Income distribution, credit and fiscal policies in an agent-based Keynesian model

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ABSTRACT

This work studies the relations between income distribution and monetary/fiscal policies using an credit-augmented version of the agent-based Keynesian model in Dosi et al. (2010). We model a banking sector and a monetary authority setting interest rates and credit lending conditions in a framework combining Keynesian mechanisms of demand generation, a Schumpeterian innovation-fueled process of growth and Minskian credit dynamics. We show that the model is able to account for a rich ensemble of empirical features underlying current and past recessions, including the impact of financial factors on the real economy, and the role in that of income distribution. We find that more unequal economies are exposed to more severe business cycles fluctuations, higher unemployment rates, and higher probability of crises. From a policy perspective, the model suggests that fiscal policies dampen business cycles, reduce unemployment and the likelihood of experiencing a huge crisis and, in some circumstances, also affect long-term growth. Furthermore, the more income distribution is skewed toward profits, the greater the effects of fiscal policies. Interest rates have instead a strong non-linear effect on macroeconomic dynamics. Tuning the interest rate when it is below a given threshold has no detectable effects. Conversely, increasing the interest rate when it is above that threshold yields lower and more volatile output growth, higher unemployment rates, and higher likelihood of crises.

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1. Introduction

This work studies the interactions between income distribution and monetary and fiscal policies in terms of ensuing dynamics of macro variables (GDP growth, unemployment, etc.) on the grounds of an agent-based Keynesian model.[4]

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  [4] In this work we employ the term "income distribution" meaning functional distribution (i.e. how income is distributed between wages and profits), as distinct from personal income distribution (related to how income is distributed across individual agents in the population). However, empirically the two move in the same direction. Hence, in the model below an unequal "functional" income distribution should be considered also as a proxy for an unequal "individual" income distribution.

The empirical counterpart of this work is quite straightforward. Major recessions characterized by negative growth and prolonged periods of high unemployment rates are recurrent phenomena in the history of capitalist economies, and so are persistent fluctuations in output and employment. In all that, financial factors often appear to play an important role, at least as triggering factors of the outburst of recessionary dynamics: it was so in the Great Depression of 1929, and similarly is with the subprime mortgage crisis in the current Great Recession. Conversely, on the real side, income distribution is a serious candidate in the determination of degrees of (negative or positive) amplification of demand impulses. Interestingly, when one looks at how income is cross-sectionally distributed among individuals, one finds that contemporary industrialized economies have never been so unequal since the Great Depression. So, for example, in the U.S. the ratio between the top 1% and the bottom 90% of incomes has gone from less than 2.6 in the 1970s to more than 3.7 in the new millenium (Atkinson and Piketty, 2010). Indeed, there are solid reasons to believe that individual-income inequality is contributing – now as well as in the aftermath of the 1929s crisis – to depress aggregate demand (Fitoussi and Saraceno, 2010; Kumhof and Rancière, 2010; Stiglitz, 2011). In the model that follows we shall precisely explore the relationships between financial and real domains of the economy, the role played by income distribution (proxied by the distribution of income between profits and wages) and the impact of monetary and fiscal policies in shaping macrodynamics.

The direct ancestor of this work is the "Keynes meeting Schumpeter" formalism (K+S, henceforth) presented in Dosi et al. (2010). To that model, we add a banking sector and a monetary authority setting interest rates and credit lending conditions.

Our approach considers the *economy as a complex evolving system*, i.e. as an ecology of heterogenous agents whose far-from-equilibrium interactions continuously change the structure of the system itself (more on that in Kirman, 2010; Dosi, 2011; Rosser, 2011). In this framework, the statistical relationships exhibited by macroeconomic variables should be considered as emergent properties stemming from microeconomic disequilibrium interactions.

More specifically, we develop an agent-based model that combines Keynesian mechanisms of demand generation, a "Schumpeterian" innovation-fueled process of growth and Minskian credit dynamics.

The model, with its evolutionary roots (Nelson and Winter, 1982), belongs to the growing body of literature on agent-based models (Tesfatsion and Judd, 2006; LeBaron and Tesfatsion, 2008) addressing the properties of macroeconomic dynamics (more on that in Section 2 below).[5] The model is grounded on a "realistic" – i.e. rooted in micro empirical evidence – representation of agents' behavior, thus providing an explicit "behavioral" microfoundation of macro dynamics (Akerlof, 2002). The robustness of the model is checked against its capability to jointly account for a large set of empirical regularities both at the micro level (e.g. firm size and growth-rate distributions, productivity dispersions, firm investment patterns) and at the macro one (e.g. persistent output growth, output volatility, unemployment rates, etc.).

The model portrays an economy composed of capital- and consumption-good firms, a population of workers, a bank, a Central Bank and a public sector. Capital-good firms perform R&D and produce heterogeneous machine tools. Consumption-good firms invest in new machines and produce a homogeneous consumption good. Firms finance their production and investment choices employing internal funds as well as credit provided by the banking sector. The Central Bank fixes the interest rate and determines the credit multiplier. Finally, the public sector levies taxes on firm profits and worker wages, and pay unemployment benefits.

As in every ABM, the properties of the model are analyzed via extensive computer simulations. We perform our simulations exercises employing a three-steps strategy. First, we empirically validate the model, i.e. we assess whether the statistical properties of simulated microeconomic and macroeconomic data are similar to empirically observed ones. Second, we experiment with different income distribution scenarios and study a few key implications in terms of macrodynamics. Third, we use the model as a sort of "policy laboratory" exploring the short- and long-run effects of different fiscal and monetary policies.

In line with Dosi et al. (2010), the model is able to match a long list of macro and micro empirical regularities. Moreover, the extended version of the K+S model can replicate new macro and micro stylized facts concerning credit dynamics (including procyclical firm debt and bankruptcy rates, power-law distributed firm-level "bad debt", etc.).

We believe that the credit-enhanced K+S model is able to catch salient features underlying the current as well as previous recessions, the impact of financial factors and the role in them of income distribution. Indeed, we find that different income distribution regimes heavily affect macroeconomic performance: more unequal economies (i.e. economies where income distribution is more skewed towards profits) are exposed to more severe business cycles fluctuations, higher unemployment rates, and higher probability of crises.

Moreover, the interactions between credit dynamics and economic fluctuations are strongly "Minskian". The model can easily account for regimes whereby higher production and investment levels rise firms' debt, eroding their net worths and consequently increasing their credit risk. Banks, in turn, increase the level of credit rationing in the economy and force firms to curb production and investment, thus setting the premises for an incoming recession.

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[5] For germane ABMs, see Verspagen (2002), Delli Gatti et al. (2005, 2010, 2011), Saviotti and Pyka (2008), Dawid et al. (2008, 2011), Ciarli et al. (2010), Ashraf et al. (2011), Cincotti et al. (2010), and Gai et al. (2011). See also Fagiolo and Roventini (2012) for a critical comparison of policy analysis in DSGE and agent-based models.