Praise for "Clearing Up the Fiscal Multiplier Morass: A comment":

Your comment on Leeper, Traum and Walker (2017) makes the point that the fact that DSGE models have evolved over time in the academic literature indicates that none of them represents the complete truth–and that the model itself (typically used to form "rational expectations") will change over time; yet this is not typically accounted for in the model solution. This is a valuable exercise. I read your paper and found it quite interesting.

Coeditor, American Economic Review,
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# Clearing Up the Fiscal Multiplier Morass: A comment

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**Abstract**

"Clearing up the fiscal multiplier morass" would be a very welcomed endeavour because it would inform politics about the right choice for steering the business cycle. Therefore, Leeper, Traum and Walker's (2017) landmark contribution deserves special attention. However, looking at their modelling strategy through the lens of the Lucas critique (Lucas, 1976) reveals that Leeper et al.'s (2017) approach inevitably fuels the morass rather than clearing it up.

*JEL classification:* B4, C5, E52, E62, E63, H50
*Keywords:* fiscal multiplier, Lucas critique, deep rational expectations

## 1 Introduction

The financial crisis spelled trouble not only for firms and households when financing pyramids collapsed and private expenses started to exceed revenues at an alarming rate. It also raised the issue of how fiscal policy could best respond to the crisis. Economists discuss this fiscal policy response in terms of the so-called fiscal multiplier. Unfortunately, exactly how this multiplier operates and how large it is remains largely unknown (Gechert and Will, 2012; Blanchard and Leigh, 2013) which is why Leeper et al.'s (2017) project for "Clearing Up the Fiscal Multiplier Morass" is very welcomed.

Needless to say, an informed policy choice is only feasible when policy makers can gauge the impact of their actions. Leeper et al. (2017) offer a way to do exactly that. In the following, their suggestion will be thoroughly scrutinised. The analysis leads to the conclusion that Leeper et al. (2017) offer excellent insights into a problem that has not much to do with their stated research objective.

## 2 Article structure, research aim and levels of scrutiny

The article has two parts. Part one develops a theoretical model and estimable equations. The second part is empirical. It provides parameter estimates for the theoretical model based on past data. Interpretation and conclusions draw on the parametrized model.

The main goal of the paper is to shed light on the properties of fiscal multipliers. The theoretical and empirical models are intermediate steps towards addressing the ultimate research question. Therefore, the contribution by Leeper et al. (2017) must be analysed at two different levels. The contribution to modelling the economy is at the top whereas the methodology underlying the model itself constitutes the ground level. Since the model builds on a certain methodology, innovations to the modelling level are conditional on the soundness of the model foundations: only if the model foundations are without doubt supportive of the model, improvements of the model can contribute to answering the actual research question. We therefore start commenting on the model foundations first and turn to the modelling level afterwards.

# 3 Zooming in on the methodology

## 3.1 Background

Leeper et al. (2017) approach the theoretical research question by assuming that individual decision makers trigger the response to fiscal shocks. In order to so, they employ what is commonly called microfounded macromodelling. Their workhorse model belongs to the class of dynamic stochastic general equilibrium (DSGE) models. More precisely, they augment the model suggested by Smets and Wouters (2007) (Leeper et al., 2017, p. 2409). This augmentation allows to also consider the effects of fiscal shocks which have alternatively been analysed by Galí, López-Salido and Vallés (2007) or Corsetti, Meier and Müller (2012), for example.

The DSGE model class assumes that rational agents populate the economy with rationality meaning, among other things, that all available information is used for decision making. This assumption also implies that these agents rest their decisions on forecasts of the future, in particular on what they suppose the effects of the fiscal policy will be. The available information set of rational agents can logically not be smaller than the information set of rational researchers (and vice versa). The joint assumption of rationality and forward looking behaviour is commonly called "rational expectations".

The key idea of the analysis hence is to base the analysis of economic policy on the rational individual decisions in response to policy shocks. These rational decisions are based on the world view that the model itself conveys (Lucas, 1976).

The first part of the paper thus employs (simple) rational expectations and DSGE modelling. It is probably fair to say that these two constitute what we may call conventions in the literature. Therefore, there is little to add or to explain, except maybe, that

convention must not be mistaken for appropriateness or reason.

In the second part, the authors estimate the model parameters with U.S. data ranging from 1955:I through 2007:IV (Leeper et al., 2017, p. 2410, baseline version, through 2016 else). It follows that the U.S. economy is Leeper et al.'s (2017) reference system and so is Smets and Wouters's (2007) as well as the latter's predecessor, the model due to Christiano, Eichenbaum and Evans (2005). Since all three models describe the U.S. economy they are mutually exclusive which means that only one of them can form the best or optimal basis for individual decision making. If neither of these three correctly describe actual economic conditions, agents form expectations on grounds different from all three approaches.

It is important to stress (again) the fact that the model is part of the agents' information set. Considering that agents are forward-looking this information set also includes knowledge about potential future changes of the model even if this knowledge is not more specific than to know that the model may or may not change in the future. Hence, rational agents (should) optimise with respect to this information be it specific or not.

We may henceforth label the agents' consideration of future model changes "deep rational expectations" in order to distinguish it from the more widely used Muthian (simple) rational expectations approach that builds on a given model that is not explicitly supposed to change (Muth, 1961).

### 3.2 Deep rational expectations

Deep rational expectations have already been alluded to by Robert Lucas when he noted:

> No one, surely, expected the initial parametrizations of [the traditional] models to stand forever. Lucas (1976, p. 24)

To put it the other way round, only if we can reasonably assume that a certain model "stands forever" can we conclude that the information set is complete. If the former cannot be assumed then ignoring the future changes of the model obviously indicates irrational behaviour.

Consequently, rational agents who are aware of future changes of their model will rationally choose to include this information in their decisions and so will policy makers who want to gauge the impact of their actions. Hence, clearing up the fiscal multiplier morass requires an answer to the evolution of one's underlying world view.

Therefore, under deep rational expectations model solutions can be valid only if agents' decisions are modelled accounting for future model changes. If agents are aware of future model amendments but fail to take this knowledge into account the according model results are apparently invalid. This invalidity holds despite the fact that agents hold rational expectations. Moreover, rationality in this case also implies that agents are aware of the invalidity of the respective model solution.

For the time being it has to remain unknown what exactly the behavioural consequences would be in response to knowing that one's model will change. What is for sure, however, is, that there are consequences.

Consider, for example, the differences between Smets and Wouters's (2007) and Leeper et al.'s (2017) respective models. In 2007, agents could be assumed to build expectations based on the then (arguably) most advanced model which was due to Smets and Wouters (2007). Now, consider this: quite as in Leeper et al. (2017), agents in Smets and Wouters's (2007) optimise over an infinite time horizon. It took only ten years, however, for this basis to be outdated by the innovation offered by Leeper et al. (2017). Because both models refer to the same economy, only one model can be optimal for decision making and

rational individuals, including policy makers, do know that.

Unfortunately, in 2007 the 2017 model was unknown. Therefore, agents could not actually choose between these models in 2007. But had they had a choice, they would have strictly preferred the 2017 model over the 2007 model. This is for two reasons.

First, the differences in the implications of consecutively amended models are not negligible because they would otherwise not have been accepted for publication in respected journals. Second, model amendments make sense only if they imply sufficient gains in profits, utility or consumption and the like. Therefore, agents will invest in these innovations only if they are worth the while. It follows that had agents in 2007 already known the 2017 model they would have chosen it as they knew that their decisions based on the 2007 model would be worse than decisions under the 2017 model. Being rational in 2007, they would have been aware of the fact that their decisions were inferior to some then still unknown alternative. This knowledge of inferiority must have had an impact on their decisions in 2007. Unfortunately, this impact is neither modelled nor accounted for in any appropriate nor in any other way in Smets and Wouters (2007) which casts serious doubts on their model solutions and hence on their policy conclusions.

It must be stressed at this point that the issue of deep rational expectations does not constitute a case against rational expectations or against DSGE modelling. Quite to the contrary, taking into account agents' expectations is the key selling proposition of DSGE models which means that they actually aim at taking agents' expectations into account.

Therefore, the DSGE model class is in the pole position to also account for deep rational expectations. The above observation thus merely shows that DSGE models, including Smets and Wouters (2007) and Leeper et al.'s (2017) versions do not (yet) live up to their own key promise.

We have now collected all major issues for evaluating the contribution by Leeper et al. (2017).

# 4 Evaluations

## 4.1 Evaluating the model solution

Given the above arguments, for evaluation we need to distinguish between (A) rationality v. non-rationality in the sense of taking into account all available information for obtaining the model solution and between (B) future amendments v. no future amendments.

Starting with the assumption of rationality of agents we must concede that these agents will optimise their behaviour taking account of future model amendments. The question, therefore, arises if the agents can assume or should assume that Leeper et al.'s (2017) model is going to be (significantly) amended in the future. Given the history of the model which is itself an augmentation of a previous model we might already suspect that there will be modifications in the future. This suspicion is supported by the authors with the hint:

> We restrict attention to closed economies. Leeper, Traum, and Walker (2011) and the online Appendix explore open economies. Leeper et al. (2017, footnote 5 on p. 2416)

Although the authors apparently do not take an explicit stance on this issue, it seems reasonable to assume that rational agents would not actually expect this particular model of Leeper et al. (2017) to be the last word as that would, among other things, imply that the AER would stop accepting articles dealing with the Smets and Wouters (2007) class

of models, and in fact with all DSGE models referring to the U.S. economy. Consequently, if we assume that there will be future changes to the model, the model solution of Leeper et al. (2017) must be invalid since the agents optimise over an infinite time horizon during which the model will change but this future change is not accounted for by the agents. At the same time, the model solution can safely be labelled rational because we can without loss of generality assume that agents are not aware of the invalidity of their model solution.

Alternatively, assuming for the sake of completeness that Leeper et al. (2017) indeed and against all odds do have the last word, their model solution would be valid and rational.

We may now sum up the three possible assessments of the contribution as evaluations of the model solution. For convenience, we refer to figure 1 (see p. 9) that describes the necessary distinctions (A: rationality yes or no, B: future model amendments yes or no) and relates them to the characterisation of Leeper et al.'s (2017) model solution.

The first criterion (A: rationality) differentiates between complete information and incomplete information. We call a model solution rational if it respects (simple and deep) rational expectations. Therefore, rational model solutions are explicit about whether or not future changes to the model are taken into account for individual decision making. Non-rational model solutions do not need to do so.

The first endpoint of the evaluation tree in figure 1, therefore, indicates a model solution that is not rational but valid conditioning on the non-rational behaviour. We will refer to this evaluation as outcome (iii).

Taking the other turn at A, we follow the rational model solution branch. At B, we have to consider whether or not the current model will "stand forever". If there will not be any future amendments to the model then we know that and the current individual

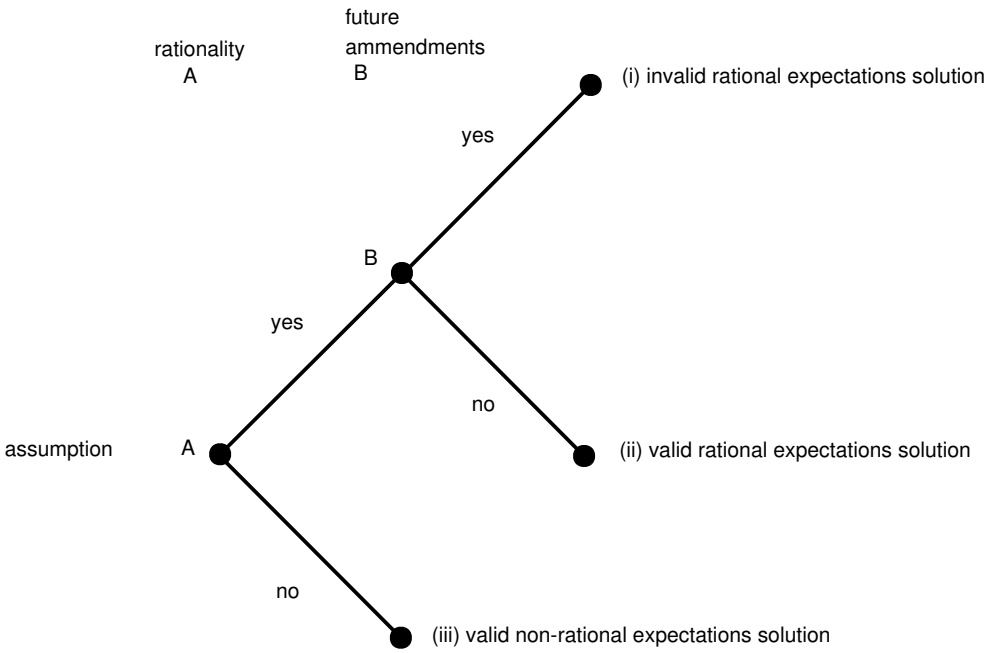


**Figure 1:** Evaluation of model solution

optimisation and hence model solution is both valid and rational (ii). If, against that, there will be future amendments the model solution is invalid but rational (i). We thus have three possible results. The model solution of Leeper et al. (2017) is either of the following:

**(i)** rational and invalid

**(ii)** rational and valid

**(iii)** non-rational and valid

Absent a clear stance on whether or not Leeper et al. (2017) can reasonably argue that their model will "stand forever", it is not possible to give a final judgement. From our

point of view, outcome (i) is the most plausible one: The model solution offered by Leeper et al. (2017) is rational but invalid.

A last remark on the above list is in order. For the time being, and to the best of our knowledge, no solution to the optimisation problem exists that takes into account the fact that future model amendments will occur without actually knowing the features of these future models. As long as this problem remains unresolved, the outcomes (i) and (iii) are observationally equivalent. This equivalence puts DSGE model at pars with alternative modelling approaches without microfoundations and without rational expectations such as Vector Autoregressions which are also non-rational in the above sense but valid according to their modelling philosophy.

### 4.2 Upstream sampling

Let us now turn to Leeper et al.'s (2017) model parametrization. Unfortunately, the parametrization of the model that is necessary for actual policy analysis must be regarded invalid as well.

To see why, let us remind ourselves of the fact that the actual model was published in 2017 only. Hence, agents could not possibly optimise their behaviour in the described way any time before 2017 (give or take three, four years for discussion paper versions and the limit can be put at 2013). Therefore, any data that has been generated before 2017 (2013) cannot possibly be intelligible about the actual parameter values. This conclusion is similar to a case in which river water is sampled upstream to prove a pollution further downstream. Nobody would seriously consider the water sample to be informative about the suspected contamination but Leeper et al. (2017) (implicitly) claim that the sample 1955 through 2007 (baseline version, through 2016 else) nevertheless is informative. In

light of the obvious contradiction to the actual events, a thorough proof of why the early data is intelligible for later events would be highly desirable.

Again, a remark is in order. It may very well possible that the specific optimisation problems described by Leeper et al. (2017) belongs to a wider class of problems which are all equivalent in the sense that they also cover older (as well as future) schedules. If so, the novelty of the model would be as much in doubt as its particular value added for policy analysis.

In sum, the fact that the parametrization rests on a non-informative data sample adds to the doubts about the policy analysis conducted by Leeper et al. (2017).

## 5 Discussion: Possible solutions and non-solutions

It has already been mentioned that a model solution under deep rational expectations has to the best of our knowledge not yet been developed. Sometimes, the Leeper et al. (2017) kind of modelling (aka DSGE) is defended on grounds that "all models are wrong". While that is obviously true, this argument cannot and should not be used against known and significant deficits of a model. If agents know that they make decisions sub-optimally the natural null hypothesis is that being aware of this knowledge they will behave different from a situation in which they know that they do actually decide optimally. As long as this null cannot be rejected, we are bound to maintain it. Note, however, that if we reject the null hypothesis and take comfort in the fact that optimal and sub-optimal decision making lead to the same outcome, then the whole rational expectations microfoundation of macromodelling becomes somewhat less urgent.

Another popular way to address the existence of multiple models for resolving the

same problem is (Bayesian) model averaging. However, model averaging presumes detailed knowledge about the models to be averaged about. In practice (and in theory), this knowledge is not available and cannot be so whenever future models are concerned. Therefore, standard (Bayesian) model averaging cannot resolve the modelling challenge of deep rational expectations. It might, however, offer a hint as to how agents may actually respond to knowing that superior decisions exist. Generally speaking, confidence bands of impulse-responses will be wider and the actual effects of certain policy actions will hence be known with lower precision if at all. This, in turn, will affect the assessment of the contribution of any particular model.

There is yet another way to justify ignoring deep rational expectations. If we assume that events unfold independently of what people actually do think and what the consequences of their considerations are, then deep rational expectations would not matter because no link between individual optimisation and aggregate outcome exists. Physicists, chemists and basically all problems in science are of that kind of nature. It does not matter for the planet earth if we apply the correct formula for describing its revolutions. According to Lucas (1976), it does matter, however, for the economy what people think what the laws of the economy are because that affects their decisions and actions which in turn compose what we call the economy. If, for the sake of principle, we instead assume that human decisions do not matter, then upstream sampling would provide the correct information. It would also have to be admitted, however, that microfoundations of macromodelling would be totally irrelevant because the law of motions of the economy would hold irrespective of individual behaviour. Since the link between individual behaviour and economy-wide outcome is at the heart of Leeper et al.'s (2017) DSGE method, ignoring deep rational expectations would be a shot in this very heart.

In conclusion, no proper solution for decision making under deep rational expectations exists yet. Therefore, any concrete model must be assessed on the grounds of being either not valid but rational, or valid but not rational. According caution must be exercised when it comes to policy recommendations.

## 6 Zooming in on level two: the model

The second level of scrutiny has to address the innovations to the employed model. Apparently, the extension of Smets and Wouters's (2007) model to include a fiscal policy shock, the consideration of policy regimes and the particular estimation strategy are indeed invaluable contributions to the understanding of the used model class.

These contributions to the modelling technique must be distinguished from the contribution to our understanding of fiscal multipliers, however. This is because only if the methodology underlying the model is sound, the model solution is able to shed light on fiscal multipliers. Therefore, although Leeper et al. (2017) admirably and significantly add to our understanding of the Smets and Wouters (2007) modelling approach these additions do not automatically advance our understanding of the fiscal multiplier.

## 7 Conclusions

When building on shifting sands, wiping the windows is of little help against the threat of collapse. Quite like shining windows cannot stabilise the foundations, the fiscal multiplier morass cannot be cleared up by Leeper et al.'s (2017) top level model innovations. Wiping the windows may be part of a Spring ritual but that does not imply that this habit can

contribute anything to reinforcing the structure of the house.

Similarly, in order to truly "clear up" the multiplier morass, we must not comfort ourselves with modelling conventions and habits. The convention in the literature has it that the model (class) employed by Leeper et al. (2017) does not respect rational expectations about the evolution of economic models. Rational expectations take centre stage in these models, however. Therefore, measured by the key promise of their very model class Leeper et al.'s (2017) model solution must be considered invalid because it knowingly disrespects (deep) rational expectations. Moreover, the parametrization of their empirical model rests on estimation with a logically non-informative data sample.

With respect to the second level of scrutiny we have to emphasize that the case for deep rational expectations does not imply that the particular contribution by Leeper et al. (2017) such as varying the number and type of monetary-fiscal policy regimes, the choice of priors, or estimation method, is not useful or not innovative in its own right. It certainly is and would serve a research objective directed at the model class itself rather well. The invalidity of the model solution is to say, however, that the actual research objective – understanding fiscal multipliers – has not been properly addressed.

Maybe ironically, owed to the fact that Leeper et al.'s (2017) approach is unable to yield a valid solution as long as deep rational expectations are not taken into account, their attempt to clear up the morass has the opposite effect. Instead of drying up the swamp their invalid solution adds muddy waters and the fiscal multiplier morass has only got worse than it had ever been before.

## References


Blanchard, O. J. and Leigh, D. (2013). Growth Forecast Errors and Fiscal Multipliers, *American Economic Review* **103**(3): 117–120.

Christiano, L. J., Eichenbaum, M. and Evans, C. L. (2005). Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy, *Journal of Political Economy* **113**(1): 1–45.

Corsetti, G., Meier, A. and Müller, G. J. (2012). Fiscal Stimulus with Spending Reversals, *The Review of Economics and Statistics* **94**(4): 878–895.

Galí, J., López-Salido, J. D. and Vallés, J. (2007). Understanding the Effects of Government Spending on Consumption, *Journal of the European Economic Association* **5**(1): 227–270.

Gechert, S. and Will, H. (2012). Fiscal Multipliers: A Meta Regression Analysis, *IMK Working Paper 97-2012*, IMK at the Hans Boeckler Foundation, Macroeconomic Policy Institute.

Leeper, E. M., Traum, N. and Walker, T. B. (2017). Clearing Up the Fiscal Multiplier Morass, *American Economic Review* **107**(8): 2409–54.

Lucas, R. J. (1976). Econometric policy evaluation: A critique, *Carnegie-Rochester Conference Series on Public Policy* **1**(1): 19–46.

Muth, J. F. (1961). Rational Expectations and the Theory of Price Movements, *Econometrica* **29**: 315–335.

Smets, F. and Wouters, R. (2007). Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach, *American Economic Review* **97**(3): 586–606.