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Macroeconometric equivalence, microeconomic dissonance, and the design of monetary policy ☆

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ABSTRACT

Macroeconometric equivalence means that estimates of DSGE models using first-order approximations to equilibrium conditions fail to distinguish between alternative preference/technology configurations. Microeconomic dissonance means that the underlying microeconomic differences between ostensibly equivalent models become important when optimal monetary policy is derived. The relevance of these concepts is established by analysis of optimal monetary policy using a small-scale New Keynesian model. Microeconomic and financial datasets are promising tools with which to overcome the equivalence/dissonance problem.

1. Introduction

A significant dilemma for monetary policy advice and model selection arises from the coexistence of two phenomena: *macroeconometric equivalence* and *microeconomic dissonance*. The term *macroeconometric equivalence* describes a situation where approaches based on estimating first-order approximations of model equilibrium conditions on aggregate time series data do not reveal definitively the economy's underlying preference/technology structure. For some positive-economics applications—for example, determining the degree of forward-looking behavior in pricing or spending decisions—the equivalence need not pose major problems. The first-order properties of the model may be sufficient for answering many positive-economics issues, and no harm may arise from taking two models to be interchangeable if their first-order dynamics are isomorphic. Normative applications, however, raise more concern. Results regarding optimal monetary policy do depend on the objective functions and production functions in the underlying nonlinear economy. Models that are equivalent when loglinearized therefore need *not* be equivalent in what they imply for optimal monetary

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policy—i.e., for the optimal steady-state inflation rate and the characteristics of efficient policy in the stochastic economy. *Microeconomic dissonance* refers to case where two models whose structural equations are first-order equivalent yield different optimal monetary policies. This study considers several strategies for resolving the dilemma posed by the equivalence/dissonance dichotomy, and offers conclusions about which strategy should be followed.

The macroeconometric equivalence/microeconomic dissonance issue has received little attention in the modern monetary policy literature. While King and Wolman (1996), for example, provide a detailed analysis of the sensitivity of the optimal inflation rate to different parameter assumptions in their dynamic general equilibrium model, they do not consider the sensitivity of the optimal-policy analysis to assuming a different (but first-order equivalent) price-setting specification. This is despite the fact that economists have been well aware of the tendency for macroeconometric equivalence to arise between models that are far apart in their basic assumptions about private sector behavior. The notion that different rational expectations models may deliver the same linearized dynamics is of long standing: Sargent (1976) noted that two different structural models can deliver the same reduced form even when only one model imposes the natural rate restriction, while Taylor (1997), among others, noted that certain sticky-price and Lucas-style imperfect-information models deliver similar aggregate supply relationships.

Likewise, instances of microeconomic dissonance, while less prevalent and less appreciated, underpinned such early contributions to the New Keynesian literature as Caplin and Spulber (1987) and Ball and Romer (1990). Caplin and Spulber produced a case where price stickiness at the microeconomic level magnifies the welfare costs of inflation but produces identical monetary-neutrality results to those of a flexible-price model. Ball and Romer provided an example of two preference specifications which, while equivalent in their implications for the degree of aggregate output volatility, lead to substantially different welfare costs from that volatility.

But the taking-off of New Keynesian models in the last fifteen years has not been associated with a major reaffirmation of the dissonance warning. The modern New Keynesian literature has typically proceeded under the assumption that observationally equivalent models do deliver similar policy prescriptions. Our conjecture is that this conclusion has been prevalent until now because it followed from the study of the best-known instance of macroeconometric equivalence in the New Keynesian literature: that of the Rotemberg (1982) and Calvo (1983) price-setting specifications.[1] Rotemberg and Calvo price schemes have very different microfoundations: in the Rotemberg setup, all firms vary prices each period as a continuous function of marginal cost; in the Calvo setup, a fraction of firms is selected randomly to adjust prices each period, the remaining fraction being prohibited to adjust, so price adjustment at the individual-firm level is very abrupt rather than continuous. Yet the two price adjustment specifications deliver equivalent aggregate Phillips curves (Rotemberg, 1987; Roberts, 1995). There is therefore macroeconometric equivalence and, given the different model underpinnings, the potential for microeconomic dissonance. But the optimal policies implied by the Calvo and Rotemberg alternatives are not, in fact, very different quantitatively.[2] This influential equivalence result is therefore probably responsible for the widespread impression that microeconomic dissonance is not an important phenomenon in modern New Keynesian modeling.

The objects of this study are to dispel this impression and offer strategies to resolve the resulting dilemma for policymaking and modeling. Our examples of equivalence do not simply draw on the existing literature; nevertheless, and unlike the aforementioned early New Keynesian contributions, the focus is on the standard, modern New Keynesian model consisting of the forward-looking IS and Phillips curves. This focus establishes that important equivalence and dissonance results emerge even with this widely used benchmark model. This model is, in addition, essentially a restricted and stripped-down version of the dynamic stochastic general equilibrium (DSGE) models estimated in such studies as Christiano et al. (2005), Smets and Wouters (2003, 2005) and Levin et al. (2005). As these medium-scale models explain actual U.S. and euro area data well, it is realistic to say that the New Keynesian literature is converging on a DSGE model whose first-order approximation is a good description of macroeconomic data. It has accordingly become imperative to evaluate the differences in policy advice implied by models that are equivalent in their first-order properties, and also to determine the best strategy for discriminating between alternative microeconomic underpinnings of such models.

And it deserves emphasis that policy advice cannot typically be determined by the first-order dynamics of these models. True, in some positive-economics applications—for example, estimation of Phillips or IS curves, or estimation of the monetary policy rule over a sample period in which policy has not attempted to maximize household utility—only the loglinear approximation of the model may be needed. But, as noted above, the same is not true for normative applications. Increasingly, it has become standard to draw out the policy implications of a microfounded model by determining optimal monetary policy in that model. Even when studying simple monetary policy rules, it is not unusual to rank these rules according to the extent that they maximize household utility. This involves evaluation of the nonlinear utility function, or of a second- or higher-order approximation of utility. Either way, higher-order properties of the model become relevant, and one cannot draw policy implications immediately from the loglinear representations of the model, which do not adequately identify these nonlinear elements.

[1] The Calvo specification is the most prevalent price-adjustment setup in the New Keynesian literature. Calvo himself noted that his price-setting scheme was "a close relative of the staggered contracts model... of Taylor (1979, 1980)."

[2] In fact, Lombardo and Vestin (2007) and Nistico (2007) both demonstrate that second-order welfare functions (approximated near an efficient steady state) are identical across Calvo and Rotemberg settings. The quantitative results presented by Lombardo and Vestin further suggest that, even when the steady state is inefficient, the characteristics of the Ramsey-optimal equilibrium are very similar across the two pricing specifications.