Consumer Sentiment and Countercyclical Fiscal Policies*

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Abstract

We re-explore the consequences of some popular countercyclical intervention rules in a simple Keynesian-type macroeconomic model in which the dynamics of consumer sentiment and business cycles are intertwined. We find that fiscal policy does not only have a direct effect on national income via the well-known Keynesian multiplier process but also an indirect effect by affecting consumer sentiment. The good news is that the indirect effect may amplify the direct effect and therefore increases a policy maker's impact on national income. However, the bad news is that due to the interactions between the business cycle and the evolution of consumer sentiment, the stabilization of national income is an intricate matter.

Keywords

Business cycles; Consumer sentiment; Heterogeneous agents; Countercyclical fiscal policies.

JEL classification

D11; E12; E32; E62.

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* We thank two anonymous referees and Malcolm Sawyer (the editor) for helpful comments.

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1 Introduction

All modern industrial economies regularly experience severe short-run output fluctuations (Stock and Watson 1999). Such boom and bust cycles may be welfare decreasing: every recession in which workers become involuntarily unemployed results in an income loss that cannot be regained. Policy makers may therefore try to stabilize the economy. However, the variability of national income may also increase if intervention rules are ill-designed (Baumol 1961). A thorough understanding of the effectiveness of stabilization policies thus seems to be quite important. Since the results obtained may depend on the underlying macroeconomic framework, it seems appropriate to look at this challenging issue from different angles. The goal of the current paper is to explore the impact of certain countercyclical fiscal policy rules on the evolution of national income within a simple Keynesian-type model in which the dynamics of consumer sentiment and business cycles are intertwined.

Based on empirical evidence (e.g. Throop 1992, Carrol et al. 1994, Doms and Morin 2004, Souleles 2004) supporting the view that consumer sentiment significantly influences household expenditure, Westerhoff and Hohnisch (2007) have recently developed a simple Keynesian-type business cycle model to take this aspect into account. Their model roughly works as follows: consumers are heterogeneous in the sense that they are either optimistic or pessimistic. A change in the proportion of consumers that are optimistic will then, ceteris paribus, raise the aggregate propensity to consume. Hence, if the number of optimistic consumers increases (decreases), total consumption expenditure increases (decreases) and a boom (recession) may emerge. The evolution of consumer sentiment, i.e. the relation between the number of optimistic and pessimistic agents, is driven by direct interactions between individual agents. To be precise, consumers repeatedly interact in some way with each other and thus may influence their opponents to follow their behavior. The probability of convincing someone depends on the prevailing economic conditions. If the economy is booming, then the probability that an optimist will be able to convert a pessimist is larger than the other way around.[1] The model reveals that business cycles may be driven by changes in consumer sentiment but also that business cycles may cause swings in consumer sentiment. Clearly, the dynamics of consumer sentiment and business cycles is intertwined.

Here we use this framework to reassess the effectiveness of certain stabilization policies. Since our model precludes closed analysis, we rely on simulation analysis to derive our results. Note that simulations are a frequently used and important tool in macroeconomic policy analysis to guide decision-making. Our main results may be summarized as follows. In our model, fiscal policy not only influences national income via the usual Keynesian multiplier process, but also via movements in the consumer sentiment it induces. Suppose, for instance, that expansive fiscal policy manages to increase national income. Then it is likely that consumers will become more optimistic, which, in turn, should give the economy a further boost. However, the interplay between individual consumer attitudes, national income and fiscal policy is quite complex. While policy makers seem to have some instruments to influence national income, the analysis based on our model indicates that stabilization policies that are not carefully designed may amplify fluctuations in economic activity.

The current paper may be regarded as being part of the agent-based computational field of economic research. This literature aims at modeling the behavior of heterogeneous agents at the individual level and is surveyed in Tesfatsion and Judd (2006). Let us briefly mention some related papers. Hohnisch et al. (2005) develop a stochastic model of interactive

[1] As pointed out by one of the referees, these aspects of the model may appear a bit narrow. People not only talk to each other but they also observe what others do. In our setting, we use a so-called tandem recruitment mechanism in which always only two agents are involved. In reality, there may be larger group interactions. Moreover, outlooks may be revised in light of new information communicated through the popular media. And, of course, consumption may also be subject to other factors such as the instinct of emulation. Yet, to build a simple mathematical model, we abstain from such extensions.

expectation formation. In their model, the expectation formation of business managers about future business prospects is influenced by the expectations prevalent in their professional peer group. As reported in many empirical studies, interactions between agents may lead to phenomena such as herding behavior. A framework in a similar spirit is developed by Flieth and Foster (2002). Both approaches are able to reproduce some salient features of the German business climate index, for instance the occurrence of abrupt large but rare up and down swings. In Westerhoff (2005), an opinion formation model in which agents randomly meet each other is linked with a macroeconomic model. It is shown that swings in agents' sentiment may generate endogenous business cycles. The aforementioned model of Westerhoff and Hohnisch (2007) extends the latter approach by considering that there may also be a feedback force from macroeconomic variables acting upon the opinion formation process. Hohnisch and Westerhoff (2008) model the formation of investor sentiment in a multi-country setting and find that an international sentiment spillover may cause business cycle synchronization. Franke (2007a, 2007b) and Lux (2008) have recently developed tools to estimate such opinion formation models. This line of research is very interesting and promising since it may help us to validate models in this spirit in the future.

The remainder of our paper is organized as follows. In section 2, we present the model. In section 3, we briefly illustrate how our model functions. In section 4, we investigate the impact of some popular governmental intervention strategies. The last section offers some conclusions.

2 The model

Our model comprises two main building blocks: the well-known Keynesian multiplier model and Kirman's (1993) opinion formation model. According to the Keynesian multiplier model, national income Y at time step $t+1$ is given as

$$Y_{t+1} = C_{t+1} + G_{t+1} + I_{t+1}, \tag{1}$$

where C, G and I stand for consumption, government and investment expenditures, respectively.

Aggregate consumption depends on the national income of the last period

$$C_{t+1} = A_t Y_t. \tag{2}$$

The marginal propensity to consume A changes over time with respect to consumer sentiment. When agents are optimistic they spend more of their income than when they are pessimistic. For simplicity, we only consider two different marginal propensities to consume so that we may write

$$A_t = W_t a^O + (1 - W_t) a^P. \tag{3}$$

Here a^O and a^P are the proportions of income consumed by optimistic and pessimistic agents, with $0 < a^P < a^O < 1$. The weights of optimistic and pessimistic agents are denoted by W and $(1 - W)$, respectively.

Inspired by Kirman's (1993) seminal opinion formation framework, the fraction of optimistic agents evolves as follows.[2] There are N consumers in total, each holding a specific view of the world (i.e. they are either optimistic or pessimistic). In each time period, two consumers meet at random and the first will adopt the opinion of the other with a given probability $1 - \delta$. In addition, there is a small probability ε that a consumer will change his attitude independently (think of a random shock or the replacement of an old agent by a new one). Contrary to Kirman's approach, however, the probability that one agent will convert another agent is asymmetric and depends on the current state of the economy. Suppose that, due to a random increase from one period to the next in the number of optimistic consumers, an upswing takes place. Then it is more likely that an optimist will convince a pessimist than

[2] Kirman's opinion formation process is also able to explain herding behavior in financial markets, see, e.g. Kirman (1991), Lux and Marchesi (2000) or Alfarano et al. (2005).

the other way around. Similarly, when output decreases, chances are higher that pessimists will successfully challenge optimists. Let K be the number of optimistic agents. The transition probability of K may be expressed as

$$K_t = \begin{cases} K_{t-1}+1 & \textit{with probability} \quad p_{t-1}^{+} = \dfrac{N-K_{t-1}}{N}(\varepsilon + (1-\delta_{t-1}^{P\to O})\dfrac{K_{t-1}}{N-1}) \\ K_{t-1}-1 & \textit{with probability} \quad p_{t-1}^{-} = \dfrac{K_{t-1}}{N}(\varepsilon + (1-\delta_{t-1}^{O\to P})\dfrac{N-K_{t-1}}{N-1}) \\ K_{t-1} & \textit{with probability} \quad 1-p_{t-1}^{+}-p_{t-1}^{-} \end{cases}, \qquad (4)$$

where the probability that a pessimist is converted into an optimist is

$$(1-\delta_{t-1}^{P\to O}) = \begin{cases} 1-\delta+\gamma & \textit{for} \quad Y_{t-1}-Y_{t-2}>0 \\ 1-\delta-\gamma & \textit{otherwise} \end{cases} \qquad (5)$$

and the probability that an optimist is converted into a pessimist is

$$(1-\delta_{t-1}^{O\to P}) = \begin{cases} 1-\delta-\gamma & \textit{for} \quad Y_{t-1}-Y_{t-2}>0 \\ 1-\delta+\gamma & \textit{otherwise} \end{cases}, \qquad (6)$$

respectively.

The fraction of optimistic agents may then be defined as

$$W_t = K_t / N. \qquad (7)$$

The fraction of pessimistic agents is obviously $(1-W_t) = 1-K_t / N$.

As in Baumol (1961), we consider two common governmental intervention strategies. One policy seeks to adjust for income levels. In this case, the government decides to compensate for the difference between the actual output and a benchmark value $\overline{Y}$ (e.g. a long-run average value). The second policy aims at offsetting income trends. Policy makers increase (decrease) their spending when income has just been falling (rising). We thus formalize the policy makers' aggregated interventions as

$$G_{t+1} = \overline{G} + b(\overline{Y}-Y_t) + c(Y_{t-2}-Y_{t-1}), \qquad (8)$$

where the first term of the right-hand side of (8) captures the level-adjusting policy and the second term represents the trend-offsetting policy. The intervention force depends on control parameters $b, c \geq 0$.

Finally, investment expenditures are given as

$$I_{t+1} = \bar{I}, \tag{9}$$

i.e. they are set at constant.

3 How the dynamics of the model functions

Let us first explore the dynamics of the model with passive policy makers. We make use of the following parameter setting:

$$N = 100,\ a^{O} = 0.91,\ a^{P} = 0.89,\ \delta = 0.5,\ \gamma = 0.45,\ \varepsilon = 0.05,\ b = 0,\ c = 0,\ \bar{I} = 10.$$

The first line of panels of figure 1 shows a typical simulation run for 10000 observations (displayed every 100 time steps). The left panel depicts the evolution of national income and the right panel presents the corresponding number of optimistic agents. Visual inspection reveals that the model is able to generate irregular business cycles. Similar to actual business cycles, the amplitude and frequency of cycles vary considerably (Stock and Watson 1999). The number of optimistic agents, which may be regarded as a measure of consumer sentiment, is correlated with the level of national income.

What is going on in this model? Suppose an upswing takes place. Then the probability that an optimist will convince a pessimist is relatively high. If the number of optimists increases, the aggregate marginal propensity to consume increases, too. This, however, implies that the equilibrium income, given as $Y(A) = \bar{I}/(1-A)$, rises. Since the dynamics of our model is due to a simple dynamic multiplier process, national income needs some time to catch up with equilibrium income.[3] Hence, the upswing shows some persistence. We may observe a turning point when the number of optimists decreases again. The probability that this will occur increases with the number of optimistic agents (there is obviously an upper bound in that not more than N agents may become optimistic).

---------- Figure 1 goes about here ----------

4 Policy analysis

The dynamics of the model is driven by the interactive formation of the marginal propensities to consume. The number of optimistic and pessimistic agents depends on socio-economic interactions. In this context, it may be interesting to ask how fiscal policy may affect the dynamics. In the classical Keynesian model, for instance, expansive fiscal policy impacts on national income via the multiplier process. In our approach, fiscal policy may also affect consumer sentiment. In the following, we try to shed some light on this “novel” channel. Although there is much talk in the popular media about the importance of consumer sentiment to the development of an economy, not many scientific papers deal with this issue.

Let us start by investigating the level-adjusting policy (i.e. c remains 0). Since 50 percent of the agents are on average optimistic, the long-run average income is equal to 100. We assume that the target output level of policy makers is $\overline{Y} = 100$. In the five panels of figure 1, we increase control parameter b stepwise from 0, 0.05, 0.1, 0.2 to 0.5. Simple visual inspection reveals that the larger the control parameter, the lower the amplitude of the business cycles. For $b = 0.5$, fluctuations in economic activity basically no longer exist. Note also that interventions have an impact on consumer sentiment: fluctuations in consumer

[3] For a fixed value of A, the dynamics of the model is due to a first-order linear difference equation. Since 0<A<1, there is always a monotonic convergence towards the fixed point. See Westerhoff and Hohnisch (2007) for more details.

sentiment decrease, albeit not as strongly as the amplitude of national income. The dampening of consumer sentiment helps to stabilize the economy. If consumer sentiment is more balanced, then the variability of the average marginal propensity to consume declines, which, in turn, contributes to the taming of business cycles.

The first line of panels in figure 2 gives us a clearer view of the long-run consequences of level-adjusting interventions. The panels display the average absolute distance between national income and its long-run average value

$$gap = \frac{1}{T}\sum_{t=1}^{T}\left|Y_t - \overline{Y}\right| , \tag{10}$$

the average absolute size of the interventions

$$size = \frac{1}{T}\sum_{t=1}^{T}\left|G_t\right| \tag{11}$$

and the average accumulated net position of the government

$$position = \frac{1}{T}\sum_{t=1}^{T}G_t \ . \tag{12}$$

All statistics are based on T=100000 observations. We see that, as the intervention parameter increases, the output gap narrows. While the average size of intervention hovers around 0.2 units, which corresponds to 0.2 percent of the national income, the average position of policy makers is more or less flat. We may thus conclude that level-adjusting interventions may have some potential in stabilizing the economy.

---------- Figure 2 (consisting of part a, b and c) goes about here ----------

Let us turn to trend-offsetting interventions. In figure 3, we increase the control parameter c between 0, 0.8, 0.9, 0.925 and 0.949, while parameter b is equal to 0. At first sight, this policy also appears to be an effective stabilization instrument. For instance, for $c = 0.925$ fluctuations in economic activity are relatively moderate. However, the panels reveal that if one intervenes slightly too weakly or slightly too strongly, national income does not really become stabilized. This becomes even more evident when the second line of panels in figure 2 is inspected. We see that the output gap only decreases for a small window of parameter *b*. Otherwise, variability of national income may increase due to trend-offsetting interventions.

---------- Figure 3 goes about here ----------

Figure 4 investigates whether policy makers may have the chance to increase the average level of national income. In this figure, they apply a biased level-adjusting policy, that is, they vary their target output level between 100, 102, 104 and 106. While policy makers do not manage to push output exactly to these (biased) levels, they are nevertheless able to increase national income. [4] But this policy has a price. In the third line of panels of figure 2, the target output level of policy makers is set to 102. This policy requires on average higher interventions and, what is even more important, the net position of the government becomes unbalanced. This policy is presumably not viable in the long run.

---------- Figure 4 goes about here

6 Conclusions

The goal of our paper is to explore the impact of fiscal spending on the evolution of national income when the economy is influenced by consumer sentiment. We find that policy makers may indeed have some options available to them to shift output in a desired direction. For instance, a policy which seeks to adjust for income levels may push national income closer towards its long-run average value. However, our model also reveals that stabilizing fluctuations in economic activity is an intricate issue. Business cycles are apparently driven by swings in consumer sentiment, which, in turn, changes with respect to complex socio-economic interactions between consumers.

[4] As pointed out by one of the referees, similar results may hold for monetary policy rules. For instance, a monetary contraction might depress consumption through its effect on consumer sentiment.

Finally, we would like to point out some potential avenues for future research. Interaction between agents occurs randomly in our model (i.e. two agents are always randomly drawn from an urn and then – “after exchanging arguments” - put back into it again). It would be interesting to study also local interactions between agents, e.g. to look what happens if they are placed on a lattice. It would furthermore be interesting to use a somewhat more developed macroeconomic model, e.g. a simple dynamic IS-LM setup, to check how an endogenous interest rate may affect the dynamics of our model. Of course, one could even imagine that changes in consumer sentiment may cause growth cycles. In the framework discussed here, only consumers are subject to swings in sentiment. One may generalize this idea and let both consumers and investors display “animal spirits”.

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Captions for figures

Figure 1: A level-adjusting policy. The left-hand (right-hand) panels show the evolution of output (number of optimistic agents) for 10000 periods. From top to bottom, parameter *b* takes the values 0, 0.05, 0.1, 0.2 and 0.5. The other parameters are as in section 3.

Figure 2: Summary statistics of intervention rules. The panels show the impact of interventions on the output gap, the average size of the interventions and the average position of the government, respectively. First line of panels: Level-adjusting interventions. Parameter *b* is increased from 0 to 1 in 100 discrete steps. Second line of panels: Trend-adjusting interventions. Parameter *c* is increased from 0 to 1 in 100 discrete steps. Third line of panels: Biased level-adjusting interventions with target output level equal to 102. Parameter *b* is increased from 0 to 1 in 100 discrete steps. The other parameters are as in section 3.

Figure 3: A trend-adjusting policy. The left-hand (right-hand) panels show the evolution of output (number of optimistic agents) for 10000 periods. From top to bottom, the parameter *c* takes the values 0, 0.8, 0.9, 0.925, 0.949. The other parameters are as in section 3.

Figure 4: A biased level-adjusting policy. The left-hand (right-hand) panels show the evolution of output (number of optimistic agents) for 10000 periods. From top to bottom, the target output level takes the values 100, 102, 104 and 106. The policy maker’s control parameter is b=0.2. The other parameters are as in section 3.

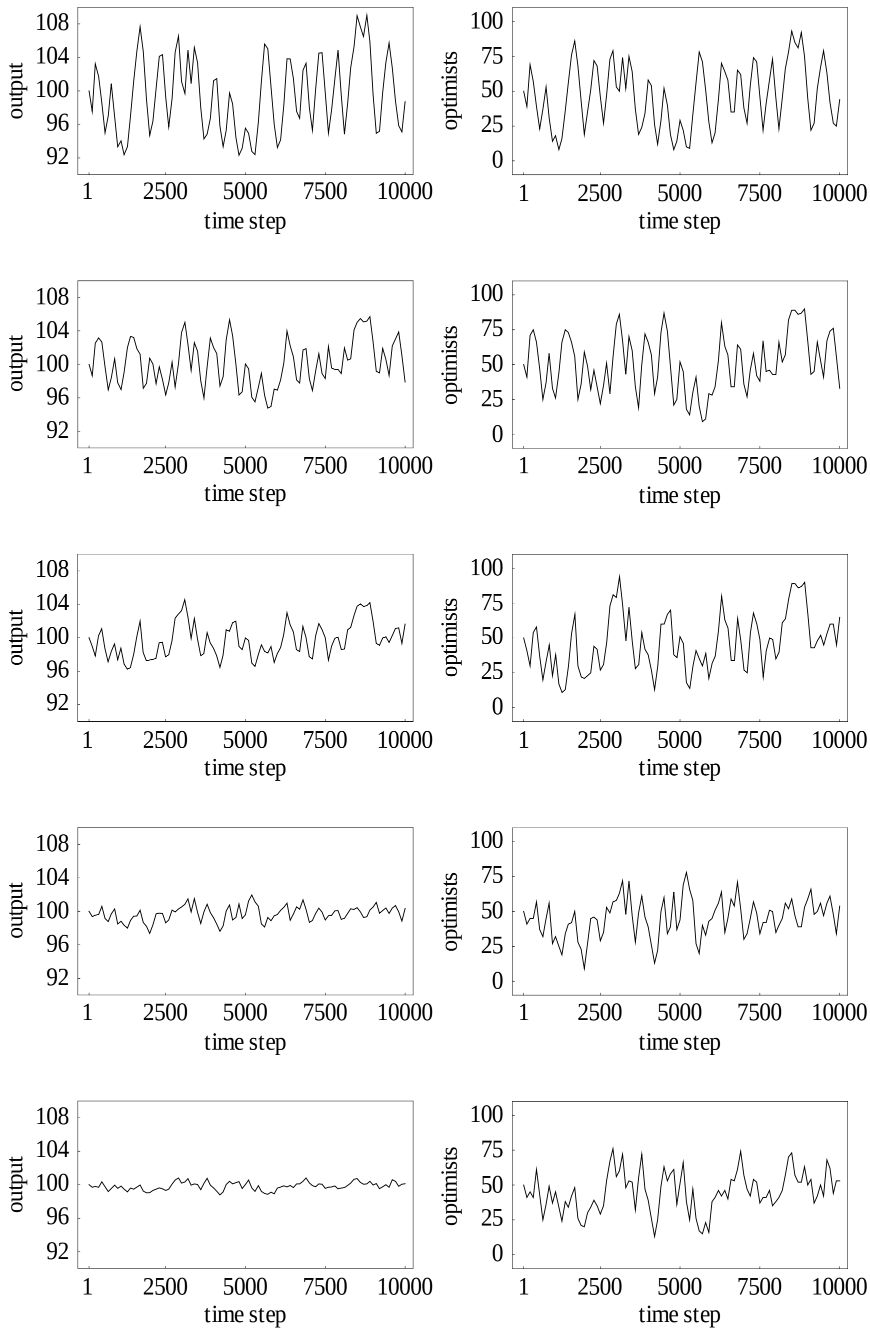
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Figure 1

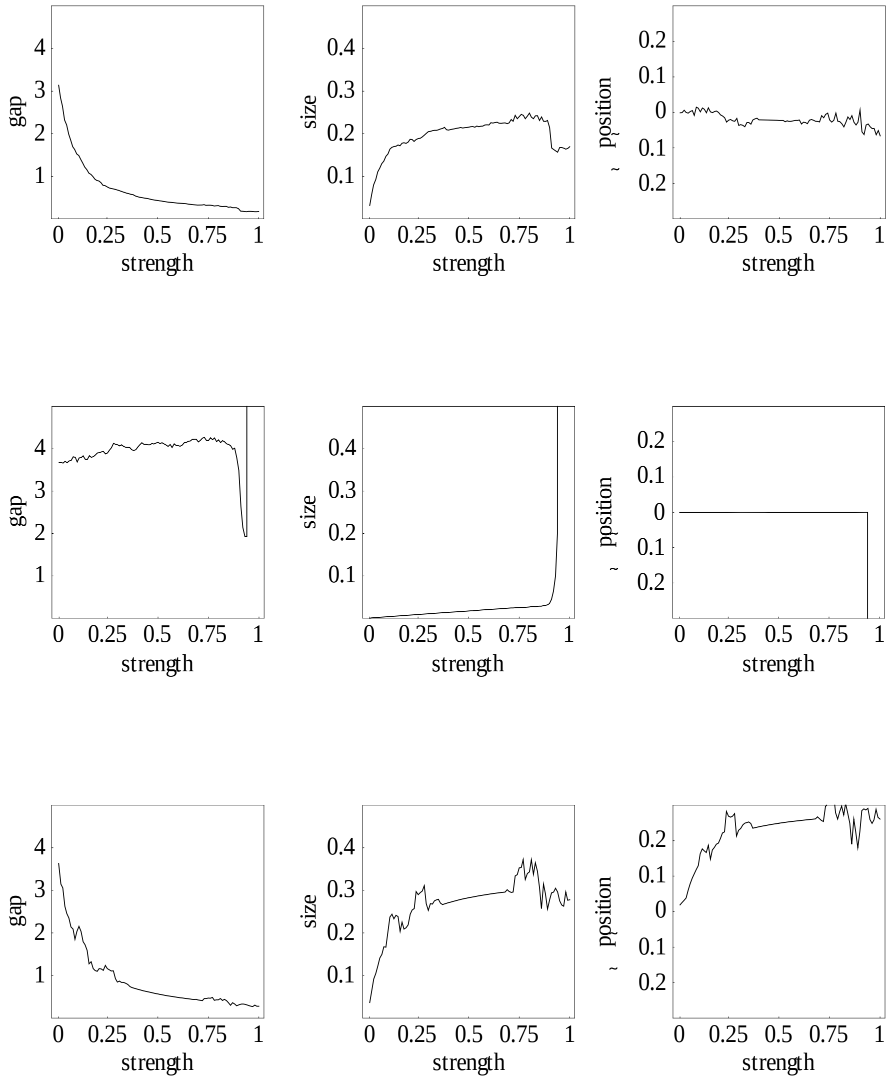
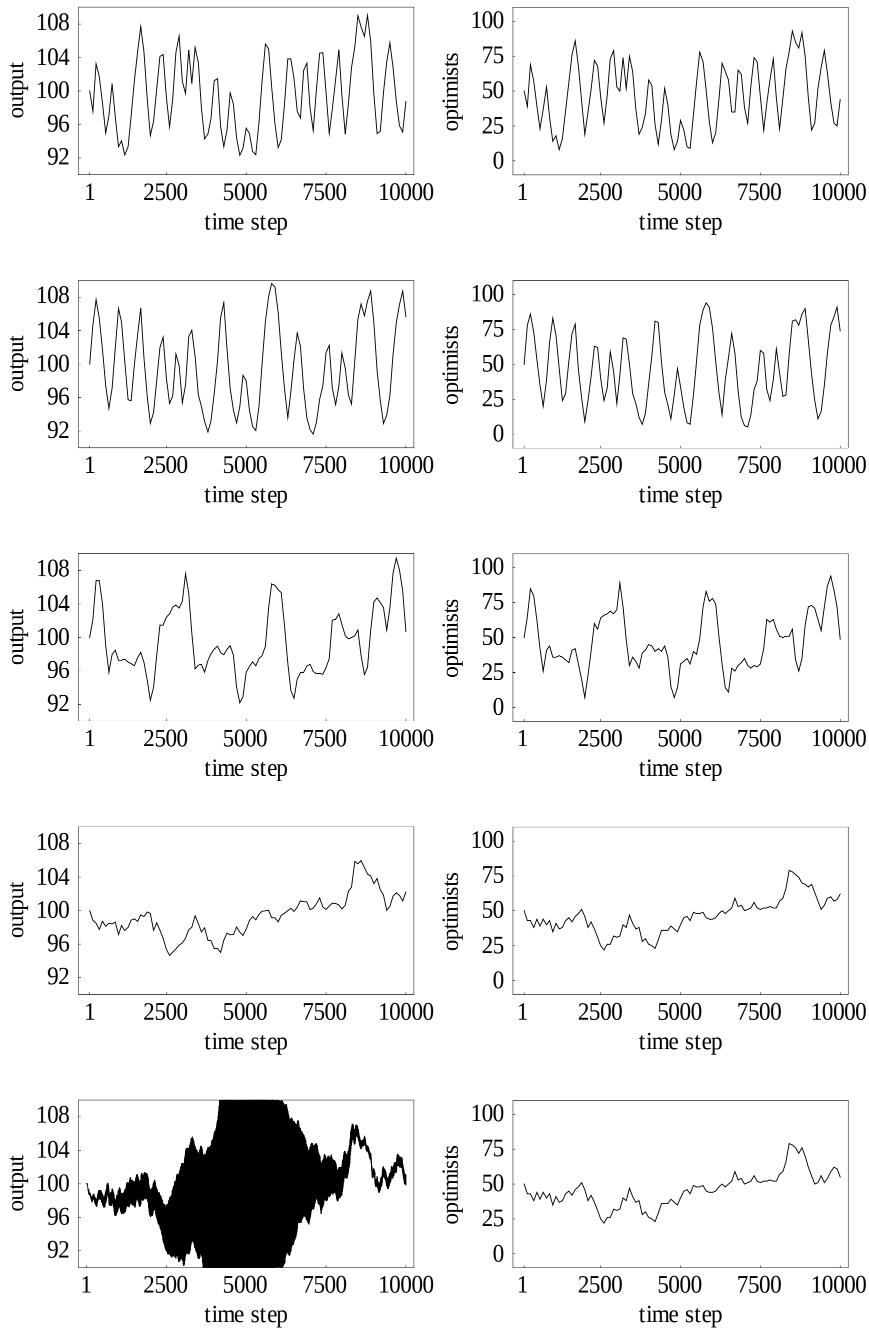


Figure 2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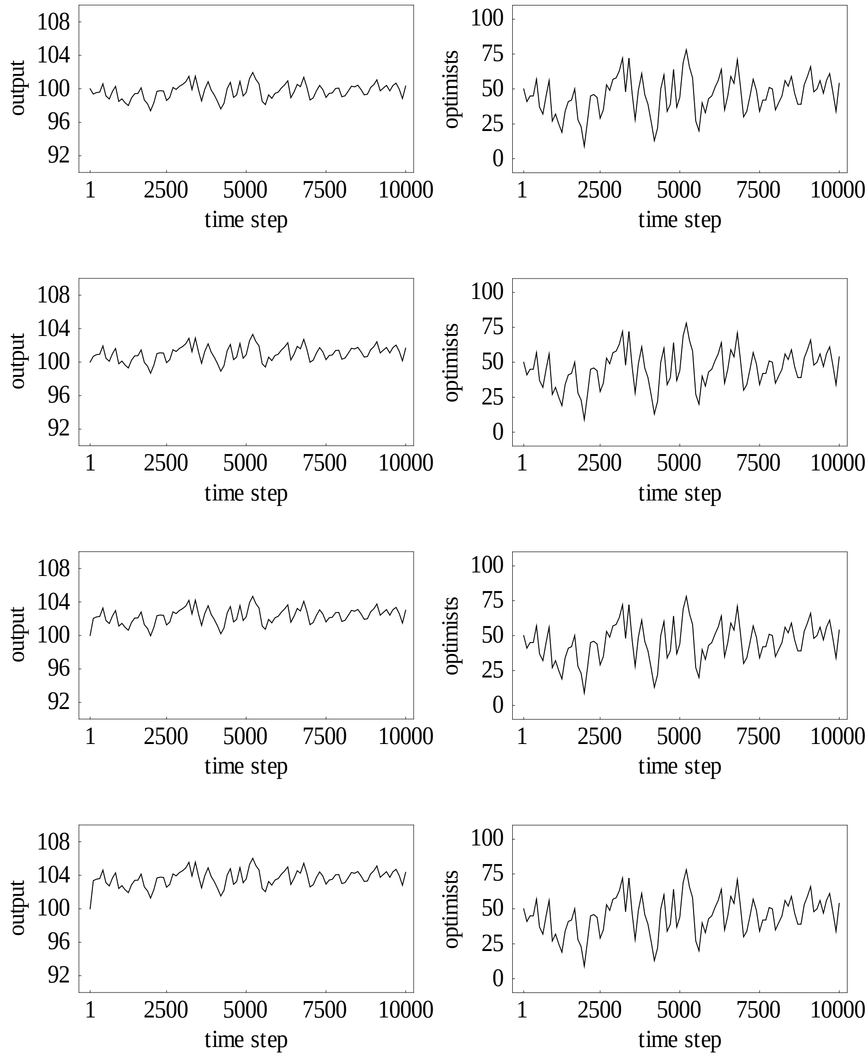
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Figure 4