Simulating the Blanchard Conjecture in a Multi-Period Life-Cycle Model

Forthcoming in the *American Economic Association Papers and Proceedings*

Session Title: Is Deficit Finance Playing with Fire?

Paper Title: Simulating the Blanchard Conjecture in a Multi-Period Life-Cycle Model

Author: Jasmina Hasanhodzic, Assistant Professor of Finance, Babson College
Jhasanhodzic1@babson.edu

Abstract

In recent writings, Olivier Blanchard has suggested that additional deficit-financed U.S. federal spending would come at no cost to any future generation and benefits to some, with welfare measured in terms of expected remaining or entire lifetime utility. This paper studies this question in a ten-period overlapping generations model in which agents face macroeconomic uncertainty about their future earnings and demand government bonds to limit their risk. It shows that the safe rate on government debt can, on average, be far less than the economy's growth rate without its implying that ongoing redistribution from the young to the old is Pareto improving. Indeed, in a 10-period, OLG, CGE model, whose average safe rate averages negative 2 percent on an annual basis, welfare losses to future generations resulting from the introduction of pay-go Social Security, financed with a 15 percent payroll tax, are enormous – roughly 20 percent measured as a compensating variation relative to no policy.

Introduction

In many developed countries, short-term interest rates are now very low or negative. This unusual situation is expected to continue for some time. Since the projected nominal growth rate of these economies exceeds their safe rates, Blanchard (2019) and others have asked whether a fiscal Ponzi scheme could be Pareto efficient, i.e., raise at least one generation's expected utility without lowering any others. In related papers, Blanchard and Summers (2019) and Rachel and Summers (2019) propose using additional deficit-financed U.S. federal spending to help reduce or eliminate the output gap if welfare costs associated with higher public debt are limited.

This paper constructs a more detailed version of Blanchard's (2019) model to revisit his findings that successful Ponzi schemes are a distinct possibility. First, the paper's model has ten, not two overlapping generations. This is crucial, as more periods permits more intergenerational risk sharing among contemporaneous generations, which leaves less scope for Social Security to share generational risk (see Krueger and Kubler, 2016). Second, unlike in Blanchard's paper, where a large fraction of the wage is safe for computational feasability, in our baseline model the wage is fully variable and is determined by the marginal product of labor. This is important since a safe endowment limits the main downside from Ponzi schemes – the crowding-out of capital's induced reduction in real wages. Third, while Blanchard models risk via TFP shocks only, we include two uncorrelated sources of risk – TFP shocks and iid capital depreciation shocks. This renders the income of the young more diversified and makes them the natural suppliers of safe bonds to the old. Apart from these three modifications, the paper's model and calibration adheres as closely as possible to Blanchard's. In particular, the model, like his, features zero growth and uses extreme parameter values to generate an average negative safe rate, in our case roughly negative 2 percent on an annualized basis.

We find that, when the prevailing, time 0 annual risk-free rate is negative 2 percent annually, implementing a pay-go pension Ponzi scheme financed with a 15 percent payroll tax makes all newborn generations significantly worse off. Those born in the long run are worse off by 19.9 percent on average in terms of their expected lifetime utility, measured as a consumption-compensating differential. Some of the generations who are alive at time 0 are better off in terms of their remaining expected lifetime utility. Specifically, the initial older generations – four-year olds through nine-year olds – experience welfare gains ranging from 0.65 percent to 4.64 percent.[1] Reducing the payroll tax to 5 percent yields a welfare loss of 6.3 percent on average across newborns through time. Making a share of the wages certain and again employing the 5 percent payroll tax reduces further but does not reverse the expected utility loss.

Understanding Welfare Losses

In our model, the average risk-free rate remains negative with the introduction of Social Security. This means that, as in Blanchard's theoretical model, Social Security provides cheaper safe future consumption to the young than what they would otherwise have to pay to transfer resources across time – zero return rather than a negative return. So then, why does Social Security hurt future generations in our model and not in Blanchard's? First, as mentioned

[1] When simulating the model with Social Security in place, we start from the same, time 0 initial condition as we employ in the model without it. Hence, the initial oldest (10-year old) generation experiences no change in welfare from the introduction of Social Security.

above, one channel is the effect of crowding out of capital on the wages. In Blanchard's model, this effect is minimized since with a large safe wage endowment the wages cannot drop much. In our model, crowding out is significant: the capital stock drops by 15.8 percent on average when Social Security is introduced, which translates into a 5.5 percent average drop in wages.[2] The corresponding values for Social Security at the 5 percent payroll tax level are 6.0 percent and 2.0 percent for the drop in capital and wages respectively.

Another reason is that with Social Security, average net transfers over a newborn's lifetime are negative and account for a large fraction of their average lifetime resources. In particular, in the stochastic steady state, the present value of net transfers (tax payments when working and benefits in retirement), discounted by the average risky rate, accounts for 14.3 percent (4.7 percent) of the present value of pre-tax wages with 15 percent (5 percent) payroll tax level. Finally, consumption variability when old increases by 18.8 percent (6.3 percent) with 15 percent (5 percent) Social Security relative to no policy. This is to be expected since with the benefit proportional to the wage, old-age consumption is more connected to the TFP risk (in bad times, the old get back less than what they put in during their working periods of life).

Simulating the Blanchard Conjecture Under Favorable Assumptions

To investigate whether the welfare losses associated with the introduction of Social Security can be reversed, following Blanchard we introduce a safe wage endowment equal to 43 percent of average wage and reduce the Social Security payroll tax to 5 percent. We calibrate the model so that the average risk-free rate is negative 2 percent without Social Security in place and start

[2] The corresponding maximum values of the drop are 18.80 percent and 6.64 percent, for capital and wages, respectively.

from the initial condition featuring an annual risk-free rate of negative 2.50 percent. With this, crowding out resulting from the introduction of Social Security is much less pronounced than before: now the capital stock drops by at most 1.46 percent, which translates into 0.48 percent maximum drop in wages. (The average percentage changes are negative 1.26 and negative 0.42 for capital and wages, respectively.) Nevertheless, all newborn generations are hurt from the introduction of Social Security, although welfare losses are much smaller, averaging 1.48 percent in the long run. Thus, our model does not reproduce Blanchard's result, even when employing assumptions favorable to making Ponzi schemes efficient.

We next present the model and its calibration, discuss our measurement of welfare gains and losses in more detail, and conclude with remarks on possible future directions.

The Model and Its Calibration

We employ the model of Hasanhodzic and Kotlikoff (2018 and 2019). This paper's version features 10 overlapping generations with total factor productivity and capital depreciation shocks. Each agent works full time through retirement age of 7, supplying one unit of labor, dies at age 10, and maximizes expected lifetime utility. Cohort members are identical. Following Blanchard (2019), we assume that utility has an Epstein-Zin-Weil representation (Epstein and Zin 2013, Weil 1990) with the intertemporal elasticity of substitution equal to 1. Production is Cobb-Douglas, with total factor productivity given by a trend stationary AR(1) process with normal innovations. There are no adjustment costs, so firms maximize static profits. Like Blanchard, we abstract from government consumption.

Households save and invest in either risky capital or one-period safe bonds. Bonds are in zero net supply, but, as shown in Green and Kotlikoff (2008), fiscal policy can be labeled in an infinite number of ways to produce whatever time path of explicit and implicit debts the government wishes to report. Such relabeling makes no difference to this or any other neoclassical model. Hence, our model can be viewed as including government debt or not depending on the reader's preferences.

Except for risk aversion and the volatility of the stochastic rate of depreciation, the calibration is standard and follows that in the above-mentioned papers. These parameters are chosen to yield a risk-free rate of negative 2 percent annually. Specifically, in the baseline model, we set risk aversion to 16 and the volatility of depreciation rate to 3.2 times the empirically relevant estimate of Ambler and Paquet (1994). In the fixed endowment model, the values are 14 and 4 for the risk aversion and empirical volatility multiple, respectively.

Defining Welfare Gains and Losses

Each newborn's welfare gain or loss is defined as the compensating consumption differential needed to achieve the average expected lifetime utility across newborns. It is the factor by which consumption of generation x needs to be multiplied in all possible states it might experience in the model with Social Security to achieve the same lifetime utility as all generations enjoy on average in the model without Social Security. For the initial generation x, the compensating consumption differential is the factor by which one needs to multiply x's consumption in all possible states that might arise to equate their *remaining* expected lifetime utility to that of generation x in the model without Social Security.

The distance of the consumption differentials from 1 is defined as welfare gain if it is positive and welfare loss if it is negative. Given the stationary nature of the model, the volatility of the expected lifetime utility differentials is very small once the economy settles in its new stochastic steady state (ergodic distribution) after the introduction of Social Security.

Conclusion

In recent writings, Olivier Blanchard has suggested that when the safe rate on government debt is less than the economy's growth rate, fiscal Ponzi schemes, such as Social Security, would come at no cost to any future generation if one measures their welfare in terms of expected lifetime utility. Blanchard (2019) confirms this conjecture in a two-period overlapping generations model in which a large portion of the wage is safe for computational feasability. This paper studies this question in a more detailed ten-period OLG, CGE model in which the wage is fully variable and given by the marginal product of labor. It finds that welfare losses can be enormous – as large as 20 percent – for generations born after the introduction of Social Security.

Solving a model like ours is difficult because of the well-known curse of dimensionality, but recent computational breakthroughs have made it eminently feasable. The difference between Blanchard's results and ours highlights the importance of deploying such computational advances for more robust and realistic modeling when testing conjectures about the real world.

A crucial aspect of studying the Blanchard conjecture is producing a model which exhibits a negative safe rate of return and thus meets the preconditions for a successful Ponzi scheme. We, like Blanchard, resort to very large shock volatility and risk aversion to achieve this. With a realistic calibration of these parameters, the risk-free rate is virtually indistinguishable from the rate of return on capital, which in our model is 8.14 percent on average annually. This begs the question of where negative interest rates come from. We address this question in our ongoing work, where we focus on generating negative interest rate environments via more realistic channels, such as borrowing constraints, interaction between idiosyncratic and aggregate risks, and shocks to capital production technology in place of shocks to depreciation.

References

Ambler, Steve and Alain Paquet, 1994, “Stochastic Depreciation and the Business Cycle”, International Economic Review 35, 101–116.

Blanchard, Olivier, 2019, “Public Debt and Low Interest Rates”, *American Economic Review* 109, 1197–1229.

Blanchard, Olivier and Lawrence Summers, eds., ``*Evolution or Revolution? Rethinking Macroeconomic Policy after the Great Recession*,'' MIT Press, 2019.

Green, Jerry and L. J. Kotikoff, 2008, “On the General Relativity of Fiscal Language”, in A. J. Auerbach and D. N. Shapiro, editors, “Institutional Foundations of Public Finance”, Cambridge: Harvard University Press, 241–256.

Hasanhodzic, Jasmina and Laurence Kotlikoff, 2018, “Generational Risk–Is It a Big Deal?: Simulating an 80-Period OLG Model with Aggregate Shocks”, NBER Working Papers 19179, National Bureau of Economic Research.

Hasanhodzic, Jasmina and Laurence Kotlikoff, 2019, “Valuing Government Obligations When Markets Are Incomplete”, *Journal of Money, Credit, and Banking* 51, 1815–1855.

Krueger, D. and F. Kubler, 2006, “Pareto-Improving Social Security Reform when Financial Markets are Incomplete!?”, American Economic Review, 96, 737–755.

Rachel, Lukasz and Lawrence Summers, 2019, ``On Falling Neutral Real Rates, Fiscal Policy, and the Risk of Secular Stagnation”, Brookings Papers on Economic Activity, forthcoming.