parentheses

Control variables show the same pattern as in Table 3. The high significance levels of multiplier calculation method and horizon that appeared in the total sample seem to have their roots in MACRO, VAR and SEE approaches, since they do not appear in subsamples #I and #II.

Subsample #IV focuses on VAR and SEE approaches only. It is thus the complement to subsample #I. Results are displayed in Table 7. They largely affirm the previous results. The two model classes do not make a significant difference; public investment seems to be most effective among fiscal impulses; tax cuts seem to be less effective in comparison to public spending, but differences are not significant; control variables show the familiar pattern of the total sample and subsample #III. However, excluding them in column (2) increases the variance of the reference multiplier which ends up with an insignificant value for κ .

What can be said about the additional characteristics, which deal with the properties of the time series that the included studies draw upon? It is striking that they alter the reference value, as can be seen by a comparison with column (3). That is, controlling for the properties of the time series increases the reported multiplier. When the time series ends later, the multiplier decreases significantly. This is in line with findings of some papers in the literature that focus on this effect (van Brusselen 2009; Bilbiie et al. 2008; Bénassy-Quéré and Cimadomo 2006; Perotti 2005). One should, however, be aware that even the most recent time series in our sample do not cover a reasonable part of the effects of the stimulus packages in response to the Great Recession. The coefficient of LENGTH indicates that the longer the time series, the higher is the multiplier. Moreover, using annual instead of quarterly data tends to reduce the multiplier. Combining both information, one could draw the conclusion that studies with a larger sample size point to higher multipliers. However, this conclusion needs to be confirmed by other instruments in a later version of this paper, because both LENGTH and ANNUAL could carry other information. LENGTH may also contain information on the sample period as longer time series on average reach farther back in time and therefore comprehend periods when multiplier effects were supposed to be higher. The quarterly vs. annual dummy may be a proxy for precision, but it may also contain a bias regarding the identification of discretionary fiscal impulses as discussed for example in Beetsma and Giuliodori (2011: F11). It should be pointed out, that the coefficients of the other variables are not affected by including or excluding the additional variables.

We now turn to subsample #V in order to contribute to the discussion on different identification methods in the VAR literature on fiscal impulses. Results are reported in Table 8. To start with similarities to other subsamples, again, public investment seems to be the most effective fiscal impulse. Furthermore, additional characteristics and control variables are largely in line with those of subsample #IV. An exemption is the JOUR dummy, which, again, has a negative coefficient, but is significant for the first time. This finding points to a possible negative publication bias in VAR studies, but in a later stage of this paper we need to check whether this conclusion is robust to more sophisticated methods of testing publication biases, such as funnel plots (Stanley and Doucouliagos 2010).

The reference value κ is positive and highly significant throughout all columns. The

Table 7: subsample #IV (Dep. Var.: multiplier)

	(1) prime ^a	(2) plain1 ^b	(3) plain2 ^c	(4) gspend-ref ^d
κ	1.379** (0.6573)	1.609 (1.067)	0.6329 (0.5955)	1.353** (0.6189)
<i>model class</i>				
SEE	0.5250 (0.4045)	-0.2097 (0.3568)	-0.1877 (0.3591)	0.5306 (0.3469)
<i>fiscal impulse</i>				
CONS	0.3129 (0.3009)	0.3804 (0.3048)	0.3970 (0.3044)	
INVEST	0.8920*** (0.2888)	0.8410*** (0.2853)	0.8541*** (0.2839)	
MILIT	-0.02927 (0.4433)	-0.1135 (0.4476)	-0.06190 (0.4452)	
TRANS	0.0004343 (0.1052)	0.07596 (0.08863)	0.07145 (0.08903)	-0.02455 (0.09958)
TAX	-0.1467 (0.1370)	-0.1656 (0.1391)	-0.1746 (0.1426)	-0.2190 (0.1385)
EMPLOY	0.6324 (0.9302)	0.7260 (0.9938)	0.6292 (1.113)	0.1951 (0.8464)
<i>additional characteristics</i>				
END	-1.995*** (0.7572)	-2.135** (0.8701)		-1.940** (0.7529)
LENGTH	0.01295* (0.007801)	0.02575*** (0.008605)		0.01385* (0.007434)
ANNUAL	-0.6684* (0.3470)	-0.3940 (0.3063)		-0.6764** (0.3251)
<i>control variables</i>				
JOUR	0.4354 (0.5933)			0.3419 (0.4036)
PEAK	0.7199*** (0.1767)			0.6558*** (0.1715)
HORIZON	0.03577*** (0.01155)			0.03108*** (0.01103)
M/GDP	-2.375*** (0.6595)			-2.359*** (0.6851)
N	317	317	317	317
$Adj.R^2$	0.3526	0.2831	0.2638	0.3027
ℓ	-300.7	-318.7	-324.7	-314.3

^a reference: VAR, SPEND, WP/BOOK, INTEGRAL, QUARTER

^b reference: VAR, SPEND, QUARTER

^c reference: VAR, SPEND

^d reference: VAR, GSPEND, WP/BOOK, INTEGRAL, QUARTER

*, **, *** indicate significance at the 10, 5, 1 percent level

respectively

Standard errors in parentheses

Table 8: subsample #V (Dep. Var.: multiplier)

	(1) prime ^a	(2) plain1 ^b	(3) plain2 ^c	(4) plain-ph ^d	(5) plain-nm ^e	(6) recursive-ref ^f
κ	3.756*** (0.9659)	3.729*** (0.9560)	1.844*** (0.3433)	1.330*** (0.4102)	4.140*** (0.9223)	4.167*** (0.9791)
<i>identification strategy</i>						
WAREPI						-0.4104 (0.2633)
SIGNRES	0.003446 (0.5799)	0.05113 (0.5752)	0.05113 (0.5714)	0.002196 (0.5753)		-0.4070 (0.5692)
RECURSIVE	0.4104 (0.2633)	0.5325** (0.2139)	0.5324** (0.2131)	0.4073 (0.2636)		
STRUCTURAL	0.4086 (0.2626)	0.4985** (0.2185)	0.4984** (0.2177)	0.4063 (0.2630)		-0.001857 (0.2950)
NARRATIVE	0.4086 (0.2626)	0.4985** (0.2185)	0.4984** (0.2177)	0.4063 (0.2630)		-0.001857 (0.2950)
<i>fiscal impulse</i>						
CONS	0.5319 (0.3396)	0.5863* (0.3432)	0.5870* (0.3419)	0.5353 (0.3328)	0.5384 (0.3359)	0.5319 (0.3396)
INVEST	1.138*** (0.3294)	1.071*** (0.3261)	1.071*** (0.3247)	1.135*** (0.3253)	1.147*** (0.3260)	1.138*** (0.3294)
TRANS	-0.08965 (0.1488)	0.08000 (0.08814)	0.08000 (0.09360)	-0.09394 (0.1064)	-0.09460 (0.1495)	-0.08965 (0.1488)
TAX	-0.1447 (0.1485)	-0.1857 (0.1518)	-0.1857 (0.1566)	-0.1435 (0.1517)	-0.1259 (0.1428)	-0.1447 (0.1485)
MILIT	0.1575 (0.6361)	0.06835 (0.6559)	0.06839 (0.6516)	0.1600 (0.6297)	0.1685 (0.6300)	0.1575 (0.6361)
EMPLOY	1.352 (1.141)	1.475 (1.188)	1.264 (1.442)	1.270 (1.450)	1.359 (1.132)	1.352 (1.141)
<i>additional characteristics</i>						
END	-2.117*** (0.8010)	-2.420*** (0.9142)			-2.118*** (0.7936)	-2.117*** (0.8010)
LENGTH	0.01602 (0.01007)	0.03358*** (0.01090)			0.01582 (0.009982)	0.01602 (0.01007)
ANNUAL	-0.7341* (0.3836)	-0.5832* (0.3448)			-0.7303* (0.3844)	-0.7341* (0.3836)
<i>control variables</i>						
JOUR	-1.916** (0.8331)				-1.924** (0.8255)	-1.916** (0.8331)
PEAK	0.7248*** (0.1827)			0.7371*** (0.1724)	0.7388*** (0.1826)	0.7248*** (0.1827)
HORIZON	0.03571*** (0.01168)			0.03662*** (0.01129)	0.03676*** (0.01191)	0.03571*** (0.01168)
M/GDP	-2.334*** (0.6565)				-2.334*** (0.6502)	-2.334*** (0.6565)
N	255	255	255	255	255	255
$Adj.R^2$	0.3223	0.2437	0.2172	0.2751	0.3288	0.3223
ℓ	-252.1	-267.9	-274.1	-263.1	-253.3	-252.1

^a reference: WAREPI, SPEND, WP/BOOK, INTEGRAL, QUARTER

^b reference: WAREPI, SPEND, QUARTER

^c reference: WAREPI, SPEND

^d reference: WAREPI, SPEND, INTEGRAL

^e reference: SPEND, WP/BOOK, INTEGRAL, QUARTER

^f reference: RECURSIVE, SPEND, WP/BOOK, INTEGRAL, QUARTER

*, **, *** indicate significance at the 10, 5, 1 percent level respectively

Standard errors in parentheses

extraordinary high values of κ in columns (1), (2), (5) and (6) depend on the inclusion of the additional characteristics, as the plain specifications of column (3) and (4) reveal.

As a central issue, the estimation tests the influence of the various identification strategies. The prime specification, including all additional characteristics and control variables shows insignificant differences between identification strategies. They, however, turn significant when excluding control variables. Recursive VARs, Structural VARs and VARs using the narrative record all seem to have a similar positive impact on the reported multiplier in comparison to the sign restricted VARs and those based on war episodes. A stepwise inclusion of control variables reveals that whether differences are significant or not, depends on the inclusion of PEAK and HORIZON, as shown in column (4). This is not surprising, since the different identification strategies come along with specific shapes of impulse response functions that are also connected to multiplier calculation method and horizon. Thus, one could conclude that part of the difference among identification strategies concerning reported multipliers is simply a question of timing of measurement. This result is in line with Caldara and Kamps (2008: 28).

Before we conclude, we would like to refer the reader to the statistical appendix that contains further robustness checks concerning a possible overweighing of comprehensive studies. First we test weighted versions of all (sub-)samples by weighting each observation of a paper by the number of observations in the paper. Results are shown in Table 9. Finally, in column (1) of Table 10 we test a model without paper dummies for the total sample using only the median multiplier of each study. The other columns of Table 10 show results, when dropping single papers with many observations ($N \geq 30$) from the sample. The results largely affirm our prime specifications.

7 Conclusions

We now draw a broad picture of our results from the meta-analysis. First, reported multipliers depend on model classes. Controlling for additional variables reveals that RBC models come up with significantly lower multipliers than the rest of model classes. DSGE-NK models and MACRO models also report significantly different multipliers, however their implications are not significantly different from those of the more data oriented VAR and SEE approaches.

Second, direct public demand tends to have higher multipliers than tax cuts and transfers, even though the difference is not always significant. However, public investment seems to be the most effective fiscal impulse, a result, which is robust against many specifications. Military spending is preferred solely by the more model based approaches, especially DSGE-NK and RBC models. For VAR and SEE approaches, multiplier effects of military spending do not differ from those of public spending in general.

Third, reported multipliers strongly depend on the method and horizon of calculating them. Thus, a simple listing of multiplier values without additional information on how they were computed could provide a biased picture.

Fourth, longer time series and those with a higher frequency tend to imply higher multipliers in our sample. Time series that end in more recent years tend to imply lower multipliers. One should, however, be aware that even the most recent time series in our

sample do not cover a reasonable part of the effects of the stimulus packages in response to the Great Recession. Fifth, the more open the import channel of an economy, the lower seems to be the multiplier.

Sixth, in model based approaches the interest rate reaction function is a key parameter to the reported multiplier value. Multiplier effects are highest, when the central bank accommodates fiscal policy or is bound to a zero interest rate. Moreover, an increasing share of Keynesian agents, for whom Ricardian equivalence is broken, significantly increases multiplier values. Both an accommodating monetary policy and liquidity constrained households correspond to the current macroeconomic setting which could imply a higher effectiveness of fiscal policy in times of the current crisis.

Reported multipliers very much depend on the setting and method chosen, thus, economic policy consulting based on a certain multiplier study should lay open by how much specification influences the results. Our meta-analysis may provide guidance concerning such influential specifications.

To improve this paper, a next step should be to collect better instruments for the issue of quality of studies, such as degrees of freedom, journal ranking and confidence intervals for VAR models to compute funnel plots. Moreover, it is intended to collect consistent information to which degree fiscal impulses are permanent or temporary and whether they are financed by taxes or public debt. Additional subsamples and specifications may help to better discriminate between certain characteristics. Finally, it should be useful to broaden our sample size by including the growing literature on quasi experiments within countries that sheds new light on the ongoing multiplier discussion.

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Statistical Appendix

Table 9: Weighted (sub-)samples (Dep. Var.: weighted multiplier)

	(1) total-w ^a	(2) #I-w ^b	(3) #II-w ^b	(4) #III-w ^c	(5) #IV-w ^d	(6) #V-w ^e
κ	-0.01104 (0.006947)	0.006354 (0.007223)	0.008997 (0.008584)	0.9482*** (0.2967)	-0.011 (0.07071)	1.784*** (0.4747)
<i>model class</i>						<i>identification strategy</i>
DSGE-NK	0.7773*** (0.1574)	0.1589 (0.1507)	0.127 (0.1702)	0.3671 (0.5023)	0.547 (0.6076)	RECURS (0.2464)
MACRO	1.394*** (0.1817)	0.6545*** (0.1878)		0.2527 (0.4154)		STRUCT (0.2152)
SEE	0.9784*** (0.1702)					SIGNRES (0.5577)
VAR	1.242*** (0.1735)					NARRAT (0.2152)
<i>fiscal impulse</i>						
CONS	0.1065 (0.1795)	-0.1646 (0.1727)	-0.04544 (0.2358)	0.5457* (0.284)	0.8268 (0.5202)	0.4023 (0.5108)
INVEST	0.5173*** (0.2081)	-0.1141 (0.2237)	-0.2503 (0.2232)	0.8140*** (0.3631)	1.293** (0.6172)	0.5659 (0.5979)
TRANS	-0.5188*** (0.1768)	-0.5513*** (0.1677)	-0.6997*** (0.1973)	-0.1359 (0.2474)	0.1966 (0.1436)	-0.05503 (0.1889)
TAX	-0.1265 (0.2125)	-0.6401*** (0.1494)	-0.6216*** (0.1594)	0.1505 (0.2342)	0.2457 (0.2355)	0.2122 (0.2743)
MILIT	0.1793 (0.132)	0.09957 (0.1062)	0.1077 (0.1152)	0.4402** (0.1762)	0.4664*** (0.1776)	0.05593 (0.6769)
EMPLOY	0.4401 (0.3241)	-0.3985** (0.1947)	-0.3401 (0.2087)	0.03525 (0.5279)	0.1607 (0.5794)	0.995 (1.203)
<i>additional characteristics</i>						
KEYNES		0.9205*** (0.2776)	0.9459*** (0.2721)			
INFL		-0.05222 (0.1206)	-0.0213 (0.1314)			
ZLB		1.127*** (0.1629)	1.208*** (0.1833)			
FIXED		0.1156 (0.1936)				
OPEN		0.1914* (0.1001)	0.1419 (0.1176)			
END					-1.843*** (0.6692)	-1.860** (0.718)
LENGTH					0.01085*** (0.003984)	0.01520** (0.006608)
ANNUAL					-0.6439 (0.4687)	-0.7237 (0.4705)
<i>control variables</i>						
JOUR	-0.1298 (0.1304)	0.1419 (0.09245)	0.1555 (0.1106)	-3.100*** (1.078)	1.301 (1.285)	-3.877*** (1.052)
CAL	0.6604*** (0.1765)	0.3116*** (0.09105)	0.3244*** (0.1009)			
PEAK	0.2069* (0.1247)	0.5958*** (0.1434)	0.5980*** (0.1645)	0.5181* (0.3044)	0.7354* (0.4146)	0.6979 (0.4324)
HORIZON	0.02060*** (0.003777)	0.01963*** (0.003523)	0.01895*** (0.003988)	0.01729 (0.01741)	0.0358 (0.02841)	0.02843 (0.02892)
M/GDP	-1.801*** (0.5328)	-1.686*** (0.5295)	-1.957*** (0.6591)	-2.382*** (0.7299)	-2.527** (0.9838)	-2.488*** (0.8933)
N	743	426	332	411	317	255
$Adj.R^2$	0.7098	0.8555	0.8117	0.9037	0.8905	0.8852
ℓ	605.5	452.2	326.9	498.9	374.1	271.4

^a reference: RBC, SPEND, WP/BOOK, ESTIM, INTEGRAL

^b reference: RBC, SPEND, WP/BOOK, LOANABLE, ESTIM, INTEGRAL

^c reference: VAR, SPEND, WP/BOOK, INTEGRAL

^d reference: VAR, SPEND, WP/BOOK, INTEGRAL, QUARTER

^e reference: WAREPI, SPEND, WP/BOOK, INTEGRAL, QUARTER

*, **, *** indicate significance at the 10, 5, 1 percent level respectively

Standard errors in parentheses

Table 10: Robustness of total sample (Dep. Var.: multiplier)

	(1) median	(2) no d6	(3) no d45	(4) no d46	(5) no d48	(6) no d51
κ	0.6571** (0.3103)	-0.1994 (0.4398)	-0.1492 (0.4231)	-0.08811 (0.4167)	-0.1287 (0.4180)	-0.3812 (0.4871)
<i>model class</i>						
DSGE-NK	0.4870** (0.2094)	0.7925*** (0.2414)	0.7643*** (0.2330)	0.7635*** (0.2338)	0.7645*** (0.2332)	0.7515*** (0.2350)
MACRO	1.024*** (0.2264)	1.214*** (0.2640)	1.183*** (0.2476)	1.182*** (0.2492)	1.180*** (0.2484)	1.412*** (0.3405)
SEE	0.3098 (0.3396)	1.143*** (0.3728)	0.9074*** (0.2488)	0.9069*** (0.2469)	0.9234*** (0.2472)	0.9523*** (0.2476)
VAR	0.6159*** (0.2250)	0.9987*** (0.3610)	0.8176*** (0.2589)	0.8151*** (0.2601)	0.8199*** (0.2596)	0.8171*** (0.2604)
<i>fiscal impulse</i>						
CONS	-0.1323 (0.1558)	0.1764 (0.1391)	0.2649** (0.1174)	0.2835** (0.1178)	0.2956*** (0.1063)	0.2945** (0.1211)
INVEST	0.002781 (0.2752)	0.6121*** (0.1533)	0.5825*** (0.1275)	0.5679*** (0.1303)	0.4871*** (0.1227)	0.6112*** (0.1304)
TRANS	-0.6874*** (0.1561)	-0.3070*** (0.1133)	-0.3472*** (0.09846)	-0.3470*** (0.09727)	-0.3695*** (0.09468)	-0.3189*** (0.1028)
TAX	-0.1531 (0.1619)	-0.3032*** (0.08411)	-0.3026*** (0.08342)	-0.3012*** (0.08167)	-0.3045*** (0.07993)	-0.2590*** (0.09316)
MILIT	0.1888 (0.1986)	-0.1911 (0.3195)	-0.1910 (0.3187)	-0.1911 (0.3176)	-0.2525 (0.2563)	-0.1742 (0.3190)
EMPLOY	-0.3538** (0.1696)	0.2126 (0.2510)	0.2218 (0.2563)	0.2224 (0.2542)	0.2016 (0.2512)	0.2470 (0.2535)
<i>control variables</i>						
JOUR	-0.06521 (0.1095)	-0.1958 (0.4544)	-0.04211 (0.3706)	-0.08453 (0.3645)	-0.03491 (0.3615)	0.1866 (0.4444)
CALIB	0.2047 (0.1677)	0.4198 (0.3094)	0.2156* (0.1131)	0.2137* (0.1130)	0.2109* (0.1126)	0.2233* (0.1146)
PEAK	-0.03329 (0.1053)	0.4412*** (0.1272)	0.4043*** (0.1221)	0.4065*** (0.1181)	0.4157*** (0.1164)	0.4357***
HORIZON	0.008721* (0.004848)	0.01805*** (0.006320)	0.01678*** (0.006478)	0.01504** (0.006559)	0.01693*** (0.006398)	0.01725*** (0.006267)
M/GDP	-1.820** (0.7026)	-1.696*** (0.4219)	-1.175*** (0.3062)	-1.321*** (0.3365)	-1.329*** (0.3232)	-1.565*** (0.3857)
N	89	667	713	709	713	710
$Adj.R^2$	0.3402	0.3504	0.3600	0.3737	0.3857	0.3648
ℓ	-47.44	-579.2	-580.8	-587.4	-553.2	-599.7

reference: RBC, SPEND, WP/BOOK, ESTIM, INTEGRAL

*, **, *** indicate significance at the 10, 5, 1 percent level respectively

Standard errors in parentheses