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Labor Market Search Frictions and Dynamics of Human Capital Accumulation

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I. Introduction

Human capital is a concept in economics that represents the ability, skill, and knowledge that individuals possess. Traditionally, human capital has been noted as a driving force for a nation's economic growth, and has been analyzed as an important factor affecting individuals' lifetime income and asset formation. Since human capital has different macroeconomic implications depending not only on the total accumulated amount but also on how it is distributed and with what dynamics it is accumulated, both the accumulation dynamics and the distributional and aggregated results are still being researched.

In reality, economic agents accumulate human capital in various ways depending on their state of economic activity. For example, when one is looking for a job, he/she can accumulate human capital by making preparations for employment, such as studying for certifications or exams; and when one is employed, he/she will accumulate human capital by enhancing his/her skills at work. In the case of the former, Ben-Porath (1967) presented an economics model that can consider this. In this study, the model is called the BP mechanism. The latter case is called Learning-By-Doing (LBD) in the economics literature, and its dynamics and effects have been studied theoretically and empirically. In reality, both BP and LBD will be operating, and the way of accumulation may vary depending on the state of economic activity. In addition, policies such as unemployment benefits and the earned income tax credit affect not only economic agents' consumption levels but also their choice of economic activity status, which may have effects on human capital accumulation and even lifetime income and assets. In the existing literature, studies have been conducted in consideration

of BP or LBD according to the interests of each study.

Against such a backdrop, this study aims to answer the following questions: When the state of economic activity and the way of human capital accumulation are closely linked, what implications does each way of human capital accumulation have for lifecycle inequality dynamics and unemployment benefits policy effects, such as the minimum amount, the specified number of days for which benefits are payable, and changing the income replacement rate? How will these policy effects differ compared to the case of considering only BP or LBD as in previous studies?

To answer the above questions, this study calibrated a structural model in which economic agents with heterogeneity in the level of initial assets and human capital, and learning ability at the time of labor market entry maximize utility in an economy where search frictions exist. Compared to the existing literature, this structural model is differentiated in that it considers that the way of human capital accumulation can differ depending on the state of economic activity. In other words, the structural model constructed and calibrated in this study (hereinafter referred to as the BP & LBD model) allows individuals to accumulate human capital by LBD when employed and by BP when unemployed and seeking work. In addition, with this structural model, it is possible to adjust the income replacement rate of unemployment benefits, the maximum and minimum amount, and payment period flexibly and similarly to the real system as in Griffy (2021). Also, using the calibrated structural model, this study analyzed the effect of the adjustment of the income replacement rate of unemployment benefits and of the lump-sum transfer payment to all unemployed job seekers on lifetime income or consumption.

This study does not shed light on which way of human capital accumulation—BP & LBD (benchmark model), BP, or LBD (counterfactual models)—is better to consider, nor is it of interest. Instead, by considering the method of human capital accumulation that is more expanded than those in previous studies, it attempts to see the effect of each method on lifecycle inequality and how the same policy simulation can have different effects in each method. To the author's knowledge, an integrated model that considers both labor market search frictions and BP & LBD is not only presented for the first time in the economics literature, but also has the advantage of being flexible and expandable. More importantly, as far as the author is aware, this study is also the first to analyze the effects of changing the details of the unemployment benefits policy, such as the income replacement rate of unemployment benefits, the maximum/minimum amount, the payment period, and the payment of lump-sum transfer, according to different ways of human capital accumulation on workers' wages or consumption inequality.

This study is structured as follows: Section II reported the stylized facts related to lifetime wage income using recent KLIPS data. In section III, a lifecycle search BP & LBD model was constructed and calibrated. section IV conducted various quantitative experiments using the calibrated structural model. Section V presented a conclusion and policy implications.

II. Empirical Study : Stylized Facts on Lifetime Wage Income

This section summarized and reported stylized facts related to Korea's lifetime wage income using data from the 6th to 23rd waves of the Korean Labor Income and Panel Study (KLIPS). The major findings are as

follows:

1) The average wage income shows an inverted U-shape, increasing along the lifecycle and decreasing before retirement.
2) Earned income variance gradually increases over the lifecycle and then decreases before retirement.
3) The skewness, which indicates the bias in earned income, has a negative (-) value until retirement, then gradually increases to a positive (+) value before retirement.
4) The Gini coefficient shows a behavior similar to the variance, and the magnitude is between about 0.3 and 0.4. This is not much different from the Gini coefficient of 0.331 to 0.388 based on equalized disposable income reported in the 2011-2020 Survey of Household Finances and Living Conditions by Statistics Korea.

Overall, the results were similar to Kim (2020), but it was found that the average income of those in their 30s was relatively higher compared to the past due to the difference in sample period. Such results suggest that depreciation can be calibrated to a larger value to explain the average earned income behavior over the lifecycle found in the recent KLIPS data, even if the BP model is used, for example, in the same way as Kim (2020).

III. Structural Model Analysis : Lifecycle Labor Search BP & LBD Model Calibration

In this section, as in Huggett, Ventura and Yaron (2011, hereinafter HVY), a structural model in which the way of human capital accumulation can vary depending on the state of economic activity due to the existence of prior heterogeneity in human capital, assets, and learning ability and of labor market search frictions at the time of labor market entry was constructed and calibrated in a lifecycle model. As described earlier, with the structural model of this study, human capital can be accumulated by LBD when one is employed and by BP when one is seeking employment. While either BP or LBD has been considered separately in the existing literature, this model was built so that BP and LBD can naturally be considered together when labor market friction exists.

Despite the fact that the calibrated structural model has more parameters that are difficult to identify compared to Griffy (2021), it explained the average earned income by age, that is the first moment, relatively well. Although the variance of earned income by age was not well explained, it should be noted that Griffy (2021)—the main reference for this study—also did not explain the second moment very well.

The structural model presented in this section seems to have made a significant contribution in that, in addition to the technical aspect of providing a basis for simultaneously considering BP and LBD, it is capable of flexibly reflecting the labor market conditions of different countries, such as Korea and the United States. For example, in Korea, there are many cases of re-employment after accumulating human capital through obtaining a license/certification in the state of job search. It is expected that the structure and calibration of this model, unlike other models, will be used in follow-up studies because ① human capital accumulation itself is possible through learning even in unemployment, and ② the rate of return to human capital accumulation through work and the rate of return to human capital accumulation through learning are different from each other, and in calibration $\phi_n > \phi_s$, so it is possible to take

into account both the loss of human capital due to unemployment and related opportunity costs.

IV. Effects of Initial Conditions on Lifecycle Inequality; Income Replacement Rate of Unemployment Benefits and Quantitative Analysis on Policy Effects of Lump-sum Payments

The results and policy implications from quantitative analysis and unemployment benefits policy simulation to identify the cause of lifecycle inequality using the structural model calibrated in section III are as follows. In policy simulation, policy effects in the case where human capital is accumulated only by the BP method (BP model) and the case where human capital is accumulated only by the LBD method (LBD model) are analyzed together to compare with the benchmark model (BP & LBD) and reported.

The quantitative analysis results are as follows. Similar to the existing literature, it was found that the level of initial human capital retention is an important factor in explaining lifecycle inequality. Additionally, unlike the model in which labor market search frictions are absent, policy simulation results of the benchmark model show that the effect of learning ability gaps among economic agents on lifecycle inequality can be large. This may be because changes in the way of human capital accumulation according to the state of economic activity can widen inequality according to the gap in learning ability. Also, asymmetry was found between increases and decreases in learning ability, which may be due to the high calibration of the minimum amount of unemployment benefits. The difference in the initial asset level has a quantitatively insignificant effect on lifecycle inequality and lifetime consumption, and has only a very temporary effect.

The results of policy simulation are as follows. In the case of the benchmark model, lump-sum transfer payments to all unemployed job seekers was more effective than raising the income replacement rate (60→72%) both in terms of boosting average consumption levels and mitigating consumption inequality. If lump-sum transfer payments were made to all unemployed job seekers, individuals would be more active in supplying labor instead of saving money to prepare for the risk of job loss so the overall level of consumption would rise significantly due to the additional accumulation of human capital. However, the wealth effect may work against the human capital investment efforts of unemployed job seekers, partially offsetting the described effect.

In the case where human capital accumulation is achieved only through the BP method, it was also shown that it may be better to make lump-sum transfer payments to all unemployed job seekers rather than raising the income replacement rate. However, in terms of income inequality, the implications were different. In the benchmark model, the consumption inequality decreased due to lump-sum transfer payments, whereas in the BP model, the consumption inequality increased when lump-sum transfer payments were made. This may be due to differences between workers who experienced unemployment and those who did not. In this structural model, because of the endogenous human capital accumulation of unemployed job seekers, it may reduce the investment in learning among the low-income class, thereby reducing income and consumption over the lifecycle. On the other hand, employed workers can invest more in human capital to increase future earnings instead of current earnings. In other words, when unemployed job seekers can also decide that human

capital accumulation is endogenous, policy effects can be different even if only the BP method is considered, as in Griffy (2021). This suggests that an accurate identification of the way of human capital accumulation can be of great importance.

Finally, in the LBD model, both lump-sum transfer payments and an increase in the income replacement rate reduced average consumption levels. This suggests that when human capital accumulation is achieved only by LBD, an increase in lump-sum transfer payments can have a significant effect on raising the unemployment rate by changing outside options. On the other hand, an increase in lump-sum transfer payments lowers the consumption inequality significantly, one possible reason being that the low-income class has a longer period of unemployment and the resulting higher unemployment benefits leads to a smaller reduction in consumption than the high-income class.

V. Conclusion and Policy Implications

From the quantitative analysis and policy simulation results of section IV, the following additional policy implications were derived. First, it was found that understanding the labor market structure and human capital accumulation mechanism in terms of labor market performance can be of great help to efficient management of education and human capital. For example, where there is no unemployment and it is important to accumulate human capital through the BP method, i.e., investment in separate learning, as in the case of HVY or Kim (2020), it may be important to enhance the accumulated human capital stock at the time of labor market entry. In this case, the importance of elementary, middle, high school, and university education before labor market entry is more emphasized than the importance of forming additional human capital after labor market entry. However, when unemployment exists, Griffy (2021) and the results of this study imply that human capital formation after labor market entry is equally important as the difference in human capital can widen even after labor market entry due to learning ability. Through the training of new industrial technologies at work, reduction of mismatches, and retraining of job seekers, there exists room for improving human capital accumulation through institutional factors. However, this study did not identify which human capital accumulation mechanism is the best, and in both Griffy (2021) and this study, there are aspects of data that cannot be explained well compared to HVY and Kim (2020). Thus, it would be necessary to substantiate the theoretical possibility thoroughly through follow-up studies.

Second, since the mechanism of policy propagation may also differ depending on the labor market structure and the way of human capital accumulation, it is suggested that the identification of the relevant factors can be important. As described above, even if the results of policy simulation in the benchmark model are similar to Griffy (2021), which has a different form of human capital accumulation, the propagation mechanism may be different. Together with the results of Blandin and William (2019), this study implies that considering both the structure of the labor market and the way human capital is accumulated are just as important as considering the amount of human capital accumulation.

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