

An Agent-Based Approach to Examine Interactions of Firms for Investment Revival

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Abstract : One conundrum that macroeconomic theory faces is to explain how an economy can revive from depression, in which the aggregate demand has fallen substantially below its productive capacity. This paper examines an autonomous stabilizing mechanism using an agent-based Wicksell-Keynes macroeconomic model. This paper focuses on the effects of the number of firms and the length of the gestation period for investment that are often assumed to be one in a mainstream macroeconomic model. The simulations found the virtual economy was highly unstable, or more precisely, collapsing when these parameters are fixed at one. This finding may even suggest us to question the legitimacy of these common assumptions. A perpetual decline in capital stock will eventually encourage investment if the capital stock is short-lived because an inactive investment will result in insufficient productive capacity. However, for an economy characterized by a roundabout production method, a gradual decline in productive capacity may not be able to fall below the aggregate demand that is also shrinking. Naturally, one would then ask if our economy cannot rely on an external stimulus such as population growth and technological progress to revive investment, what factors would provide such a buoyancy for stimulating investments? The current paper attempts to answer this question by employing the artificial macroeconomic model mentioned above. The baseline model has the following three features: (1) the multi-period gestation for investment, (2) a large number of heterogeneous firms, (3) demand-constrained firms. The instability is a consequence of the following dynamic interactions. (a) A multiple-period gestation period means that once a firm starts a new investment, it continues to invest over some subsequent periods. During these gestation periods, the excess demand created by the investing firm will spill over to ignite new investment of other firms that are supplying investment goods: the presence of multi-period gestation for investment provides a field for investment interactions. Conversely, the excess demand for investment goods tends to fade away before it develops into a full-fledged boom if the gestation period of investment is short. (b) A strong demand in the goods market tends to raise the price level, thereby lowering real wages. This reduction of real wages creates two opposing effects on the aggregate demand through the following two channels: (1) a reduction in the real labor income, and (2) an increase in the labor demand due to the principle of equality between the marginal labor productivity and real wage (referred as the Walrasian labor demand). If there is only a single firm, a lower real wage will increase its Walrasian labor demand, thereby an actual labor demand tends to be determined by the derived labor demand. Thus, the second positive effect would not work effectively. In contrast, for an economy with a large number of firms, Walrasian firms will increase employment. This interaction among heterogeneous firms is a key for stability. A single firm cannot expect the benefit of such an increased aggregate demand from other firms.

Keywords : agent-based macroeconomic model, business cycle, demand constraint, gestation period, representative agent model, stability

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