

Evaluating DSGE Models for Monetary and Fiscal Policy Analysis

Abhishek Gupta

This dissertation creates and applies a framework for evaluating the suitability of misspecified dynamic stochastic general equilibrium (DSGE) models for particular tasks. The first essay applies the framework to the task of monetary policy analysis; the second lays out the framework more generally; and the third is a structural VAR exercise regarding fiscal multipliers.

1 A Forecasting Metric for Evaluating DSGE Models for Policy Analysis *Job Market Paper*

This paper evaluates the suitability of current DSGE models for monetary policy analysis from a Bayesian perspective, recognizing that these models may be useful even if they are misspecified along some dimensions, using the framework laid out in Faust and Gupta (2009). The paper argues that practical monetary policy analysis deals with determining how intended policy should be revised in light of the structural interpretation of incoming news. Standard DSGE models are linear and Gaussian, so this analysis reduces to i) the variance-covariance properties of one-step ahead reduced-form forecast errors and ii) Kalman gains relating those forecast errors to unobserved structural shocks. Standard model evaluation tools assess the degree to which the model matches *all aspects* of the reduced form of the data. The paper provides new tools for evaluating both the forecast error properties and the structural implications. Finally the paper illustrates this approach using the noted Smets-Wouters model (*AER*, 2007), finding strengths and some important shortcomings.

2 Bayesian Evaluation of Misspecified DSGE Models (with Jon Faust), *in progress*

This paper starts with the view that existing DSGE models are seriously misspecified in some dimensions and yet may offer valuable insights in others. The problem, then, is to determine the suitability of the model for a particular use. Conventional Bayesian model comparison tools reveal which model best accounts for *all aspects* of the reduced form of the data. When deciding whether to proceed with a misspecified model (in lieu of an alternative), we argue that tools for evaluating strengths and weaknesses for the task at hand would be more appropriate. Geweke's (2010) approach to analyzing *incomplete models* forms our starting point, but when the task at hand requires causal inference regarding general equilibrium questions, treating the model as *incomplete* becomes problematic. Our proposed tools have the Bayesian interpretation that the analyst has difficult-to-codify prior information on both the structural misspecification of the model and the causal interpretation of events in the sample. The tools are constructive and could thereby be seen as a way to elicit and analyze these priors. Therefore, they provide a natural path to model improvement and/or provide information about what model implications should be discounted until that improvement can be achieved. The main mechanical steps are analyzing the task at hand for "reduced form" and "structural" features and then performing the relatively standard prior and posterior predictive analysis.

3 Fiscal Policy Multipliers at the Zero Bound: Analysis of Japan's Lost Decade, *in progress*

This paper estimates fiscal policy multipliers at the zero bound for Japan. As recently formalized New Keynesian models have illustrated, fiscal policy shocks may have different effects when the central bank is unable to accommodate deflationary pressures at the zero bound. The paper is an empirical assessment of how the effects of fiscal shocks differ when an economy is stuck at the zero bound. It estimates a structural VAR on Japanese data, following the Blanchard-Perotti (*QJE*, 2002) approach to tax-code-based identification using newly available quarterly Japanese data on income tax, corporation tax, and consumption tax. The paper estimates fiscal policy multipliers for taxes and spending separately for two sample periods—one where the interest rates are not bound at zero (prior to 1995) and one where they are at the zero bound (post 1995).

Essays on Price Discrimination, Information Sharing and R&D Return

Guofang Huang

1 Posted Price and Hagglng in the Used Car Market (*Job Market Paper*)

Though hagglng has been the conventional way for auto retailers to sell their cars, the last two decades have witnessed the systematic adoption of no-haggle prices by many large dealerships, including the largest used car dealership, Carmax. This paper develops a structural empirical model to estimate dealers' profits under posted price and hagglng and investigate the conditions leading to the heterogenous choices of pricing policies that we observe. The model incorporates a simple class of bargaining mechanisms into the standard BLP model. With the extension, the paper is able to estimate the product-level demand system using data with only list prices and estimate the discounts achieved in hagglng. The counterfactual experiments based on the estimates yield a few interesting findings. First, dealers using posted price would see their profits increase only slightly if they hagglng, whereas the hagglng dealers' profits would drop significantly if they switched to posting prices. Second, the market power enjoyed by the non-hagglng dealerships through vertical differentiation and carrying large number of models is a major factor contributing to the variation in the relative performance of posted price and hagglng.

2 Information Sharing in the Insurance Market

It has been observed that, through information brokers, insurance companies voluntarily share their private information about customer risk types with each other. This fact is puzzling because such information sharing tends to intensify competition between the insurers as any informational advantage is reduced. The existing explanations of this phenomenon attributes it to some form of direct benefits, such as efficiency gains, that is brought about by exchanging information. This paper proposes a novel explanation for such voluntary information sharing among firms. The basic idea is the following. With the information about customers' risk types shared among a group of firms, these firms would later be expected to charge their customers the marginal costs of serving them. Whereas if a firm kept its customers' risk types private, its customers would expect to be charged the competing offers obtainable from other insurers. But such competing offers would be higher than the cost of serving the low-risk customers because the insurer's customers' risk types are not shared. Expecting such a hold-up problem, low-risk customers would be less likely to choose an insurer not committed to share information. Therefore the insurer would be penalized by the customer adverse selection induced by its decision to not share information. This force causes all insurers to voluntarily share their private customer information in equilibrium as long as the cost of sharing such information is not too high.

3 R&D Return and R&D Spillovers in China (with Wei Li and Lixin Colin Xu), Submitted

This paper estimates the R&D return and R&D spillover effects in China's manufacturing sector by using panel data from a large survey conducted by the World Bank. The goal of the investigation is to assess R&D as an alternative source of sustainable growth for China when the growth driven by institutional reform eventually fades. The paper finds that the average annual return to R&D investment is about 40 percent, and the R&D spillover effects are very impressive in such industries like Chemical Fiber. The estimated R&D returns are robust to the potential endogeneity in R&D expenditure, and the estimated R&D spillover effects are robust to unobserved regional shocks.

Three Essays on Labor Economics

Ning Ma

1 Child Support and Remarriage, *Job Market Paper*

This paper studies the reasons for low levels of child support paid by non-custodial divorced fathers. In divorce, non-custodial father's necessary child support is typically reduced once the mother remarries, as some financial burden of raising their children shifts from biological father to the step-father. This provides an incentive for the father to encourage mother's remarriage through the use of strategically picked payment level. Assuming father's income is to some degree unobservable by mother after divorce, his current payment will serve as a signal of his true level of income to the mother, and she will use his payment level to form an expectation of his true income. With a sufficient low level of current payment, she is likely to assume that the father has low income and hence be more likely to remarry, given exogenous and randomly-arriving remarriage options. Thus the father has the potential to manipulate the mother's remarriage probability for his own benefit. In my paper, I first formulate a theoretical model of the father's optimal transfer and the mother's remarriage decision in a two-period dynamic Stackelberg game. The equilibrium closed form solution shows that the father's optimal transfer is lower when his income is partly unobservable to the mother than when it is fully observable. I then investigate the issue empirically, using data from the Panel Study on Income Dynamics (PSID) in the U.S., examining whether the father's payment is related to the degree of unobservability of his income, using proxies for that unobservability. The results show that the payment is indeed lower, the greater the degree of unobservability.

2 Compensating Wage Differentials over the Life Cycle, *in progress*

Although there is empirical evidence of a positive compensating wage differential for fatality risk, little research has explored the effect of lagged riskiness on the current wage. Workers' current occupational risk may affect future earning capacity. In this paper, five channels through which current risk affect future earning capacity are investigated: the wage rate, the labor supply, the persistent risk, the job quit, and the health endowment. Using job information about current and previous employment from Census 1970, I find that workers in risky occupations tend to work more in the future than their safe counterparts, without earning higher income. This implies that workers in risky jobs sacrifice future wages in exchange for higher wages today, biasing upward static estimates of a compensating wage differential.

3 Household Consumption Patterns During a Financial Crisis: The Case of Pakistan (with Xiaohui Hou and Cem Mete (World Bank)), *in progress*

Before 2007, Pakistan maintained an expensive wheat subsidy program to keep wheat prices low and stable. As world food prices soared in 2007 financial crisis, this program became increasingly expensive and was hard to maintain. Consumer prices increased, reflecting both increasing world prices and the insufficiency of subsidy. This paper analyzes the impact of rising retail prices on wheat expenditure using a series of cross-sectional surveys. Estimates of the price elasticity of wheat demand in Pakistan are used to estimate the monetary transfer needed to compensate poor Pakistanis for rising prices.

Essays on Asymmetric Pricing and NBA Referees

Marc Remer

1 An Empirical Investigation of the Determinants of Asymmetric Pricing, *Job Market Paper*

In this paper, I empirically test the leading theories of asymmetric price movements: the tendency for prices to respond in greater magnitude to cost increases than decreases. Recently developed theories (Tappata, 2008; Yang and Ye, 2008) have shown asymmetric pricing to be a consequence of oligopolistic competition and consumer search costs. After constructing a data set with more than 11,000 unique gasoline retailers over the course of a year, I test the prediction that asymmetric pricing is stronger when search costs are higher. Based upon independent evidence that consumers of premium gasoline have higher search costs, I compare the asymmetry of the price of premium gasoline to that of regular gasoline. The empirical investigation reveals that ten days following a 10¢ negative cost shock regular prices fall by 2¢ more than premium, but after a 10¢ positive cost change both prices rise by the same magnitude. This finding, in conjunction with additional testing, confirms that products whose consumers face higher search costs are priced with greater asymmetry. Additional testing rejects focal price collusion as a meaningful determinant of asymmetric price adjustments.

2 Market Structure, Firm Characteristics, and Asymmetric Price Movements, *in progress*

The second chapter of my dissertation studies the impact of market composition and firm traits on dynamic retail price adjustments. Of particular interest is the impact of firm branding on the degree of price asymmetry. The empirical results suggest the marginal effect of switching a firm's brand critically depends upon the brand of its closest competitor. If a firm switches its brand from major to independent (or vice versa) then the change in asymmetry is twice the size if its closest competitor is independently branded. Thus, in performing counterfactuals to measure the effect of switching a firm's brand the characteristics of the surrounding market must be accounted for. I also investigate how the degree of market penetration of a single brand effects the magnitude of asymmetry throughout the market. Results suggest that price asymmetry is not a consequence of major brands coordinating their actions across a given market.

3 Sub-Perfect Game: Profitable Biases of NBA Referees, (with Joseph Price and Daniel F. Stone)

This paper empirically investigates three hypotheses of biased refereeing by National Basketball Association (NBA) referees. Using a sample of 28,388 quarter-level observations from six seasons, we find that NBA referees make calls that favor home teams, teams losing during games, and teams losing in playoff series. All of these biases are likely to be profitable to the league. We identify these effects as caused by referee bias, as opposed to player behavior, by using play-by-play data that allows us to separately analyze turnovers over which referees have relatively high or low discretion to judge. We also find that the biases do not increase in situations where their direct financial benefit to the league would be greater, and conclude that the biases are likely of an implicit nature. These findings have been reported in, "Researchers' NBA officiating study detects biases, but not necessarily the ones fans suspect," an article published in *The Oregonian* (June 3rd, 2009).

Rationalizability and the Theory of Large Games

Haomiao Yu

Environments with a continuum of agents have been the subject of increasing investigation in several areas of economic theory, going beyond non-cooperative (and cooperative) game theory to more applied formulations arising in industrial organization, macroeconomic dynamics and even political economy. A continuum of potentially heterogeneous agents pervasive in the economic literature is now studied in a context where interdependence is made explicit and rendered analytically tractable. In the “theory of large games,” a player’s payoff depends (of course) on his or her actions, but rather than those of “each and everyone else,” it depends on a statistical summary of their actions: unlike finite games, each agent is strategically-negligible. The *other* is no longer a player or a fully delineated group of players, but rather the society or the collectivity that is the formalized subject of the game. A player’s actions then are influenced by how he or she conceives and conceptualizes the society of which he or she is a part, rather than a specific individual. My thesis is a contribution to this theory, and it takes the form of three essays.

The first substantive essay of the dissertation examines the Bernheim-Pearce *rationalizability* notion in the theory of large games. The second goes beyond Schmeidler’s formalization of a *societal response* as an average of individual responses, when a linear structure on the action set is available, or as a distribution of individual responses, when it is not; and examines situations where only more general transformations may be available. The third essay examines a formulation that takes an intermediate position between the *anonymous* and *non-anonymous* polar aspects of the theory, and through the introduction of a space of player characteristics, in addition to a space of players’ names, broadens its reach and scope.

[The first essay is to be my job-market paper, but by the time of the completion of the thesis, I am hoping to bring together the richer structures of the second and third essays to bear on it, and thereby offer a coherent and uni-directed contribution to the theory of large games.]

1 Point-Rationalizability in Large Games

In this paper, I characterize *point-rationalizability* in large non-anonymous games with three different formulations of societal interdependence. More specifically, societal interdependence is formulated as distributions of individual responses, integrations of actions and averages of the transformed actions. Given the introspection and “mentalizing” that the rationalizability notions presuppose, a large motivation behind the work is to examine their viability in situations where the terms *rationality* and *full information* can be given a more parsimonious, and thereby more analytically viable, expression.

2 Transformed Societal Responses in Large Games

In this paper, I contribute to the existence theory of pure strategy equilibria in large games with transformed summary statistics. I also generalize, for the same class of games, the existence result for undominated pure strategy Nash equilibria despite the fact that the set of pure strategy Nash equilibria may fail to be weakly compact.

3 Multiplicity of Characteristics in Large Games

In this paper, we present a comprehensive analysis of large non-anonymous games in which every agent has a name as well as a type. We show the existence of pure strategy Nash equilibria under alternative cardinality assumptions on the common set of actions and on the space of types. The space of names is formulated as a *saturated* probability space while the space of types is a complete separable metric space. Also, we show by a counterexample that the existence result fails when the Lebesgue interval is used as the space of names. (This is part of a larger ongoing project with Professors Khan, Rath and Sun)