

# A Post-Keynesian model of the business cycle

Pedro Leão<sup>\*</sup>

ISEG - School of Economics and Management, Universidade de Lisboa,  
and UECE – Research Unit on Complexity and Economics\*\*

## Abstract

This paper argues that the effect of a *rise* in investment on the rate of capacity utilization of an economy depends on the level of net investment. As long as net investment is not very high, a rise in investment leads to a paradoxical rise in capacity utilization - and thus to a new rise in investment in the following period. And so on. The result is an economic expansion. However, once net investment has grown over an expansion to a very high level, a further rise in investment reduces utilization - and thus leads to a decline in investment in the following period. The result is a recession.

**Keywords:** paradox of investment, dynamic analysis, Kaleckian growth models, business cycle, fiscal policy.

**JEL:** E32, E62

---

<sup>\*</sup> **Postal Address:** Pedro Leão, ISEG – Department of Economics, Rua Miguel Lupi, 20 1249-078 Lisbon, Portugal. **E-mail:** [pleao@iseg.ulisboa.pt](mailto:pleao@iseg.ulisboa.pt).

<sup>\*\*</sup> The Research Unit on Complexity and Economics is financially supported by FCT (Fundação para a Ciência e a Tecnologia), Portugal. This article is part of the Strategic Project (UID/ECO/00436/2013).

## **A Post–Keynesian model of the business cycle**

“As the [economic] system progresses in the upward direction, the forces propelling it upwards at first gather force and have a cumulative effect on one another, but gradually lose strength until at a certain point they tend to be replaced by forces operating in the opposite direction; which in turn gather force for a time and accentuate one another, until they too, having reached their maximum development, wane and give place to their opposite.” Keynes (1936, pp. 313-4)

This paper presents a model which aims to explain part of the forces behind the several stages of the cycle mentioned by Keynes – forces on the *real* side of the economy. It is however important to emphasize from the outset that a more complete explanation of the cycle should integrate other factors, in particular those analyzed by Minsky (1982) – expectations of entrepreneurs and their bankers, and the way these interact with financial conditions.

According to Keynes (1936, chapter 22), cyclical fluctuations in demand and output are mainly caused by fluctuations in investment. These in turn are brought about by oscillations in the marginal efficiency of capital associated with the volatile expectations of entrepreneurs. While accepting the validity of this view, this paper argues that there is additionally an *objective* mechanism that also contributes to explain the cyclical oscillations of demand and output. This is based on the interaction over time between the rate of utilization of production capacity and

investment – utilization influences investment which in turn affects utilization.

Post–Keynesian macroeconomics has focused on the determination of output in the short period or on the determination of the growth rate of output in the long period. By contrast, the model presented in this paper attempts to analyze *a sequence of short periods*, by investigating how each short period position leads to the next one. In this sense, it takes up the challenge of Casserta and Chick (1997) and constitutes a dynamic analysis of the economy set in historical time.

The model assumes a closed economy with government but without fixed costs/incomes. It is inspired by the canonical Kaleckian growth model, and in essence includes its three fundamental equations (cf. Lavoie, 2014, p. 361).<sup>1</sup> There are however two differences. First, because our objective is to explain the movements of output over the cycle rather than long-run growth, variables are considered in levels rather than in growth rates: output instead of its growth rate, investment instead of the growth rate of the capital stock, etc. The second difference is that in our model investment affects utilization not only because of its effect on demand and

---

<sup>1</sup> The Kaleckian growth model was initially suggested by Del Monte (1975), and then independently put forward by Dutt (1984) and Rowthorn (1981). An excellent exposition of the model can be found in Lavoie (2014, pp. 360-7).

output, *but also as a result of its effect on the production capacity of the economy.*

According to the Kaleckian growth model, economies converge to a long-run steady-state characterized by a constant rate of accumulation and a constant rate of capacity utilization. Yet, this conclusion is debatable. First, the Kaleckian steady-state rate of utilization is in general different from the desired rate, a conclusion that some authors find difficult to accept (Kurz, 1986; Auerbach and Skott, 1988).<sup>2</sup> Second, the real-world behavior of accumulation and utilization does not seem to support the existence of a steady-state equilibrium like the one envisioned by the Kaleckian model. In fact, rather than staying constant over time, investment and utilization are *always in a state of change*: they rise substantially in economic expansions and fall in recessions (Figures 1 and 2).

The model presented in this paper is not subject to these two criticisms. In fact, and first, the model reproduces the mentioned oscillations of investment and utilization over the cycle. Secondly, in the model entrepreneurs are always trying to achieve their desired rate of utilization. However, because of a macroeconomic paradox – the ‘paradox of investment’ - actual utilization always ends up going above or below

---

<sup>2</sup> Kaleckians have responded to this criticism (Amadeo, 1986; Dallery and Treeck, 2008). Skott (2012, pp. 117-25) and Hein et. al. (2012, pp. 145-54) present the views of each side of the debate.

that desired rate. In this way, the model explains why actual utilization should in general be different from the desired rate.

The paper is organized as follows. We begin with the relevant stylized facts, and then present the key equations of the model and the mechanisms that generate the cycle. Afterwards, we illustrate how the model helps make sense of the behaviour of real world economies, by using it to analyze the effects of the U.S. fiscal policy of 2009-10. The appendix presents the complete set of equations that make up the structural form of the model, and explains the way it differs from the Kaleckian growth model.

### **Stylized facts**

The key insights of this paper were first inspired by the cyclical behaviour of utilization, investment and profits (Figures 1, 2 and 3) and, in a second stage, by the facts presented in Tables 1 and 2 and in Figures 4 and 5. The original data of Table 1 is from the Federal Reserve Bank of St. Louis. Based on this, Harvey (2014, pp. 396-7) calculated the annual percent changes in GDP and in investment in three stages of each of the 10 U.S. cycles observed since 1950: expansions except the last year; the last year of

expansions; and recessions. The correspondent quarterly percent changes in profits were also calculated.

An average of the numbers is presented in Table 1. The major lesson that can be learnt is that expansions lose strength after a certain point. On average, in the last year of expansions GDP and investment growth slowed markedly, while the growth of profits stopped altogether.<sup>3</sup>

In turn, Figure 4 shows the behavior of *net* investment over U.S. cycles since 1947. As can be seen, net investment rose markedly over economic expansions and fell in recessions. However, net investment fell to negative values in only one recession; in the other recessions, it fell at most to zero.

Thirdly, Table 2 presents the average changes in capacity utilization in four stages of the seven U. S. cycles observed since 1967: the first two halves of expansions until utilization reached its peak; the last stage of expansions after the utilization peak; and recessions. Two conclusions can be drawn. First, the rise in utilization slows down significantly between the first and the second half of expansions before the utilization peak. Second, with one exception utilization starts to fall between six months and one

---

<sup>3</sup> In addition, Harvey's calculations show that, behind these averages, GDP growth slowed down in all late expansions and, with the exception of one of them, the same happened with investment. As for profits, their growth slowed in six of the late expansions and was actually negative in the remaining four.

year before the end of expansions (9.6 months on average). Similar conclusions can be drawn from Figure 5, which presents the *changes* in utilization observed in the U.S. in each year since 1967. As can be seen, rises in utilization tended to occur at lower and lower rates as expansions progressed, and were followed by actual declines in their final stages.

## **The model**

### *The key equations*

The model is centred on two ideas. The first is that investment has a dual effect on the economy: it affects aggregate demand and output; and it increases production capacity. Investment affects demand and output through the multiplier:

$$Y = \{ 1/[1 - (c_w.(1 - \pi) - c_p.\pi).(1 - \tau)] \}. (I + C_p^* + G) \quad (1)$$

Where  $Y$  is output,  $c_w$  and  $c_p$  are the marginal propensities to consume out of wages and out of profits,  $\pi$  is the profit share,  $\tau$  is the overall tax rate,  $I$  is investment,  $C_p^*$  is the autonomous consumption of capitalists and  $G$  is government expenditure (for simplicity, time subscripts “ $t$ ” are omitted).<sup>4</sup>

---

<sup>4</sup> Equation (1) is derived from equations (1A), (2A), (5A) and (7A) of the structural form of the model presented in the appendix. In an economy without government (hence  $\tau = 0$ ) and with no saving out of wages ( $c_w=1$ ), the multiplier would be reduced to the more familiar  $1/(s_p.\pi)$ ,  $s_p$  denoting the marginal propensity to save out of profits.

In turn, the effect of investment on production capacity is equal to net investment times the productivity of capital. Production capacity is given by:

$$Y_{FC} = a.K_{-1} + a.(I - \partial.K_{-1}) \quad (2)$$

Where  $a$  is the productivity of capital,  $K_{-1}$  is the capital stock and  $\partial.K_{-1}$  is capital depreciation (both of the previous period).

The second idea on which the model is based is that investment responds with a *lag* to deviations of the actual rate of utilization from a certain desired rate. Investment is given by:

$$I = \partial.K_{-1} + I_A + \gamma.(u_{-1} - u^*) \quad (3)$$

Where  $I_A$  denotes autonomous investment, and  $u$  and  $u^*$  represent the actual and the desired rates of utilization. Notice that, following Kalecki (1971, p. 110) and Keynes (1930, p. 159), induced investment responds with a lag to economic conditions; within a certain period (say, *a quarter*) it is fixed and does not react to changes in utilization. Autonomous investment is the part of investment not related to the rate of utilization and instead linked to other factors such as the expected long-run growth of sales.



Two types of arguments justify the above specification of the investment function. First, if the actual rate of utilization is above the desired rate, businesses will undertake positive net investment to increase their capital stock, and thereby try to reduce utilization towards the desired rate. In the opposite case, entrepreneurs will carry out negative net investment to reduce their capital stock and in that way try to raise utilization to the desired rate.

Second, changes in utilization over the cycle are strongly associated with changes in the profit rate and in total profits.<sup>5</sup> This provides two further reasons for investment to be influenced by utilization. First, Klein and Moore (1985, p. 254) present evidence that the actual profit rate influences the expected profit rate with a lag of three or four months. Therefore, because it is linked to the actual profit rate, utilization is also related with the expected profit rate. Secondly, because it is associated with total profits, utilization is also linked to firms' financial capacity to invest – “an important part of investment is financed out of retained profits. Moreover, the amount that a company puts up of its own finance influences the amount it can borrow from outside” (Robinson, 1962, p. 86). Brown et.

---

<sup>5</sup> With prices determined by a mark-up on direct unit costs, without fixed costs utilization, the profit rate and total profits would all vary in the same proportion over the cycle (see appendix, equations 9A and 10A) . In the real world with fixed capital and labour costs, changes in utilization over the cycle are associated with *amplified* changes in profits. (Lavoie, 2014, pp. 331-6).

al. (2009) and Fazzari and Mott (1986-7) provide empirical evidence that supports this fundamental point.<sup>6</sup>

### *The engine that drives expansions*

We start with a fundamental question of macroeconomics: *what makes aggregate demand grow?* According to mainstream economists, supply creates its own demand. The increases in aggregate demand along expansions are thus explained by the increases in aggregate supply in those periods. Post-Keynesian economists have a different view. They reject Say's Law, and argue that aggregate demand growth is instead determined by the growth of investment along expansions. While not proved, this view is suggested by the fact, presented in Table 1, that investment grows more than aggregate demand along expansions (and falls more than aggregate demand in recessions).

But the Post-Keynesian view poses another fundamental question:

*what makes firms increase investment year after year over expansions?*

---

<sup>6</sup> Two final notes the above investment function. (i) In the initial Keynesian models of the cycle, investment depended on past *changes in demand* (Harrod, 1936; Samuelson, 1939; Hicks, 1950). These models were abandoned because of the lack of realism of that rigid form of the accelerator and because they failed to reproduce the main features of real-world cycles. In contrast, our investment function relies on a more flexible form of the accelerator, which is more in line with the empirical evidence and which is a standard element of Kaleckian growth models. (ii) Bhaduri and Marglin (1990) have argued that the Kaleckian investment function that we use should *in addition* include the profit share. The argument is that investment depends on a single variable, the profit rate, and that this depends not only on utilization but also on the profit share:  $P/K = (P/Y) \cdot (Y/Y_{FC}) \cdot (Y_{FC}/K)$ , where  $P/K$  is the profit rate,  $P/Y$  is the profit share,  $Y/Y_{FC}$  is the rate of utilization, and  $Y_{FC}/K$  is the productivity of capital. Be as it may, the argument developed in this paper does not hinge on changes in the profit share, and therefore the investment function (3) is appropriate for our purposes. Lavoie (1995, pp. 795-802) presents the critiques the Kaleckian investment function has been subject to and the Kaleckian responses to them.

The answer implied by Keynes (1936, p. 313) is that investment depends on entrepreneurs' optimism, and this rises year after year along expansions. Instead, we will propose an answer based on objective factors. This answer can be viewed as complementary to Keynes's and, in addition, may help explain how the growing optimism of entrepreneurs along expansions may come about.

We begin at the point of an expansion when utilization eventually rises above the desired rate. When this happens, entrepreneurs raise induced investment above the reposition level in an attempt to reduce utilization back towards the desired rate. If only a *single* individual entrepreneur acted in this way, his productive capacity would rise relative to his output, and therefore the rate of utilization would go down towards the desired level.

But when *many* entrepreneurs raise their investment from the reposition level, besides increasing the productive capacity of the economy, they unconsciously provoke a macroeconomic effect: they increase aggregate demand and output. As a result, actual utilization does not necessarily fall back towards the desired rate. Instead, if the capacity effect (given by the productivity of capital) happens to be smaller than the aggregate demand effect (given by the multiplier), actual utilization will paradoxically move further above the desired rate.

Is the productivity of capital smaller than the multiplier? (i) Ponder first on the value of the multiplier. If we consider an overall tax rate of 0.4, the stylized facts  $c_p=0.4$ ,  $c_w=0.9$  and  $\pi=0.4$  mentioned by Lavoie (2014, p. 369 and p. 380) point to a multiplier of 1.72. Ninety percent of this value is associated with the initial change in investment expenditure plus the first and second rounds of consumption expenditure that follow it. Therefore, almost all of the effect of the multiplier occurs within a short period of time - probably one quarter, at most one semester. (ii) On the other hand, Lavoie (2014, p. 380) and Sherman (1991, p. 179) mention a productivity of capital of 1/3 per year (1/12 per quarter) as a stylized fact.<sup>7</sup> (iii) Therefore, we can conclude that the productivity of capital, 1/12 per quarter, is smaller than the multiplier effect, 1.55 ( $= 0.9 * 1.72$ ) exerted over one quarter.

Moving back to our argument, we can now illustrate numerically how a self-sustained expansion may be brought about. Assume that the reposition level of investment is fixed at \$100, that the productivity of capital per quarter is 1/10, and that the multiplier is 1.5 (the full operation of which requires one quarter; *if it required a longer period of time, the*

---

<sup>7</sup> A somewhat higher value, 0.38 per year, is obtained through the following procedure. (i) For the years from 1967 to 2015, the reciprocals of the rates of utilization of the total U. S. industry multiplied by actual outputs yield estimates of the full-capacity outputs of the corresponding years. (ii) In turn, these estimates of the full-capacity outputs divided by the capital stocks of the corresponding years provide estimates for the productivities of capital of the various years. (iii) The average value of these estimates between 1967 and 2015 was equal to 0.38.

*result would be the same*, as explained in the next section).<sup>8</sup> In this setting, consider a period  $t$  of an expansion when utilization eventually rises above the desired rate. In response to this, in *period  $t+1$*  entrepreneurs will raise induced investment above the reposition level, say from \$100 to \$110, in an attempt to drive utilization back to the desired rate. However, this will lead to a bigger increase in demand,  $\$10 \times 1.5$ , than in productive capacity,  $\$10 \times (1/10)$ , and therefore will end up in a paradoxical increase in utilization further above the desired rate. Output will rise according to demand and profits will rise in an amplified way. To fix ideas:

$\uparrow u_t \text{ above } u^* \Rightarrow \uparrow I_{t+1} \text{ above reposition} \Rightarrow \uparrow \text{demand}_{t+1} > \uparrow \text{capacity}_{t+1} \Rightarrow$   
 $\Rightarrow \uparrow u_{t+1} \text{ further above } u^* \Rightarrow \uparrow \text{profits}_{t+1}.$

And this process – which may be called the ‘paradox of investment’ - will repeat itself over several periods. Indeed, the mentioned rise in utilization in  $t+1$  will lead to a new increase in investment in  $t+2$ , which will again have a bigger effect on demand than on capacity, and thus will lead to a new rise in utilization in  $t+2$ . And so on.

Five final notes. First, along the way profits will rise with utilization and reinforce the upward movement. Second, the description assumes so far that entrepreneurs judge the future rates of utilization and profit by their

---

<sup>8</sup> For simplicity, we neglect the fact that capital accumulation along the expansion will imply increasing levels of reposition investment and assume this fixed at \$100.

current levels. But if they develop a state of mind in which increasing utilization and profit rates lead them to expect further increases in the future, the boom will be exacerbated. Third, the above process may be the engine behind the sustained increases in utilization, profits and investment observed along expansions (Figures 1, 2 and 3). Fourth, the expansions after 1970 have been enhanced by rises in the propensity to consume and in the multiplier; the opposite happened with pre-1970 expansions (Figure 6). Fifth and fundamentally, besides providing an understanding of the self-sustained nature of expansions, the paradox of investment has a more general application in macroeconomics – namely, it helps us move from a static to a dynamic analysis of demand shocks. Here is one example. The analysis of fiscal austerity is usually restricted to its multiplier effect on consumption and output in the short-period. But this short-period effect has an impact on the next short-period, and so on. Specifically, the initial decline in utilization in the short-period resulting from the multiplier effect of austerity reduces investment and thus utilization in the *next short-period*, and so on; that is to say, it depresses the paths of these two variables (and those of consumption and output) along a whole sequence of short periods. This being so, it is not surprising that the effects of the fiscal austerity implemented in the Euro Area after 2010 turned out to be much worse than initial forecasted (as recognized by the IMF (2012, pp. 41-3) itself). In fact,

austerity affected not only consumption in the short period, but also investment and consumption over a sequence of short-periods. Over a period of three years, investment fell around 20 percent in Italy and Spain, 30 percent in Portugal and 45 percent in Greece; and, with the exception of Spain, it has stagnated thereafter until today (Ameco database).

*Relationship between increases in investment and increases in demand if the operation of the multiplier requires more than one quarter*

It is now important to explain that if, instead of just one quarter the operation of the multiplier requires one semester, a whole year, or even more, the relation between the increases in investment in the various quarters of an expansion and the increases in demand in the corresponding quarters still ends up being given by the full value of the multiplier.

Suppose first that the operation of the multiplier requires *one semester* (say, because the first and the second rounds of consumption expenditure only take place in the quarter *after* the increase in investment that generates them). In this case, the \$10 increase in investment that takes place in the *first* quarter of the expansion described in the previous section leads to an increase in aggregate demand of only \$10 in that first quarter (instead of \$15). However, in the second quarter of the expansion demand will rise by \$15: \$10 as a result of the increase in investment in that second

quarter plus \$5 associated with the increases in consumption resulting from the increase in investment in the previous quarter. Extending this reasoning forward leads to the conclusion that the \$10 increases in investment in the various quarters of the expansion end up being associated with \$15 increases in demand in the corresponding quarters: \$10 of increases in investment plus \$5 of increases in consumption resulting from the increases in investment in the preceding quarters.

A quick look at Table 3 leads to the conclusion that the same happens if the operation of the multiplier requires *three quarters* (say, because the first and the second rounds of consumption expenditure take place, respectively, in the first and the second quarters *after* the quarter of the increase in investment that generates them). The only difference is that it now takes three instead of two quarters for the \$10 increases in investment to start generating \$15 increases in aggregate demand.

General conclusion: if the multiplier requires more than one quarter to exert its effect, the relation between the increases in investment in the various quarters of an expansion and the increases in demand in the corresponding quarters still ends up being given by the full value of the multiplier; the only difference is that it will take more than one quarter for that to start to happen.



### *The boom loses strength*

In the real world utilization rates do not rise through the roof. In U.S. expansions, they have risen up to only 85-90 percent (Figure 1). So the question is: what does eventually tame the upward movement described on pages 12-13 above?

Here is a possible answer. As investment grows period after period along an expansion, successive increases in investment continue to have a multiplier effect on demand of roughly the same size. But, because they are associated with higher and higher levels of *net* investment, they generate larger and larger increases in production capacity.<sup>9</sup> As a result, the paradox of investment loses strength: the increases in utilization become smaller and smaller.

Although progressively smaller, these rises in utilization still continue to lead to increases in investment – but at slower and slower rates. Therefore, the expansion loses strength. This argument is in line with the behavior of net investment, utilization, gross investment and output over U.S. expansions (Figures 4 and 5 and Tables 1 and 2).

---

<sup>9</sup> For example, the \$10 increase in gross investment earlier in the expansion from \$100 to \$110 led to a net investment of \$10 and to an increase in capacity of  $\$10 \times (1/10)$ ; but the same \$10 increase in gross investment later in the boom, say from \$190 to \$200, translates into a bigger net investment, \$100, and into a bigger increase in capacity,  $\$100 \times (1/10)$ .

### *The crisis*

Once net investment has grown to a very high level, a subsequent increase in investment will eventually start to have a smaller effect on demand than on capacity. For example, at a very late stage of the expansion the same \$10 increase in gross investment, say from \$250 to \$260, will still imply an increase in demand of  $\$10 \times 1.5$  - but a bigger increase in capacity,  $\$160 \times (1/10)$ . Consequently, the paradox of investment ceases to hold: utilization falls. This in turn leads to a decline in investment and thus in output. In sum, once net investment has grown to a very high level:

$$\uparrow I_t \Rightarrow \uparrow \text{demand}_t < \uparrow \text{capacity}_t \Rightarrow \downarrow u_t \Rightarrow \downarrow I_{t+1} \Rightarrow \downarrow \text{output}_{t+1}$$

Note that this argument is distinct from the old ‘over-investment’ account of crises. According to this, investment falls because at the end of the boom there is too much capital – in other words, the rate of capacity utilization is *too low*.<sup>10</sup> This view is not supported by the data (Figure 1). In contrast, according to our argument investment falls because at the end of the boom a further rise in investment leads to a *decline* in utilization, a view that is generally consistent with the data (Figure 1 and Table 2).

---

<sup>10</sup> In Keynes’s words (1936, pp. 320-1): “[According to the over-investment theory, at the end of the boom] every kind of capital-goods is so abundant that no new investment is expected, even in conditions of full-employment, to earn in the course of its life more than its replacement cost.”

On the other hand, it should be said that the decline in utilization at the end of the boom is just one of the factors contributing to the observed crises – and probably not the most important in several of them. In fact, and first, some observed economic crises – including the most acute ones - are the result of financial crises, whose origins and contours have been explained by Minsky (1982). Secondly, the declines in investment that lead to some crises may also be caused by the reductions in profits triggered by the rising costs in raw materials that typically occur in the last third of expansions (Figure 7; see also Sherman, 1991, p. 222 and p. 259); with one or two exceptions, real interest rates do not rise significantly in the second half of expansions and thus cannot contribute to explain that decline in investment (Figure 8). Last but not least, some crises may be primarily caused by the too optimistic expectations that entrepreneurs tend to develop over a boom:

“It is an essential characteristic of the boom that investments which will in fact yield, say, 2 per cent in conditions of full-employment are made in the expectation of a yield of, say, 6 per cent ... When the disillusion comes, this expectation is replaced by a contrary ‘error of pessimism’, with the result that the investments, which would in fact yield 2 per cent in conditions of full-employment, are expected to yield less than nothing; and the resulting collapse of new investment then leads to a state of

unemployment in which [those] investments ... in fact yield less than nothing.” (Keynes, 1936, pp. 321-2).

### *The recession*

As mentioned, according to our model the decline in utilization at the end of the boom reduces investment and thus output. One consequence is a decline in profits. On the other hand, net investment falls at first to a level that is positive (Figure 4). Therefore, capacity keeps on rising, at a time when output is declining. As a result, there is *a new* decline in utilization which, along with the dwindling profits, produces a further decline in investment. And so on. Needless to say, if entrepreneurs develop a state of mind in which declining utilization and profit rates lead them to expect further declines in the future, the recession will be intensified. This account of recessions is in line with the data (Figures 1, 2 and 3).

### *The revival*

Before World War 2, some revivals of economic activity might have occurred for the following reason. Once gross investment dropped to very low levels, it could not fall much further and would become stagnant – and, as a result, the same would happen with demand and output. A period would then arise when investment remained below the reposition level - implying an erosion of capacity - and output was more or less stagnant.

This state of affairs would lead to a gradual increase in utilization, which would eventually induce a revival of investment. In the famous words of Keynes (1936, p. 318): “[After a sufficient interval of time has passed], the shortage of capital through use, decay and obsolescence causes a sufficiently obvious scarcity to increase its marginal efficiency.”<sup>11</sup>

By contrast, in post-war recessions the U. S. capital stock has barely decreased – with one exception, gross investment has at most fallen to reposition levels (Figure 4). Therefore, the pre-war explanation of revivals no longer applies; the fact that these occur when utilization is at its lowest levels (Figure 1) reinforces this conclusion. Which factors may then explain the revivals of investment that have initiated post-war economic expansions? The answer is probably the following one. A significant part of investment is not related to the rate of capacity utilization. Instead, it includes investment associated with innovations, housing investment associated with population growth, and investment which is only expected to pay for itself over a long period and which is linked to the expected long-run growth of sales (e. g. a hydroelectric dam). This autonomous part of investment is related to the overall size of the economy and is subject to a *rising trend*. This being so, we may recast the pre-war explanation of revivals in the following way. Once *induced* gross investment drops to very

---

<sup>11</sup> This increase in the marginal efficiency would be enhanced by the erasure of the bad memories of the contraction as time went by (Keynes, 1936, p. 317).

low levels in a recession, it cannot fall much further. Therefore, its decline begins to be offset by the rising trend of autonomous investment and thus to be associated with a revival of overall investment. In turn, this leads to an increase in utilization (Figure 1) and thereby to a new economic expansion.

Finally, it should be noted that two other aspects may have also contributed to the revivals of investment that initiated post-war economic expansions: (i) the positive effect on profits of the sharp decline in the cost of raw materials relative to consumer prices that typically occurred in the post-1970 recessions (Figure 7; see also Sherman, 1991, p. 222 and p. 261); (ii) and, less importantly, the declines in real interest rates that occurred in two or three recessions (Figure 8).

### **The effects of the expansionary U. S. fiscal policy of 2009-10**

We now illustrate how the model can help us *think dynamically* about real world economies, by using it to analyze the effects of the U.S. expansionary fiscal policy of 2009-10.

### *The effect on the path of output*

The stimulus package of the Obama Administration of 2009-10 translated into a rise in total U.S. government spending between the first and the third quarters of 2009, followed by stabilization at a high level until the third quarter of 2010. Afterwards, the expiration of the stimulus package led to a decline in total government spending. All this is shown in Figure 9.

According to short-period multiplier analysis, this behavior of government spending should have led to rises in output from mid-2009 to mid-2010, followed by declines in output afterwards. Thus, the U.S. Congressional Budget Office estimated the effect of the Obama stimulus on GDP shown in Figure 10. And, based on this, Krugman (2011) argued that “the U.S. federal government has been practicing destructive fiscal austerity since the middle of 2010 - and that’s not even talking about what’s happening at the state and local level”.

Yet, instead of falling after 2010 output kept on rising ever since (Figure 11). How was this possible at a time of “destructive austerity”? The model presented in this paper suggests the following answer. The Obama stimulus led to a revival of economic activity after the middle of 2009. This afterward led to rises in utilization and profits, which in turn produced a revival of business investment in the beginning of 2010

(Figures 12, 13 and 14). As a result, a dynamic interplay between rising utilization and profits and increasing investment followed – and this brought about a continuous expansion of output.

### *The effect of expansionary policy on the debt-to-GDP ratio*

We now analyze the implications of our argument on the debate about the effects of fiscal policy on the sustainability of public finances.

It is possible to argue that expansionary policy tends to reduce the debt-to-GDP ratio in the *short-term* (Leão, 2013). (i) Through the multiplier a fiscal stimulus raises output – the denominator of the ratio. (ii) On the other hand, the higher GDP brings about larger tax revenues and lower government social transfers. Therefore, the rise in government spending translates only partially into an increase in debt – the numerator of the mentioned ratio. (iii) Since it raises both the numerator and the denominator, a rise in government expenditure has *a priori* an uncertain effect on the debt-to-GDP ratio. (iv) However, if we do the arithmetic using estimates of the relevant parameters (the multiplier, the tax rate and the impact of a higher output on social transfers), we conclude that a rise in government spending raises public debt by a smaller percentage than GDP – and therefore leads to a lower debt-to-GDP ratio.



However, according to the theory of the multiplier this is only a short-term result. The reason is that when the fiscal stimulus is withdrawn output falls back to its initial level – *but the larger debt remains*. Thus, after a brief decline, the debt-to-GDP ratio will rise above its level before the stimulus.<sup>12</sup>

By contrast, according to this paper's model (i) if the stimulus is withdrawn only after it has started a virtuous spiral of rising utilization, profits and private investment, output will grow continuously. (ii) In turn, the growing output will generate swelling tax revenues and decreasing government social transfers – and thus lead to a continuous improvement of the budget balance and of the path of public debt. (iii) Finally, the decelerating (or declining) debt and the growing GDP will lead to a continuous deceleration (or reduction) of the debt-to-GDP ratio.

The evolution of the U.S. public finances since 2010 illustrates this point. The economic expansion that followed the Obama stimulus led to a big decline in the budget deficit, from almost 10 percent in 2009 to a little over 2 percent of GDP in 2015 (Figure 15). This combination of dwindling

---

<sup>12</sup> The result will be the same if the stimulus is *not* withdrawn and government spending stays constant at the higher level. In fact, while in this case output will stay constant rather than fall back to its initial level, the budget deficit will remain. Therefore, public debt will keep on growing period after period, and so will the debt-to-GDP ratio.

budget deficits and rising nominal GDP in turn led to a halt in the increase of the debt-to-GDP ratio since 2013 (Figure 16).

The contrast with the evolution of the Eurozone is worth noting (Table 4). Since the implementation of austerity in 2011, Eurozone's output has been roughly stagnant: GDP in 2015 was only 1.3 percent higher than in 2011 (the U.S. GDP was 8.8 percent higher). And because the stagnant output prevented an automatic growth in tax revenues and an automatic reduction in government social transfers, the budget deficit declined by only 2.2 percent of GDP between 2011 and 2015 - despite all the austerity. Over the same period the U.S. budget deficit fell by 6.1 percent of GDP.

## **Conclusion**

Post-Keynesian macroeconomics focuses on the analysis of the short-period or on the study of the long-period. In contrast, this paper analyzed how successive short-period positions lead to one another. It was argued that successive short-period positions are linked through the following mechanism:

Utilization and profits of a period  $t$  influence investment of *period*  $t+1$ . This in turn affects utilization and profits of period  $t+1$ , which afterwards influence investment of period  $t+2$ . And so on.

Based on this dynamic interaction, the paper presented the following account of the business cycle. (i) The growth of aggregate demand along expansions is driven by the following mechanism. When in a period  $t$  utilization eventually rises above the desired rate, in period  $t+1$  entrepreneurs respond by raising induced investment above the reposition level, in an attempt to drive utilization back to the desired rate. However, this leads to a bigger increase in demand than in capacity, and therefore ends up in a paradoxical increase in utilization in  $t+1$ . Output rises according to demand and profits rise in an amplified way.

And this process – the paradox of investment - repeats itself over several periods. In fact, the mentioned rise in utilization in  $t+1$  leads to a new increase in investment in  $t+2$ , which again has a bigger effect on demand than on capacity, and thus leads to a new rise in utilization in  $t+2$ . And so on. Along the way profits rise markedly with utilization and reinforce the upward movement. *This account of expansions is the main contribution of the paper.*

(ii) As investment grows period after period along an expansion, the successive increases in investment continue to have roughly the same multiplier effect on demand. But, because they are associated with increasingly higher levels of net investment, they generate larger and larger increases in production capacity. As a result, the paradox of investment

loses strength: the increases in utilization become smaller and smaller. Although progressively smaller, these rises in utilization still continue to lead to increases in investment – but at slower and slower rates. As a result, the expansion loses strength.

(iii) Once net investment has grown over the expansion to a very high level, a further rise in investment will start to have a smaller effect on demand than on capacity. Consequently, the paradox of investment ceases to hold: utilization falls. This in turn leads to a decline in investment and in output: a crisis.

(iv) The reduction of output then causes a decline in profits and a *new* decline in utilization. In turn, these declines produce a further reduction in investment and thus in output. And so on.

(v) Once induced gross investment drops to very low levels, it cannot fall much further. Therefore, its decline begins to be offset by a rising trend of autonomous investment and thus to be associated with a revival of overall investment. In turn, this leads to an increase in utilization and thereby to a new economic expansion.

Needless to say, the model just summarized does not provide a complete explanation of the cycle. In particular, and as mentioned along the

text, the explanation of the upper and lower turning points of the cycle should include other important factors.

Using fiscal policy as an example, the last pages of the paper illustrated how the model can help us think dynamically about real world economies. According to the static multiplier analysis, a fiscal stimulus raises GDP and lowers the debt-to-GDP ratio in the short-term. However, when the fiscal stimulus is withdrawn, output will fall back to its initial level and the debt-to-GDP ratio will rise above its level before the stimulus.

By contrast, according to the dynamic analysis developed in this paper, if the fiscal stimulus is carried out for a period long enough to start a virtuous spiral of rising utilization, profits and investment, it will set off an economic expansion. In turn, this will lead to a continuous reduction of the budget deficit and to a correspondent slowdown in the growth of public debt. And this, combined with the growing GDP, will lead to a deceleration and eventual reduction of the debt-to-GDP ratio.

## REFERENCES

- Amadeo E. (1986): 'The role of capacity utilization in long-period analysis', *Political Economy: Studies in the Surplus Approach*, 2 (2), pp. 147–59.
- Auerbach P. and Skott, P. (1988): 'Concentration, competition and distribution', *International Review of Applied Economics*, 2 (1), pp. 42–61.
- Bhaduri A. and Marglin S. (1990): 'Unemployment and the real wage: the economic basis for contesting political ideologies', *Cambridge Journal of Economics*, 14 (4), pp. 375–94.
- Brown J., Fazzari S. and Petersen B. (2009) 'Financing Innovation and Growth: Cash Flow, External Equity, and the 1990s R&D Boom', *Journal of Finance*, 64(1), pp. 151-185.
- Caserta M. and Chick V. (1997): 'Provisional equilibrium and macroeconomic theory', in Arestis P., Palma G. and Sawyer M. (eds.), *Markets, Employment and Economic Policy: Essays in Honour of G. C. Harcourt*, vol. 2, pp. 223-237, Routledge, London.
- Dallery T. and Treeck T. (2011): 'Conflicting claims and equilibrium adjustment processes in a stock-flow consistent macro model', *Review of Political Economy*, 23 (2), pp. 189-212.
- Del Monte A. (1975): 'Grado di monopolio e sviluppo economico', *Rivista Internazionale di Scienze Sociali*, 83 (3), pp. 261–83.
- Dutt A. (1984): 'Stagnation, income distribution and monopoly power', *Cambridge Journal of Economics*, 8, pp. 25–40.

Fazzari S. and Mott T. (1986-7): ‘The investment theories of Kalecki and Keynes: an empirical study of firm data, 1970-1982’, *Journal of Post Keynesian Economics*, 9(2), pp. 171—87.

Harrod, R. (1936): *The Trade Cycle*, Oxford University Press, Oxford.

Harvey J. (2014): ‘Using the General Theory to Explain the U.S. Business Cycle, 1950-2009’, *Journal of Post Keynesian Economics*, 2014, 36(3), pp. 391-414.

Hein E., Lavoie M. and van Treeck T. (2012): ‘Harroddian instability and the ‘normal rate’ of capacity utilization in Kaleckian models of distribution and growth – a survey’, *Metroeconomica*, 63(1), 139-169.

Hicks, J. (1950): *A Contribution to the Theory of the Trade Cycle*, Oxford University Press, New York.

International Monetary Fund (2012): *Coping with High Debt and Sluggish Growth*, World Economic Outlook, October.

Kalecki M. (1971): *Selected Essays on the Dynamics of the Capitalist Economy*, Cambridge University Press, Cambridge.

Keynes J.M. (1930): *A Treatise on Money*, volume VI, The Collected Writings of J. M. Keynes, edited by D. Moggridge, Macmillan, London.

Keynes J.M. (1936): *The General Theory of Employment, Interest and Money*, Macmillan, London.

Klein P. and Moore G. (1985): *Monitoring Growth Cycles in Market-Oriented Countries*, Ballinger, Cambridge Mass.

Krugman P. (2011): ‘The effect of the Obama stimulus on the level (not the rate of growth) of GDP’, Nov 23, *New York Times Blog*.

- Kurz H. (1986): 'Normal positions and capital utilization', *Political Economy*, 2(1), pp. 37–54.
- Lavoie M. (1995): 'The Kaleckian model of growth and distribution and its neo-Ricardian and neo-Marxian critiques', *Cambridge Journal of Economics*, 19 (6), pp. 789–818.
- Lavoie M. (2014): *Post-Keynesian Economics: New Foundations*, Edward Elgar, Cheltenham.
- Leão P. (2013): 'The Effect of Government Spending on the Debt-to-GDP Ratio: Some Keynesian Arithmetic', *Metroeconomica*, 64 (3), pp. 448-465.
- Minsky H. (1982): *Can "It" Happen Again? Essays on Instability and Finance*, M.E. Sharpe, New York.
- Robinson J. (1962): *Essays in the Theory of Economic Growth*, Macmillan.
- Rowthorn B. (1981): 'Demand, real wages and economic growth', *Thames Papers in Political Economy*, Autumn, pp. 1-39.
- Samuelson, P. (1939) 'Interactions between the multiplier analysis and the principle of acceleration', *Review of Economic Statistics*, 21, pp. 75–8.
- Sherman H. (1991): *The Business Cycle: Growth and Crisis under Capitalism*, Princeton University Press, New Jersey.
- Sherman H. (2010): *The Roller Coaster Economy: Financial Crisis, Great Recession and the Public Option*, M.E. Sharpe, New York.
- Skott P. (2012): 'Theoretical and empirical shortcomings of the Kaleckian investment function', *Metroeconomica*, 63 (1), pp. 109-138.



## Appendix

This appendix presents the set of equations that make up the structural form developed in the paper, and then explains the way it differs from the Kaleckian growth model.

### The structural form of the model

We consider a closed economy with government but without fixed costs/incomes. For simplicity, time subscripts “t” are omitted.

#### *Aggregate demand and output*

Aggregate demand - composed by consumption, investment and government expenditure - determines output:

$$Y = C + I + G \quad (1A)$$

Consumption is a proportion of total wages plus consumption out of profits (which includes an autonomous component):

$$C = c_w \cdot W + C_p^* + c_p \cdot P \quad (2A)$$

Investment includes an autonomous component and responds with a lag to capital depreciation and to the gap between actual and desired rates of utilization:

$$I = \partial \cdot K_{-1} + I_A + \gamma \cdot (u_{-1} - u^*) \quad (3A)$$

### *Pricing and income distribution*

Firms set their prices through a mark-up on unit labour costs:

$$\text{Price} = (1 + \theta) \cdot (w/q) \quad (4A)$$

Where  $w$  is the nominal wage and  $q$  is the average labour productivity.

Aggregate income is composed by wages and profits:

$$Y = W + P \quad (5A)$$

The share of profits in aggregate income is determined by the mark-up:

$$\pi = \theta / (1 + \theta) \quad (6A)$$

Tax revenues are equal to the tax rate times aggregate income:

$$T = \tau \cdot (W + P) \quad (7A)$$

### *Utilization and profit rates*

Utilization is the ratio between output and full-capacity output:

$$u = Y/Y_{FC} \quad (8A)$$

The profit rate can be expressed as the product of three ratios:

$$P/K = (P/Y) \cdot (Y/Y_{FC}) \cdot (Y_{FC}/K) \quad (9A)$$

Where  $P/Y$  is the profit share and  $Y_{FC}/K$  is the productivity of capital. With

$r = P/K$ ,  $\pi = P/Y$ ,  $u = Y/Y_{FC}$  and  $a = Y_{FC}/K$ , this equation can be rewritten as:

$$r = \pi \cdot u \cdot a \quad (9A')$$

If we multiply (9A) by  $K$ , we conclude that aggregate profits depend on the profit share, on utilization and on the production capacity of the economy:

$$P = (P/Y) \cdot (Y/Y_{FC}) \cdot Y_{FC} = \pi \cdot u \cdot Y_{FC} \quad (10A)$$

#### *Accumulation and capacity*

Capital is equal to the capital of the previous period plus net investment:

$$K = K_{-1} + (I - \partial \cdot K_{-1}) \quad (11A)$$

In turn, production capacity is equal to capital times its productivity:

$$Y_{FC} = a \cdot K = a \cdot K_{-1} + a \cdot (I - \partial \cdot K_{-1}) \quad (12A)$$

Given the values of all the parameters ( $C_p^*$ ,  $c_p$ ,  $\partial$ ,  $I_A$ ,  $\gamma$ ,  $\tau$ ,  $q$ ,  $\theta$  and  $a$ ), the exogenous values of government expenditure and of the nominal wage, and the values of utilization and of the capital stock in period  $t-1$ , the above set of 12 equations determines the values in period  $t$  of the 12 endogenous variables:  $Y$ ,  $C$ ,  $I$ ,  $W$ ,  $P$ ,  $T$ , Price,  $\pi$ ,  $u$ ,  $r$ ,  $K$  and  $Y_{FC}$ .

#### *The three key equations of the model*

Taking into account that  $\pi = P/Y$ , equations (1A), (2A), (5A) and (7A) lead to the multiplier:

$$Y = \{1/[1-(c_w(1-\pi)-c_p\pi)(1-\tau)]\}(I + C_p^* + G) \quad (1)$$

This is the first key equation mentioned in the main text. The other two key equations are equations (3A) and (12A).

### **Comparison with the Kaleckian growth model**

The best way to compare our model with the Kaleckian growth model is perhaps to represent the two models in similar graphs incorporating the respective key equations.

#### *The model developed in this paper*

Our model is represented in Figure 17. The key idea behind this figure is that utilization influences investment which in turn determines utilization, and so on. The effect of utilization on investment – equation 3 of the main text - is represented by the investment curve,  $I(u)$ . In turn, the effect of investment on utilization is represented by the non-linear utilization curve,  $u(I)$ . This results from the effect of investment on both demand and capacity – equations 1 and 2 of the main text.

Start with utilization at the desired rate,  $u^*$ , and with induced investment at the reposition level,  $I_R$ . If for some reason utilization then rises to  $u_0$ , induced investment will rise to  $I_1$ . But, instead of reducing utilization back towards the desired rate, this rise in investment will

paradoxically increase utilization further above that rate, to  $u_1$ . In turn, this higher utilization will lead to a new rise in investment, to  $I_2$ , and so on.

However, as net investment becomes bigger and bigger, further rises in investment will lead to progressively smaller rises in utilization – that is, the utilization curve  $u(I)$  becomes increasingly steeper. Hence, when net investment has grown to a high level and, as a result of a rise in utilization to  $u_3$ , a further increase in investment to  $I_4$  takes place, utilization drops (to  $u_4$ ). This then leads to a reduction in investment (to  $I_5$ ), which in turn leads to a new decline in utilization (to  $u_5$ ). As a result, induced investment falls to a very low level ( $I_6$ ) and cannot fall much further. This being so, the decline in induced investment begins to be offset by the rising trend of autonomous investment and thus to be associated with a revival of overall investment. In turn, this leads to an increase in utilization (to  $u_0$ ) and thus to a rise in induced investment (to  $I_1$ ). And with this, a whole cycle begins again.

#### *The Kaleckian growth model*

The Kaleckian growth model is represented in Figure 18 (see Lavoie, 2014, pp. 361-2). A first difference between this figure and Figure 17 is that the vertical axis now represents the rate of accumulation instead of the level of induced investment. The key idea behind the figure is that utilization

influences accumulation which in turn determines utilization, and so on. The effect of utilization on accumulation is represented by the investment curve,  $g^i = \gamma + \gamma_u \cdot (u - u^*)$ . In turn, the effect of accumulation on utilization is represented by the *linear* savings curve,  $g^s = s_p \cdot \pi \cdot u \cdot a$ . This corresponds to the utilization curve of Figure 17. There is however a crucial difference: according to that savings curve accumulation affects utilization *only* through its effect on demand and output, whereas according to our utilization curve investment affects utilization *also* through its effect on production capacity.<sup>13</sup>

The model works in the following way. If we start with accumulation at  $g^*$ , utilization will rise above the desired rate, to  $u_0$ . As a result, entrepreneurs raise accumulation to  $g_0$  - but this will increase demand and output and therefore make utilization rise further above the desired rate, to  $u_1$ . (The fact that the rise in accumulation also affects utilization because it increases production capacity is not considered). In turn, this higher utilization will lead to a new rise in accumulation (to  $g_1$ ), and so on.

---

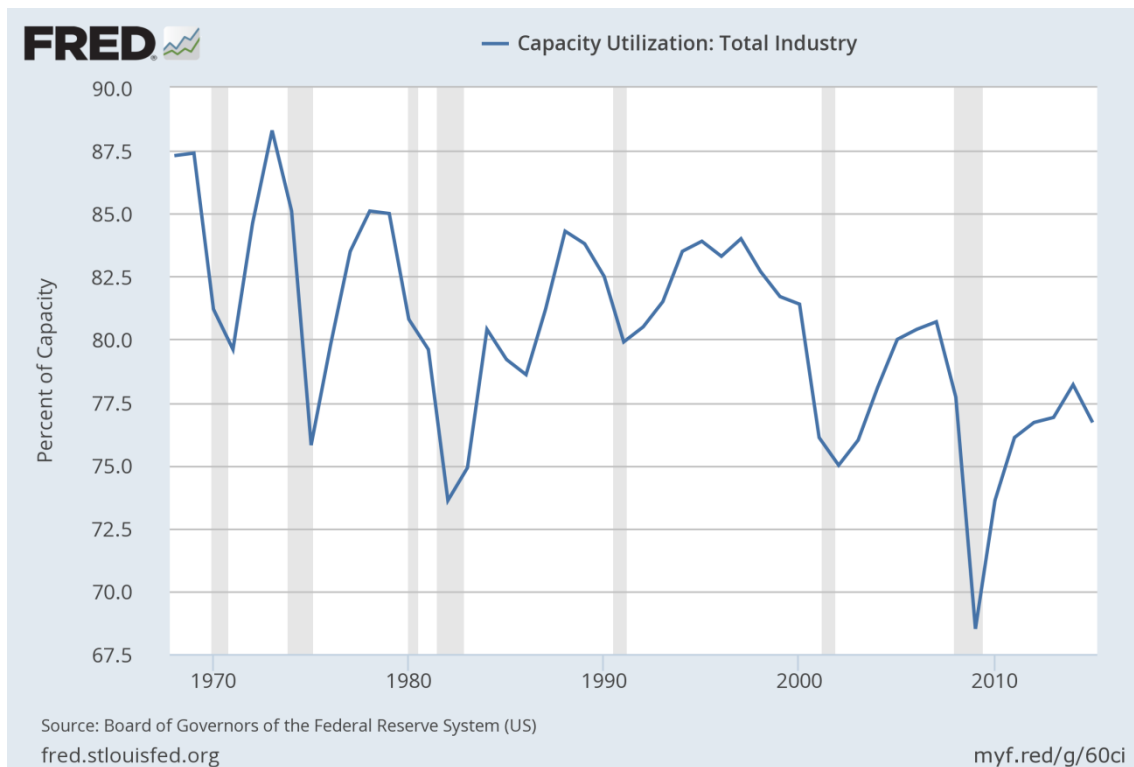
<sup>13</sup> The fact that, according to the Kaleckian savings function, accumulation affects utilization *only* through its effect on demand and output can be seen in the following way. The expression of that function,  $g^s = s_p \cdot \pi \cdot u \cdot a$ , is obtained by inserting the profit rate,  $r = \pi \cdot u \cdot a$ , into the Cambridge equation,  $r = g/s_p$ , and then solving for  $g$ . And the Cambridge equation *has its origin in the equation of the multiplier* in an economy without government and no saving out of wages:  $Y = C + I \Leftrightarrow W + P = [W + (1-s_p) \cdot P] + I \Leftrightarrow s_p \cdot P = I \Leftrightarrow s_p \cdot P/K = I/K \Leftrightarrow s_p \cdot r = g \Leftrightarrow r = g/s_p$ . (Cf. Lavoie, 2014, pp. 309-11, pp. 348-9 and pp. 361-2).

Now, since the mentioned increases in accumulation only affect utilization through their multiplier effect on demand and output, the savings curve – unlike our utilization curve – is linear. As a result, the economy eventually settles at point E.<sup>14</sup> This point defines a steady-state of the economy characterized by constant rates of utilization and accumulation equal to  $u_e$  and  $g_e$ . As pointed out in the introduction of the paper, the existence of such a steady-state in real-world economies is debatable.

---

<sup>14</sup> This will happen as long as the savings curve is steeper than the investment curve. Otherwise, there will be the so-called Keynesian instability with ever-growing rates of utilization and accumulation (see Lavoie, 2014, pp. 377-8).

*Figure 1. Capacity utilization over U.S. business cycles, 1967-2016*



*Figure 2. Log of Private investment over U.S. business cycles, 1947-2016*

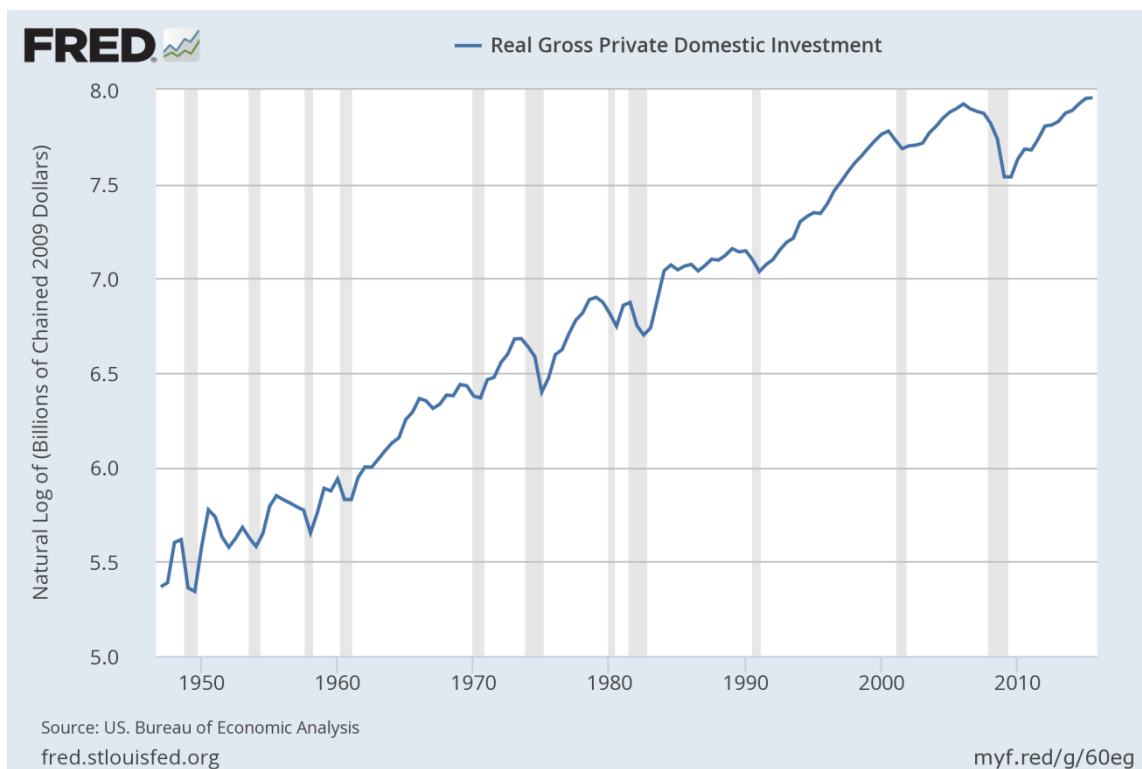




Figure 3. Log of Profits over U.S. business cycles, 1947-2016

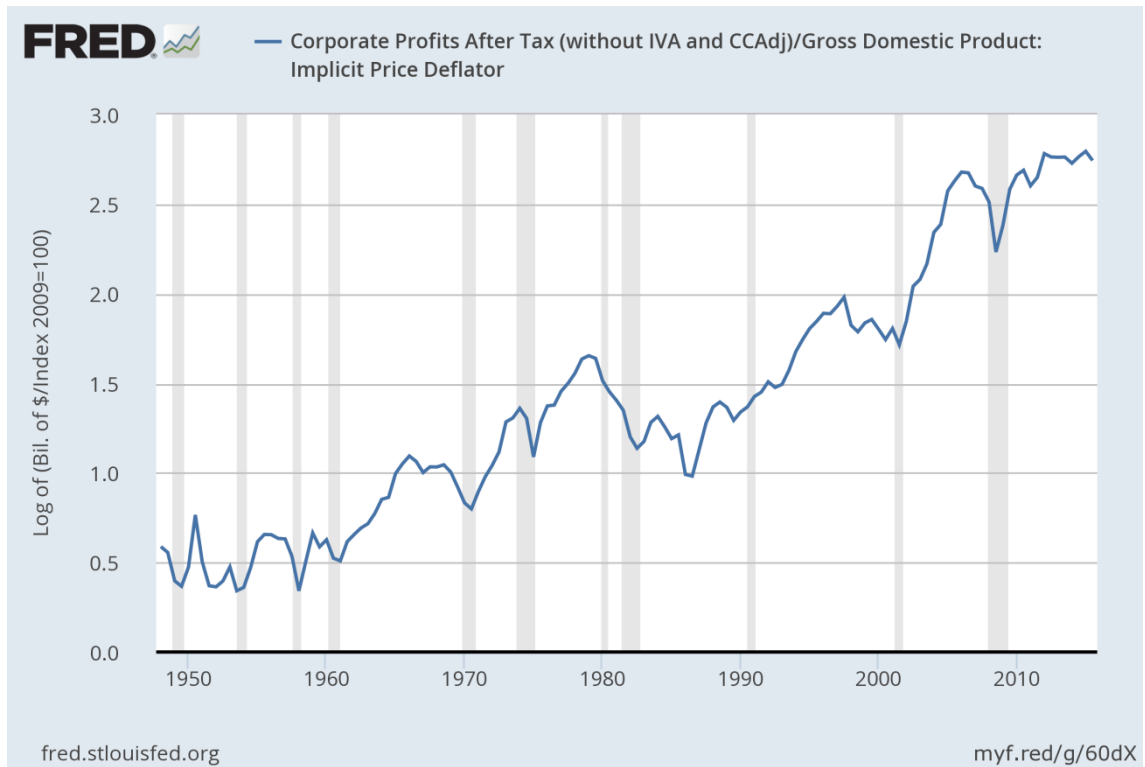
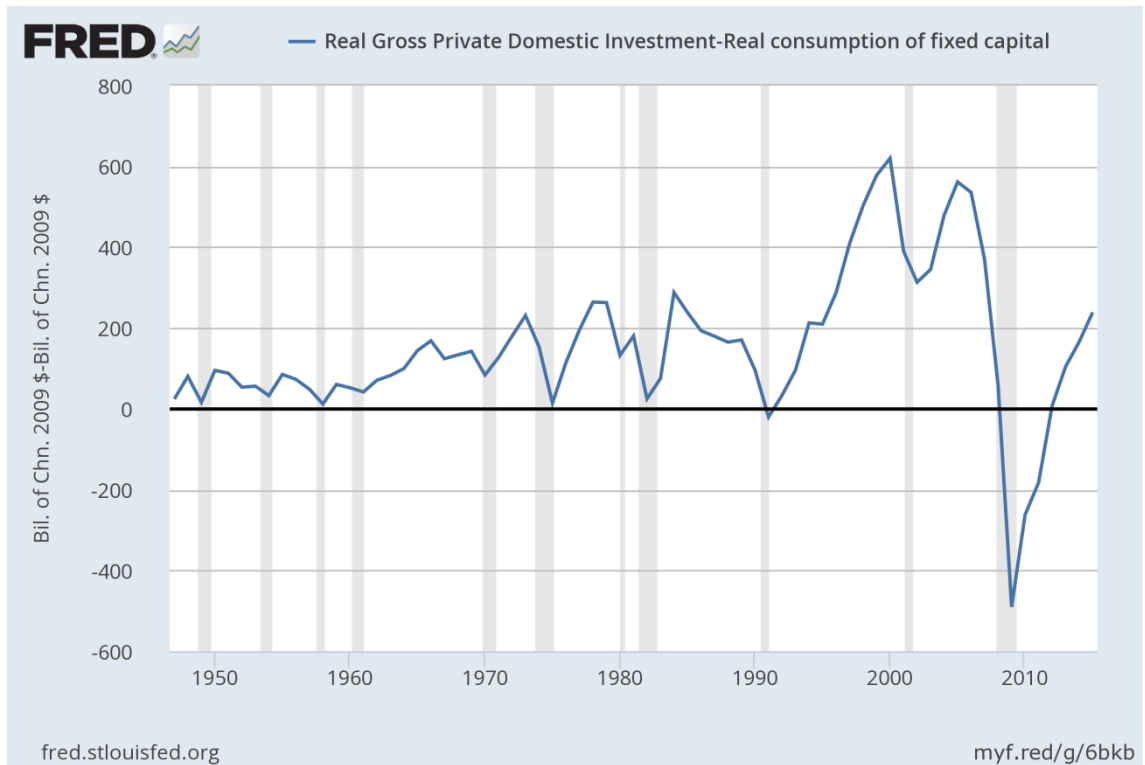
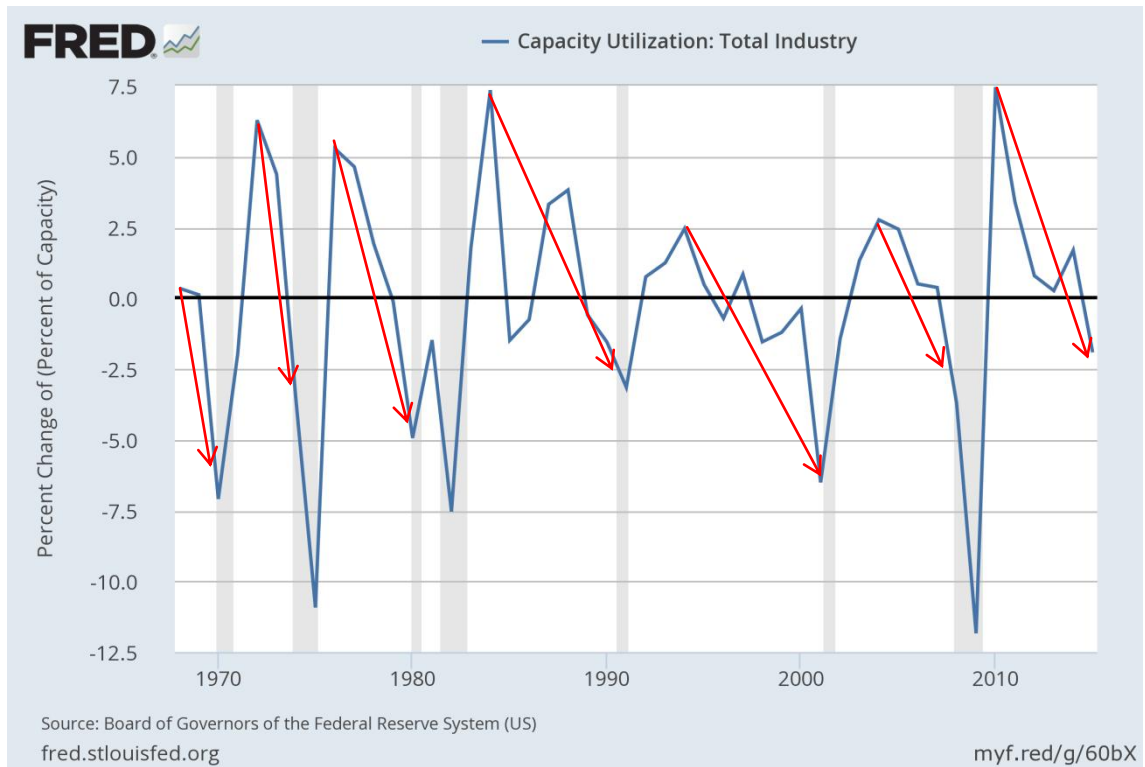


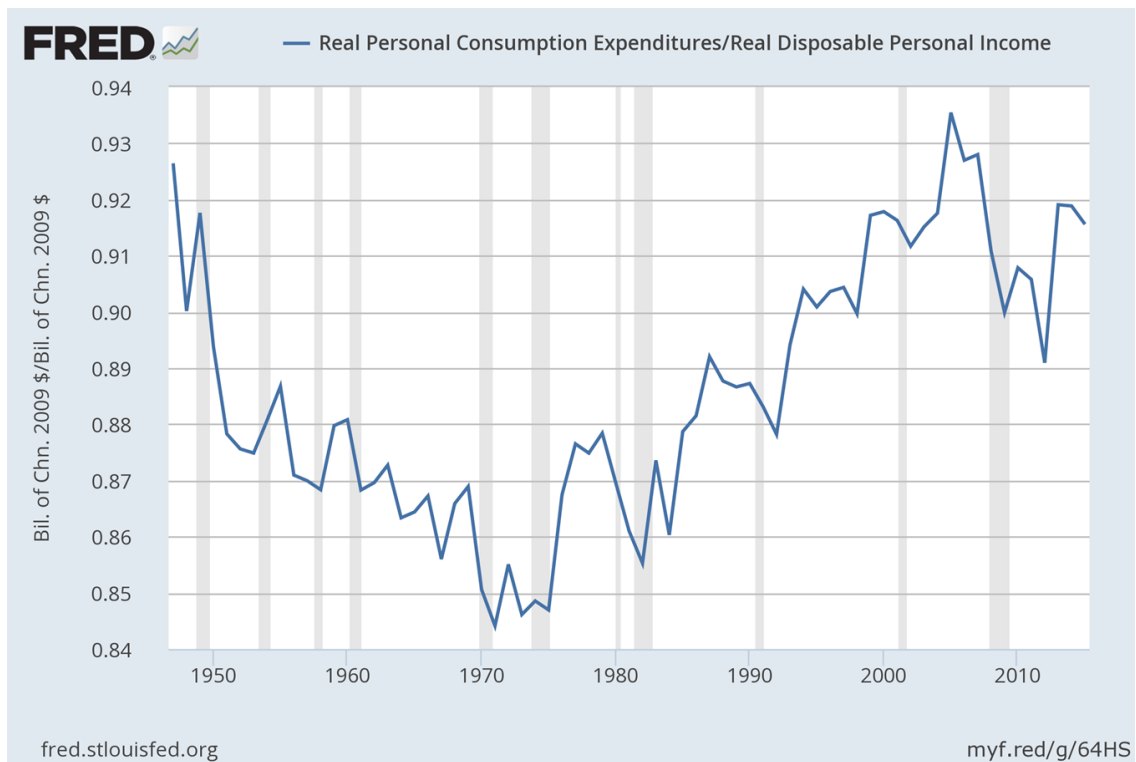
Figure 4. Net investment over U.S. business cycles, 1947-2015



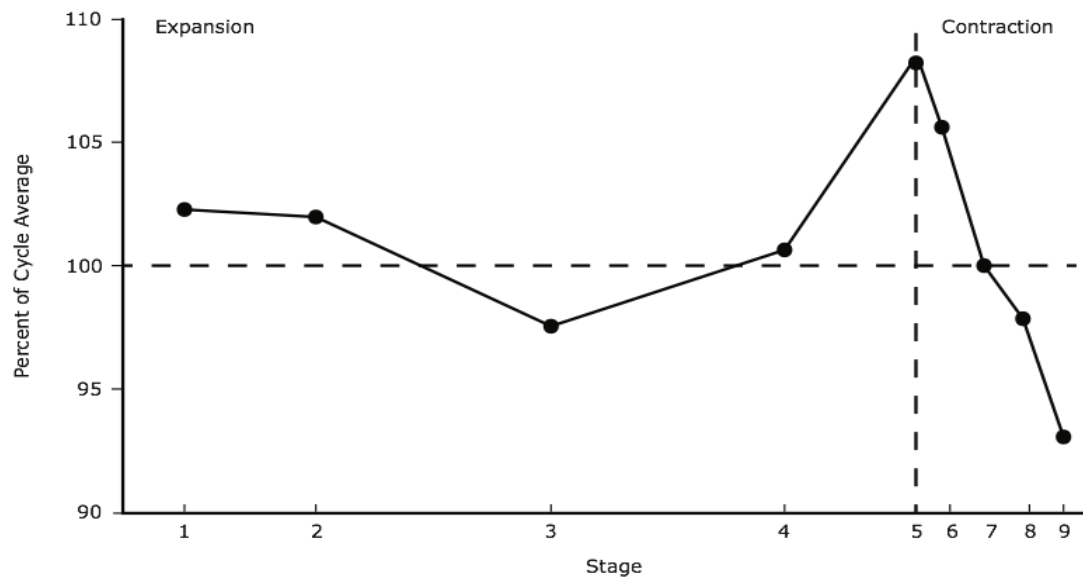
*Figure 5. Rises in utilization at lower and lower rates as U.S. expansions progressed, followed by actual declines in their final stages, 1967-2015*



*Figure 6. Propensity to consume over U.S. business cycles, 1947-2015*



*Figure 7. Ratio of raw material prices to consumer prices over the average U.S. business cycle of 1970-2001*



Source: Sherman (2010, p. 141). Note: Sherman divides the cycle in 9 stages. Stage 1 is the first quarter of the expansion. The rest of the expansion is divided into three pieces of equal length, stages 2, 3 and 4. Stage 5 is the expansion peak, just one quarter long. The recession is then divided into three equal pieces, stages 6, 7 and 8. Stage 9 is the last quarter of the recession.

*Figure 8. Real interest rates over U.S. business cycles, 1949-2015*

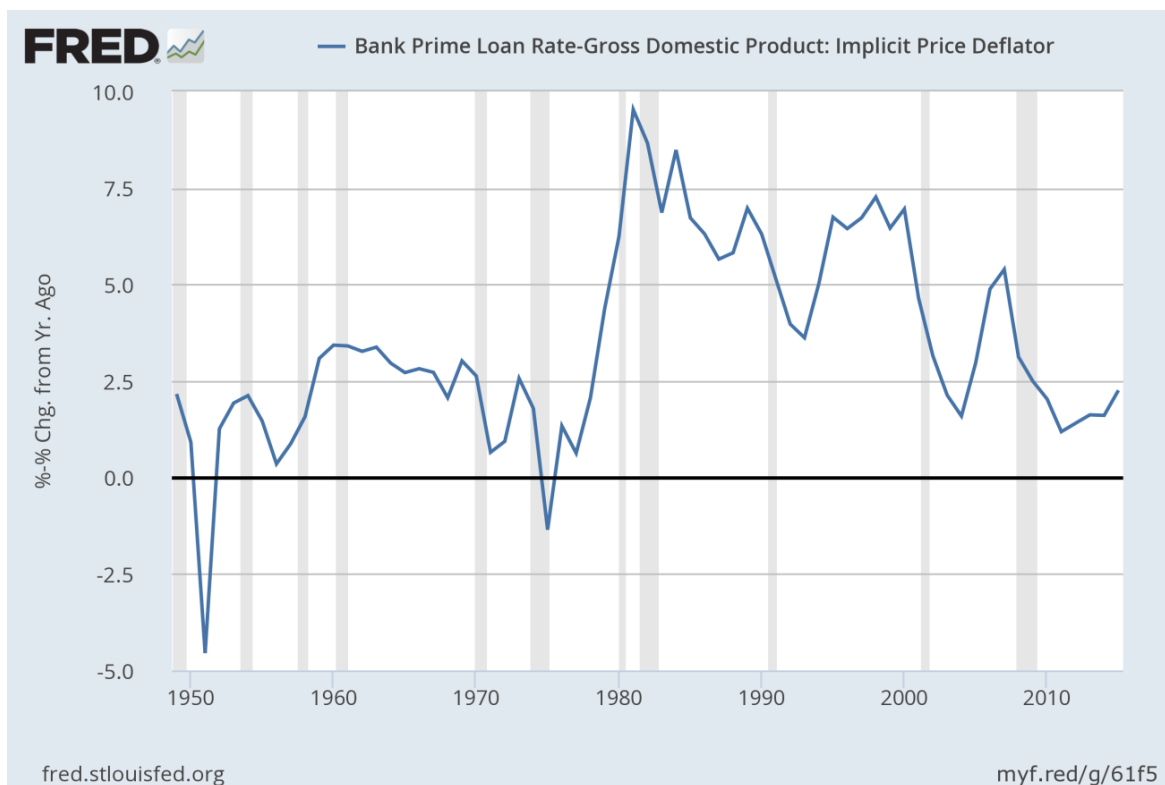


Figure 9. U.S. Government spending, 2007-2015

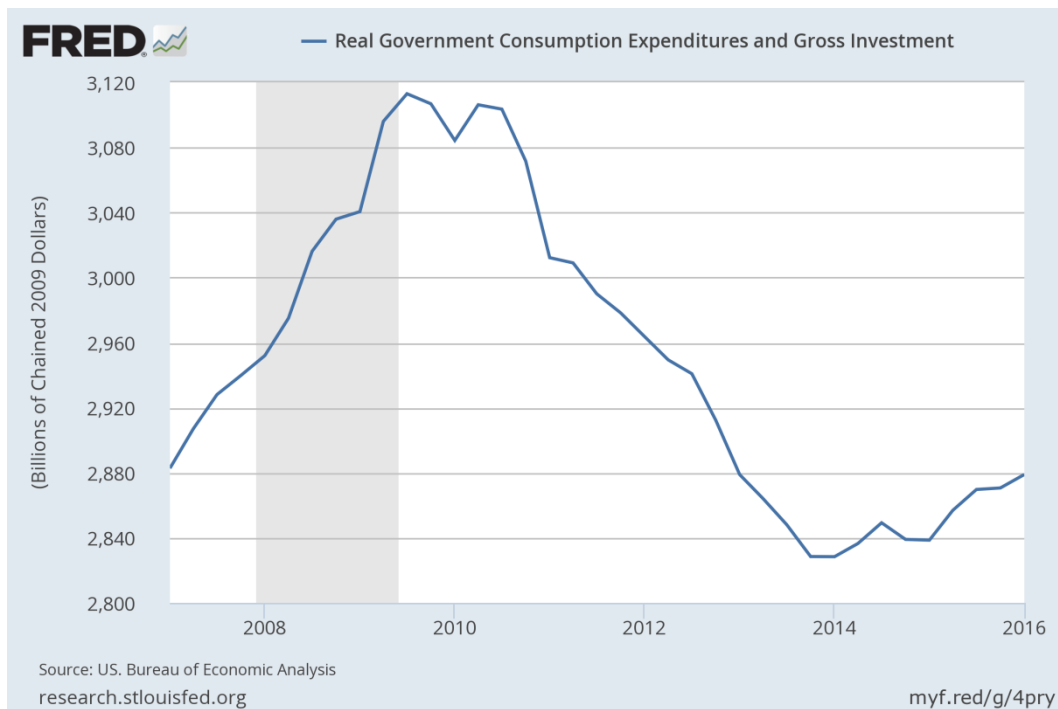
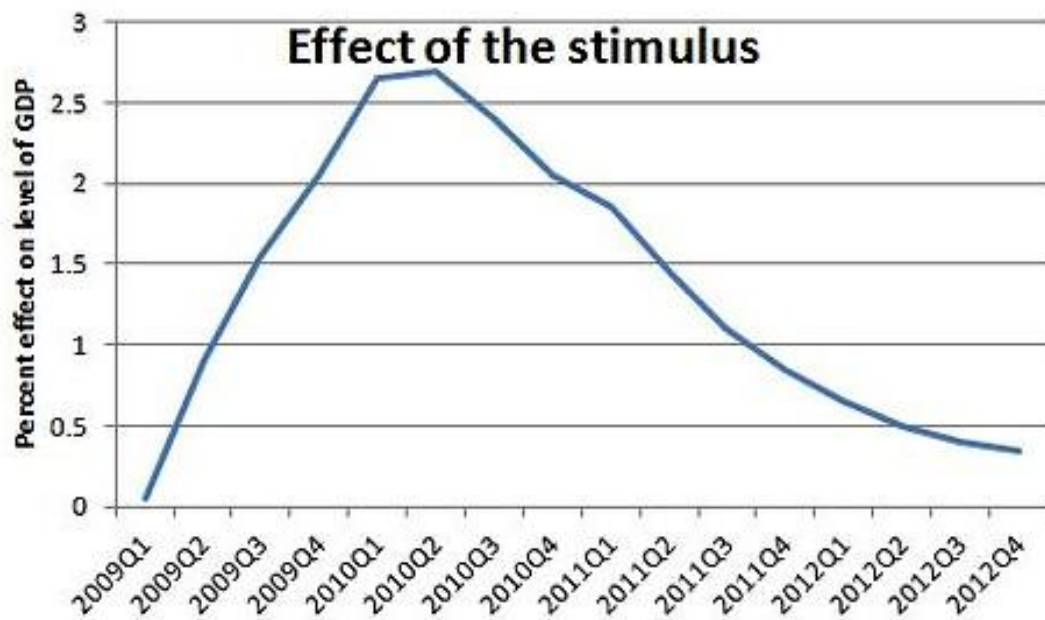
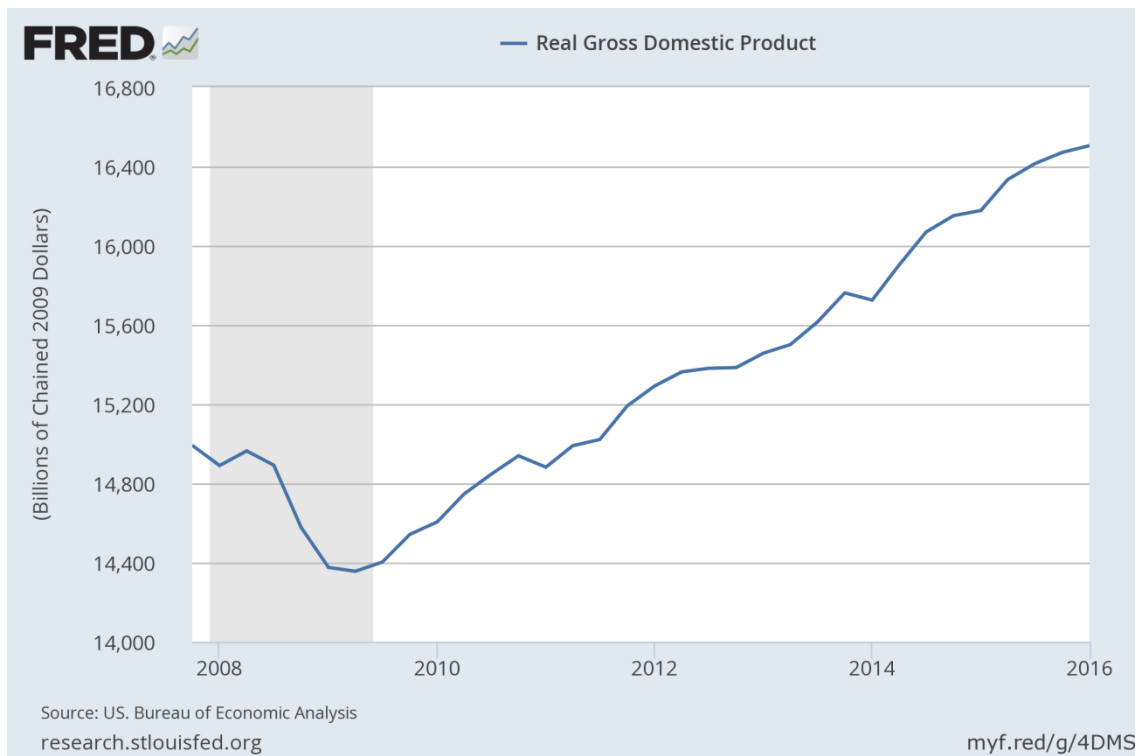


Figure 10. The effect of the Obama Stimulus as estimated by the U.S. Congress Budget Office

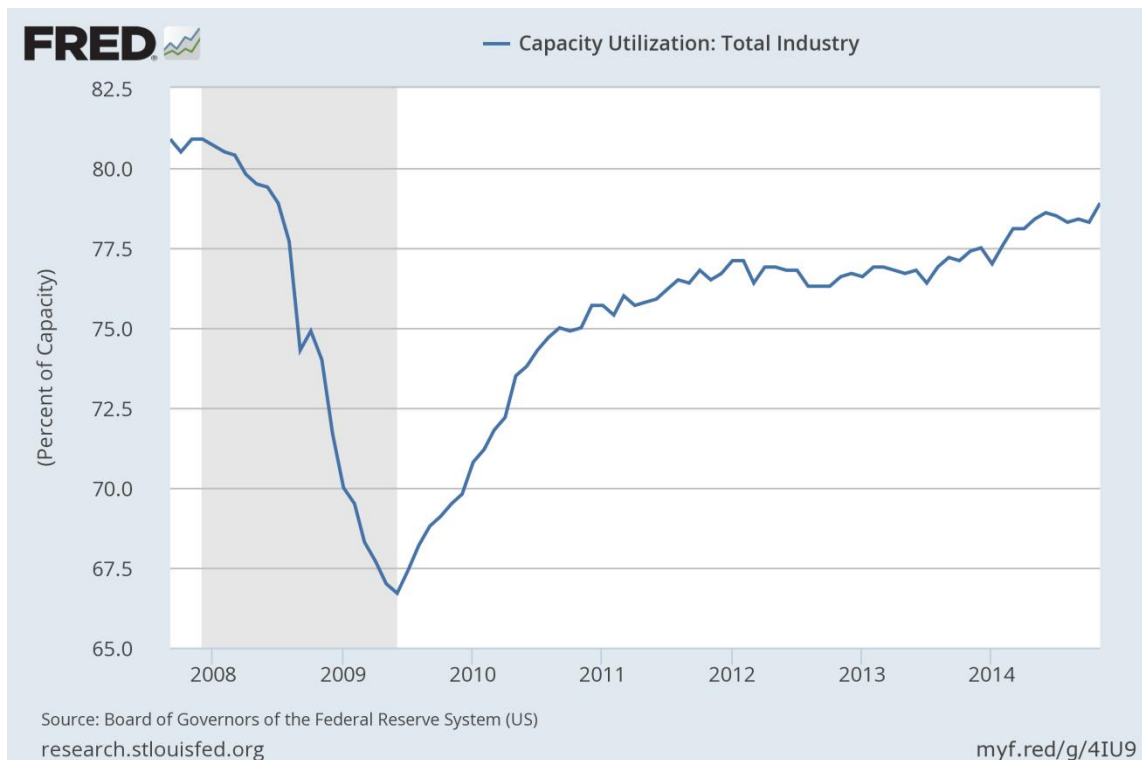


Source: Krugman (2011).

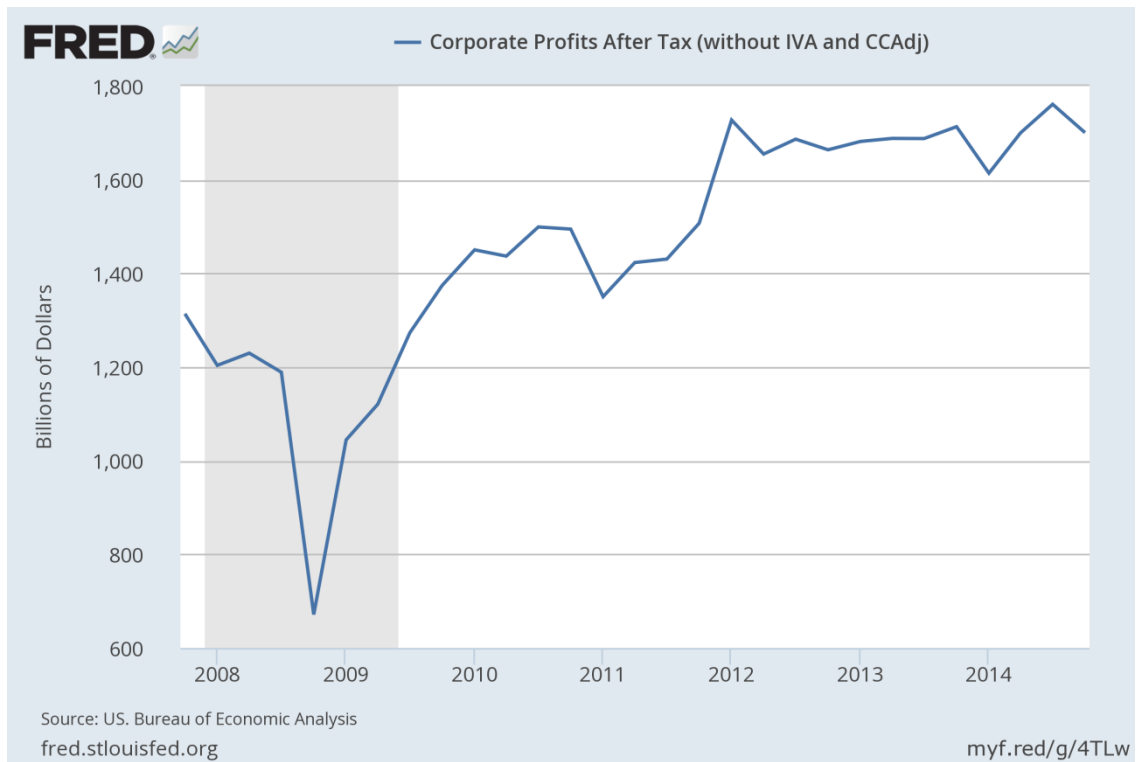
*Figure 11. U.S. GDP, 2007-2015*



*Figure 12. U.S. Capacity utilization, 2007-2014*



*Figure 13. U.S. Corporate profits, 2007-2014*



*Figure 14. U.S. Private business investment, 2007-2014*

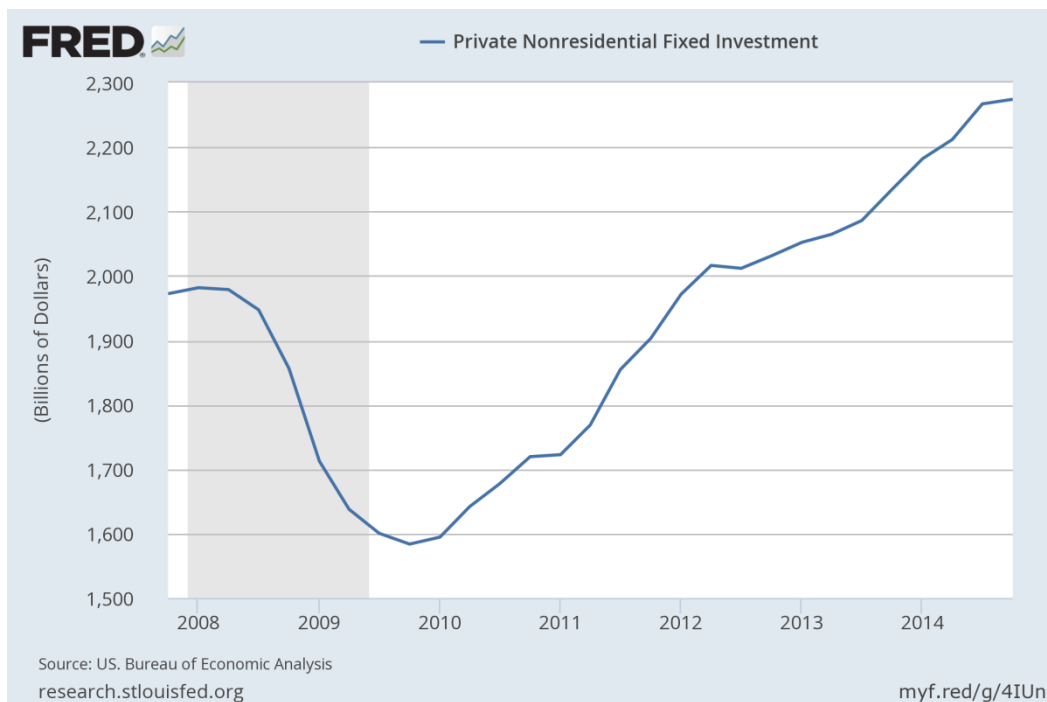


Figure 15. U.S. Government budget balance, 2007-2014

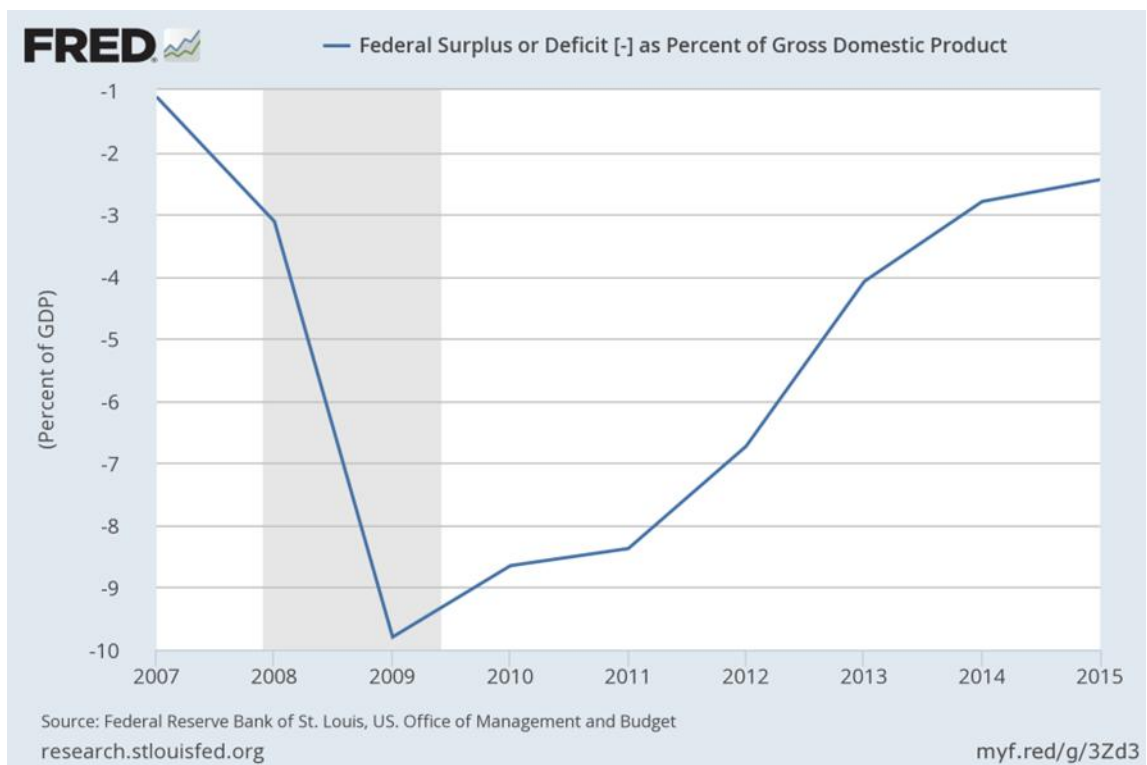


Figure 16. U.S. Public debt, 2008-2015

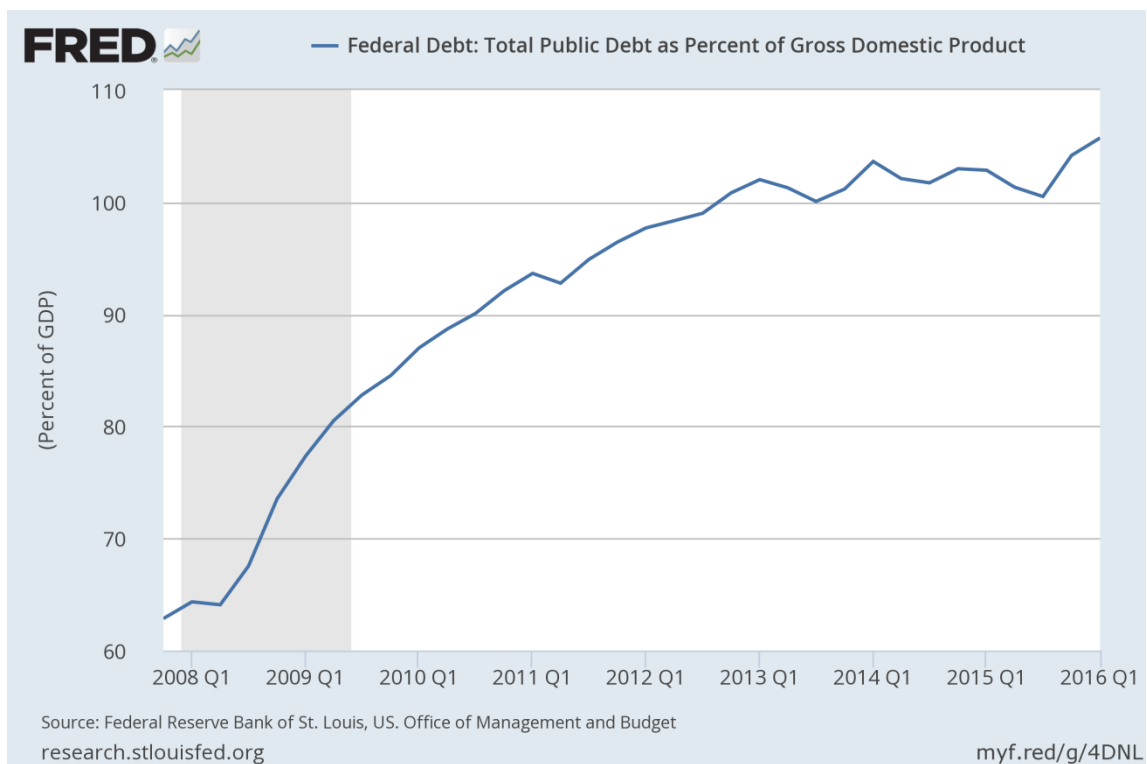


Figure 17. A graphical representation of the model

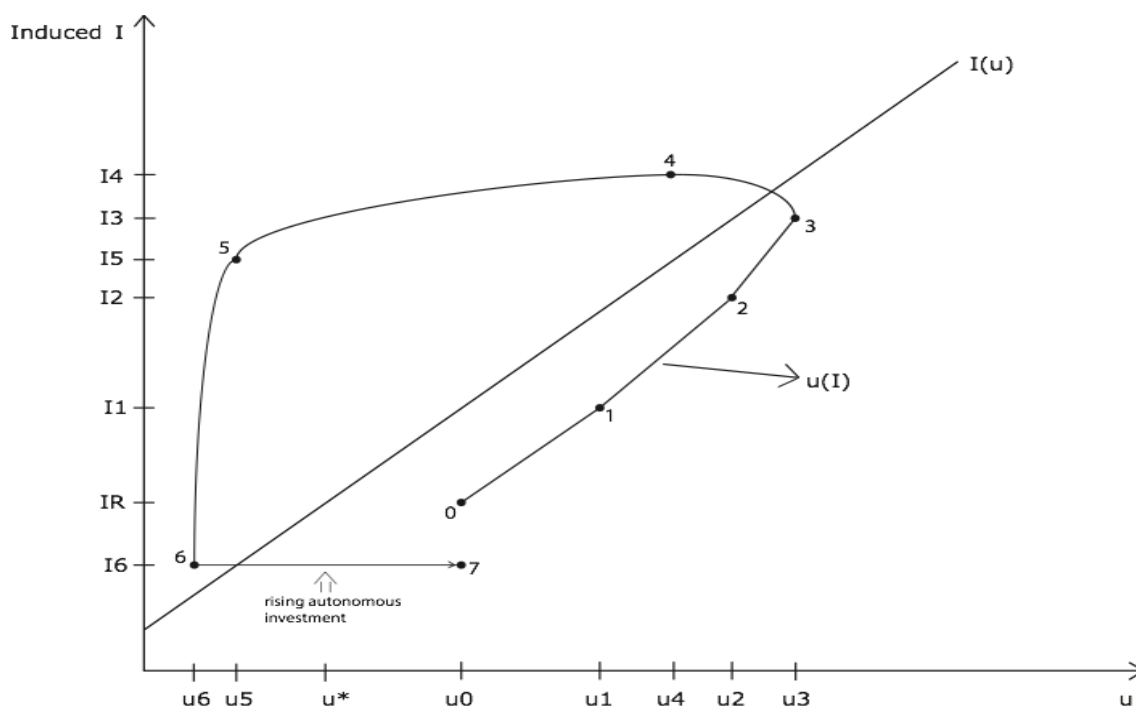
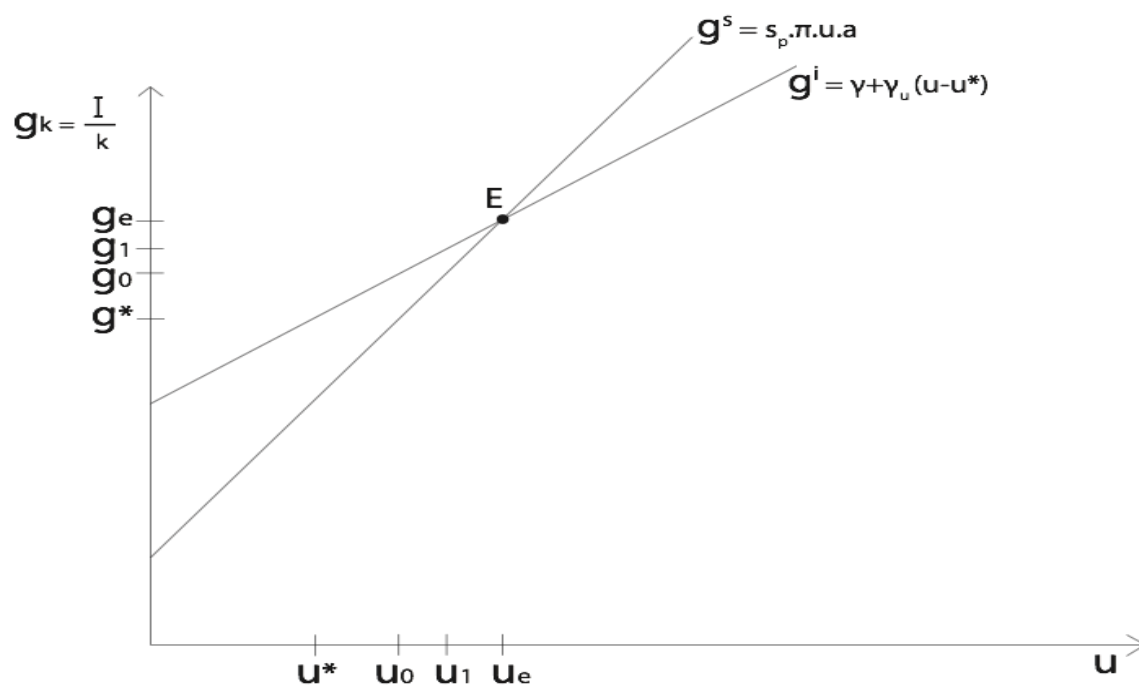


Figure 18. The Kaleckian growth model





*Table 1. Average changes of GDP, investment and profits in 10 U.S. business cycles, 1950:1-2009:2*

	Units	Expansions except the last year	Last year of expansions	Recessions
GDP	% change per year	5.63	3.50	-1.28
Investment	% change per year	15.93	6.57	-13.91
Profits	% change per quarter	12.5	-0.003	-5.0

Source: Harvey (2014, p. 397)

*Table 2. Average changes in capacity utilization in seven U.S. business cycles, 1967-2009:2*

	Average change in percentage points	Average duration in months	Average change per month in p.p.
First half of expansions <sup>a</sup>	5.72	31.2	0.18
Second half of expansions <sup>a</sup>	3.24	31.2	0.10
Last part of expansions after the utilization peak	-1.59	9.6 <sup>b</sup>	-0.17
Recessions	-8.04	14.6	-0.55

<sup>a</sup> The numbers are averages of only five of the seven cycles. The available data only starts in 1967 and thus prevents calculations for the expansion of the 1960s before the utilization peak. In turn, the expansion of the first cycle of the 1980s lasted only three quarters and prevents the same type of calculations.

<sup>b</sup> With the exception of the expansion of the 1990s, *utilization always peaked between six months and one year before the end of expansions.*

Source of the data: Federal Reserve Bank of St. Louis, series “Capacity Utilization: Total Industry”, 1967-2016. Author’s calculations.

*Table 3. Increases in investment and in demand in the various quarters of the expansion if the multiplier requires three quarters to exert its effect*

Quarters	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>
↑ Investment	\$10	\$10	\$10	\$10	\$10
↑ Consumption*	\$0	\$3	\$2+\$3	\$2+\$3	\$2+\$3
↑ Demand	\$10	\$13	\$15	\$15	\$15

\* The first and the second rounds of consumption expenditure that take place in the first and the second quarters *after* the quarter of the increase in investment that generates them are assumed to be equal to \$3 and \$2, respectively.

*Table 4. Eurozone GDP and budget deficit, 2011-15*

	Units	2011	2012	2013	2014	2015
GDP	Percent change	1.6	-0.9	-0.3	0.9	1.6
Budget deficit	Percent of GDP	4.2	3.7	3.0	2.6	2.0

Source: Ameco database