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BACKGROUNDER

TAX COMPETITIVENESS PROGRAM

Once on the Lips, Forever on the Hips:

A Benefit-Cost Analysis of Fiscal Stimulus in OECD Countries

Bev Dahlby

In this issue...

The author evaluates the fiscal stimulus policies of 20 OECD countries within a simple benefit-cost framework. Among his findings: in Canada, to be justifiable on a benefit-cost basis, a fiscal stimulus project that improves consumptive public services must provide at least 73 cents in benefits for every dollar of fiscal stimulus.

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The Study in Brief

The large fiscal stimulus measures recently adopted by most member countries of the Organisation for Economic Co-operation and Development (OECD) have been justified on the basis of the income and employment generated through the "Keynesian multiplier effect" of such measures. This paper addresses two questions:

- Can fiscal stimulus measures be justified on a benefit-cost basis?
- What accounts for the large variation in the fiscal stimulus measures OECD countries have adopted?

This *Backgrounder* evaluates the discretionary fiscal policies of 20 OECD countries within a simple benefit-cost framework. Using estimates of these countries' fiscal multipliers and the marginal cost of funds they borrow to undertake public-sector spending, it is possible to calculate the minimum marginal benefit that a fiscal stimulus project must provide to be justified on a benefit-cost basis. That benefit varies widely among these OECD countries and differs between projects that provide direct consumption benefits, such as renovating a hockey arena, and productivity-enhancing projects, such as investing in transportation infrastructure. In Canada, to be justifiable on a benefit-cost basis, a fiscal stimulus project that improves consumptive public services must provide at least 73 cents in benefits for every dollar of fiscal stimulus. For a productivity-enhancing infrastructure project, the present value of the increase in labour productivity must be at least 61 cents for each dollar spent on infrastructure.

Projects that would not satisfy benefit-cost criteria in "normal times" might be justified during a major recession as part of a fiscal stimulus package, but fiscal stimulus cannot justify "useless projects" such as Keynes's famous example of burying money in bottles in abandoned mines.

Differences in the 20 OECD countries' economic and fiscal circumstances – the size of the shock to their economy, the size of their economy's automatic stabilizers, the magnitude of their fiscal multiplier, the level of taxation, and the marginal cost of funds from public-sector borrowing – explain much of the variation in the magnitudes of the fiscal stimulus measures they have adopted.

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INDEPENDENT • REASONED • RELEVANT

In response to severe economic shocks in 2008, many governments have tried to stabilize their economies by increasing spending or cutting taxes. Two questions immediately present themselves:

- Can fiscal stimulus measures be justified on a benefit-cost basis?
- What explains the large variation in the fiscal stimuli that major industrialized countries have adopted?

There is considerable debate about whether the short-term benefits of these fiscal stimulus programs are large enough to justify the long-term costs arising from the subsequent increase in the public debt, but there has been little formal analysis of this issue. The objective of this *Backgrounder* is to evaluate the discretionary fiscal policies of 20 member countries of the Organisation for Economic Co-operation and Development (OECD) within a simple benefit-cost framework. I begin by computing the minimum direct marginal benefit (MDMB) of a consumption-oriented public project and the minimum marginal productivity (MMP) – the minimum net present value of the increase in labour income from spending an additional dollar – of a productivity-enhancing infrastructure project that is needed to justify discretionary fiscal policies on a benefit-cost basis. The results indicate that the minimum marginal benefits required to justify fiscal stimulus measures vary widely across OECD countries.

I then investigate some of the factors that are responsible for the different levels of fiscal stimulus OECD countries have adopted. The model predicts that the level of fiscal stimulus a country adopts should increase with the size of its adverse shock, increase with the product of its overall tax rate and its marginal cost of funds from public-sector borrowing, and decrease as the magnitude of its automatic stabilizers grows. Despite the small size of the sample, this model fits the data reasonably well. I hope that the analysis presented here can offer the public and policymakers some guidance concerning the desirability of adopting fiscal stimulus measures in the future.

Benefit-Cost Analysis of Fiscal Stimulus Measures

Fiscal stimulus has emerged as a pre-eminent economic policy issue as countries cut taxes and increased spending to combat the worst global recession since the 1930s. The intellectual foundation for the use of discretionary fiscal policy was laid by John Maynard Keynes in his justly famous work, *The General Theory of Employment, Interest and Money,* published in 1936. After World War II, Keynes's framework was modified and extended by a generation of economists, and many governments adopted Keynesian fiscal policy to combat involuntary unemployment and stabilize their economies. In the 1970s, however, reliance on Keynesian fiscal policies fell out of favour in light of the emergence of the phenomenon known as "stagflation" (i.e. when the economy has both high rates of inflation and unemployment), and skepticism about the ability of governments to use fiscal policy for short-term stabilization of the economy. At the same time, there was renewed interest in neoclassical models of the economy, which supplanted the simple Keynesian macroeconomic models. Monetary policy replaced fiscal policy as the main stabilization tool, and attention turned to long-run growth models. The key elements of the Keynesian framework – the size of the fiscal multiplier and the strength of an economy's automatic stabilizers – were no longer on the research agendas of most macroeconomists.

In the past year, however, in the light of the macroeconomic shocks sustained by countries around the world, economists have dusted off the Keynesian models and concepts in the search

I would like to thank Colin Busby, Paul De Grauwe, Ergete Ferede, David Laidler, Stuart Landon, Alex Laurin, Bill Robson, Michael Smart, and members of the Tax Competitiveness Council for their comments on an earlier draft of this paper. However, they are not responsible for any of its shortcomings.

for guidance to offer governments as they adopt fiscal stimulus packages. Yet, despite the widespread adoption of such packages, there is a lively debate among economists concerning the efficacy of current fiscal stimulus programs; Box 1 offers a flavour of the debate by presenting the views of some prominent economists on discretionary fiscal policy.[1]

On the pro-stimulus side of the debate, there is Keynes's famous statement that, when there are many involuntarily unemployed workers, any spending project, including burying jars full of money in abandoned mines, would result in a net social gain. In other words, government spending on "useless" projects could be justified because of the stimulus it provides private-sector employment

Box 1: Views of Prominent Economists on Discretionary Fiscal Policy

"If the Treasury were to fill old bottles with banknotes, bury them at suitable depths in disused coalmines which are then filled up to the surface with town rubbish, and leave it to private enterprise on well-tried principles of laissez-faire to dig the notes up again…there need be no more unemployment and, with the help of the repercussions, the real income of the community, and its capital wealth also, would probably become a good deal greater than it actually is. It would, indeed, be more sensible to build houses and the like; but if there are political and practical difficulties in the way of this, the above would be better than nothing."

John Maynard Keynes (1936, chap. 10).

"The components of a fiscal stimulus package are costs to the federal budget; but to the extent that they put otherwise unemployed labor and idle industrial capacity to work, they do not impoverish the economy; in fact, they enrich it. (Of course, one would prefer useful projects to wasteful ones.) If fiscal stimulus works, even imperfectly, there is no doubt which way the benefit-cost ratio goes."

Robert M. Solow (2009).

"My main point is that we should not use the cover of fiscal stimulus to undertake massive public works programs that do not pass muster from the perspective of cost-benefit analysis."

Robert J. Barro (2009, 3).

"There are drawbacks [to discretionary fiscal policy]: the subsequent deadweight loss of financing all the extra government debt that has been incurred, and the fear that too rapid a run-up in debt may discourage private investors from building physical assets, which form the tax base for the future governments that will have to amortize the extra debt."

Brad Delong (2009, 2).

"America's projected deficits may sound large, yet it would take only a modest tax increase to cover the expected rise in interest payments — and right now American taxes are well below those in most other wealthy countries."

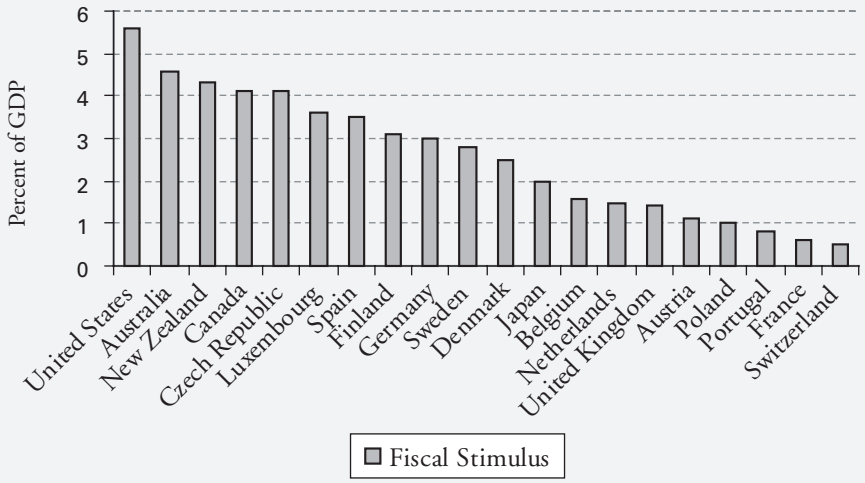
Paul Krugman (2009a).

"[T]he claim that we'll have to pay for stimulus spending now with higher taxes later is mostly wrong. Spending more on recovery will lead to a stronger economy, both now and in the future — and a stronger economy means more government revenue. Stimulus spending probably doesn't pay for itself, but its true cost, even in a narrow fiscal sense, is only a fraction of the headline number."

Paul Krugman (2009b).

1 See also the exchange between Lee Ohanian (2009) and Robert Frank (2009) on the merits of fiscal stimulus, and the views of Phelps (2009) on the inadequacies of both the Keynesian and neoclassical models.

Figure 1: Discretionary Fiscal Stimulus as a Percentage of GDP, 20 OECD Countries, 2009 and 2010



Source: Estimates from OECD (2009).

and output. This view, updated and slightly hedged, has recently been echoed by Nobel Prize-winning economist Robert Solow (2009), who argues that, in the US context, the fiscal stimulus is justified on a benefit-cost basis. Speaking for the other side of the debate is eminent US economist Robert Barro (2009), who is skeptical that the fiscal multipliers are large enough to justify "massive public works programs that do not pass muster from the perspective of cost-benefit analysis."[2]

In addition to concerns about whether the multiplier effects are large enough to justify fiscal stimulus programs on a benefit-cost basis, some economists, such as Brad Delong (2009), are wary of the long-run consequences of the increase in public-sector debt used to finance the fiscal stimulus packages; others, such Paul Krugman (2009a, 2009b), a Nobel laureate and high-profile commentator on US public policy, feel that the financing problem is "manageable" because current tax rates in the United States are low compared to those in other OECD countries and the stimulus measures generate additional tax revenues.

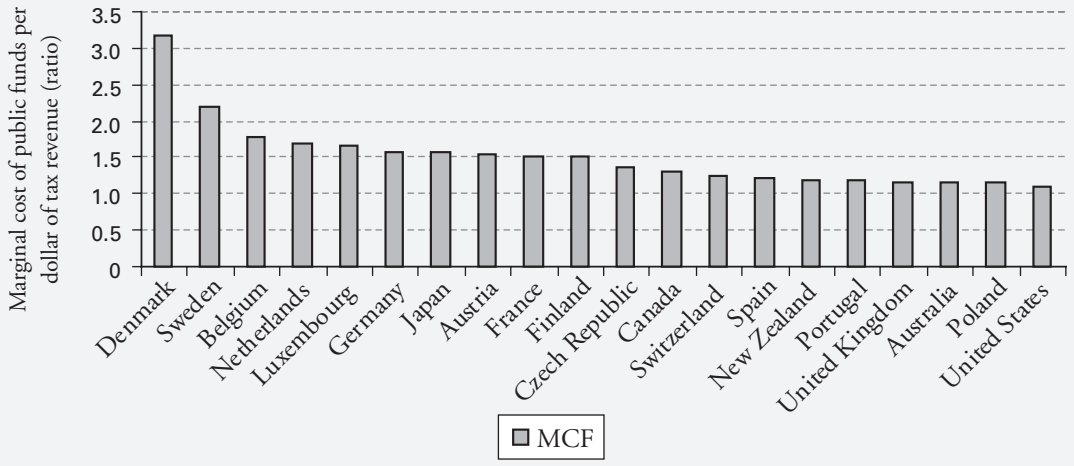
Concerns about the efficacy of discretionary fiscal policy are not restricted to US economists. Almost all OECD countries and many developing countries, including China, have increased spending and reduced taxes as part of their fiscal stimulus packages. One would expect that the key parameters – the size of the fiscal multiplier, the magnitude of the automatic stabilizers, and the marginal cost of funds from public-sector borrowing – will vary across countries, making fiscal stimulus highly advantageous in some and less beneficial, or even undesirable, in others. Consequently, it is worthwhile examining these issues for a group of OECD countries, using data developed by the OECD in its review of the fiscal stimulus measures adopted by member countries.

As Figure 1 indicates, there has been a wide range of fiscal responses to the crisis.[3] Of the 20 OECD countries in the survey, the United States has adopted the largest fiscal stimulus package in 2009 and 2010, equivalent to nearly 5.5 percent of gross domestic product (GDP), while Switzerland's package, at 0.5 percent, is the small-

2 See also Barro and Redlick (2009) on the size of the fiscal multipliers in the United States.

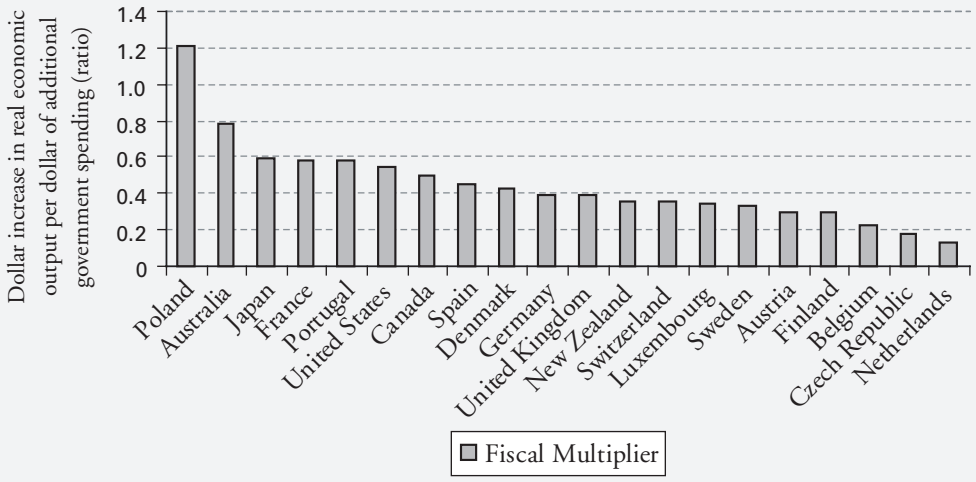
3 Most of the data used in this Backgrounder are taken from OECD (2009) and from various issues of OECD Outlook published in 2009. See also Horton, Kumar, and Mauro (2009) for an analysis of the fiscal policy responses of the G20 countries.

Figure 2: Marginal Cost of Funds (MCF), 20 OECD Countries



Source: Author's calculations using a model described in Dahlby (2006; 2008).

Figure 3: Fiscal Multipliers, 20 OECD Countries



Source: Estimates from OECD (2009, fig. 3.4.B).

est.[4] By way of comparison, Canada (federal and provincial governments combined) has the fourth-largest stimulus package, at just over 4.0 percent of GDP, while the (unweighted) average fiscal stimulus is 2.6 percent of GDP. It is important to note that these figures refer to the discretionary fiscal stimulus that countries have adopted and do not include the effects of automatic stabilizers (such as increases in social assistance and unemployment insurance payments) that have contributed to increases in governments' deficits.

The cost to the private sector when a government borrows an extra dollar – which economists refer to as the marginal cost of funds (MCF) from public sector borrowing – generally exceeds a dollar because the increase in tax rates that is required to finance interest payments on the public debt creates disincentives to work, save, and invest that reduce output. Figure 2 shows that the MCF varies widely across the 20 OECD countries in the survey, with Denmark having the highest at 3.18 and United States the lowest

4 Since Hungry, Iceland, and Ireland have adopted contractionary fiscal policies in 2009, they have been excluded from the study.

at 1.10.[5] In general, countries with high tax rates also have a high MCF because the additional distortion caused by a tax rate increase is greater the higher is the initial tax rate.[6] Canada's MCF is 1.30, which is close to the value for a personal income tax increase that Baylor and Beauséjour (2004) obtain using a different dynamic general equilibrium model. Kleven and Kreiner (2006), who calculate the MCF for Denmark, France, Germany, and the United Kingdom under a variety of assumptions about the labour supply and participation decisions, obtain rankings for the four countries that are generally the same as those in Figure 2; they find that Denmark's MCF exceeds 3.00 when the labour force participation of low-income workers is highly responsive to their real after-tax wage rate.

There is a great deal of controversy over the size of the multiplier effects of government fiscal stimulus programs.[7] For example, the U.S. Council of Economic Advisors' (United States 2009) reports multipliers for the United States that are as high as 1.57. Barro (2009), however, argues that the use of multipliers that exceed 1 is unrealistic. His recent research, reported in Barro and Redlick (2009), indicates that, in the United States, "the multiplier effect of defence spending falls more in the range of 0.6 to 0.8, and we find it unlikely that non-defence multipliers would be larger." Recent research by Christiano, Eichenbaum, and Rebelo (2009) and Cogan et al. (2009) also reach vastly different conclusions regarding the size of US fiscal multipliers. These differences seem to be based on different assumptions about how long US interest rates will remain low and how long the fiscal stimulus will be applied.

Rather than the wide range of multipliers that have been put forward in the literature, in my analysis I used those of the OECD, which has vast experience in forecasting the macroeconomic responses of its member countries; moreover, the OECD's fiscal multipliers are available on a consistent basis for the group of countries in the sample. As Figure 3 shows, the multipliers range from 1.21 for Poland to 0.13 for the Netherlands, while the average for the 20 OECD countries is 0.45. The OECD's estimate of the multiplier in Canada is 0.50, a figure that is well below estimates ranging from 0.8 to 1.5 for spending and from 0.1 to 0.9 for tax cuts published by the Department of Finance in the 2009 budget (see Canada 2009, table A1.1). Similarly, the OECD's estimate of the multiplier for the United States, 0.55, is considerably lower than that used by "Team Obama." In my view, the OECD's more conservative multipliers seem reasonable given that many households in Canada and the United States have increased their savings rates to offset the decline in their wealth caused by recent losses in the housing and stock markets.

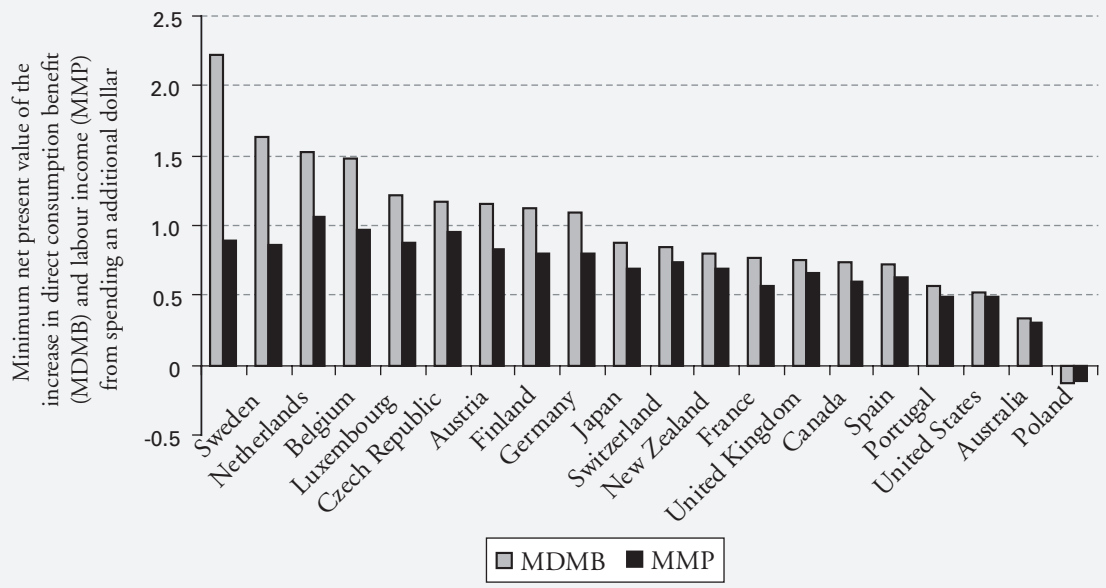
Thus, using the OECD's estimates of the fiscal multipliers and my computations of the MCF from public-sector borrowing, it is possible to calculate the minimum marginal benefit of a fiscal stimulus project that would justify its use on a benefit-cost basis. In doing so, I distinguish between projects (such as renovating a hockey rink) that provide direct consumption benefits, for which I calculate the MDMB, and those (such as investment in transportation infrastructure) that enhance labour productivity, for which I calculate the MMP. The MDMB and MMP represent thresholds that projects must satisfy to be justified on a benefit-cost basis. These thresholds are higher when the MCF is higher or when the fiscal multiplier is lower. When both the MDMB and MMP are higher, fewer projects satisfy the benefit-cost criterion, and a country should adopt a lower level

5 Auerbach and Gale (2009) argue that the tax and expenditure policies in the United States are not sustainable, largely because of future increases in Medicare spending, and that a five-to-ten percentage point increase in taxes or cut in spending is required to close the fiscal gap. My computations assume that governments maintain a sustainable fiscal policy and, therefore, the US MCF might be substantially underestimated because its future tax rates could be substantially higher. Similar issues also might affect the computations of the MCF of other OECD countries, notably the United Kingdom, which also faces a long-term problem of fiscal sustainability — see Buiter (2009) and Wolf (2009) on that country's fiscal situation.

6 The correlation coefficient between the tax rate and the MCF for this group of countries is 0.69.

7 On the magnitude of multiplier effects, see Hemming et al. (2002a, 2002b); and Ilzetski, Mendoza, and Vegh (2009).

Figure 4: Minimum Direct Marginal Benefit (MDMB) and Minimum Marginal Product (MMP) from Fiscal Stimulus, 20 OECD Countries



Source: Author's calculations from estimates in OECD (2009, chap. 3).

of fiscal stimulus. (Appendix A explains how the MDMB and MMP are calculated.)

As Figure 4 shows, Denmark has the highest MDMB of the 20 OECD countries, at 2.22. This means that, in Denmark, a project providing a direct consumption benefit would not be justified as a fiscal stimulus measure unless an additional krone spent on the project yielded at least 2.22 kroner in direct benefits, a condition that presumably relatively few "off-the-shelf" projects would satisfy. The four countries with the highest MCF – Denmark, Sweden, Belgium, and the Netherlands – are also those with the highest MDMB; they also have relatively low fiscal multipliers, in part because of their high tax rates, but also because they are small, open economies with a relatively high marginal propensity to import. At the other extreme, Poland's MDMB is negative. Taken literally, this means that the Polish government could even hire workers to fill community swimming pools with stones and demolish schools and such harmful projects could still be justified because of their income-generating effects. Poland, in fact, is the only country for which the OECD assigns a fiscal multiplier greater than 1.

Canada's MDMB is 0.73, meaning that Canadians must receive at least 73 cents in benefits from an additional dollar spent on a fiscal stimulus measure, such as a home renovation tax credit, that generates a direct consumption benefit for it to be justified on a benefit-cost basis. The MDMB for the United States, 0.53, is lower than Canada's because the United States has a lower MCF and a higher fiscal multiplier. For both countries, however, the MDMB is less than 1, indicating that projects that would not normally be funded would qualify as fiscal stimulus measures. These results for Canada and the United States probably offer more comfort to proponents of discretionary fiscal policies than to skeptics.

Figure 4 also shows the MMP for fiscal stimulus measures that enhance labour productivity. Notice that, for all countries except Poland, the MMP is less than the corresponding MDMB. This means that an infrastructure project has a lower threshold than a pure public service project because a productivity-enhancing project generates additional tax revenues in the future, reducing the future tax increase required to pay for the public-sector borrowing that is used to finance it. For Canada, the MMP is 0.61, meaning that an infrastructure project, such as a highway improvement, must increase labour productivity by at least 61 cents for each dollar spent on the project for it

to be justified on a benefit-cost basis. Presumably, many infrastructure projects could satisfy this condition, but it is difficult to get them "off the shelf" fast enough to provide the fiscal stimulus when it is needed. Leigh and Stehn (2009, table 1) highlight the problem of delays in using capital projects as fiscal stimulus measures.

Can spending on useless projects ever be justified? If the MCF is 1.50, its average value for the sample of 20 OECD countries, and if the tax rate is 0.33, which is close to the overall OECD average, then the MDMB is zero if the multiplier is 1.29. Thus, for many OECD countries, the fiscal multiplier would have to be greater than 1.29 to justify Keynes's belief that useless projects could be used to stimulate the economy "if there are political and practical difficulties" in funding sensible projects.

Determinants of the Fiscal Policy Responses of OECD Countries

In an article in the *Financial Times,* Paul De Grauwe (2009) claims that disputes among prominent economists about the effectiveness of fiscal stimulus have affected policy responses:

> With so much disagreement it is no surprise that policymakers are unsure and vacillate. Some countries, such as the US and France, go all out for the Keynesian story; others, such as Germany, put more faith in the Ricardians. Personally I think the Keynesians are right, but my opinion is irrelevant. The point is that the cacophony of analysis helps to explain why policymakers react in different ways to the same crisis and why it is so difficult for them to come up with co-ordinated action.

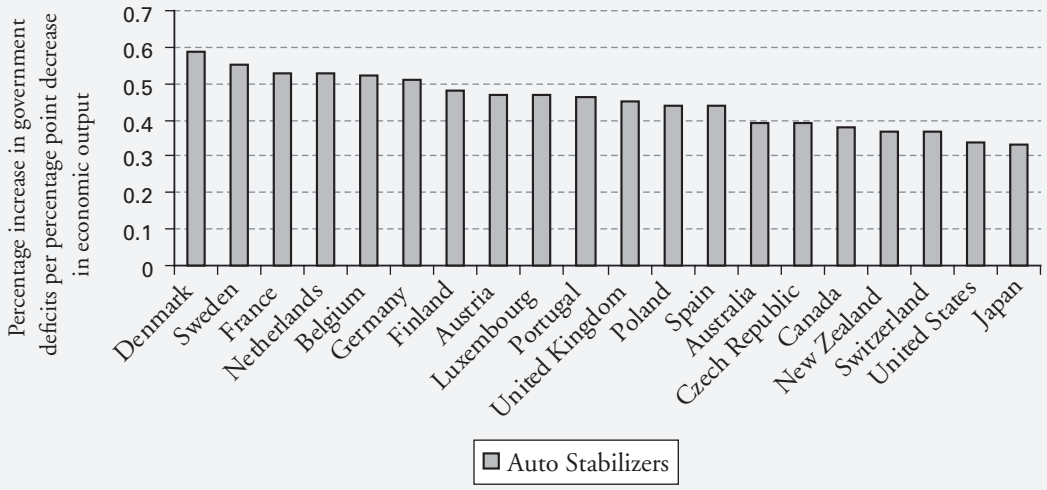
While there are clear differences among leading economists about the size of fiscal multipliers and the harm caused by increases in the public debt to finance fiscal stimulus, policymakers in different countries may have made different choices because they face different circumstances. In this view, it is not so much the differences in the views of economists, but differences in the economic and fiscal situations of these countries, that account for the variety of policy responses. Can the fiscal stimulus measures adopted by the 20 OECD countries in the sample in fact be explained by differences in their economic and fiscal circumstances?

The model outlined in the previous section suggests that the degree of fiscal stimulus should be larger in countries that have a lower MDMB and MMP. Regression analysis indicates, however, that these two measures are not closely related to the degree of fiscal stimulus the 20 OECD countries have adopted. The model, it turns out, lacks two factors that might have influenced policymakers' responses: the size of the shock to their economy and the strength of their economy's automatic stabilizers. Indeed, the latter factor has often been used to explain the difference in the policy responses of the United States and members of the European Union.

Appendix B outlines a model that predicts that the fiscal stimulus a country adopts should increase as the severity of the economic shock and the product of its tax rate and the MCF increase, and should be lower the larger are the economy's automatic stabilizers. The size of the multiplier could either raise or lower the optimal fiscal stimulus. Horton and Ivanova (2009) attribute the variation in the fiscal policy responses among G20 countries to differences in their automatic stabilizers, output gaps, fiscal multipliers, and their fiscal circumstances, as reflected in their level of public debt, contingent liabilities, and interest rates.

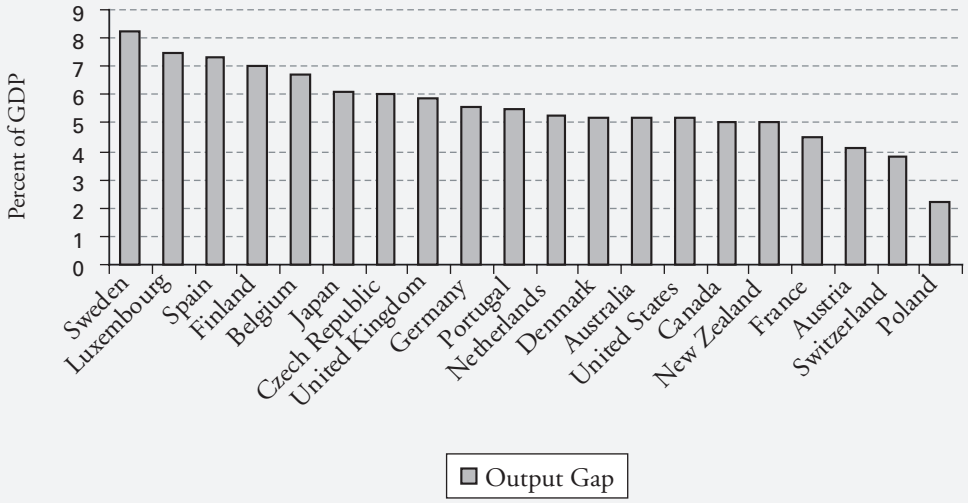
To test the predictions of the model, one needs values for the automatic stabilizer, the increase in the government deficit when the economy's total output declines by one percentage point, and the size of the shock that each OECD country received during the current recession. As Figure 5 shows, not surprisingly, countries with large social welfare programs – Denmark, France, the Netherlands, and Sweden – have the largest automatic stabilizers, while Canada, Japan, Switzerland, and the United States, with relatively lower tax rates and less comprehensive social welfare programs, have the smallest automatic stabilizers.

Figure 5: Automatic Stabilizers, 20 OECD Countries



Source: Girouard and André (2005).

Figure 6: Average Output Gap as Percentage of GDP, 20 OECD Countries, in 2009 and 2010



Source: OECD Economic Outlook 85 database.

Another key variable is the size of the output gap, which measures the difference between an economy's output with full employment and its actual output. Since the output gap reflects the impact of each country's fiscal stimulus and its automatic stabilizers, is not a direct measure of the size of the economic shock. Figure 6 shows the OECD's estimates of the output gaps in the 20 countries in the sample in fiscal year 2009 and 2010. Given the OECD's estimates of fiscal stimulus measures, automatic stabilizers, and fiscal multipliers, however, one can "back out" the size of the shock for each economy (see Figure 7). Note that, although Sweden is predicted to have the largest output gap in 2009/10, Australia appears to have received the largest shock to its economy, while Switzerland received the smallest shock even though Poland had the smallest output gap. These

Figure 7: Estimated Economic Shock as Percentage of GDP, 20 OECD Countries, in 2009 and 2010

Source: Author's calculations.

reversals in ranking reflect the fiscal stimulus Australia has adopted and the size of Poland's multiplier.[8]

A country's use of fiscal stimulus relative to the size of the economic shock it has received is shown in Figure 8. By this measure, New Zealand and the Czech Republic, followed closely by the United States, have been the most aggressive in adopting discretionary fiscal policies, with fiscal stimulus measures that exceed 50 percent of the shock. On the other hand, France's fiscal stimulus has been less than 10 percent of its shock. These calculations indicate, contrary to De Grauwe's claim, that France has not adopted a very activist Keynesian fiscal policy.

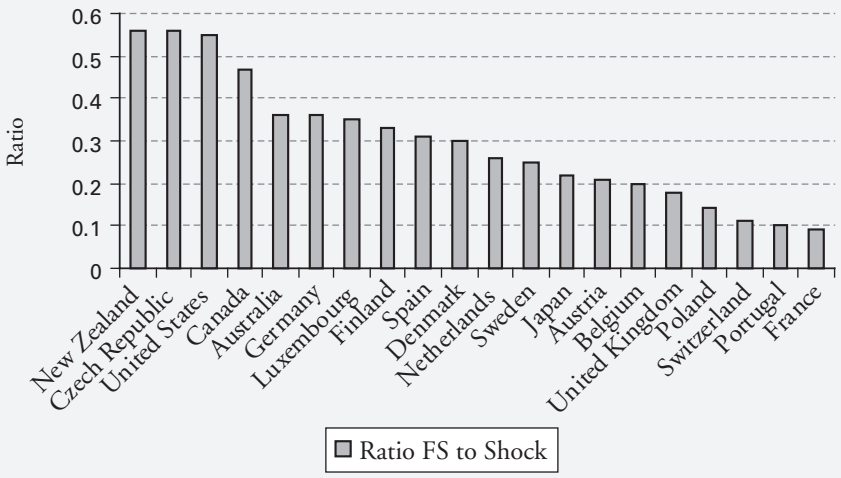
Figure 9 shows the actual fiscal stimulus and predicted fiscal stimulus for the 20 OECD countries (see Appendix B for the regression equation containing these variables). The figure reveals that the predictions in the model tend to underestimate the level of fiscal stimulus adopted by high-fiscal-stimulus countries such as the United States and Canada, and to overestimate the level of fiscal stimulus adopted by low-fiscal-stimulus countries. The prediction errors are especially large for Japan, New Zealand, and Sweden, perhaps reflecting differences in the type of shock these countries received. For example, a country that received a shock to its housing sector might have responded in a different way than one that received a shock to its export sector. Further analysis might reveal the underlying cause of these prediction errors. My overall conclusion, however, is that, while the differing views of economists might have had some influence on countries' fiscal policy responses, differences in these countries' objective circumstances explain a large part of the variation in the fiscal stimulus measures they have adopted.

Conclusion

Using estimates of 20 OECD countries' fiscal multipliers and their marginal cost of funds from public-sector borrowing, I find that the minimum marginal benefit of fiscal stimulus packages varies widely both among these countries and between projects that provide direct consumption benefits, such as renovating a hockey rink, and productivity- enhancing projects, such as investing in transportation infrastructure. For Canada, a fiscal stimulus project that improves consumptive public services has to provide at least 73 cents in benefits for each dollar of fiscal stimulus to be justifiable on a benefit-cost basis. For a productivity-enhancing infrastructure project, the present value of the

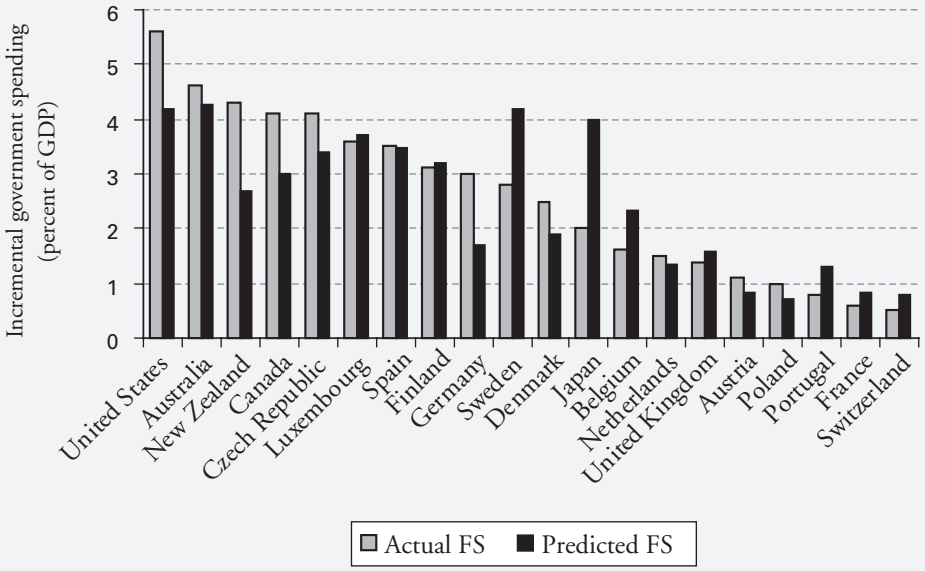
8 Although there are differences between each country's estimated economic shock and its output gap, the correlation coefficient between the two series, at 0.59, is high.

Figure 8: The Ratio of Fiscal Stimulus Measures to the Size of the Economic Shock to 20 OECD Economies, in 2009 and 2010



Source: author's calculations.

Figure 9: Actual and Predicted Fiscal Stimulus, 20 OECD Countries, in 2009 and 2010



Source: author's calculations.

increase in labour productivity must be at least 61 cents for each dollar spent on infrastructure to pass the benefit-cost test.

These results suggest that projects that would not satisfy benefit-cost criteria in "normal times" might be justified as part of a fiscal stimulus package in "abnormal times" when there is substantial involuntary unemployment. However, except for Poland, "useless projects" – such as Keynes's famous example of burying bottles full of money in abandoned mines – cannot be justified simply because they provide fiscal stimulus.

Differences in the economic and fiscal circumstances of OECD countries – the nature of the shock to their economy, the size of their economy's automatic stabilizers, the magnitude of their fiscal multiplier, the level of taxation, and their marginal cost of funds borrowed for public sector spending – explain a high proportion of the variation in the fiscal stimulus measures these countries have adopted.

Appendix A A Simple Benefit-cost Framework for Evaluating Fiscal Stimulus

The cost of a project takes two forms: the value of the resources the project uses and the harm caused by tax rate increases required to finance the project. Consequently, spending an additional dollar on a project is worthwhile if the present discount value of the marginal benefit of the project, MB_G, satisfies the following condition:[9]

$$MB_G \geq MCF\left(1 - R_G\right) \tag{A.1}$$

where *MCF* is the marginal cost to society of raising an additional dollar to finance the project and R_G is the additional tax revenue that is generated as a result of spending an additional dollar on the project. *MCF* is often greater than 1 because tax increases distort the allocation of resources in the economy. The expression in round brackets is the net amount to be financed, which may be less than a dollar if, for example, the project enhances productivity and therefore helps to generate additional tax revenues at existing tax rates. If the project is financed by debt, instead of current tax revenues, the MCF concept is still applicable and can be interpreted as the cost imposed on society in raising the additional tax revenue to finance interest payments on the debt.[10]

The above condition is very general, however, so I adopt notation that is more applicable to the evaluation of fiscal stimulus. Consider two types of fiscal stimulus: projects that provide a direct consumption benefit, such as repairing a hockey arena or a tax credit for home renovations, and projects that make the private sector more productive, such as investing in transportation infrastructure. For the former, the last dollar spent on a fiscal stimulus package financed by an increase in public debt will generate a net social gain if the following variant of the above condition holds:

$$\left(1 - \tau\right) m + DMB \geq MCF\left(1 - m\tau\right) \tag{A.2}$$

where *m* is the fiscal policy multiplier, *DMB* is the direct marginal benefit from a dollar spent on fiscal stimulus, and τ is the tax rate. I assume that the economy has unemployed resources and, therefore, the additional dollar of government spending (or tax cut) generates additional after-tax income equal to $(1 - \tau)m$. On the right-hand side, I substitute $m\tau$ for R_G in equation (A.1) to make explicit the idea that the additional income generated by the project through the multiplier effect also increases tax revenues. In evaluating a fiscal stimulus program, *MCF* reflects the cost to society of financing an additional dollar of public-sector debt.

Every fiscal stimulus package is made up of a variety of measures, and the direct marginal benefits of these measures may vary widely and are not usually reported in any of the background documentation provided by government. Consequently, I calculate the minimum direct marginal benefit (MDMB) required for a fiscal stimulus measure to satisfy the benefit-cost condition. The MDMB is defined by the following equation:

$$MDMB = MCF\left(1 - \tau m\right) - \left(1 - \tau\right) m \tag{A.3}$$

MDMB is a threshold direct marginal benefit that projects must meet or exceed. When *MDMB* is higher, fewer projects will satisfy the benefit-cost criterion and a country should adopt a lower level of fiscal stimulus. A larger *MCF* will raise *MDMB* (assuming $m\tau$ is less than 1) and *MDMB* will be lower when the multiplier is higher.

9 This is a variant of the Atkinson-Stern condition for the optimal provision of a public good. In general, MB_G and MCF would also reflect the distributional effects of the public service and the taxes that are used to finance it, but that issue is ignored in the current application.

10 See Dahlby (2006, 2008) on the theory and measurement of the MCF for public-sector borrowing.

How high does the multiplier have to be to justify spending on a "useless" project? If one sets *MDMB* equal to zero in equation (A.3), the multiplier must be larger than $MCF/(1 + \tau(MCF - 1))$ to justify spending on a useless project. For Canada, with $MCF = 1.30$ and $\tau = 0.43$, this implies that spending on a useless project could be justified if the multiplier is greater than 1.15. This is considerably higher than the OECD's estimate of the multiplier for Canada, 0.50.

Infrastructure projects that boost labour productivity are evaluated in a slightly different manner. Suppose an investment in public infrastructure is financed by a tax on labour income at the rate τ, and it increases labour productivity and workers' wage rates by w_G. The direct net benefit of the infrastructure project is $(1 - \tau)Lw_G$, where L is the total amount of labour employed. In a full-employment economy, the additional tax revenue generated by an additional dollar spent on the project is $\tau(1 + \eta)Lw_G$, where η is the elasticity of labour supply. The MCF from taxing labour is $1/(1 - \tau\eta/(1 - \tau))$. In a full economy, the optimal level of spending on public infrastructure is determined by the condition $F_G \equiv Lw_G = 1$.[11] The additional revenue that the public infrastructure generates by increasing labour incomes just offsets the disincentive effect for labour supply from raising the tax rate on labour income, and infrastructure should be provided up to the point where an additional dollar spent on infrastructure increases the present value of labour income by one dollar. With unemployed labour, the optimality condition would be modified to reflect the additional net income generated through the multiplier effect, and would be equal to:

$$(1 - \tau)m + (1 - \tau)F_G = MCF\left[1 - \tau m - \tau(1 + \eta)F_G\right] \tag{A.4}$$

Solving for F_G, one obtains:

$$MMP \equiv F_G = \frac{MCF - (1 + \tau(MCF - 1))m}{1 + \tau\left[(1 + \eta)MCF - 1\right]} \tag{A.5}$$

The right-hand side of the equation represents the required minimum net present value of the increase in labour income from a productivity-enhancing infrastructure project, MMP. In the computations of *MMP* in Figure 4, I use 0.15 for the aggregate labour supply elasticity for all countries. The computations indicate that the minimum marginal product of an infrastructure project is generally lower than the minimum direct marginal benefit from a project that provides direct consumption benefits. (The one exception is Poland, where the multiplier exceeds 1.)

Finally, a cautionary note needs to be mentioned about the framework used in deriving these benefit-cost results. In adding the after-tax income generated by the multiplier effects to the benefit side of the equation and taking into account the additional tax revenues that this increase in income generates, I use a simple Keynesian framework based on short-run responses to fiscal stimulus in an economy with involuntarily unemployed resources. The cost of fiscal stimulus, the MCF from public-sector borrowing, is computed using a long-run growth model in which it is assumed that the economy is always at full employment and the debt-to-GDP ratio is stable. Thus, the empirical measures of benefits and costs are derived from two very different frameworks, and I do not take into account the transition from the short run to the long run. This inconsistency reflects the gap in the economics profession's set of tools, but one hopes that the recent recession and the revival of fiscal stimulus as a tool for macroeconomic stabilization will spur research efforts to close the gap and integrate short-run neo-Keynesian models with long-run growth models.

11 This is a special case of the Atkinson-Stern condition for the optimal provision of a public good.

Appendix B Predicting Fiscal Stimulus Measures Adapted by OECD Cointries

In this appendix, I incorporate the automatic stabilizer and the size of the fiscal shock in a simple model of the optimal fiscal stimulus and then estimate the model to see if it is consistent with the variation in fiscal responses by OECD countries. Appendix Tables B-1 and B-2 provide sources and descriptions of key variables and Descriptive Statistics used in the model.

Table B1: Sources and Descriptions of Key Variables

Variable	Symbol	Source	Notes
Automatic stabilizer		Girouard and André (2005, table 9)	Estimate of the change of the budget balance, as a % of GDP, for a 1% change in GDP.
Fiscal multiplier	m	OECD (2009, fig. 3.4.B)	Figures for Italy, Mexico, and Norway not provided.
Fiscal stimulus	FS	OECD (2009, table 3.1)	Figures for Greece and Turkey not provided; Hungry, Iceland, and Ireland had contractionary fiscal policies and were excluded from the sample of countries.
Marginal cost of public funds	MCF	Author's calculations based on Dahlby (2006, 2008)	Examples of computations are available from the author upon request.
Output gap	Y	OECD Economic Outlook 85 database.	Average fiscal gap in fiscal year 2009/10; figures for South Korea and Slovakia not provided.
Shock	S	Author's calculations based on equation (5).	
Tax rate		OECD Economic Outlook 84 database, annex table 26.	Average general government total tax and nontax receipts, 1996–2006.

Table B2: Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
FS	2.585	1.507	0.50	5.60
MCF	1.512	0.479	1.096	3.175
m	0.449	0.238	0.13	1.21
	0.436	0.0736	0.32	0.58
	0.451	0.0741	0.33	0.59
Y	5.573	1.387	2.20	8.20
S	8.411	2.026	4.65	12.63

I begin by incorporating the idea that the additional income generated through the multiplier effect is more valuable the larger is the decline in output during a recession. In other words, fiscal stimulus is more "valuable" if people will suffer a larger income shock. Second, I assume that the direct marginal benefit from fiscal stimulus measures declines with the amount of fiscal stimulus. In other words, the quality of the marginal project declines when more projects are funded as part of a stimulus package. In particular, I assume that $DMB = v - \delta FS$, where v and δ are positive constants and *FS* is the magnitude of the fiscal stimulus package, measured as a percentage of GDP. With these two modifications, the condition for the optimal fiscal stimulus becomes

$$\lambda m \Delta Y + \left[v - \delta FS\right] = MCF\left(1 - \tau m\right) \tag{B.1}$$

where ΔY is the reduction in income caused by the shock to the economy and λ is a positive constant.

The reduction in income (or the output gap) will depend on the size of the shock to the economy, ΔS, the size of its automatic stabilizers, and the level of fiscal stimulus that the country adopts. This is formalized as

$$\Delta Y = \Delta S - \alpha m \Delta S - mFS \tag{B.2}$$

where *a* is the increase in the fiscal deficit because of increased social assistance and unemployment benefits and/or reductions in tax revenues because of the shock. The parameter *a* is a measure of the economy's automatic stabilizers. I also assume that, under "normal conditions," when the economy does not need fiscal stimulus, the marginal project satisfies the condition $v = MCF$. Using this condition and substituting equation (B.2) into (B.1), we obtain the following equation for the optimal fiscal stimulus:

$$FS = \frac{m}{\lambda\left(1 - \tau\right)m^2 + \delta}\left[\tau\, MCF + \lambda\left(1 - \tau\right)\left(1 - \alpha m\right)\Delta S\right] \tag{B.3}$$

This model indicates that the optimal fiscal stimulus should increase with the product of the tax rate and *MCF*, decrease with the size of its automatic stabilizer, and increase with the size of the shock to the economy if $am < 1$. It also indicates that the size of the multiplier has an ambiguous effect on the size of the optimal fiscal stimulus.[12] Equation (B.3) indicates that there should be no fiscal stimulus if the economy is at full employment and the fiscal multiplier is zero, because additional government spending simply displaces private spending. During a recession, when there are unemployed resources in the economy and the fiscal multiplier is positive, the optimal fiscal stimulus depends on the magnitude of the multiplier, but direction of the effect could be positive or negative. That the optimal fiscal stimulus could be lower when the multiplier is larger might seem surprising, but it could arise if the automatic stabilizers are relatively large and, therefore, there is less need for fiscal stimulus. Also, the prediction that optimal fiscal stimulus will be larger when the product of the tax rate and *MCF* is higher might seem counterintuitive, but note that τMCF measures the gain from the induced increase in tax revenues from the fiscal stimulus. Finally, note that am is less than 1 for all countries (including Poland, where the multiplier is greater than 1) and, therefore, the optimal fiscal stimulus should increase with the size of the shock.

The magnitude of the economic shock to each country can be inferred from the OECD's estimates for each of the output gap, ΔY, and the level of fiscal stimulus, *FS*, by solving equation (B.2) for ΔS, or

$$\Delta S = \frac{\Delta Y + mFS}{1 - \alpha m} \tag{B.4}$$

12 Evaluated at $m = 0$; that is, when the economy is at full employment, the derivative of *FS* with respect to *m* is positive and decreasing in *a*.

As noted above, the optimal fiscal stimulus a country adopts should increase in τMCF and ΔS and decrease in a, and the size of the multiplier could either raise or lower the optimal fiscal stimulus. This model can be tested based on OECD data and parameters and my calculations of each country's MCF, although, with only 20 observations, one's ability to test these predictions is rather limited. Because the optimal fiscal stimulus is highly nonlinear in these variables, I specify the regression equation in log linear form, with the following results (the t-statistics are shown in parentheses):

$$\ln FS = -6.46 + \underset{(6.06)}{0.57}\ln(\tau\, MCF) - \underset{(1.38)}{0.60}\ln m - \underset{(2.84)}{2.56}\ln\alpha + \underset{(2.73)}{2.30}\ln \Delta S + \underset{(5.91)}{}$$

$$F(4,15) = 11.85 \quad \overline{R}^2 = 0.6955$$

The statistical results are consistent with the predictions of the optimal fiscal stimulus model. The fiscal stimulus is high in countries that have received larger shocks and lower in countries with higher automatic stabilizers. The product of the tax rate and MCF has a positive effect on *FS*, as predicted, but the effect is not statistically significant at the 95 percent confidence level. Finally, the regression results indicate that the fiscal stimulus is lower in countries with higher fiscal multipliers, a result that is consistent with the predictions of the model if automatic stabilizers are relatively large.

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