Summary of

'Essays on Dynamic General Equilibrium Modeling

and Empirical Analyses of Macroeconomics'

by Naohisa Hirakata

This dissertation consists of three parts. Part I is an essay on modeling of open economy ma-

croeconomics. The essay in Part I provides a theoretical framework to study international trans-

mission mechanism of shocks to firms' entry cost and market size as well as standard productivity

shock. Part II consists of two essays relationship between oil and macroeconomy. An intersection

of part I and part II is to examine international transmissions of various shocks, such as shocks to

oil demand and supply, productivity, firms' entry cost, market size. In contrast to Part I and II, Part

III provides essays on roles of financial friction in macroeconomy. The essays in Part III present

both theoretical investigations and empirical evidences on relationship between financial friction

associated with financial intermediaries and macroeconomy. Part I and Part III share common in-

terests in developing theoretical frameworks to evaluate effects of shocks that existing models

cannot analyze.

Part I, which includes one chapter, is an essay on international macroeconomy. Recent empirical

findings conclude that the terms of trade improve even after the positive productivity shock hits the

economy among advanced countries. This is quite contrary to the conventional wisdom since the

home technological progress usually results in lower domestic prices. Corsetti, Martin and Pesenti

(2007, henceforth, CMP) analytically show that a static two country model with endogenous firm entry can generate improvement of the terms of trade in response to a positive technology shock in the form of lowering the entry cost. Against this background, the essay in Part I is to attempt to evaluate the robustness of the results in CMP in a model with richer and more realistic dynamics such as nominal price and wage stickiness. We first set up a model that incorporates firm dynamics into the Global Economy Model (henceforth, GEM). Then, we demonstrate how the economic variables respond to the shocks that shift the production frontier outwards, namely productivity gains in manufacturing, efficiency gains in creating new firms, and an increase in the labor force. Our main conclusions are as follows; (1) the elasticity of substitution between domestic and foreign goods matters for the directions of responses in the steady state since it alters the impacts of domestics shocks on foreign demand conditions; (2) short-run responses could be different from those in CMP because of the existence of real as well as nominal rigidities; (3) persistence of shocks also alters the direction of responses via the wealth effect. These results suggest that it is of great importance for policy institutions to acknowledge the dynamic aspects of productivity spillovers by simulating a model with richer dynamics.

Part II provides two essays on the relationship between oil and macroeconomy. The first essay in Chapter 3 provides considerations of time series change of the relationship between oil price and output. On the other hand, the second essay presents evidences that dynamic responses of activities to shocks to global oil demand and supply are heterogeneous among industries and countries.

The first essay, Chapter 3, in Part II attempts to account the weakening effect of the oil price-output relationship using standard real business cycle model. Recent empirical studies reveal that the oil price-output relationship is weakening in the US. Oil price-output correlation is less negative, and output reduction in response to oil price rise is more moderate after mid 1980s. In contrast to the conventional view that there have been changes in the economic structures that have made output less responsive to oil price shocks, we show that what have changed are the sources of oil price variation. We develop a DGE model where oil price and US output are endogenously determined by the exogenous movements of US TFP and the oil supply. Having no changes in economic structure, our model yields dynamics of the oil price and output that show a weakening in the oil price-output relationship. There are changes in the way that the exogenous variables evolve. Two changes are important. First, oil supply variation has become moderate in recent years. Second, oil supply shortage is no longer followed by a large decline in TFP. We show that less vo-latile oil supply variation results in less negative oil price-output correlations, and a smaller TFP decline during oil supply shortfall implies a smaller output decline during oil price increases.

Second chapter of Part II provides empirical investigations of heterogeneities of responses to some types of shocks related to world oil market. To this end, decomposition of oil price changes into their component parts following Kilian (2009) and estimate the dynamic effects of each com-ponent on industry-level production and prices in the U.S. and Japan using identified VAR models. The way oil price changes affect each industry depends on what kind of underlying shock drives

oil price changes as well as on industry characteristics. Unexpected disruptions of oil supply act mainly as negative supply shocks for oil-intensive industries and act mainly as negative demand shocks for less oil-intensive industries. For most industries in the U.S., shocks to the global demand for all industrial commodities act mainly as positive demand shocks, and demand shocks that are specific to the global oil market act mainly as negative supply shocks. In Japan, the oil-specific demand shocks as well as the global demand shocks act mainly as positive demand shocks for many industries.

Essays in Part III are on financial friction and macroeconomy. This part consists of four chapters. Specifically, Part III studies the roles of financial intermediaries in the macroeconomy. The first chapter of this part, Chapter 5, provides a theoretical framework to study the effect of changes of financial intermediaries' balance sheet. Chapter 6 and Chapter 7 attempt to evaluate U.S. and Japanese economy by estimating the DSGE model developed in Chapter 5 and identifying shocks that derive economic fluctuations using Bayesian technique.

Chapter 5 develops a dynamic general equilibrium model for a chain of credit contracts in which financial intermediaries (hereafter FIs) as well as entrepreneurs are subject to credit constraints. The model developed in this chapter is based on the financial accelerator model of Bernanke et al. (1999). Financial intermediation takes place through chained-credit contracts, lending from investors to FIs, and from FIs to entrepreneurs. Calibrated to U.S. data, our model shows that the chain of credit contracts enhances the financial accelerator effect, depending on the distribution of net

4

worth across sectors: (i) our model reinforces the effects of the net worth shock as well as the technology shock, compared with a model that omits the FIs' credit friction a la Bernanke et al. (1999); (ii) the sectoral shock to FIs has a greater impact than the sectoral shock to entrepreneurs; and (iii) the redistribution of net worth from entrepreneurs to FIs reduces the amplification of the technology shock. The key features of the results arise from the asymmetry of the two borrowing sectors: smaller net worth and larger bankruptcy costs of FIs relative to those of entrepreneurs.

Chapter 6 applies the DSGE model with chained credit contracts developed in Chapter 5 to U.S. economy by Bayesian estimation. Recent financial turmoil and existing empirical evidence suggest that adverse shocks to the financial intermediary (FI) sector cause substantial economic downturns. The quantitative significance of these shocks to the U.S. business cycle, however, has not received much attention up to now. To determine the importance of these shocks, we estimate a sticky-price dynamic stochastic general equilibrium model with chained credit contracts, considered in Chapter 5. In this model, credit-constrained FIs intermediate funds from investors to credit-constrained entrepreneurs through two types of credit contract. Using Bayesian estimation, we extract the shocks to the FIs' net worth. The shocks are cyclical, typically negative during a recession, such as the one that began in 2007. Their effects are persistent, lowering economic activity for several quarters after the recessionary trough. According to the variance decomposition, shocks to the FI sector are a main source of the spread fluctuations, explaining 39% of the FIs' borrowing spread and 23% of the entrepreneurial borrowing spread. At the same time, these shocks play an important but not

dominant role for macroeconomic variables, accounting for 15% of investment variations, 3% of output variations, and 4% of inflation variations.

Chapter 7 provides empirical investigations on Japan's prolonged stagnation during the lost decade by estimating Chained BGG model developed in Chapter 5. There are two opposing views as to the cause of Japan's prolonged stagnation during the lost decade. The first view argues that the deteriorated balance sheets of banks and entrepreneurs dampen the economy by impairing financial intermediation. The second view stresses the role played by the nonfinancial factors such as productivity slowdown. To quantitatively evaluate these views in an integrated framework, as is the case of U.S. data in Chapter 6, we estimate a dynamic stochastic general equilibrium (DSGE) model with credit-constrained banks and entrepreneurs, using the Japanese data from 1981 to 2007. Then, we distill shocks to the net worth of banks and entrepreneurs together with non-financial shocks to assess their impacts on the economy. As a result, it is found that these net worth shocks constitute a important portion of macro economic fluctuations during the lost decade. Shocks to the entrepreneurial net worth disrupt the economy mainly in the early 1990, and those to the bank's net worth continuously dampen the economy over the 1990s. Quantitatively, the two net worth shocks explain 43% of investment variation, 11% of output variation, and 34% of inflation variation during the 1990s.

Chapter 8 studies the responses of bank loans to shocks to monetary policy and bank capital in Japan's economy by estimating the bank loan responses disaggregated by borrower firms' size and

6

industry and explore the determinants of the bank loan responses. The estimation results of estimations show that the loans respond differently depending on the shocks and firms' category, and the difference is related to the firms' liability condition. A contractionary monetary policy shock leads to a clear shift from small non-manufacturing firms to large manufacturing firms. Its negative impact becomes greater when the firms' bank borrowing ratio is high. A positive bank capital shock causes a larger increase in bank loans to the firms with higher capital ratio, while the loan shift across firms is less obvious. The results indicate the importance of a change in the bank loan portfolio in the transmission of monetary policy and capital injection policy.