Transportation funding in the EU: An instrumental variables approach to measure the fiscal multiplier

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**I. Introduction**

Understanding the size and nature of the fiscal multiplier (the effect government spending and/or taxing has on output) has taken on greater importance as governments have recently wrestled with the wisdom of conducting expansionary policy to combat recessions or contractionary policy to combat high debt levels. The renewed interest has led to a number of empirical advances in attempting to measure the size of the fiscal multiplier.

Much of this literature has focused on the United States for two fundamental reasons. First, the government resorted to active fiscal policy in response to the financial crisis and resultant recession beginning in 2008. Second, the available empirical techniques used to measure the fiscal multiplier rely on data that are only readily available in the United States. The focus of these studies was to see how government spending and taxing policies could stimulate GDP in order to combat the recession in a manner such that it did not crowd out private investment. The results of numerous studies have yet to provide any conclusive answer to this question. More recent literature removes itself from the ideological argument about the actual value of the fiscal multiplier and focuses more on the circumstances that lead to a stronger multiplier as well as the fact that there is no one fiscal multiplier, but that it varies in size across countries and circumstances (Cimadomo, and Benassy-Quere, 2012).

The need to more fully understand the fiscal multiplier in a European context has been heightened with the deficit crisis in Europe set off by the Greek admission of higher deficit and debt levels than previously reported in late 2009. The question for Europe, however, is not how to combat a recession with fiscal policy, but how austerity measures would or would not affect economic growth. As Europe fell into recession and continues to experience weak growth the question of the supposed effects of austerity led to sometimes comical (as in the well-publicized banter between Paul Krugman in *the New York Times* and the leaders of the Baltic States), as well as serious (Greece in particular) political upheaval. Yet the question is essentially the same as those posed in the literature for the United States, what is the size of the fiscal multiplier, regardless of whether or not you are increasing or decreasing deficits.

As important as the question has become for Europe, empirical estimates of the size of the fiscal multiplier in Europe are limited. Much of this is due to the limitations in data needed to perform the empirical studies that have been done in the United States (lack of quarterly fiscal data or significant military buildups for example). The challenges are also due to the specific makeup of Europe. Even though many of the countries in Europe operate as a monetary union much like the states in the United States, they do not operate as a fiscal union. Fiscal policy is independently taken by each individual country in the EU with very little (in relative terms) spending directed from the supranational (or federal) level. These limitations make empirical estimates using that traditional techniques a challenge.

[NOTE: I still need to flesh out the idea of how the institutional structure effect the measurement of the fiscal multiplier]

Recently, however, a new method to measure the fiscal multiplier has been introduced which can overcome some data and institutional limitations in Europe. The new method relies on instrumental variable estimation of the size of the fiscal multiplier. If the researcher can identify elements of spending or taxation that are related to elements of government spending or taxation but is uncorrelated with current movements in GDP, then they do not need quarterly data or large military buildups to identify the fiscal multiplier. As with any study using instrumental variables, the challenge is to find an appropriate instrument. Many of the early studies on the fiscal multiplier using instrumental variables have focused on nuances of various spending and taxation packages with cross-state differences in the United States. Kraay (2012), however, identifies valid instruments using disbursements of funds for World Bank-financed projects in less developed countries. Disbursements of funds on previously approved projects (which make up a large portion of government spending in these countries) meets the criteria for a valid instrument.

Using the framework proposed by Kraay (2012), this study sets out to measure the size of the fiscal multiplier in Europe using data on disbursements of transportation infrastructure funds in Europe. Transportation projects are of particular interest because they usually take a number of years to complete and the disbursement of funds designated for a particular project are spread out over a number of years. Since the disbursement of funds in usually agreed upon before the project begins they are independent of current economic conditions. In addition, there has been a concerted effort by the members of the EU to improve transportation links across Europe. The Trans-European Transportation Network (TEN- T) was created as part of the Maastricht treaty in 1991 in order to fund transportation projects that would enhance European integration. This has led to a number of significant transportation infrastructure projects that are underway in the EU with meticulous record keeping by the Networks Executive Agency of the European Commission (INEA), the current facilitators of the TEN-T initiative. These data detail the progress and disbursements of funds that can be used to construct a panel data set of disbursements of transportation spending. This spending can then be used as an instrument for government spending in order to measure the size of the local fiscal multiplier in Europe.

Using disbursements of TEN-T funded transportation projects across twenty-three EU countries as an instrument for government spending on economic affairs we find a fiscal multiplier that has a range of 0.87 and 1.36. The results, however, are potentially biased because the instrument is a weak instrument. At this point, it is unknown whether the weak instrument problem is a result of insufficient data or if the disbursements themselves are not correlated enough with total government spending on economic affairs. Disbursements in this paper are only a fraction of total disbursements on transportation spending, though we are currently waiting for approval to receive the whole data set from the INEA.

The remainder of this paper will be organized in the following manner. In the next section I briefly discuss the challenges in empirically measuring the size of the fiscal multiplier and introduce some of the literature on the measurement of the fiscal multiplier in the United States and Europe. In section three we explain the instrumental variable estimation used in this study and provide a detailed explanation of the data and how appropriate they are for instrumental estimation. Section four contains the results followed by the conclusions in section five.

**II. Measuring the fiscal multiplier**

Measuring the size of the fiscal multiplier in empirical studies is difficult because fiscal variables are endogenous to output fluctuations. Output levels are determined in part by fiscal variables, yet at the same time, automatic stabilizers and active fiscal policy make fiscal variables respond to output fluctuations. Two possible empirical solutions to the endogeneity problem, structural VARs (SVAR) and the narrative approach, have dominated the literature. The SVAR approach relies on timing restrictions to identify structural parameters to address the endogeneity problem (Blanchard and Perotti, 2002). The narrative approach focuses on fiscal events subjectively identified by the researcher as exogenous to the business cycle (the most commonly identified events are exogenous military buildups) (Ramey and Shapiro, 1998). Each approach has its limitations and there is yet to be a consensus on which is correct (see Perotti (2007) and Ramey (2009) for the debate over the validity of each technique). Current research on the size of the fiscal multiplier in the United States using these techniques places it around unity (Burriel et al., 2009). Unfortunately, for ideological reason having a multiplier below or above unity is important to address the effectiveness of the policy relative to the amount of private investment that is “crowded-out”. There have been various extensions and applications of both of these techniques with the newest literature focusing on the situations that lead to a smaller or larger fiscal multiplier rather than focus on the actual number (Ilzetzki et. al. 2011).

There are few studies that use these techniques to measure the size of the fiscal multiplier for Europe due to restrictive data requirement. In order for the timing restrictions to be valid, the SVAR requires quarterly fiscal data, which is unavailable for European nations for a sufficient period of time or has been extrapolated from annual data (see Paredes et. al., 2009 for the extrapolated data). Burriel et al. (2009) has used the SVAR approach for the extrapolated data while Beetsma and Giuliodori (2011) use the SVAR approach on European data using annual data. Neither of these approaches can meet the specific criteria for the SVAR approach, but Burriel et al. find a multiplier below unity while Beetsma and Giuliodori find a multiplier above unity. There are no examples the narrative approach being used for Europe as a whole because of the lack of a large military buildup since World War II or other easily identifiable exogenous fiscal events across Europe.

While the debate over the accuracy of these two dominate empirical techniques continues, recent papers have focused on measuring the size of the fiscal multiplier using simple instrumental variable (IV) techniques as an alternative. This approach relies on the researcher identifying changes in government spending that are uncorrelated with contemporaneous economic shocks and then using those as an instrument for overall government spending. In many ways this is similar to the narrative approach, but instead of relying on a few special events and their impact, it allows the researcher to use ongoing events and spending to measure the size of the fiscal multiplier. For the United States, Chodorow-Reich et al. (2012) use state aid through Medicaid reimbursement as part of the American Recovery Act as an instrument, Nakamura and Steinsson (2013) use difference in military procurement across states as instruments, while Shoag (2013) uses state pension shocks as instruments for government spending. The first example of this technique applied on European data specifically is Acconcia, Coresetti, and Simonelli (2014). They estimate the size of the Italian fiscal multiplier using changes in spending that result from the removal of the local government as a result of mafia infiltration as an instrument for overall government spending.

[NOTE: I need to expand the literature review to talk about what is the size of the multiplier in these type of studies and how they are more limited in their interpretation as a universal multiplier because they measure just the local effect of the fiscal windfall as discussed in Serrato and Wingender, 2014]

In one of the few papers that uses this technique for countries outside of the United States, Kraay (2012), uses infrastructure spending by the World Bank in less developed countries as an instrument for overall government spending. Infrastructure spending provides an appropriate instrument because it is spread out over time. Even if the original spending request was somehow correlated with the business cycle, the disbursement of these funds over the subsequent years of the project would not be correlated with that year’s business cycles and thus serves as an appropriate instrument. To further address endogeniety concerns, Kraay uses projected spending on the projects per year instead of actual spending to account for any possible spending that was slowed or accelerated due to business cycle concerns in the subsequent years.

The limitations in data for possible estimation of fiscal multipliers in Europe as well as the emergence of an alternate measure of these local fiscal multipliers using the IV approach, provide a fertile research avenue to identify instruments that are currently available in European data to provide an accurate measure of the size of the fiscal multiplier. Kraay (2012) demonstrates that disbursements for already planned projects provide a potential valid instrument for estimation. As one looks at government spending in the EU, one possible candidate that involves multi-year contract with much of the funds being disbursed after the project has been agreed upon is spending on transportation infrastructure improvements.

Publically funded transportation projects across Europe have traditionally been funded by individual national governments, independent of other country’s transportation projects and ignored European-wide objectives. In the process of increasing economic integration across Europe, it became apparent that a coordinated effort was needed to link transportation infrastructure across Europe. The more economically integrated countries are, the greater the chances a monetary union could be successful. As a result, facilitating transnational transportation projects became one of the objectives for the framers of the European Monetary Union (EMU) when they created the Trans-European Transportation Network (TEN-T).

The objectives of TEN- T were established in the Maastricht Treaty in 1992 as one piece of the overall effort to support European integration in the view of adopting a common currency (TEN-T, 2010). The program’s purpose was to take Europe-wide funds and partially fund through a grant system air, road, rail, and sea transportation projects that improved transportation across and through European member state boarders with the overreaching goal of “European competitiveness, job creation, and cohesion” (http://inea.ec.europa.eu/en/ten-t/). These improved transportation links were seen as important in facilitating commerce across the member nations. Enhanced commerce and trade across boarders within the member states, was to facilitate greater integration which is viewed as essential for a successful monetary union (Mundell, 1961 and Frankel and Rose, 1998). Thus improving transportation links is essential to the ultimate goal of linking the economies of European nations together in such a way that the conflicts that had engulfed the continent for centuries would come to an end (Wyplosz, 2006).[[1]](#footnote-1)

The monitoring and data collection associated with TEN-T projects has made it possible to track spending and disbursement data on transportation projects that can be used as an instrument in an empirical specification that seeks to find the fiscal multiplier in Europe. In following Kraay’s identification strategy using European transportation data, it is important to clarify that the estimated fiscal multiplier found in this study does not constitute a deep structural fiscal multiplier (i.e. a model-based parameter), but an “empirical correlation between a plausibly exogenous component of change in government spending and changes in output.” (Kraay 2012, p. 833).

**III. Empirical Specification and Data**

The immediate magnitude and effect of government spending on output in the panel setting could be simply estimated using:

Where is real GDP for country (i) in year (t) and is a measure of government spending for country (i) at time (t). The change in government spending is scaled by last period’s level of GDP. The estimation includes country fixed effects () to account for country specific characteristics that might influence the effect of government spending on GDP as well as time fixed effects () to account for common economic conditions across the members states and their influence on the size of the fiscal multiplier. These together with the error term () contains all other sources of GDP fluctuations.

The possible and probable endogeniety between output growth and government spending either due to automatic stabilizers or discretionary policy, however, invalidate the basic assumptions needed for simple regression: namely, that the error term be uncorrelated with the independent variable. To address this issue an instrumental variable approach using two stage least squares is used, where the first stage estimation is:

Where Ti,t is total planned disbursements of funds for transportation spending for country (i) at time period (t).

Many of the data come from the European Commission’s Statistical Database (Eurostat). Real GDP is measured in millions of chain linked euros (at 2005 exchange rates) (extracted December 12, 2014). Total government spending, government spending on economic affairs, and total government spending on transportation are drawn from Eurostat’s Government Financial Statistics general government expenditure by function. The disbursements of transportation funding for TEN-T projects were collected from the INEA mid-term review (INEA 2010). Government spending and transportation variables are converted to real terms using the government spending deflator available from Eurostat. Data on total government spending are presented in ten different categories, one of which is economic affairs.[[2]](#footnote-2) This paper will focus on government spending on economic affairs which consists of spending on agriculture, forestry, fishing, and hunting; fuel and energy; mining, manufacturing, and construction; communications; research and development; general spending on economic affairs; and transportation. We focus on this subsection of spending because it contains total transportation spending and excludes transfers.

[NOTE: I need to include some literature on the theory of the fiscal multiplier as to why I want to exclude transfer payments in my measure of the fiscal multiplier. Excluding transfers, however, is consistent with other empirical studies of the fiscal multiplier]

Though information is available on the total amount spent on transportation in each country each year, information on the disbursements of funding for individual transportation projects is not readily available. Using disbursements on previously approved transportation projects is important of the exogeneity requirement of our instrument. In 2010 the INEA conducted a mid-term review of 92 separate TEN-T projects that originated from the 2007-2013 call for projects and funding scheme (INEA 2010). The purpose of this review was to evaluate the progress of each of the selected projects as stewards over the funds that had been granted. In the Mid-term review the original projected disbursements of each of these projects was presented as well as the revised projections of disbursements following the results of the review. It provides both what INEA anticipates the individual countries will disburse each year as well as what TEN-T will pay out in each year. This publication thus provides a snapshot of the needed information for our instrument. It contains both the originally planned disbursement for both the project as a whole and the EU contribution as well as the revised disbursement schedule for the project as a whole and the EU contribution.

The Mid-Term Review only reviews those projects that were approved in 2007. Fortunately, the great majority of TEN-T funding awarded in the 2007-2013 Annual and Multi-Annual call for projects were awarded in 2007. In 2007, 140 projects were accepted totaling € 6.148 billion, which is over 65% of the total awarded TEN-T funds for the 2007-2013 funding schemes (<http://inea.ec.europa.eu/en/ten-t/ten-t_projects/statistics/statistics.htm>). The information on disbursements in this report are only available starting in 2010. Due to the fact that each of these projects were part of the 2007 call for projects, we do not need to worry about the possibility that the decision to submit an application could have been driven by current economic conditions. The total disbursements for each project (both originally planned and the revised planned) within a country are summed for each year for the instrument. Ideally we would have the full set of disbursement data for each project, but requests for such data from INEA, have yet to prove successful.

Ultimately data are collected for twenty-three EU countries[[3]](#footnote-3) for the years 2010-2012 (due to the limited number of years covered in the Mid-term report). In evaluating the size of the fiscal multiplier using this time period it is important to note that there was significant excess capacity in the economy, which numerous studies have identified as an important determinate in evaluating the size of the fiscal multiplier. See Appendix B for the summary statistics.

Table 1 illustrates the share of total government spending dedicated to economic affairs, the share of economic affairs spending dedicated to transportation spending, and the share of disbursements from TEN-T projects evaluated in the Mid-Term Review as a share of total transportation spending averaged from 2010 to 2012 for each country in the sample.

Table 1: Share of spending

|  |  |  |  |
| --- | --- | --- | --- |
| Country | Percent of total government spending on economic affairs | Percent of economic affairs spending on transportation | Percent of transportation spending disbursed for TEN-T projects\* |
| Austria | 10.9 | 42.0 | 28.0 |
| Belgium | 12.2 | -- | -- |
| Bulgaria | 13.3 | 65.9 | 0.1 |
| Czech Republic | 13.8 | 68.9 | 0.8 |
| Denmark | 6.0 | 59.8 | 2.9 |
| Estonia | 11.4 | 64.3 | 3.5 |
| Finland | 8.7 | 48.7 | 10.6 |
| France | 6.5 | 35.3 | 12.8 |
| Germany | 8.4 | 41.8 | 5.1 |
| Greece | 6.6 | 40.0 | 2.1 |
| Hungary | 13.0 | 53.8 | 0.5 |
| Ireland | 20.6 | 27.0 | 0.4 |
| Italy | 7.2 | 57.4 | 2.4 |
| Latvia | 16.3 | 53.5 | 7.7 |
| Lithuania | 9.9 | 41.7 | 26.8 |
| Luxembourg | 10.0 | 68.1 | 19.2 |
| Netherlands | 11.1 | 50.0 | 2.0 |
| Portugal | 7.7 | 64.6 | 38.5 |
| Romania | 17.0 | 1.0 | 1.3 |
| Slovenia | 9.2 | 55.4 | 5.5 |
| Spain | 13.2 | 46.3 | 5.0 |
| Sweden | 8.4 | 66.6 | 10.5 |
| United Kingdom | 6.0 | 52.7 | 2.3 |
| **Average** | **10.6** | **50.2** | **8.54** |

\* This only includes originally planned disbursements on TEN-T projects recorded in the Mid-Term Review

The size of government spending on economic affairs relative to total government spending varies across countries. On average 10 percent of government spending in on economic affairs. The fact that transfer spending constitutes a large portion of total government spending, 10 percent constitutes a significant portion of non-transfer spending [NOTE: I need a new measure here to make this point more firm]. Transportation spending in a given year makes up on average 50 percent of total government spending on economic affairs. This indicates the importance of transportation spending in the whole of how governments spend their non-transfer funds. The disbursements of funds on the TEN-T projects reviewed in the Mid-Term Review, however, make up on average only 8.5 percent of total transportation spending. This small percentage presents a potential problem in assuring that this instrument is strong enough to provide unbiased results.

In order for disbursements of funds for transportation projects to be a valid instrument for government spending, TEN-T projects must be awarded and allocated irrespective of the current state of the economy. Decision No 661/2010/EU recasts the guidelines for the development of the trans-European transportation network (TEN), clearly lays out the objectives of this program are to “smooth functioning of the internal market and the strengthening of economic and social cohesion “ (paragraph 2). With a stated goal of relieving congestion to optimize the capacity of the network and to improve transportation safety and reducing its environmental impact (paragraphs 3, 4, and 5). Regulation No 680/2007 (20 June 2007) sets out the legal framework for the selection of projects and emphasizes that project selection is based on meeting above stated objectives with emphasis given to those projects that are a common interested to the EU as a whole to eliminate bottlenecks, are cross-border in nature, optimized capacity, improves service, ensures interoperability between national networks, contribute to the completion of internal markets, and those that promote more environmentally-friendly modes of transport (chapter two article five). Only once (Paragraph 3 in Decision No 661/2010/EU) are the possible economic benefits of the transportation projects mentioned where it states: “Job creation is one of the possible spin-offs of the trans-European network”, yet nowhere is it included as a parameter on which projects will be accepted. In fact there was a separate call for projects in 2009 under the European Economic Recovery Plan (EERP) that was designed specifically to act as a stimulus. These are “shovel ready” projects, yet none of them are included in our analysis (39 of the 99 EERP proposed projects were accepted and awarded € 500 million, whereas awards granted under the Annual and multi-annual call totaled € 436.6 million).

Even though the selection criteria do not take into consideration the current state of the economy, the timing of proposing projects could potentially be affected by the current state of the economy. In order to avoid any possibility of endogeneity due to the decision to propose a project we do not use any TEN-T data from the year the project was proposed. Each project in the study was approved in 2007 and we are using the disbursements for years 2010-2012, so even if the choice of selecting or proposing the project was influenced by the current state of the economy the disbursements are not. In addition, instead of using actual disbursements of the funds for each of the projects which could have potentially been adjusted in order to meet some short term economic objective, we will use the originally planned disbursement of the funds for TEN-T projects as well as the revised planned disbursements. The use of planned disbursements follows the instrumental strategy of Kraay (2012).

In addition to the requirement that the instrument be exogenous to the independent variable, in order to be a strong instrument it must also have explanatory power, or play an significant role in explaining the fluctuations in the variation of the variable it is meant to instrument. In other words the instrument needs to be highly correlated with the potentially endogenous variable in the original equation. In this case we need to evaluate the relationship between the disbursements of funds for TEN-T projects to government spending in the first stage of the two stage regression. Table 2 shows the ratio of total government spending on economic affairs to disbursements on TEN-T projects from the midterm review for the years and countries represented in the sample.

Table 2: Correlation between variables

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Correlation with changes in* | | | |
|  | GDP | Government spending on economic affairs | Originally planned disbursements on TEN-T projects\* | Revised planned disbursements on TEN-T project\*\* |
| *Changes in:* |  |  |  |  |
| GDP | 1 |  |  |  |
| Government spending on economic affairs | -0.043 | 1 |  |  |
| Originally planned disbursements on TEN-T projects\* | -0.110 | 0.028 | 1 |  |
| Revised planned disbursements on TEN-T project\*\* | -0.042 | 0.156 | 0.177 | 1 |

\* This only includes originally planned disbursements on TEN-T projects recorded in the Mid-Term Review

\*\* \* This represents the revised disbursements after the Mid-Term Review on TEN-T projects and only those recorded in the Mid-Term Review

The correlation between the growth rate of GDP and the proposed instruments are very low, indicating that the exogenieity condition of the chosen instrument may be met. The correlation between the instruments and government spending, however, is also very low. This indicates that the instrument is very likely a weak instrument. Whether this is due to the limited data (only two years of growth data on 95 TEN-T projects) or an actual weakness with the instrument, one cannot tell.

**IV. Results**

We first present the result with the naïve assumption that there is no endogeneity problem between government spending and GDP. Column 1 of Table 3 shows the estimated effect of government spending on GDP using robust standard errors clustered on country observations with country and year fixed effects.

Table 3: Estimation of the fiscal multiplier

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Changes in GDP* | | | | | | | |
|  | (1) |  | (2) | |  | (3) | |
|  |  |  | Second Stage | First Stage |  | Second Stage | First Stage |
| *Changes in:* |  |  |  |  |  |  |  |
| Government spending on economic affairs | 0.1121  (0.1323) |  | 1.3877  (1.2154) |  |  | 0.8731  (0.6870) |  |
| Originally planned disbursements on TEN-T projects\* |  |  |  | -3.2572  (4.6605) |  |  |  |
| Revised planned disbursements on TEN-T project\*\* |  |  |  |  |  |  | -3.2760  (3.3258) |
| Constant | 0.0293\*\*\*  (0.0015) |  | 0.0014  (0.0044) | 0.0110  (0.0131) |  | 0.0039  (0.0030) | 0.0113  (0.0108) |
| Country and time fixed effects | Yes |  | Yes | Yes |  | Yes | Yes |
| Observations | 46 |  | 46 | 46 |  | 46 | 46 |
| F-Statistic |  |  |  | 0.28 |  |  | 0.48 |

(1)Is the OLS estimator with clustered standard errors reported in parenthesis (2) has the two stage least squares estimation with the first column reporting the estimation of the second stage of the regression and the second column reports the first stag regression of originally planned disbursements of TEN-T projects. Robust clustered standard errors are reported in parenthesis (3) has the two stage least squares estimation with the first column reporting the estimation of the second stage of the regression and the second column reports the first stag regression of revised planned disbursements of TEN-T projects. Robust clustered standard errors are reported in parenthesis. \* This only includes originally planned disbursements on TEN-T projects recorded in the Mid-Term Review. \*\*This represents the revised disbursements after the Mid-Term Review on TEN-T projects and only those recorded in the Mid-Term Review

The model finds a low government multiplier of 0.112, which suggest that a euro of government spending on economic affairs has a 0.112 effect on output when taking into account country specific characteristics that might influence the size of the multiplier as well as any year effects that uniformly effect the size and direction of the multiplier. This is a small multiplier which is not statistically significant. Many of the studies presented above had insignificant multipliers, but this estimated multiplier is smaller than most of those reported in other papers.

The results, however, are unreliable as we assume that there is some feedback between GDP and the amount the government decides to spend on economic affairs. Thus in Column (2) the results of the two stage least squares estimation using the originally planned disbursements of funding on the select TEN-T projects reviewed in the Mid-Term review. The size of the multiplier increases to 1.388, though the number remains statistically insignificant. This estimated multiplier surpasses the significant threshold of one, meaning that a euro of government spending on economic affairs creates more than a euro of GDP.

In testing the validity of the instrument, it is significant that the coefficient in the first stage regression is negative. This indicates that many countries at this time were reducing total spending on government affairs (in response to economic conditions), while disbursements on transportation projects maintained their growth. This indicates that disbursements are indeed insulated from economic conditions. In this case, countries in Europe looking for ways to reduce their spending in response to the debt crisis, kept their obligations to disburse funds to already planned and approved transportation projects. The instrument, however, does not meet the second criteria of a strong instrument in that it has strong predictive powers over the instrumented variable; in this case government spending on economic affairs. The estimated coefficient in the first stage is insignificant and the F-statistic is well below ten which is a rule of thumb threshold of a weak instrument and could lead to bias estimators of the intended effect (Stock and Yogo, 2005). At this time it is impossible to tell if the weak instrument problem is due to the lack of observations and the incomplete coverage of transportation projects or if the instrument is fundamentally invalid.

In column (3), the two stage regression is run again, but this time the revised planned disbursements are used as an instrument for government spending on economic affairs. The estimated multiplier is again bigger than then non-instrumented case, but is still less than one and statistically insignificant. The instrument again is a weak instrument with an F-statistic well below ten. As a result, the estimated multiplier is potentially biased.

**V. Conclusions:**

Understanding the size of the fiscal multiplier has become an urgent task as Europe wrestles with the remnants of a sovereign debt crisis for a number of its members during a time of slow and negative economic growth. Due to data limitations, traditional empirical techniques used to measure the fiscal multiplier are not valid for the EU. Recent advances in the literature, however, point to the possibility of using instrumental variable techniques to estimate the size of the fiscal multiplier in Europe. Disbursements of funds for transportation projects managed by the European Commission through the Innovation and Networks Executive Agency, provide a possible instrument for estimation of the fiscal multiplier. Using disbursement data from the TEN-T Mid-Term Review as an instrument for government spending on economic affairs, we find that the fiscal multiplier ranges between 0.87 and 1.39. This is compared to a measure of 0.11 when estimating the fiscal multiplier without correcting for endogeniety through IV estimation. The instrument, however, is a weak instrument and thus the results are potentially biased. Whether this is due to the limited data (only two years of growth data on 95 TEN-T projects) or an actual weakness with the instrument we cannot yet be certain. More data collection is required to accurately address this concern.

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**Appendix A:**

**TEN-T**

The original TEN-T program covered any project that promoted the goal of European integration though transportation, but focuses mainly on 14 priority projects (TEN-T, 2010, p. 7). In 2004 number of priority projects was expanded to include 30 priority projects and the Trans-European Transportation Network Executive Agency (TEN-EA) was created to manage all TEN-T projects. In 2014 the management of projects was folded into the newly created Innovations and Networks Executive Agency (INEA) ([www.inea.ec.europe.eu](http://www.inea.ec.europe.eu)). Priority projects receive 73% of all TEN-T funding (<http://inea.ec.europa.eu/en/ten-t/ten-t_projects/statistics/statistics.htm>) (while horizontal projects such as ATM, ERTMS, ITS, and RIS receive 18% of all TEN-T funding – same source). There are two distinct funding schemes; the 2000-2006 and 2007-2013 funding schemes. By the end of 2014, 595 projects had been established under the 2007-2013 funding scheme (of which the study takes projects from exclusively) totaling € 6.74 billion of the potential € 8 billion set attributed to the 2007-2013 funding program. (updated numbers http://inea.ec.europa.eu/en/ten-t/ten-t\_projects/statistics/statistics.htm) (mdi-2013 numbers European Commission, 2013 http://inea.ec.europa.eu/download/publications/tenea\_numbers\_201306\_final.pdf).

Each year the European Commission (through its agencies DG MOVE or TEN-T) issues a call for proposals. Member states are to submit either Multi-Annual or Annual requests for funding. 80-85% of the TEN-T budget is allocated for Multi-Annual projects which are typically larger in scale and duration. The emphasis on larger projects that often involve multi-countries (44% of TEN-T funding went to multi-national projects - <http://inea.ec.europa.eu/en/ten-t/ten-t_projects/statistics/statistics.htm>). The European Commission and its agencies then evaluate the proposals based on the criteria set out in TEN Guidelines and TEN Regulations (Decision No 661/2010/EU July 7 2010 and Regulation No 680/2007 June 20 2007). The decision is based on the proposals “relevance to the TEN-T priorities and policy objectives, maturity, impart (particularly environmental), and quality”. Approximately 47% of all proposals selected were accepted to receive funding (same citation as above on national projects). Once a project has been selected the Commission and those on the proposal meet to negotiate the amount that will be funded under TEN-T and how much submitting countries will be expected to contribute as well as over what time horizon the funds will be disbursed. [would love to find the data on what percentage of accepted projects the EU is contributing – it appears all that I have is of the 26,948.5 million requested 9,416 was awarded about 35%]

**Appendix B:**

Summary Statistics

Table A1: Share of spending

|  |  |  |  |
| --- | --- | --- | --- |
| Country\* | Average GDP growth rate (percent) | Change in government spending on economic affairs as a percent of GDP | Change in transportation spending disbursed for TEN-T projects as a percent of GDP\* |
| Austria | 1.85  (1.39) | 0.13  (0.52) | 0.19  (0.01) |
| Belgium | 0.81  (1.34) | 0.35  (0.01) | 0.16  (0.02) |
| Bulgaria | 1.21  (0.89) | 0.19  (0.93) | 0.00  (0.00) |
| Czech Republic | 0.40  (2.01) | -0.50  (0.06) | 0.00  (0.03) |
| Denmark | 0.36  (1.01) | 0.15  (0.02) | 0.01  (0.02) |
| Estonia | 6.59  (2.94) | 0.33  (0.15) | -0.13  (0.18) |
| Finland | 0.91  (2.71) | -0.03  (0.08) | 0.05  (0.01) |
| France | 1.02  (1.42) | -0.12  (0.26) | -0.01  (0.00) |
| Germany | 2.01  (1.87) | -0.59  (0.75) | 0.03  (0.00) |
| Greece | -7.04  (0.09) | -0.51  (0.56) | 0.01  (0.00) |
| Hungary | -0.05  (2.28) | 0.34  (1.77) | -0.00  (0.02) |
| Ireland | 1.16  (1.42) | -9.14  (7.78) | -0.01  (0.01) |
| Italy | -0.96  (1.99) | -0.17  (0.20) | 0.02  (0.01) |
| Latvia | 5.26  (0.06) | -1.29  (1.93) | 0.11  (0.01) |
| Lithuania | 4.85  (1.69) | -0.27  (0.19) | 0.31  (0.02) |
| Luxembourg | 0.86  (1.47) | 0.03  (0.12) | 0.26  (0.00) |
| Netherlands | -0.15  (1.55) | -0.36  (0.05) | 0.02  (0.00) |
| Portugal | -2.24  (1.40) | -0.98  (0.00) | 0.59  (0.07) |
| Romania | 1.44  (1.25) | -0.02  (0.67) | 0.00  0.00 |
| Slovenia | -0.92  (2.30) | -0.38  (1.09) | 0.05  (0.00) |
| Spain | -0.80 (1.20) | 1.06  (1.99) | 0.08  (0.01) |
| Sweden | 1.93  (1.42) | -0.05  (0.18) | 0.05  (0.04) |
| United Kingdom | 0.70  (0.60) | -0.14  (0.25) | 0.02  (0.01) |
| TOTAL | 0.84  (1.40) | 0.13  (0.52) | 0.19  (0.00) |

\*County data covers years 2011 and 2012

Standard deviation in parenthesis

This only includes originally planned disbursements on TEN-T projects recorded in the Mid-Term Review

1. See Appendix A for more information about TEN-T [↑](#footnote-ref-1)
2. The other nine categories are general public services, defense, public order and safety, environmental protection, housing and community amenities, health, recreation, culture, and religion, education, and social protection. [↑](#footnote-ref-2)
3. Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Portugal, Romania, Slovenia, Spain, Sweden, and the United Kingdom. [↑](#footnote-ref-3)