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Developing and Applications of an Economic Model for World Crude Oil/Natural Gas Market

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Background and purpose of this research

This project aims to develop an empirical model which interlinks a multi-country economic models with the world crude oil and natural gas market. Our model attempts to endogenize the determination of crude oil prices and natural gas prices in order to clarify the effect of economic spillovers between energy markets and macro economy. This approach would provide wider perspective to contribute an economic policy which leads to achieve the sustainable economic growth.

This research is composed of two parts. One is construction of a model on international trade. The other is construction of a model on international finance.

Part I: Theoretical Framework of Global Crude Oil Model

This study aims to build a basic theoretical framework which illustrate interaction among global oil market, macro economy, and financial market. As Barsky and Kilian (2004) emphasize, oil prices should be endogenous in economic models. Our model allows crude oil not only to affect the global economic activity but also to response the “reverse causality” which Killian (2009) suggests. In particular, we assume the monthly model which consists of several economic major countries. In the aggregate demand block, we assume that the total production of the economy in our model is explained by employing the monthly indices of industrial production instead of applying the national accounts data, which is mainly quarterly and annual time series data. On the other side, the firms under imperfect competition aim to set the price to maximize their profits. The financial block has the determinations of the long-term interest rate and the exchange rate. The crude oil spot price is determined by the demand of the global economy. The future price is described by the spot price and market risk following the Arbitrary Pricing Theory (APT).

Part II: Empirical Approach of Global Crude Oil Model

This study aims to develop an empirical model that interlinks a multi-country economic model with the world crude oil market and financial market, which enables us to clarify the effect of economic spillovers between energy markets and macroeconomy via the financial market.

This model includes three economic major countries: Japan, Germany, and the United States. Each country's country is explained by four endogenous variables: aggregate output, price, interest rate, and exchange rate. Besides, we embed into the whole model the global crude oil market global

where illustrates the relationship between the crude oil spot price and the crude future price. In the framework, demand driven by a thriving/depressed global economy of four countries affects the increase/decrease in crude spot oil price. Then, the level of spot price is attributable to determine the future price partly. The changes in the future price via the spot price eventually affect the economic activity of producing. As the estimation results show, some variables might be unsatisfactory. Nevertheless, the overall performance of this system is acceptable. The estimated results suggest that our theoretical approach has grasped the reality of the loan market. This approach would provide wider perspectives to contribute an evaluation of economic policy which leads to achieve sustainable economic growth.