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Insurance-adjusted general equilibrium via OLG model with applications to Korea and Japan

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Summary

Insurance purchases have become one of the primary means for individuals to manage the risk of financial losses caused by unexpected events such as car accidents, diseases, injuries, and fires. The non-life insurance penetration of the OECD total, which means the ratio of annual total insurance premiums to GDP, is significant at 4.9% in 2020 and steadily increases from 3.6% in 2010, according to OECD insurance statistics. These statistics indicate that insurance accounts for a substantial portion of the economy. As life expectancy has increased rapidly, individuals' desire to protect their wealth and health by purchasing insurance to escape various risks and maintain a better quality of life is growing. For example, the demand for health insurance tends to increase because the elderly have higher health risks and higher medical expenses than the non-elderly. The rise in interest in health insurance due to aging can also have an economic impact, such as reducing per capita income growth by causing labor movement in the healthcare sector. The government also strives to expand social security networks by providing insurance benefits in cooperation with the private market to cope with the aging population. These trends will further grow the insurance industry, then the mutual influence between insurance and the economy will become more critical.

Despite the increasing significance of the insurance industry's role in the economy, few theoretical studies have been conducted on the macroeconomic model linking insurance and the overlapping generations (OLG) economy. This theoretical model is required for the following reasons: Workers and retirees can reasonably make optimal economic decisions, including insurance purchases, in consideration of their life cycle. The government can develop policies that preemptively respond to changes in agents' behavior and the economic environment by quantitatively evaluating the impact of external shocks through the model. Therefore, this paper theoretically presents a new OLG model that describes interactions between insurance and the economy based on the general equilibrium analysis. The proposed model determines the equilibrium value of economic variables such as interest rates, income, financial assets, and consumption by reflecting the mutual influence between variables. We use this model to conduct various policy experiments and economic analyses, providing agents with implications for insurance and economic decisions. The primary research framework begins with Gertler's (1999) OLG model, which captures life cycle behaviors such as savings for retirement and describes transfer payments from workers to retirees. Furthermore, this current

study extends the OLG model of Lee, Ryu, and Son (2022) by adding insurance to an individual's consumption bundle. We generalize their research framework with an insurance-adjusted valuation.

The new OLG model assumes that individuals are fully covered for losses with full insurance by Mossin's (1968) Theorem, which states that it is optimal for risk-averse individuals to take full coverage at an actuarially fair premium. It also has a framework for private and social insurance to compensate for financial losses for several types of accidents and analyzes insurance decisions considering the agents' life cycle aspects. Insurance-adjusted valuation refers to the present value of the labor income and social security benefits streams deducted by insurance premiums paid in the future. In addition, workers who avoid retirement risk place higher weights than expected on their retirement cash flows using risk-adjusted probability. The risk-adjusted probability reflects retirement risk, such as increased consumption propensity, decreased wages, and increased probability of accidents. In this insurance model, retirees make economic decisions based on the insurance-adjusted valuation. However, workers make decisions heavily depending on the insurance-adjusted valuation. This method can more realistically assess the agents' remaining lifetime income streams deducted by insurance premiums at the current decision point.

The theoretical equilibrium model is useful for the following reasons. It recognizes financial losses in the real economy and derives insurance and economic decisions in equilibrium that reflect feedback effects between economic variables. In addition, the setting of the realistic length of life is not complicated as the working period and life expectancy may vary by selected transition probability, such as work probability and survival rate. Compared to large-scale models, it takes less time to derive the equilibrium value of many economic variables by repeating the market clearing process. This insurance model also predicts the long-term equilibrium of capital returns, wealth, consumption, labor supply, insurance demand, etc., by providing abundant comparative statistics implemented through changes in economic factors such as workforce growth, technological progress, and losses as a fraction of output. Finally, these findings of scenario analyses will have implications for the economic decision-makers. Based on insurance-adjusted valuation, workers and retirees will make optimal insurance purchases, consumption, and investment. They can also predict the equilibrium amount of indemnity for private and social insurance for each scenario, respectively. In addition, the government establishes an efficient fiscal policy to respond to economic shocks by calculating the ratio of social insurance expenditures to total losses and the resulting level of taxation.

Finally this study applies the model to Korean and Japanese insurance markets. In this insurance model, we numerically risk-averse workers' optimal insurance purchases and consumption based on the insurance-adjusted valuations. The theoretical equilibrium model numerically predicts capital returns, wealth, labor supply, etc. Our findings show that higher workforce and technological progress increase private insurance demand and reduce the capital-output ratio, and higher losses as a fraction of output increase social insurance demand and reduce the capital-output ratio via numerical comparative statics.