Profits encourage investment, investment dampens profits, government spending does not prime the pump — A DAG investigation of business-cycle dynamics

Tapia, Jose

Drexel University

May 2015

Profits encourage investment, investment dampens profits, government spending does not prime the pump — A DAG investigation of business-cycle dynamics

José A. Tapia[1]

Abstract — NIPA data of the US economy for the years 1929-2013 are used to test major views about the business cycle. Direct acyclic graphs (DAGs) are used for identification purposes, i.e., as tool to elucidate causal issues. Results show that (a) investment is not autonomous, as it is stimulated by profits and consumption, and damped by government spending; (b) profits are reduced by past investment; (c) government spending appears as an endogenous variable, as both business investment and profits have negative effects on it. Regularities identified in the data are sufficient to generate the cycle. Considering the results, the "regularity" of the business cycle, and the fact that profits stagnated in 2013 and declined in 2014 after growing between 2008 and 2012, it can be concluded with reasonable confidence that a recession will occur in the next few years.

1. Introduction

Do we know the cause or causes of recessions? Are we able to predict them? Can they be prevented? In recent years distinguished economists have given explicit or implicit negative answers to these questions. In the opinion of Eugene Fama, economists do not know what causes recessions (Cassidy 2010, 28), and for Nicholas Mankiw it is basically impossible to predict them, because economic fluctuations do not follow any predictable pattern (Mankiw 2009); indeed future recessions will occur "at some unknown date for some unknown reason" (Mankiw 2010, B6).

Though many economists would agree with these views, many others would disagree, as they have proposed and sometimes vehemently argued about why recessions occur, or more generally, about the

[1] Department of Politics, Drexel University, Philadelphia, PA. E-mail: jat368@drexel.edu.

causes of the business cycle. An examination of the views of economists of different inclinations indicates that many conceptualize the business cycle in the framework of a built-in ability of the market economy to balance itself toward equilibrium. Therefore oscillations of the economy between prosperous business conditions and crisis, between expansion and recession, would be just manifestations of the reaction of the economy to exogenous causes. Thus injudicious actions of governments or central bankers (Schwartz 2010; Butler 2010), spikes in oil prices due to a variety of factors (Hamilton 1988, 593; Hamilton 2009, 215-267), idiosyncratic events impacting big firms and propagating through networks (Gabaix 2011, 733-772; Acemoglu et al. 2012, 1977-2016), or other undefined "shocks" are for some economists the *exogenous* causes that from time to time push the economy down to recession. An alternative vision is that economic disturbances have *endogenous* causes, so that business cycles are determined by the inner workings of the market system. In this view, which is usually associated with the Keynesian school (Keynes 1936; Kalecki 1954; Robinson 1979; Minsky 2008), the market economy would be unstable and prone to periods in which factors of production are unemployed.

More than a century ago W. S. Jevons and H.L. Moore attributed business cycles to astronomical influences, but the effort to look for patterns that may explain the dynamics of the economy, its movements toward expansion or contraction, has been continuous. Since the 1930s when Keynes and others in his tradition conceptualized the boom-and-bust cycle as an endogenous phenomenon of the market economy, it has been normal to look for explanatory patterns of the cycle in four basic macroeconomic variables that are monetary aggregates: consumption, investment, profits and government spending.

This paper tries to examine and test the role of these four variables in the causation of the business cycle using modern techniques to assess causality. As it will be shown, examining and testing the causal role of these four variables in the business cycle allows gaining quite a bit of insight in understanding the way the economy works. To make a bet on that, the paper ends with a forecast based on the insights on the business cycle gained through the analysis.

The view that *consumption* may have an important role as a generative factor of the business cycle was criticized decades ago by business-cycle experts of high reputation as Schumpeter and Haberler. Schumpeter thought that a basic criticism of underconsumption explanations is that they neglect an

elementary fact, that inadequacy of wages "to buy the whole product at cost-covering prices would not prevent hitchless production in response to the demand of non-wage earners either for 'luxury' goods or for investment" (Schumpeter 1954, 740). For Haberler (1960) attribution of business cycles to insufficient consumption, that is, underconsumption theories, have a scientific standard quite lower than other theories of the business cycle. Then, if insufficient consumption is a discredited theory of the business cycle, why to look at it? A plausible answer is that "discredited theories" rarely die in social science, and under different garbs the causal role of consumption in business cycles is today very present in economics. Nowadays many economists would agree with the idea that recessions are caused by a combination of "shocks," which could be for instance monetary shocks, as for Milton Friedman the quantity of money has a key role influencing the growth of the economy. In real-business-cycle (RBC) theory these shocks which would be the exogenous causes of recession would affect both production and consumption. James Hamilton has mentioned exogenous supply shocks coming from political interferences in international oil markets and causing major disturbances in both supply and demand of the US car market as a key factor in the development of the Great Recession (Hamilton 2009, 215-267) and in the causation of recessions in general (Hamilton 1988, 593). Monetary shocks as those proposed by Friedman, oil shocks as those proposed by Hamilton, or other undefined shocks as those proposed by RBC authors would hit consumption and production and thus the economy at large. But there is also an old radical tradition coming back to Rosa Luxemburg and John A. Hobson, who thought that insufficiency of purchasing power is a key explanatory element of the cycle, a point of view that was later adopted by Marxist authors such as Ernest Mandel, and in the United States by heterodox economists like Paul Baran, Paul M. Sweezy and others in the *Monthly Review* School. Thus increasing inequality of income leading to lack of purchasing power, i.e., insufficient aggregate demand, has been suggested as a cause of the Great Recession by a number of heterodox economists (Friedman, Moseley, and Sturr 2009; Foley 2010). In brief, the idea that consumption has a major role in the etiology of the business cycle is quite present in modern economics.

If the role of consumption in the business cycle is disputed, the role of *investment* is generally agreed as a key one. Any cursory examination of economic statistics shows that the main element of aggregate demand fluctuating upward during expansions and downward during recessions is

investment, while consumption varies little between expansion and recession (Sherman and Kolk 1997). Indeed, as Richard Goodwin once explained, the early efforts in econometric research on the business cycle were the pair of monographs written by Tinbergen in 1939 for the League of Nations. On the basis of general agreement among economists, Tinbergen selected investment as the crucial cycle variable to be explained (Godwin 1964, 417-468). For Keynes investment responds basically to relative confidence in the prospects of businesses, to "animal spirits," and in that sense is an autonomous variable. In the view of Keynes, Kalecki, and the Keynesian school in general, present investment and the level of present economic activity are determined by current investment and investment in the near past (Keynes 1936; Kalecki 1954; Minsky 2008; Godwin 1964, 417-468; Matthews 1959).[2]

Versus the Keynesian and post Keynesian view in which investment is autonomous, an alternative view is that investment depends on *profits*, so that movements in investment respond to previous movements in profitability, an idea that was proposed in the past by a variety of authors (Marx 1977; Veblen 1932; Mitchell 1913; Moulton 1949; Tinbergen 1950; Burns 1954).

Finally, an idea which since long ago has been ground for unending political infighting and for controversies between economists is that by prime-pumping the private economy, *government spending* is able to stabilize the economy and stimulate growth. The idea that government spending has a major role in stoking economic growth is an independent hypothesis not directly related with other views on mechanisms of the business cycle. However, it is a basic tool in the Keynesian armamentarium and often appears coupled with the view that investment is autonomous. As Hyman Minsky (2008, 184) colorfully put it,

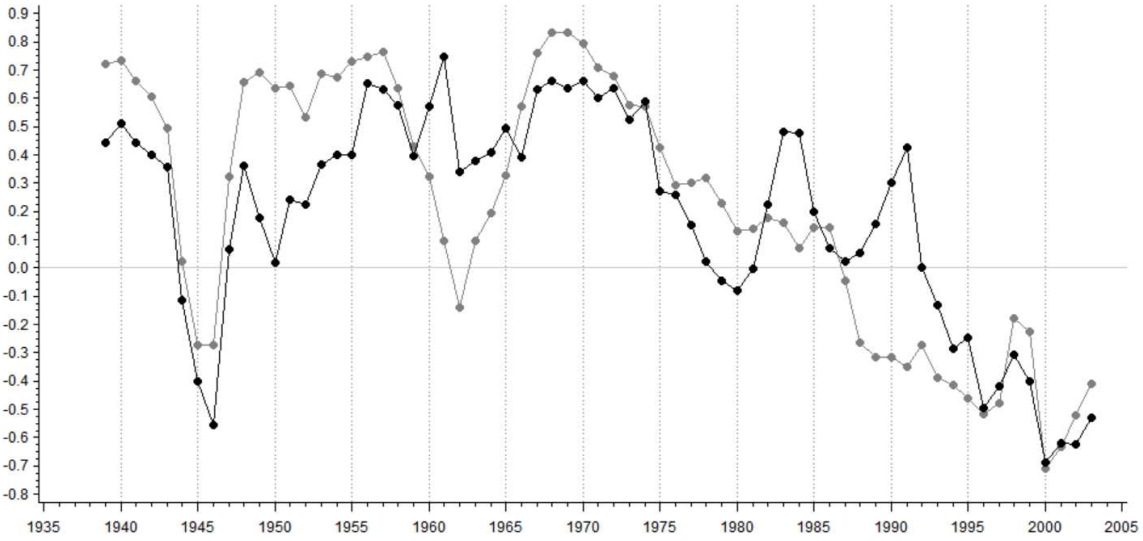
> investment and government spending call the tune for our economy because they are not determined by how the economy is now working. They are determined either from outside by policy (government spending) or by today's views about the future (private investment)"

Thus I will focus on consumption, investment, profits and government spending and I will not examine data on unemployment rates, wages or money. In the view of many authors unemployment rates and wages have a major role in business cycles as factors that may influence consumption, profits or the level of output. Both high wages and conditions of almost full or full employment leading

[2] If investment depends on "animal spirits," its causes are not determined by the economy itself and thus investment should be conceptualized as an exogenous variable. A theory in which investment is, as Keynes said, the *causa causans* of macroeconomic fluctuations (Keynes 1937, 209-223) should be rather considered an exogenous theory of the business cycle. But this consideration should be put aside for the moment.

to labor shortages that push wages up and generate a profit squeeze have been recurrently mentioned as cause of recessions (Pigou 1927, 355; Ohanian 2008, 10-16; Bhaduri and Marglin 1990, 375-393; Boldrin and Horvath 1995, 972-1004). While in theories of too high wages causing recession the causal pathway would be from wages (W) to unemployment (U) to consumption (C) and to the economy at large (W→U→C→E), in profit-squeeze theories the influence of low unemployment (U) would force wages up (W), this would cause lower profits (P) which in turn would depress the economy at large (E). Thus in the too-high wages theory of recessions the causal path would be mediated by consumption (W→U→C→E) while in the profit-squeeze theory it would be mediated by profits (U→W→P→E). Though I will not examine here independent effects of unemployment and wages, I am examining them indirectly as they are subsumed under the examination of causal paths in which consumption and profits are considered potential causes of the business cycle.

Figure 1. Correlations of the annual rates of growth of M1 (gray dots) and M2 (black dots) with real GDP growth in 10-yr windows starting at the year in the horizontal axis



Source: Author elaboration from NIPA data. For definitions of series see text.

I will not analyze data on money as part of the general analysis of the paper for several reasons. First, in spite that many theoretical models of business cycles give great emphasis to monetary forces, econometricians from Tinbergen have found monetary factors rather unimportant in explaining cycles (Tinbergen 1939b; Lucas 1977, 7-29; Morgan 1990) and it seems to be agreed today that monetary disturbances have very little explanatory power to explain recessions in recent decades (Knoop 2004). The idea that random variation in monetary policy may account for historical recessions has been rejected even in the context of dynamic stochastic equilibrium models (Sims 2012, 1187-1205; Sims

and Zha 2006, 231-272). Changes in the money supply leading the cycle—as those that were highlighted by Friedman and Schwartz—are easy to find in historical data, but they can be explained by mechanisms quite different to those proposed by the monetarists (Sims 2012, 1187-1205; Tobin 1970, 301-317; Tapia Granados 2014, Nolt 2014, Ch. 5). Second, a quick examination of the relation between the growth of the money indicators M1 and M2 and the growth of the economy reveals that it has changed very much with the pass of time. Thus in the 1970s the correlations of real GDP growth with the rates of growth of M1 and M2 were respectively 0.80 and 0.66, while in 2000-2009 the same correlations were -0.71 and -0.69 (Figure 1). The third reason that I will not include money in the general analysis is that you cannot look at everything. Thus I will put money together with movements of planets, unemployment, conspiracies of the Elders of Zion and other factors that I will not examine.

For testing empirically the causal role of consumption, investment, profits, and government spending in the business cycle I use traditional tools of statistics and directed acyclical graphs, DAGs. To a large extent DAGs were popularized by the work of Judea Pearl, a computer scientist (Pearl 2000) but they are increasingly used in many fields of science (Elwert 2013, 245-272) though to the present, they have had a rather marginal use and acceptance in economics (Heckman and Pinto 2015, 115-151). Views by Pearl himself on the use of DAGs and causal reasoning in economics were recently published in *Econometric Theory* (Pearl 2015, 152-179).

The rest of the paper is organized as follows. Sections 2 and 3 present the data and descriptive statistics. Section 4 discusses identification, the statistical methods and the results of the analysis are in sections 5 to 7, and a general discussion of the results is in section 8. Implications for business cycle theory are presented in section 9, and section 10 concludes with a forecast.

2. Data

I use for the analyses annual statistics of the US economy (Figure 2), available from the National Income and Product Accounts (NIPA) for the years 1929-2013 (BEA).[3] I use annual and not quarterly data for several reasons. First because quarterly data for major components of the national economy are only available from 1947, while annual data are available from 1929. Second, annual data allow for

[3] I did most of the analysis with data until 2013, but then the NIPA website included data for 2014 and I used them for some analysis.

the inclusion of a reasonable number of lags in the analysis without the hyperinflation of numerical data and results implied by quarterly data. I choose arbitrarily to examine lags for 5 years assuming that events that occurred more than 5 years ago are not likely to have an impact on the present condition of the economy.[4] Applying that assumption to quarterly data would imply examining data for 20 lags. As it will be explained, the results of the analysis show that in almost all cases lagged effects beyond 3 years are irrelevant. A further reason is that for descriptive and analytical purposes, annual data can be normalized as percentages of the national product without cumbersome seasonal adjustments.[5]

As measure of consumption I use personal consumption expenditure (NIPA terminology) and as measures of investment I examine both gross private domestic investment and a subset of it, private fixed non-residential domestic investment. Gross private domestic investment includes expenditures by firms on capital goods such as machinery and buildings, residential expenditures on residential structures and equipment, and changes in inventories. Private fixed investment measures spending by private businesses, nonprofit institutions, and households on fixed assets, that is, structures, equipment, and intellectual property products that are used in the production of goods and services. Since in the NIPA framework residential structures used for housing by individuals or families are viewed as businesses, so that a house occupied by her owner is considered as rendering a flow of income to her, excluding residential expenditure produces a measure of investment more indicative of the creation or improvement of productive assets, or the replacement of worn out or obsolete means of production. In other terms, while private fixed non-residential investment is used here as an index of the formation of capital and thus the willingness of business and money owners to expand the production capacity, gross private domestic investment is also used in the analysis to test the sensitivity of the results to using a more inclusive measurement of investment that includes expenditure that many authors would conceptualize as consumption spending. To avoid using long terms, I abbreviate the NIPA terminology: gross private domestic investment will be here "gross investment" and private fixed non-residential domestic investment will be "business investment."

[4] An unconvincing attempt to prove that even lags of a decade or more have noticeable macroeconomic effects can be found in Neftci (1978, 281-291).

[5] I will use gross national product (GNP) and "national product" as equivalent terms. For computation purposes I arbitrarily choose GNP as denominator to normalize business-cycle variables. For the 75 year sample 1929-2013, annual GNP is always greater that GDP, on average 0.6% greater, with the maximum difference in 2011, when GNP was 1.6% greater than GDP. Thus all results that I present would be basically identical using GDP to normalize the data.

Corporate profits are reported in NIPA before and after taxes, and since these two categories may be differently related to other variables, both are used in the analyses. Profits of all industries are used in the main analysis, but NIPA data on corporate profits for domestic industries are used to test the robustness of results.

Total government expenditure is reported in NIPA as the aggregate of (a) current expenditure, plus (b) gross government investment, plus (c) net purchase of nonproductive assets, plus (d) capital transfer payments, minus (d) consumption of fixed capital. However, estimates for the net purchase of nonproductive assets are available in NIPA from 1960 only, and thus total government expenditure is not reported for the years 1929-1959. I have used as an estimate of overall government expenditure the sum of current expenditure and gross government investment, which for the comparable years never exceeds the figure of total government expenditure reported in NIPA by more than 12%, with the difference mostly attributable to the consumption of fixed capital. To use current expenditure plus gross government investment as an indicator of the government contribution to aggregate demand seems to me defensible, as for the creation of demand for goods and services what is important is the total dollar spending of the government, and not that this spending is or is not substituting obsolete or lost fixed capital.

In the statistical analysis I do not use GDP or GNP as aggregates—except to normalize the data. The changes in these variables are composed of changes in others. To examine the changes of the components themselves illuminates what is often obscured by looking at the aggregate.

3. Descriptive statistics

Considering NIPA data for 1929-2013, the mean shares in the national product are 63.8% for consumption, 32.0% for government expenditure, 15.4% for gross investment, 10.8% for business investment, 9.1% for profits before taxes, 5.9% for profits after taxes, and 3.2% for taxes on corporate profits. The “big bills” in NIPA are consumption and government spending, but just a look at their plots (Figure 2) indicates that these two variables are much less volatile than the others. Thus the coefficients of variation are for consumption 9.3%, for government expenditure 23.0%, for gross investment 25.9%, for business investment 23.7%, for profits before taxes 26.5% and for profits after

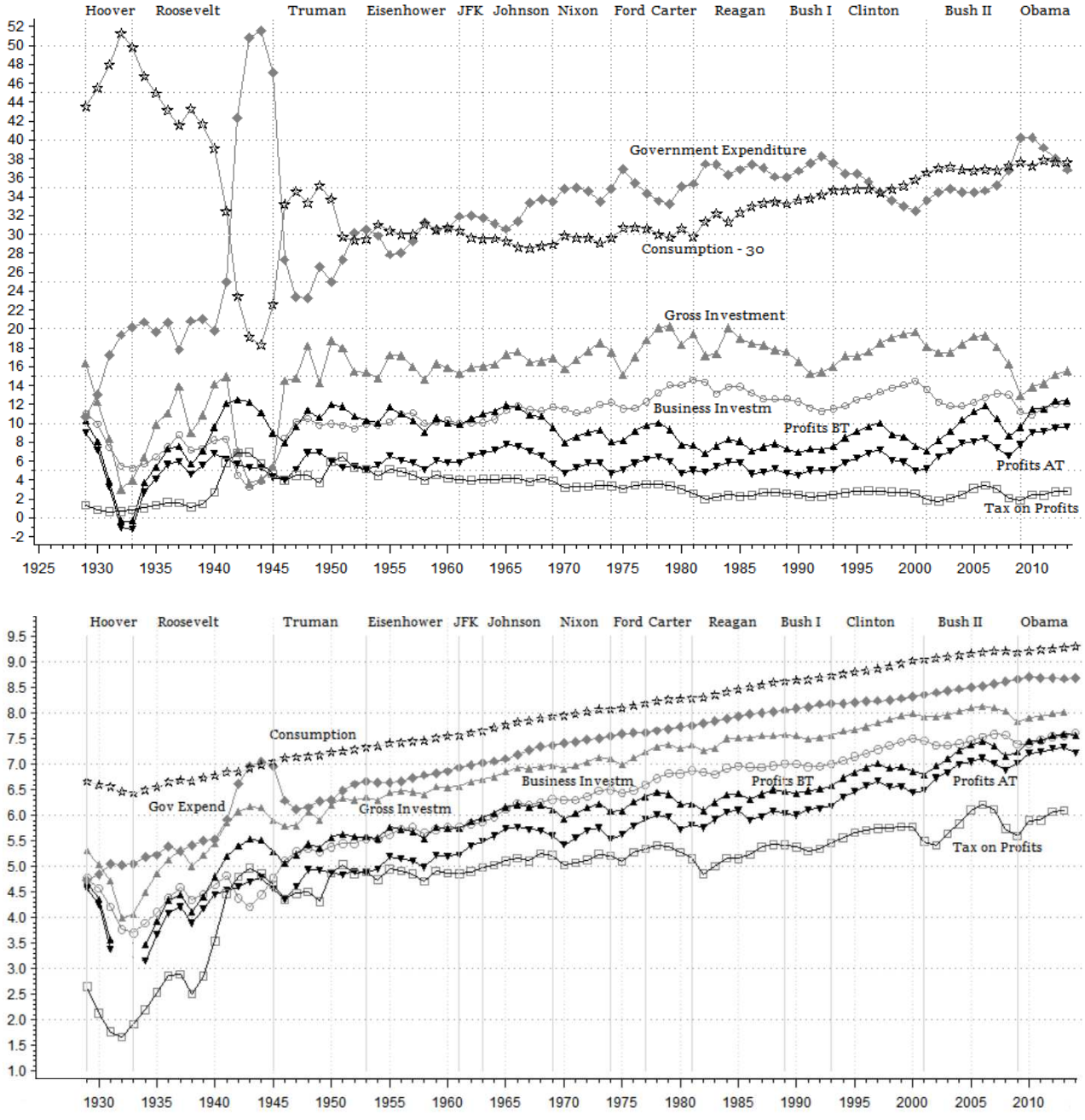
taxes 29.3%. The variability of investment is much greater than the variability of consumption, but profits, particularly profits after taxes, are the most volatile variable.

It is uncontroversial that in real terms consumption, investment and profits are procyclical, so that they fall in recessions, though this is almost impossible to appreciate for consumption when plotted in real terms (Figure 2, bottom panel). However, in terms of share in the national product (Figure 2, top panel) consumption declines in expansions and rises in recessions, countercyclically. Thus the consumption share soared during the Hoover years of the Great Depression, in the early 1930s, as well as during the "Roosevelt recession" of 1938, and during the recession of the mid-1970s. After rising quite steadily during the Bush I-Clinton period, and stagnating during the Bush II presidency, consumption rose during the Great Recession from 66.8% of the national product in 2007 to 67.3% in 2010. But in real terms, it shrank—by 2.4%—in 2009 for the first time since the 1930s.

The procyclical fluctuations of investment and profits which are intrinsic components of the business cycle are evident in the plots of the annual series, either as shares of the national product or in natural logs of real values (Figure 2). The procyclical character of business investment is illustrated for instance by its precipitous drop in the two recessions of the 1930s, in the recession at the turn of the century and in the Great Recession, when the share of business investment in the national product dropped from 13.2% in 2007 to 10.9% in 2010 (Figure 2). In general, data from recent decades are consistent with what Wesley Mitchell wrote six decades ago, that "the cyclical fluctuations in the production of capital goods are four times as violent as those in consumer goods" so that investment spending is subject to much greater shocks than consumption spending. "Though capital goods form less than 18% of the gross national product, their output is subject to such violent alternations (...) that this minor segment of the economy contributes 44% of the total cyclical fluctuation in output, and nearly half of the cyclical declines" (Mitchell 1951, 153).

The procyclical character of profits before and after taxes is illustrated for instance by the troughs of profits coinciding with the recessions of the early 1930s, the "Roosevelt recession" of 1938, the mid 1970s and the late 1990s. During the Great Recession the share of profits before taxes that had had a peak at 11.8% in 2010 dropped to 8.6% in 2008.

Figure 2. Consumption, domestic investment (gross and business), government expenditure, corporate profits (before and after taxes) and taxes on profits. In the top panel series are normalized as percentage of national product. To avoid the flattening of all the other series by the plot of consumption which is a much greater percentage of the national product, the plot of consumption series has been displaced downward by subtracting 30 percentage points to the original consumption share. In the bottom panel series are in natural logs of billion 1990 dollars. Note that the profit series are broken in 1932-1933, as NIPA data for profits are negative for these two years



Source: Author elaboration from NIPA data. For definitions of series see text.

Government expenditure is more volatile than consumption, but less than business investment and profits. In the long run government expenditure mirroring investment, particularly gross investment (Figure 1), illustrates how remarkably spending by the government fluctuates countercyclically, compensating during recessions the lack of demand from the private economy.

The three decades following the end of World War II show the minor fluctuations of investment, profits and government spending corresponding to the mild business cycles and small recessions of the time. Since the 1970s there is however a clear change, as the oscillations grow in amplitude and apparent declines in investment and profits mark the recessions in the late 1960s, mid-1970s, early 1980s, early 1990s, and 2001. According to the NBER chronology, peaks of the US business cycle signaling the start of a recession occurred in December 1969, November 1973, January 1980, July 1981, July 1990, March 2001, and December 2007. Considering the NBER recessions of 1980 and 1981 as a unique one, the dates correspond quite well with the declines in profits and investment observable in the late 1960s, mid 1970s, early 1980s, early 1990s, and around the turn of the century. The Great Recession is evident in the plots as a precipitous decline of gross investment between 2006 and 2009 and business investment between 2008 and 2010. Corporate profits that had been rising since 2001, reached a peak in 2006, and then dropped in 2007 and 2008.

An issue highlighted by recent debates on income and wealth inequality is whether there have been long-term changes that make the distribution of income more unequal. In terms of profits after taxes,

Table 1. Long-term trends (SE bracketed below the slope estimate) computed as linear models in which the share of the variable in the national product is regressed on time (year).

Variable	Sample 1929-2013 (n = 85)	Sample 1946-2013 (n = 67)
Consumption	-0.024	0.112***
	(0.026)	(0.012)
Gross investment	0.096***	0.013
	(0.014)	(0.010)
Business investment	0.079***	0.045***
	(0.007)	(0.007)
Corporate profits before taxes	0.020†	– 0.020*
	(0.010)	(0.010)
Corporate profits after taxes	0.031***	0.024***
	(0.007)	(0.007)
Taxes on corporate profits	– 0.011†	– 0.044***
	(0.006)	(0.004)
Government expenditure	0.184***	0.152***
	(0.026)	(0.014)

Computed from NIPA online data, obtained in February-March 2015. *** $P < 0.001$, * $P < 0.05$, † $P < 0.1$.

the best time for owners of capital has been indeed the most recent years, as in 2010–2013 profits after taxes reached never-seen-before levels over 9% of national product. Between 1929 and 2014 there were indeed only five years in which profits after taxes exceeded 9% of the national product, to know 1929, when profits were exactly 9.0% of GNP, and the four years 2010–2013, when profits

exceeded each year 9% of the national product and an all-time high of 9.6% in the share of profits in national product was reached in 2013. Between 1929 and 2014 there were only two years in which profits were negative, 1932 and 1933, when profits after taxes were respectively –1.0% and –1.2% of the national product.

The percentage share of corporate profits in the national product can be considered a measure of the share of capital returns in the national economy. It can be argued that this is an underestimate, as it assumes that all incomes included as wages and salaries in NIPA estimates are part of labor income. Recent reports indicate that earnings of CEOs may reach a ratio of 2,238 to 1 compared with the median earnings of the employees of a company (this was the case with Walt Disney CEO, Robert Iger, in 2014 (Morgenson 2015, B1)). In NIPA data monumental earnings of this order are conceptualized as salaries, that is, returns on labor. Michael Kalecki had the view that salaries of top-level managers, which often also have shares in the ownership of the firm, shall be considered profits (Osiatynski 1991, 237, fn. 17), but since NIPA data are not accounted following Kalecki's advice this issue will be fully ignored here.

Linear trends computed for the whole sample 1929-2013, or for the subsample 1946-2013 which excludes the turbulences of the 1930s and World War II, show that the long-term trend of profits before taxes is sample-dependent, as it has a growing trend in 1929-2013 and a falling trend in 1946-2013 (Table 1). But the share of profits after taxes in the national product has a clear rising trend in samples, growing between 0.02 and 0.03 percentage points of national product per year and reaching an all-time high in 2013. Gross investment has an increasing trend in the long run when the trend is computed for the years 1929-2013 (Table 1), but the rising trend clearly depends on the very low values during the Great Depression (Figure 1), as the trend computed for 1946-2013 has a slope of 0.013 with a standard error of 0.010, i.e., it is indistinguishable from 0. However, business investment reveals a significant long-term rising trend whatever sample we choose.

In the period 1929-2013 the annual spending of the government had a minimum of 10.7% of the national product in 1929 and a maximum of 51.5% in 1944. In the postwar period most of government spending is current expenditure, which from levels around 80% in the 1950s rose in recent years to comprise about 90% of the government expenditure. A linear trend for government spending using data for 1929-2013 has a significant rising trend with a slope of 0.18 with a standard error of 0.03 (*P*

<0.001), while for the sample 1946-2013 the positive slope is also very significant and only slightly flatter. On average, government spending has grown almost 1 percentage point per decade in national product units. For illustration of recent controversies on whether the Obama administration is spending too much, it may be proper to point out that government profligacy in recent years reached its highest in 2009 and 2010, when government expenditures were equivalent to 40.20% and 40.22% of the national product, respectively. This level of spending can be considered proper of a war economy, as in 1942 the expenditure of the government was 42.4% of the national product (Figure 1), but can be hardly considered as an accomplishment of President Obama. Much before the Great Recession, since the mid-1970—and both under Republican and Democratic administrations—annual government spending was at levels oscillating around 35% of the national product, which corresponds to World War II levels. Interestingly, and perhaps contrarily to common views, government expenditure as a share of the national product rose during the Reagan-Bush years, declined during the Clinton era, rose sharply again during the Bush II presidency, and declined again during the Obama administration (Figure 2).

Overall these results demonstrate that in the past eight decades profits after taxes and business investment are increasing fractions of the national product, corporate taxes are declining, and government spending is increasingly large as compared with the size of the national economy. In term of volatility, profits are the most volatile variable, followed by investment..

4. Identification

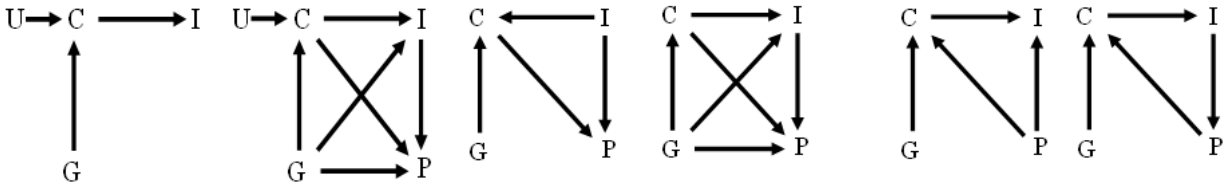
The establishment of causal relations is usually discussed in economics under "the identification problem." A usual way to pose it is to assume an underlying structure which generates the observations, so that a meaningful statistical interpretation of the data through this structure "can be achieved only if there is no other structure which is also capable of generating the observed data"; thus identification is the problem "of whether it is possible to draw inferences from the probability distribution of the observed variables to an underlying theoretical structure" (Hsiao 1987, 2:714-715). Identification is sometimes defined as deciding whether the estimates "of the parameters of a structural equation can be obtained from the estimated reduced-form coefficients" (Gujarati 2003, 739), or as a particular problem "of applying regression analysis where it is difficult to identify the

precise relationships between variables because all the variables change simultaneously" (Pass et al. 1991). For Malinvaud, "when two or more different structures imply the same distribution of the observed variables, we say they are not *identifiable*" (Malinvaud 1966, 68). Though in many economic texts in which identification is discussed the word "cause" seems to be systematically avoided, it seems quite clear that in all econometric contexts in which identification is discussed "structure" means "causal structure," so that *structural* equations are equations properly representing causal relations between variables, while *reduced-form* equations represent relations between observed variables that can represent real actual relations or just spurious association (Heckman and Pinto 2015, 115-151). Thus the identification problem is that of solving how to infer actual causal relations (if they exist) from observed data. As very clearly put by Elwert, identification determines whether, and under which conditions, it is possible to eliminate all spurious components from an observed association, so that "a causal effect is identified if a properly stripped association equals ("identifies") the causal effect" (Elwert 2013, 245-272).

Figure 3. DAGs representing potential causal relations between consumption (C), investment (I), government expenditure (G), and profits (P) in a classical or neoclassical framework. The left diagram presents the simplest classical model of an exogenous business cycle in which G is an exogenous variable modifying C, and unknown exogenous "shocks" to C (U, e.g. an increase in oil prices due to an OPEC action) will determine changes in C which in turn determine changes in I. Profits P are not considered as part of the model. The right diagram represents a more elaborated neoclassical view, in which G can have an effect not only on C, but also on I ("crowding out") and P.

Figure 4. DAGs presenting potential causal relations between consumption (C), investment (I), government expenditure (G) and profits (P) in a Keynesian framework. In the left model I and G are the exogenous variables determining all the other macro-economic variables. The lower dia-gram intends to represent more elaborated Keynesian views, per-haps New Keynesian views, in-cluding the assumption that G can have an effect not only on C, but also on I and P, and the causal link goes from C to I rather than the other way around.

Figure 5. DAGs presenting potential causal relations between consumption (C), investment (I), government expenditure (G) and profits (P) in an endogenous model of the business cycle in which G is the only exogenous variable, I depends on past P (left diagram) and present P depends on past I (right diagram). These views correspond roughly with those of Marx, Mitchell, and Tinbergen.



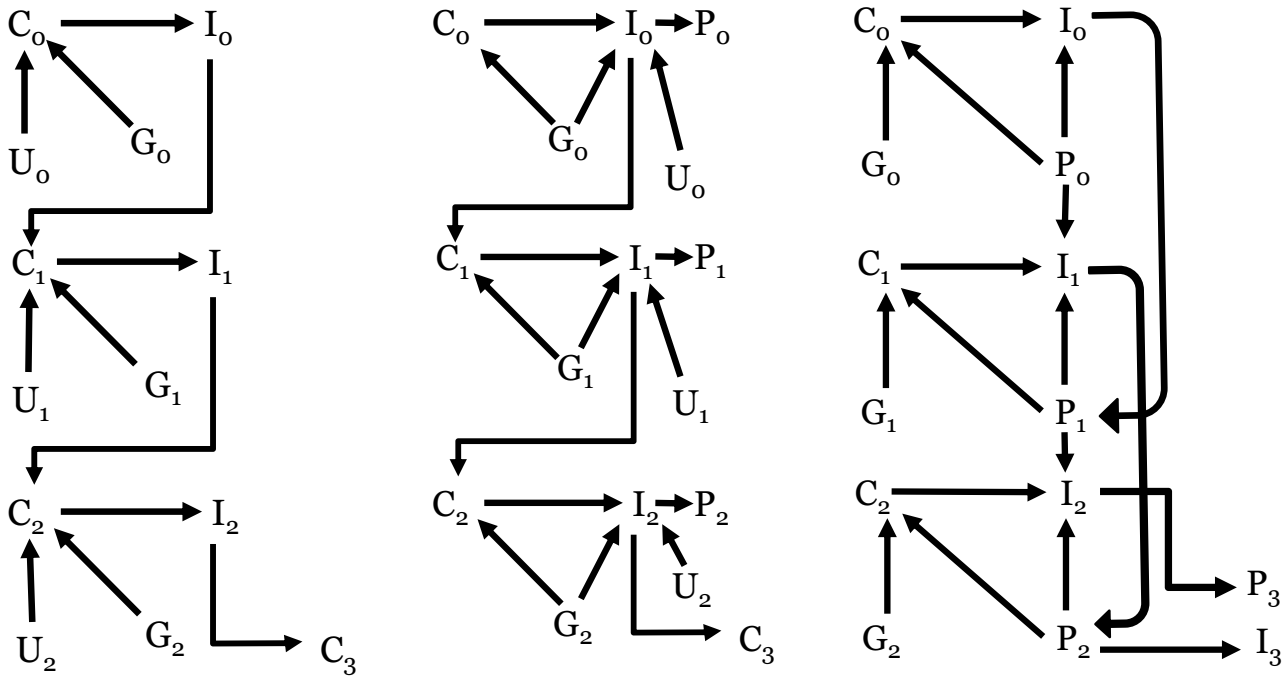
The causal relations between business-cycle variables constitute one of the most controversial issues in economics. Focusing on the four basic business-cycle variables I have intended to represent through DAGs the explanatory schemes of the business cycle which are hypothesized by different schools of economic thought. Of course, after two centuries of heated disputes about what depressions or

recessions are, and what can be their potential causes, it is not an easy task. Figure 3 intends to represent a DAG depicting the basic causal relations between investment, consumption, profits and government expenditure in the context of classical/neoclassical economics. Figure 4 intends the same for Keynesian theory, and Figure 5 for what I will call Marx-Mitchell-Tinbergen (MMT) framework. Figures 6, 7, and 8 intend to present the same causal schemes of the three frameworks in a more developed form, using subscripts to represent three consecutive time periods.

Figure 6. DAG representing the potential causal relations between consumption (C), investment (I), and government expenditure (G) in a neoclassical model with three periods. "Shocks" to C caused by government actions (G_0, G_0, G_2...) or other unknown exogenous factors (U_0, U_1, U_2) will modify I, which in turn will modify C in the next period, C_1, which itself may be modified by contemporaneous shocks G_1 and U_1. Since the system itself tends to equilibrium, only exogenous interferences or "shocks" determine upward or downward deviations of the trajectory of the system, which is determined by technological change, population growth, and other factors subsumed under the general category U_i.

Figure 7. DAG representing the potential causal relations between consumption (C), investment (I), Profits (P) and government expenditure (G) in a Keynesian model of the business cycle with three periods. Government actions (G_0, G_0, G_2...) will modify C and I, and unknown *animal spirits* (U_0, U_1, U_2) will modify I, which in turn will modify C in the next period, C_1, which itself will be modified by contemporaneous government actions G_1, at the same time that I_1 will be modified by U_1. Since U_1 are exogenous, these spirits cannot be con-trolled. However, steady growth of C can be maintained by monetary and fiscal policy G_i.

Figure 8. DAG representing the potential causal relations between consumption (C), investment (I), government expenditure (G) and profits (P) in a business cycle endogenous model in the MMT framework, in which the oscillations are endogenously generated by the dependency of I from past P, and P from past I. G and unknown factors (not represented) are the only exogenous variables, but they do not have a major role in the causation of the cycle



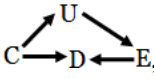
A comparison of Figures 3 and 4 reveals that the more elaborated versions of both schemes (right panel of Figures 3 and 4) are very similar, they only differs in the shocks U that are present in the

neoclassical scheme and which can be easily included in the New Keynesian scheme. The comparison of Figures 3, 4 and 5 shows how different is the role of profits in the three schemes. Profits are not even present in the more basic classical/neoclassical framework (Figure 3, left), and they are just effects of other variables in the more elaborated version of the neoclassical scheme and in the Keynesian framework. However they have a major causal role influencing other variables in the MMT framework.

Basic rules to draw a DAG are that arrows cannot be bidirectional and that there cannot be loops going from one variable to itself through other variables. Arrows in DAGs intend to link causes and effects and the whole scheme is strongly imbued by the idea that the cause have to be previous to the effect. Arrows can represent positive or negative causality, so the arrow G → I can mean both that government expenditure increases investment (for instance by creating business opportunities) or that government expenditure reduces private business investment (for instance by a mechanism of "crowding out").

Correlation does not imply causation, but a much more interesting idea, already noticed by John Stuart Mill in one of his cannons of causality (Mill 1846) is that the correlation between the changes of two variables can be explained only by one causing other or by another variable causing both. In more formal terms, the correlation between A and B can be explained only by A causing B (in DAG language A→B), by B causing A (that is, A←B), or by a third variable C. If the correlation between A and B is caused by a third variable C, it can be because C is causing both A and B in a situation that has been called "confounding" or "causal fork" and is represented with a DAG A←C→B, where C is the confounder. The other possibility that C causes a spurious association between A and B is what is called endogenous selection or inverted fork, which corresponds to a structure A → C ← B (Elwert 2013, 245-272).

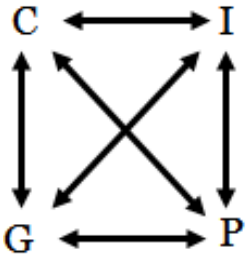
The virtue of DAG analysis is to produce neat rules on how to ascertain causal relations from observed data. Thus if we hypothesize a causal structure such as A→B→C→D←E, in which B is a mediator of the causal relation between A and C, to adjust for B when assessing the causal relation between A and C will be improper as it will "block" the causal path. But if the hypothesized causal structure is C → D ← E, and we suspect that there might be an unmeasured variable U which is an

intermediate link in a causal path between C and E, so that 

, then adjusting for E is a proper strategy in assessing the casual relation between C and D. A key element in DAGs is what is not present, which represents all that *we know* or *we assume* has no effect on the variables represented. So, DAGs presented in figures 4 to 8 all of them assume that the money supply, interest rates, imports, exports, meteorological factors, wars in Africa or major discoveries in biology do not have an effect on the business cycle in the United States. *Or if they have it, it is through independent effects on the represented variables*.

The identification strategy of this paper is as follows. I will start from scratch by ignoring causal restrictions proposed by different economic theories, so it will be assumed that all possible causal relations may exist between consumption, investment, profits and government expenditure (Figure 9). Then, by examining pairwise relations between the four variables, I will eliminate the causal pathways that are inconsistent with the statistical associations revealed by pairwise models. The rationale is that statistical effects of X at times $t - k$ on Y at time t can be explained by X causing Y or by another variable Z responsible of creating a spurious relation between X and Y by confounding or endogenous selection. However, if the statistical effects of X at times $t - k$ on Y at time t are null, that is incompatible with a causal effect of A on B. The absence of correlation between past values of one variable X and that part of another variable Y which cannot be predicted from Y's own past implies absence of causal influence from X to Y (Sims 1972, 540-552). After eliminating causal paths that are inconsistent with the associations found in the pairwise analysis, I will test the remaining potential causal path by adjusting for variables that can create spurious associations.

Figure 9. All potential causal relations between consumption (C), investment (I), government expenditure (G) and profits (P) abstracting from restrictions proposed by different economic theories. Note that this scheme is not a DAG as it includes bidirectional arrows



5. Statistical methods

To obtain mean-stationary and variance-stationary time series that allows for statistical testing I used two methods. First, series in real values (2009 dollars) were log-transformed and then converted into first differences, which amounts to using variables in rate of growth. Second, series were converted

into percentages of the national product, and then differenced.

I assume that that the structural functions linking the variables are approximately linear—if they exist—and use distributed-lag regressions to examine the associations between changes in a explanatory variable or covariate at years $t - k$ and changes in a dependent variable at year t. For instance, I regress the change in profits on the change in investment to ascertain potential associations between past investment and present profits. The regression equation is

$$\Delta P_t = \alpha + \sum_{k=1}^{r} \beta_k \cdot \Delta I_{t-k} + \varepsilon_t ,$$

where

P_t is a given category of profits,

I_t is a given measure of investment,

Δ is the difference operator so that ΔX_t is the change of the variable X between year t–1 and year t, and

ε_t is the error term.

Equations were estimated for specifications in which r, the number of lag terms of the explanatory variable, varied from 1 to 5. The criterion to choose among these five equations the equation with the best fit is to minimize AIC, the Akaike information criterion. If the AIC was minimized by the equation including five lags, I computed an equation including one extra lag to check if AIC was lower including six lags, which never occurred.

To avoid imposing unwarranted assumptions on the models I do not used Almon lags.

To make specifications with different lags comparable in terms of AIC the sample has to include exactly the same number of observations. Thus in the specification for the whole sample the observations used were actually those corresponding to the years 1934 to 2013, so that for all the sample data are available for any variable lagged up to 5 years.

To examine the robustness of the results to sample selection, I computed regression models for the whole sample 1934-2013 and for three subsamples: 1934-1960, 1961-1990, and 1991-2013.

Models to test the pairwise association between variables exclude a contemporaneous effect in which the explanatory variable at year 0 would modify the dependent variable at year 0. This is because the purpose of the models is to look for associations that are potentially causal. Statistically significant associations of a variable x on a variable y at lag 0 can be explained by x causing y, by y

causing *x*, by both causing each other, or by a third variable causing both. However, a change of *x* at time -1 followed by a change in *y* at time 0 can be an effect of *x* on *y* or an effect of a third variable on both, but never an effect of *y* on *x,* unless we disregard all rational notions of causality or assume human beings with supernatural abilities to forecast the future, and adjust their actions to make the forecast true. Indeed, since the business cycle implies more or less simultaneous oscillations of the different components of the national economy, the oscillations of many series at lag 0 are highly correlated but they tell us nothing about what can be causing what. Series of profits and investment in first differences have very high and statistically significant positive correlations (Table 2). Because they are both strongly procyclical, changes in profits before taxes and changes in gross investment have a very significant positive correlation (0.51 as shares of GNP, 0.49 as log real values, both $P < 0.001$), but government expenditure has very large negative correlations with investment, revealing its countercyclical fluctuation.

Table 2. Correlations at lag 0. In the top panel variables are in first differences of the share in the national product. In the bottom panel variables are first differences of logs of real values in 2009 dollars

	Gross investment	Profit after taxes	Profit bef. taxes	Taxes on prof	Government expenditure	Consumption
Business investment	0.80***	0.34**	0.27*	-0.01	−0.78***	0.28
Gross investment		0.48***	0.51***	0.26*	−0.79***	0.16
Profit after taxes			0.89***	0.16	−0.19†	−0.28**
Profit before taxes				0.60***	−0.09	−0.49***
Taxes on profits					0.14	−0.56***
Government expend.						−0.69***
Business investment	0.87***	0.40***	0.40***	0.33**	−0.48***	0.74***
Gross investment		0.43***	0.45***	0.41***	−0.46***	0.70***
Profit after taxes			0.93***	0.56***	0.01	0.50***
Profit before taxes				0.81***	0.15	0.58***
Taxes on profits					0.28**	0.56***
Government expend.						0.49***

*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$, † $P < 0.1$.

Omitting contemporaneous effects and focusing on models in which what happens at the present is modeled on what happened in past years facilitates establishing what covariates have an explanatory power of the changes in the variable used as dependent.

6. Pairwise associations

I examined pairwise associations by computing regression models in which present values of the dependent variable are a function of lag values of the covariate. Since autocorrelation of the residuals can be a reason for underestimated standard errors and spurious statistical significance, I systematically examined the Durbin-Watson *d*. In models computed with first differences of log-transformed real values *d* is usually in a range between 1.5 and 2.0, though in particular regressions it went down to the range 1.0 to 1.5. In regressions with data in first differences of shares in the national product, *d* was usually quite close to 2.0. Since *d* is approximately equal to 2 (1 – *r*), where *r* is the sample autocorrelation of the residuals, *d* in the range 1.5 to 2 indicates *r* in a range between 0.0 and 0.25, that is a small positive autocorrelation of the residuals. So the reduced-form equations to ascertain pairwise associations seem to have estimated standard errors unaffected by underestimation due to positive autocorrelation of the residuals.

Table 3. Associations of lag consumption with present business investment

Sample	Lag	Eq. 1	Eq. 2	Eq. 3	Eq. 4	Eq. 5
1934-2013	1	2.07***	2.2***	**2.04*** **	2.11***	2.16***
	2		-0.81	**-0.51**	-0.48	-0.38
	3			**-0.74**	-0.83	-0.86†
	4				0.22	-0.01
	5					0.52
	AIC	-354.4	-354.8	-355.5	-353.8	-353.1
	R^2	0.15	0.18	0.21	0.21	0.22
1934-1960	1	**2.20†**	2.16†	1.90	2.21	2.38
	2		-0.65	-0.35	-0.23	-0.01
	3			-0.83	-1.05	-1.13
	4				0.54	0.24
	5					0.73
	AIC	-90.3	-88.6	-87.6	-86.0	-84.8
	R^2	0.12	0.13	0.16	0.17	0.20
1961-1990	1	1.82***	**2.17*** **	2.13***	2.13***	2.15***
	2		**-1.15***	-1.11†	-1.25*	-1.23*
	3			-0.15	0.01	0.10
	4				-0.51	-0.64
	5					0.41
	AIC	-180.6	-183.8	-181.9	-181.1	-180.0
	R^2	0.29	0.41	0.41	0.43	0.45
1991-2013	1	1.55†	2.11*	**2.09***	2.08*	2.19*
	2		-1.29	**-0.72**	-0.73	-0.89
	3			**-1.26**	-0.99	-0.95
	4				-0.58	-0.19
	5					-0.93
	AIC	-126.4	-126.9	-127.8	-126.4	-125.1
	R^2	0.16	0.25	0.33	0.35	0.37

All variables in the regressions are first differences of log-transformed real values in 2009 dollars.
*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$, † $P < 0.1$.

6.1. Consumption

6.1.1. Consumption "causing" investment (C→I)

Models in which lag consumption is used as explanatory variable of present business investment (Table 3) provide sample-dependent results that are rather inconclusive as the associations of past

consumption with present investment. The model with the best fit for the sample 1934-2013 is equation 3 (Table 3, first panel) including effects for lags 1 to 3. In this model

$$\Delta C_t = 0.02 + 2.04\,\Delta I_{t-1} - 0.51\,\Delta I_{t-2} - 0.74\,\Delta I_{t-3} + \varepsilon_t$$
$$(0.03)\quad (0.56)\quad (0.55)\quad (0.46) \qquad R^2 = 0.21$$

there is a highly significant positive association of consumption at lag 1 with investment at lag 0 but the associations are negative, though not significant, at lags 2 and 3. The net association is positive and the model explains 21% of the variation of investment. In the sample 1934-1960 the association of past consumption with present investment in the specification with the best fit is positive but only marginally significant and R^2 is only 0.12. In the sample 1961-1990 there are alternate positive and negative signs of the association of past consumption—at lags 1 and 2—with present investment, though the net association is positive. In the sample 1991-2013 the model with the best fit has respectively positive and negative association of past consumption at lags 1 to 3 with present investment, with a net positive association (2.09−0.72−1.26 =0.11) close to 0.

Using gross investment as dependent variable (results not shown), the models with the best fit reveal in the whole sample statistically significant positive and negative associations of past consumption at lags 1 and 2 with present investment, but past consumption has not any significant association with present investment in the samples 1934-1960 and 1991-2013 and it has only a very small positive net association in 1961-1990.

Overall these regressions provide some evidence of an unconditioned positive association of past consumption with present investment, but the evidence is weak and inconsistent.

Table 4. Associations of lag consumption with present profits (after taxes and before taxes). Only the results of the model with the best fit (lowest AIC) are presented

Sample	Lag	After taxes	Before taxes
1934–2013	1	− 1.12	− 0.47
	2	− 1.30†	− 1.12
	3	− 0.94	− 1.75***
	4	− 1.04	
R^2		0.17	0.17
1934–1960	1	− 1.87	− 1.06
	2	− 1.51	− 1.20
	3	− 1.16	− 2.26*
	4	− 1.50	
R^2		0.27	0.25
1961–1990	1	− 0.54	0.55
	2	− 3.03*	− 2.66*
R^2		0.20	0.18
1991–2013	1	− 1.96	− 1.96
R^2		0.10	0.11

All variables are first differences of log-transformed real values in 2009 dollars

6.1.2. Consumption "causing" government expenditure (C→G)

Results of regressions with consumption being the explanatory variable of government expenditure (not shown) do not reveal significant associations in the samples 1934-2013 and 1934-1960, in which the models with the best fit have R^2 values of 0.01 and 0.04. In the sample 1961-1990 lag consumption

have significant associations (– 0.15 and 0.57) with present government expenditure at lags 1 and 2, with an R^2 of 0.24, while in the sample 1991-2013 the model with the best fit includes a negative association at lag 1 and positive associations at lags 2 to 5, with an R^2 of 0.64. Overall these results suggest a positive association in recent decades, so that changes in consumption are followed a few years later by changes in government expenditure in the same direction.

6.1.3. Consumption "causing" profits (C→P)

Regression results provide strong evidence that the unconditioned association of past consumption with present profits is negative (Table 4). Effect estimates, systematically negative and many of them significant, are found in all samples and both using as dependent variable profits either before taxes or after taxes. This is solid evidence that movements in consumption are followed by movements in profits in the opposite direction in the next few years.

6.2. Investment

6.2.1. Investment "causing" consumption (I→C)

Results of regressions with business investment as covariate and consumption as dependent show that past investment has rather weak associations with present consumption (Table 5). But the associations, revealed in regressions by significant parameter estimates with alternate signs, are overall negative, so that movements of investment are followed by movements of consumption in the opposite direction. For instance in the sample 1934-1960 and using business investment as covariate, the model with the best fit has estimates of –0.07, +0.00, and –0.08 (of which the first and the last estimates are highly significant) for the effects of investment on consumption at lags 1 to 3, and the model predicts a substantial 40% of the variation in consumption. In the sample 1991-2013 the association of past investment with present consumption is positive, but it is statistically insignificant with an R^2 of 0.04. Using gross investment rather than business investment the results are quite similar. Overall the results are quite inconsistent with the view that investment raises consumption in future years and it seems the

Table 5. Associations of lag investment with present consumption

Sample	Lag	Effect estimate
1934-2013	1	-0.04†
	2	-0.01
	3	-0.05*
	R^2	0.12
1934-1960	1	-0.07*
	2	0.00
	3	-0.08***
	R^2	0.40
1961-1990	1	-0.05
	2	-0.10†
	R^2	0.15
1991-2013	1	0.05
	R^2	0.04

All variables in the regressions are first differences of log-transformed real values in 2009 dollars.
*** P<0.001, ** P<0.01, * P<0.05, † P<0.1.

unconditioned association between past investment and present consumption must be considered either negative or null.

6.2.2. Investment "causing" profits (I→P)

Using business investment as covariate and profits after taxes as dependent variable (Table 6), the model with the best fit for the sample 1934-2013 shows negative associations of investment at lags 1 to 4 with present profits, with a significant negative effect estimate at lag 1. In the sample 1934-1960, investment has a non-significant negative association with profits at lag 1 in the model with the best fit, but in the samples 1961-1990 and 1991-2013 the association of investment at lags 1 and 2 with present profits is negative and significant. The general pattern (Table 6) is one of a negative association of past investment with present profits.

Table 6. Associations of lag business investment with present profits after taxes. Only the results of the model with the best fit are presented

Sample	Lag	Effect estimate
1934-2013	1	-0.33*
	2	-0.16
	3	-0.02
	4	-0.16
	5	-0.37***
	R^2	0.18
1934-1960	1	-0.09
	R^2	0.01
1961-1990	1	-0.95*
	2	-0.60
	R^2	0.31
1991-2013	1	-0.77*
	R^2	0.25

All variables in the regressions are first differences of log-transformed real values in 2009 dollars.
*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$, † $P < 0.1$.

Using as dependent variable profits before taxes instead of profits after taxes, or using gross investment as explanatory variable, the results (not shown) are basically the same and even in some cases more supportive of a negative association of past investment with future profits. Thus in the sample 1991-2013, in the model with the best fit in which the net association of past investment at lags 1 to 3 with present profits is negative, business investment explains 49% of the variation of profits before taxes.

Table 7. Associations of lag investment with present government expenditure. Only the models with the best fit are presented

	Lag	Sample 1934-2013	Sample 1934-1960	Sample 1961-1990	Sample 1991-2013
Panel A Business investment explaining government expenditure	1	– 0.28*	–0.40*	0.08	– 0.11
	2			0.16***	0.13†
	3				0.04
	4				0.09
	5				
	R^2	0.06	0.10	0.34	0.43
Panel B. Gross investment explaining government expenditure	1	– 0.07	– 0.11	0.02	– 0.09*
	2	0.09		0.08*	0.05
	3	0.11†			0.08*
	4				0.04
	5				0.10
	R^2	0.05	0.03	0.16	0.62

*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$, † $P < 0.1$.
Variables are in first differences of log-transformed real values in 2009 dollars

Overall these results show an unconditioned negative association of present investment with future profits. Movements in investment are followed but movements in profits in the opposite direction.

6.2.3. Investment "causing" government expenditure (I → G)

Regressions of present government spending on past investment (Table 7) show sample-dependent associations. The net association of past investment (using either business investment or gross investment) and present government expenditure is negative in the samples 1934-2013 and 1934-1960, but positive in 1961-1990 and 1991-2013. Only in the sample 1991-2013 investment has a substantial

ability to predict government spending (R^2 is 0.43 with business investment and 0.62 with gross investment), with effect estimates having opposing signs that overall yield a small positive net effect. In regressions with first differences of shares of the national product (not shown) in the subsample 1991-2013 a percentage point increase in the share of gross investment is followed one year later by a highly significant decrease of 0.58 percentage points in government expenditure, with the change in investment explaining a substantial 36% of the change in government spending.

Considering all the results, it seems the unconditioned association is neither null nor negative. Overall the association between past investment and present government expenditure is moderately positive, so that an upturn in private investment is associated with an immediate downturn in government spending the same year and the next year, but then an increase in government spending follows in the next few years. This seems consistent with the fact that during the Reagan-Bush I period and also during the Bush II presidency, government expenditure rose when the overall economy, as proxied by private investment, had been expanding for a while. At any rate, the fact that government spending has significant associations with lagged investment shows that rather than as an endogenous variable, government spending shall be treated as an endogenous one—as Christopher Sims emphasized in his Nobel lecture (Sims 2012, 1187-1205).

6.3. Government expenditure

6.3.1. Government expenditure "causing" consumption (G→C)

Models in which consumption is the covariate and government expenditure the dependent variable (results not shown) do not reveal any significant association and the highest R^2 found in these models is 0.07. In the sample 1934-2013 the model with the best fit shows statistically significant positive associations of government expenditure at lags 1 and 5 with consumption at lag 0, but the R^2 of the model is only 0.18. Overall the results of the models seems consistent with a null unconditioned association between lag government expenditure and present consumption incompatible with a causal effect G→C.

Table 8. Associations of lag government expenditure with business investment, or gross investment. Only the models with the best fit are presented

	Lag	Sample 1934-2013	Sample 1934-1960	Sample 1961-1990	Sample 1991-2013
Panel A	1	− 0.34***	− 0.35*	− 0.29	− 1.67*
Government expenditure explaining business investment	2	0.15	0.14		
	3	0.25*	0.24		
	4				
	5				
	R^2	0.23	0.28	0.01	0.21
Panel B	1	− 0.32†	− 0.41	0.61	− 1.54
Government expenditure explaining gross investment	2	− 0.19			
	3	0.53***			
	4				
	5				
	R^2	0.15	0.09	0.02	0.10

*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$, † $P < 0.1$.
Variables are in first differences of log-transformed real values in 2009 dollars.

6.3.2. Government expenditure "causing" investment (G→I)

Results of lag regressions in which past government expenditure is used to explain business investment or gross investment (Table 8) show sample-dependent results. If greater levels of government spending would contribute to stimulate the private economy, we would expect positive associations of business investment with lag government expenditure. However, for instance in the 1991-2013 the association of past government expenditure with business investment is negative and significant (Table 8, panel A). In the sample 1991 the explanatory power of government spending to explain business investment is basically null and in the samples 1934-2013 and 1934-1960 past government expenditure explains about a quarter of the variation in business investment, but the effect estimates at lags 1 to 3 have opposing signs, with a net effect small positive effect. Using as

dependent variable gross investment (Table 8, panel B), government explaining explains basically nothing in the subsamples and has effects with opposing signs with a net effect almost zero in the general sample.

Overall these results seem quite inconsistent with the hypothesis that an increase in government spending will pump-prime the economy by raising private investment in the following years. Results like the negative significant association of government spending at lag 1 with business investment at lag zero in the sample 1991-2013 do not allow to discard a potential causal effect G → I, but on face value the association is negative rather than positive.

6.3.3. Government expenditure "causing" profits (G → P)

Regressions of present profits (either before or after taxes) on lag values of government spending show that government spending has no ability at all to explain present profits. Effect estimates in all samples are erratic in sign but always insignificant; R^2 values are below 0.6. Thus G→P must be considered null.

Table 9. Associations of lag profits (either after taxes or after taxes) with present business investment. Only the results of the model with the best fit are presented

Sample	Lag	After taxes	Before taxes
1934-2013	1	0.11	0.01
	2		-0.05
	3		-0.05
	4		0.20*
	5		0.19*
R^2		0.02	0.22
1934-1960	1	-0.30	-0.33*
	2	-0.01	-0.08
	3	-0.44†	-0.15
	4	0.37	0.33*
	5		0.29*
R^2		0.32	0.65
1961-1990	1	0.28***	0.36***
R^2		0.38	0.44
1991-2013	1	0.26*	0.35***
	2	0.32***	0.27***
	3	0.12	
	4	0.14	
R^2		0.57	0.62

*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$, † $P < 0.1$.
All variables are first differences of log-transformed real values in 2009 dollars

6.4. Profits

6.4.1. Profits "causing" investment (P→I)

Results of regressions in which lag profits are used to explain present investment show a net positive association (Table 9). In general, profits before taxes have a greater explanatory power of investment than profits after taxes. Thus in the sample 1961-1990 the association is concentrated at lag 1, with profits after and before taxes explaining respectively 38% and 44% of the variation in investment, while in the sample 1991-2013 the association is spread at more lags, but now profits after and before taxes explain respectively 57% and 62% of the variation in business investment.

Using gross investment rather than business investment, the results (not shown) are quite similar in all samples. Overall, the results of all these models, excepting some for the subsample 1934-1960, are

indicative of an evident positive association of past profits with present investment, that is, a movement in profits predicting a movement in investment in the same direction in the next few years.

6.4.2. Profits "causing" government expenditure (P→G)

Regressions in which present profits are used as explanatory variable of future government expenditure reveal overall a positive association (results not shown). However, the association (with R^2 of just 0.11 for the whole sample), which is strongest in the subsample 1934-1960 (R^2 = 0. 38), is positive in this subsample as well as in the subsample 1961-1990 (R^2 =0.14) but in the subsample 1991-2013 the association appears in the model with the best fit at lags 1 and 2, and is negative in both cases (R^2 = 0.23).

Though the sign of the association P→G seems unclear, it seems the evidence does not allow to exclude it from a multivariate analysis. These results are clearly consistent with Sims's views on the endogeneity of government spending (Sims 2012, 1187-1205).

6.4.3. Profits "causing" consumption (P→C)

Regressions results (not shown) indicate positive and significant associations in the general sample and in the subsamples 1961-1990 and 1991-2013, where the variation in profits after taxes explains respectively 5%, 24%, and 13% of the variation in consumption. In the subsample 1934-1960 the association is null. Overall, past profits show a clear though rather weak positive association with present consumption.

6.5. Robustness checks

On average, for the 86 year period 1929-2014, corporate profits before taxes of domestic industries are 90.2% of all corporate profits before taxes, and for the 85 year period 1929-2013, corporate profits after taxes of domestic industries are on average 85.4% of all corporate profits after taxes. The greatest differences are observed in the past decade, when profits before taxes of domestic industries oscillated year to year around 70% to 80% of all corporate profits before taxes (the minimum, 68.4%, corresponds to 2008). For profits after taxes the share of domestic industries also reaches minimum levels during the past decade, with the minimum in 2008 when domestic profits after taxes are only 58.3% of all profits after taxes. I used corporate profits of domestic industries for robustness check of

the main results obtained with corporate profits of all industries. Using corporate profits of domestic industries—before or after taxes—in the regression models instead of profits of all industries, the results (not shown) are remarkably similar to those presented here (in Tables 6 and 9). Almost constantly the best specification in terms of number of lags that minimizes AIC is the same using total profits or profits of domestic industries. However, in some models the ability of the change in profits of domestic industries to predict the change in business investment is slightly greater, and sometimes considerably greater, than the power of total profits. Thus for the sample 1991-2013 total profits *after taxes* explain 57% of the variation in business investment (Table 9) while profits after taxes of domestic industries explain 72%.

As it was mentioned, the category of "business investment" that I have used throughout this paper is actually what in NIPA tables appears as gross private domestic nonresidential fixed investment. To check how sensitive the regression results are to a change in the category of investment, I computed equations using the category that appears in NIPA as "private domestic investment of businesses," which is only available for 1960-2013. The results (not shown) differ very little from the results for the category of "business investment" used here. I also estimated some regressions using as measure of investment a net investment variable computed as gross domestic investment minus consumption of fixed capital minus gross government investment. The results were also not very different to those presented here.

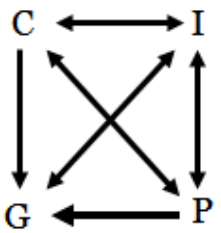
I tested the sensitivity of the results to including lag-0 effects in the regressions. The lag-0 effect is positive and very significant both for investment "causing" profits and for profits "causing" investment and for many other pairwise associations, as it is to be expected given the lag-0 strong correlation between business-cycle variables (Table 2). The other lagged-effect estimates change moderately in magnitude when the lag-0 effect is included in the model, but they do not change in sign and are substantially similar to the effects reported in the tables of this paper.

7. Multivariate equations

Once hypothetical causal paths which are incompatible with the result of the pairwise analysis are eliminated, the possible causal paths between the four business-cycle variables are reduced to those shown in Figure 10. Since only effects of government expenditure on consumption and profits are fully

inconsistent with the pairwise associations, the functional form of structural equations linking the four variables should be as follows:

Figure 10. Potential causal pathways after eliminating those inconsistent with the pairwise associations



$C = f_C(I, P)$

$I = f_I(C, G, P)$

$P = f_P(C, I)$

$G = f_G(C, I, P)$.

Estimating these models for the lags and combination of variables that produce the best fit, the following equations are obtained (standard errors bracketed below parameter estimates, error term omitted):[6]

Estimated equation	Sample	R^2
$\Delta C_t = 0.02+0.12\ \Delta I_{t-1}+0.06\Delta P_{t-1}$		
(0.00) (0.05) (0.02)	1991-2014	0.34
$\Delta C_t = 0.04-0.22\ \Delta I_{t-1}+0.08\Delta P_{t-1}+0.06\Delta P_{t-2}$		
(0.00) (0.05) (0.01) (0.02)	1961-1990	0.62
$\Delta C_t = 0.04-0.06\ \Delta I_{t-1}+0.01\ \Delta I_{t}-2-0.06\ \Delta I_{t-3}+0.04\Delta P_{t-1}$		
(0.00) (0.02) (0.02) (0.02) (0.01)	1934-2014	0.20
$\Delta I_t = -0.01 + 1.84\ \Delta C_{t-1} +0.24\Delta P_{t-1}- 1.12\ \Delta G_{t-1}$		
(0.03) (0.59) (0.06) (0.49)	1991-2014	0.61
$\Delta I_t = 0.04 + 1.13\ \Delta C_{t-1} +0.15\ \Delta P_{t-1}$		
(0.01) (0.57) (0.06)	1961-1990	0.33
$\Delta I_t=-0.05+1.70\Delta C_{t-1}-0.10\Delta C_{t-2}-1.09\Delta C_{t-3}+0.62\Delta C_{t-4}+1.15\Delta C_{t-5}+0.06\Delta P_{t-1} +0.01\Delta P_{t-2}+0.02\Delta P_{t-3}+ 0.20\Delta P_{t-4}$		
(0.04) (0.57) (0.60) (0.58) (0.58) (0.53) (0.08) (0.08) (0.07) (0.07)	1934-2014	0.30
$\Delta P_t = - 0.08 - 1.22\ \Delta I_{t-1}$		
(0.03) (0.47)	1991-2014	0.23
$\Delta P_t = - 0.08 - 1.40\ \Delta I_{t-1}$		
(0.03) (0.44)	1961-1990	0.26
$\Delta P_t = - 0.15 -0.44\Delta C_{t-1}-0.24\Delta C_{t-2}-2.66\Delta C_{t-3}- 0.27\ \Delta I_{t-1}+ 0.10\Delta I_{t-2}+ 0.47\ \Delta I_{t-3}$		
(0.05) (1.29 (1.31) (1.08) (0.25) (0.28) (0.24)	1934-2014	0.17
$\Delta G_t = 0.03-0.16\ \Delta I_{t-1} - 0.06\Delta P_{t-1}$		
(0.00) (0.06) (0.02)	1991-2014	0.33
$\Delta G_t = 0.04-0.12\ \Delta I_{t-1}$		
(0.00) (0.06)	1961-1990	0.12
$\Delta G_t = 0.06-0.29\ \Delta I_{t-1}$		
(0.00) (0.06)	1934-2014	0.07

For many reasons the parameter estimates including the years of World War II look like less reliable than the estimates from the other samples. Assuming then than the "true parameters are those estimated for the most recent sample 1991-2014, which are very similar to those estimated for 1961-1990, we obtain the following system of equations:

$$\Delta C_t = 0.02 + 0.12\ \Delta I_{t-1}+ 0.16\ \Delta P_{t-1} \quad [1]$$

[6] These equations have been estimated using business investment as measure of investment and profits after taxes of domestic industries as measure of profits, with log-transformed real values of variables in 2009 dollars.

$$\Delta I_t = -0.01 + 1.84\,\Delta C_{t-1} + 0.24\,\Delta P_{t-1} - 1.12\,\Delta G_{t-1} \quad [2]$$

$$\Delta P_t = -0.08 - 1.22\,\Delta I_{t-1} \quad [3]$$

$$\Delta G_t = 0.03 - 0.16\,\Delta I_{t-1} - 0.06\,\Delta P_{t-1} \quad [4]$$

By elimination of variables through recursive substitution, the system of equations [1] to [4] can be simplified for instance to $\Delta I_t = -0.03 - 0.82\,\Delta I_{t-2} - 0.21\,\Delta I_{t-3}$, an equation that produces dampened oscillations for any initial values.

Assuming these equations are structural and represent causal effects, we have the following relations:

- consumption is a positive function of lag investment and lag profits (confirmation of pairwise associations;
- investment is a positive function of lag consumption and lag profits, and a negative function of government expenditure (confirmation of pairwise associations);
- profits are a negative function of lag investment (the unconditioned association of lag consumption with profits is not confirmed in the multivariate analysis); and
- government expenditure is a negative function of lag investment and lag profits (the unconditioned association of lag consumption with government spending is not supported in the multivariate analysis).

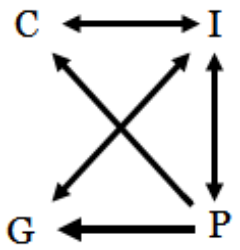


Figure 11. Potential causal pathways after eliminating those inconsistent with the multivariate models

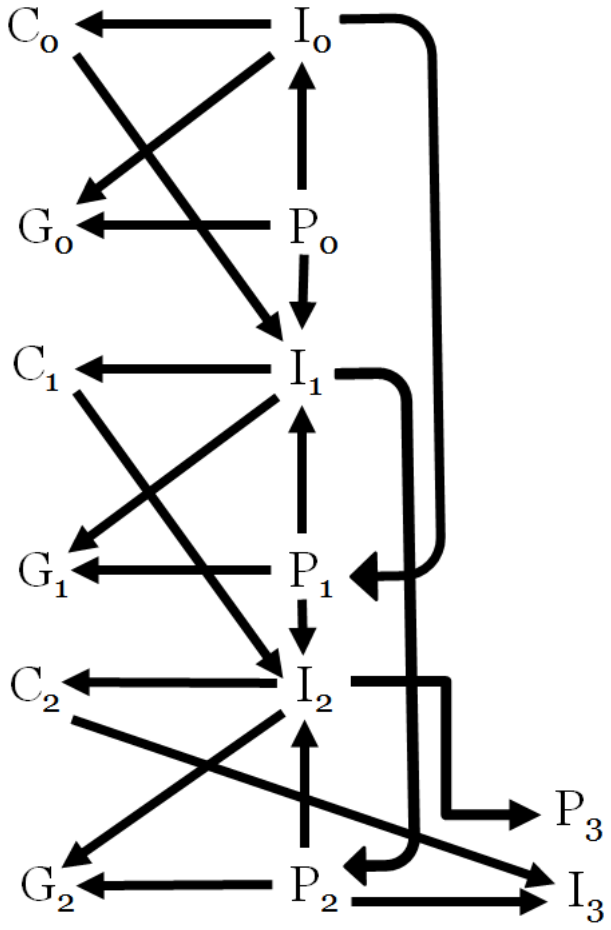
The graph corresponding to these associations is Figure 11, in which Figure 10 has lost the C→G link, and the link between C and P which was bidirectional is now P → C. Still this is not a DAG as there are bidirectional arrows. Figure 12 is an attempt to build a DAG depicting the causal relations represented by equations [1] to [4]. The resulting scheme is much more complex than any of the models represented in Figures 6, 7 and 8.

But are equations [1] to [4] properly identified? Are they "structural", that is, causal equations? Do they reflect causal effects or just spurious associations? Of course, the inference that these associations reflect causal effects holds as far as our assumptions are correct. It is always possible the existence of omitted variables that generate spurious correlations among observed variables. But to maintain that

objection with some degree of credibility, the suspected variable shall be mention. Otherwise it will be like the supposed gene that causes both lung cancer and a propensity to smoke.

The causal dependencies derived from equations [1] and [2], that consumption is a positive function of lag investment and lag profits and that investment is a positive function of lag consumption are probably uncontroversial ideas in economics. More controversial may be that investment is a positive function of lag profits, and a negative function of government expenditure also derived from [2]. Even more controversial may be the idea that profits are a negative function of lag investment or that government expenditure is a negative function of lag investment and lag profits, causal dependencies derived from [3] and [4].

Figure 12. DAG representing the potential causal relations between consumption (C), investment (I), profits (P) and government expenditure (G) in a model derived of observed pairwise and multivariate associations



Given the I checked the possibility that any of the excluded variables may be the omitted variable whose omission is creating a spurious causal association. For instance I checked that the effect estimate of investment on profits is always negative even adding to the regression model lag terms for the growth of either consumption, government expenditure, money (M1 or M2) or any combination of these. Though the parameter estimate of the statistical effect of investment on profits changes indeed when other covariates are added to the model—though never very much, always less than say by a third—the effect remains always negative. The shrinking effect of government spending on business investment will be also a puzzling idea for Keynesians, so I checked how the parameter estimate varies with the inclusion in the model of terms for M1, or M2, or with the exclusion of consumption or profits: the effect estimate of government spending on investment remains always negative. It seems

therefore that the sign of these negative effects—of investment on profits and of government spending on business investment—is properly identified.

8. Discussion

I reviewed elsewhere how causes of business cycles have been conceptualized in economic thought and examined the relation between investment and profits in quarterly data of the US economy. Results showed that profits Granger-cause investment and that profits have a significant positive association with future investment in the next few quarters; however, I did not find significant effects of past investment on present profits (Tapia Granados 2013, 229-259). The comparison of those results with the results of the present investigation with annual data is confirmatory of the positive effect of past profits on present investment, which is revealed in the analysis of both annual and quarterly series; but the comparison also shows that the analysis with annual data is able to reveal a significant negative effect of lagged investment on present profits which does not appear in the analysis of quarterly data, in which lagged investment mostly shows no effect on present profits. Disaggregation often is an appropriate tool to enhance statistical power, but also raises statistical noise and may blur effects, making them undetectable.

The negative effects shown in this investigation—of investment on profits and government spending on profits—are quite inconsistent with Keynesian views. The Keynesian idea that investment "calls the tune" is not supported by the evidence presented here. Investment is not autonomous and indeed is the variable that is better explained by the endogenous model of the business cycle embodied in the estimated equations [1] to [4] of the former page. Rather than guided by unobservable animal spirits, investment appears guided by changes in consumption, profits and even government spending.

The Keynesian view that government expenditure may pump-prime the economy by stimulating private investment is also inconsistent with the finding that the net effect of lagged government expending on private investment is rather null or even significantly negative in recent decades. In the 1991-2014 sample, assuming no change in consumption and profits, a 1% increase in government spending would be associated with a change of −0.01% ($\pm$ 0.03%) − 1.12% ($\pm$ 0.49%) in business investment (equation [4]), which is approximately a reduction of investment between 0.6% and 1.6%. Of course the confidence placed on these estimates cannot be very large, as in the 1961-1990 sample

government spending does not appear having a significant effect on investment, and the effect does not appear either in a sample 1950-2013 (results not shown). But if the negative effects of government profligacy on business investment are not fully supported by the data, the supposedly stimulating effects are completely inconsistent with the results. Certainly the whole evolution of government spending becoming with the pass of time an increasing part of the national economy (Table 1, Figure 2) and the negative correlations at lag zero between government expenditure and investment (Tables 3 and 4), demonstrate that spending by the government is increasingly needed to keep the level of output. Against the simplistic views of Tea Party activists, private business seems quite clearly insufficient to keep the US economy afloat—as revealed by government spending at levels similar to those of World War II during the past three decades.

9. Implications for business-cycle theory

Controversies on the fluctuations and crises of the market economy go back to the 19th century, when Sismondi blamed crises on insufficient consumption and rejected Say's views that production creates sufficient purchasing power for the output to be purchased, Marx wrote abundantly on the cycle of industrial crises as caused by a tendency of profitability to decline, and Juglar referred to commercial crises as generated by the interplay of commercial and financial phenomena.[7] Though not many authors in the 19th century were interested in economic crises, "panics," or "gluts" as they were referred to at the time, among those who paid attention to these phenomena the consensus was that every ten years credit panics occurred more or less at the same time that markets overflowed with unsold goods (Mills 1868, 5-40). Then, when economists started to talk about "trade cycles", "business cycles" and "recessions" in the late 19th century, a whole series of putative causes for the cycles were proposed. Since the profession had fully embraced Say's law and the tendency of markets to be efficient and to clear following the invisible hand, it was logical do not look for causes of sharp downturns inside the economic system, they had to be exogenous. Thus W. S. Jevons attributed the business cycle to weather events determined by sun spots, Henry L. Moore proposed a similar scheme based on effects of the planet Venus, and Ellsworth Huntinton proposed that fluctuations in business

[7] Sismondi presented his views on crises in his *Nouveaux principes d'économie politique,* Marx in *Capital* and Juglar in *Des Crises commerciales et leur retour periodique*. General discussions about these works can be found in (Schumpeter 1954; Morgan 1990; Burns and Mitchell 1946; Mattick 1974).

activity were actually consequences of fluctuations in mortality (Schumpeter 1954; Morgan 1990; Huntington 1920). But all these theories fitted very poorly with the data.[8] They were object of criticism among others by Wesley Mitchell, who in 1913 published his *Business Cycles,* an impressive study on the phenomenon in Great Britain, Germany, France, and the United States. After a meticulous consideration of observed data, Mitchell theorized the cycle as an endogenous phenomenon of what he called "the money economy." Influenced by his "atheoretical" empirical investigations of the activity in the business world, and also probably by Veblen's ideas, Mitchell viewed the modern industrial system as a network of free enterprises that produce merchandise with the purpose of obtaining money profits. Mitchell saw spending in capital goods as the leading force pushing the economy forward, with profitability of business as the basic engine determining investment. Thus for Mitchell the business cycle is an autonomous phenomenon determined by the endogenous fluctuations of profits and investment (Mitchell 1913; Mitchell 1951).

Though Mitchel's views, for a while continued by A. F. Burns, were part of mainstream economics during a few decades (Moulton 1949; Burns 1954; Mitchell 1951; Burns and Mitchell 1946), a remarkable event in the development of ideas on the business cycle took place at the end of the 1930s. After years of economic and political turmoil the Society of Nations asked Jan Tinbergen to dedicate his talents to study business cycles. Analyzing the scarce economic statistics available at the time, Tinbergen concluded, confirming most insights of Wesley Mitchell, that business cycles are basically a fluctuation in investment determined by a previous fluctuation in profits (Tinbergen 1939b; Tinbergen 1939a). The study was however strongly criticized, as supposedly containing major flaws, both by John Maynard Keynes and by the rising start of the anti-Keynesian field, Milton Friedman (Morgan 1990). Thus Tinbergen's views (Tinbergen 1950) were marginalized along with those of Mitchell, who had been condemned for his "atheoretical" views (Koopmans 1947, 161-172). For the next three decades the influential ideas were those of the Keynesians, who in greater or smaller degree rejected the Smithian ideas of the invisible hand and *laissez faire* and accepted the new concept of *animal spirits* and the need of government involvement in the economy. Keynesian took control of nascent

[8] Except that of Huntinton, though everything suggests that he got the direction of causality wrong, as shown by modern investigations that have found traffic injuries, heart attacks and general mortality increasing in expansions (Ruhm 2007, 829-848; Ionides, Wang, and Tapia Granados 2013, 1362-1385), with atmospheric pollution playing an important role (Heutel and Ruhm 2013).

econometrics from the Cowles Commission and to provide reasonable-looking estimates consistent with the idea that the economy was under the control of fiscal and monetary policy made many undiscussed assumptions and *ad hoc* adjustments that simplified the macroeconomic models and produced apparently accurate predictions with insufficient data and inaccurate theory (Sims 2012, 1187-1205). It was also the time when the idea of profits as a key variable in macroeconomics went into oblivion.

But the Keynesian hegemony had never been complete and indeed declined in the 1960s and 1970s, so that in the recent decades that were considered by Krugman the dark age of macroeconomics much of the research on business-cycle issues looked back for inspiration in the traditional ideas of Smith, Ricardo and Say that Keynes had at least partially rejected. Starting from these classical ideas, that is, from general equilibrium, authors of the RBC school produced models of the economy that were then compared with the real movements of the economy, i.e., "calibrated" to make them somewhat realistic. Both Keynesians and RBC authors produced complex models of the economy that supposedly enabled appropriate forecasts, but the fruits of this high-level math were scarce, as the global crisis that started in 2008 was unexpected for the RBC school as well as for most macroeconomists.

The philosopher's stone of economics is the elimination of the business cycle. Keynes said the right remedy for the business cycle is "in abolishing slumps and thus keeping us permanently in a quasi-boom" (Keynes 1937, 332). Thus it is not surprising that the leaders of the profession have repeatedly claimed, in different ways, that the business cycle is either gone or under control, which would imply that the market system is basically stable and can evolve steadily with or without the guidance of the experts. Paul Samuelson declared in 1955 that with proper fiscal and monetary policies, "our economy can have full employment and whatever rate of capital formation it wants" and in the 1960s he concluded that business cycle theorists had done themselves "out of a job." Then the business cycle was declared obsolete (Bronfenbrenner 1969) and the new concept of "growth cycle" (Moore 1961) was substituted for it for a while, as if the mild economic fluctuations observed in the 1950s and 1960s implied that in the future the economy would not alternate between boom and bust, but much more happily between strong and mild growth (Klein 1997, 289). More recently the concepts of the New Economy and the Great Moderation (Bernanke 2004) were proposed, both implying that economic turbulence is not to be expected. Playing the same tune as in Ravels's *Bolero*, in his 2003 Presidential

Address to the American Economic Association Robert Lucas stated that the central problem of economic policy, that of preventing depression, "had been solved for all practical purposes" (Lucas 2003, 1-14) and two years later the Chair of the Federal Reserve declared his awe at the degree of harmony and efficiency revealed by international finance and international trade. It would be hardly imaginable, Greenspan said, "that today's awesome array of international transactions would produce the relative economic stability that we experience daily if they were not led by some international version of Smith's invisible hand" (Greenspan 2005). All this shows that, as an institution, the economic profession had declared for more than half a century that major economic disturbances were out of the question, so it is not surprising that in 2008 the Great Recession "caught most economists flat-footed," as Nicholas Mankiw put it (Mankiw 2010, B6). Statements on the ability of economic policies to prevent recessions are no longer heard, and contrarily, Larry Summers, Paul Krugman, Martin Wolf and other leaders of the economic profession have recently expressed their beliefs in extended conditions of stagnation for the near future, or even the likelihood of another major recession coming soon.

But, can recessions be prevented or at least forecasted as Queen Elizabeth wanted? David Andolfatto, Senior Vice President of the Federal Reserve Bank of St. Louis, recently wrote in his blog comparing forecasts of volcano eruptions and economic crisis as similarly difficult. Andolfatto joked on those economists "who successfully predicted 10 out of the past 2 recessions," and claimed that there seems to be an insatiable demand for soothsayers, "clearly a case of demand creating its own supply." But then, in passing, he delivered his own forecast: "there will be another major financial crisis on the scale experienced in 2008" (Andolfatto 2015).

In any field, there are two basic methods for developing forecasting skills. One is to observe as many cases as possible of the phenomena and try to establish the statistical regularities of it, which allows for empirical forecasts. Family doctors do not known *why* most cases of common cold cure themselves in about a week, may be two, but they have verified that in their practice and that regularity allows them for a lot of quite good forecasting. Regretfully in the social sciences the method of looking for regularities seems to be disliked by quite a number of investigators, who focus themselves on one particular case—e.g., the Great Recession—rather than searching for common patterns in the increasing number of recessions that the pass of time makes available to study. The other method for

developing forecasting skills is to develop a theory, a causal scheme of why things happen. Economists are right that the business cycle is irregular, but too bad, most of them lack any theory of what causes the business cycle, what are its causes. Again, for this purpose it is proper to look at many cases of the phenomenon rather than focusing on the particularities of one case. Furthermore, elements for a theory of the business cycle exist to a large extent. If investment, the accumulation of capital, reduce profits, and profits themselves stimulate investment—as it was proposed by different authors in the past—the elements are set for a Lotka-Volterra predator-prey scheme which generates cycles. The findings of this paper are largely consistent with it. But government spending negatively affected by investment, and investment negatively affected by government spending seem to be additional levers discovered in this paper that generate oscillations and contribute to the fluctuations of the economy.

It is understanding of a phenomenon what enables us to control it. Control without understanding is just appearance that leads to disaster, as in the story of the sorcerer's apprentice. But sometimes even proper understanding is insufficient for efficient control. Geologists understand earthquakes quite well, and nuclear engineers understand atomic energy perfectly, but that allows us no control at all on earthquakes, and only partial control on atomic energy, as the cases of Chernobil and Fukushima clearly prove. After the Great Recession and two centuries of disagreement on the causes of economic crises that never stop occurring in spite of assertions that they will not, it is uncontroversial that the market economy is one of the most complex systems that human beings have ever studied. Claims that we are able to control it are now increasingly rare, they are mostly done by politicians, while leading economists acknowledge with circumspection that they do not know the causes of the basic dynamics of the economy, the business cycle. But to advance in the understanding of a complex system it is fundamental to identify the key variables that determine other variables and determine the evolution of the system. Keynes once said that

> given the psychology of the public, the level of output and employment as a whole depends on the amount of investment. I put it in this way, not because this is the only factor on which aggregate output depends, but because it is usual in a complex system to regard as the *causa causans* that factor which is most prone to sudden and wide fluctuation (Keynes 1937, pp. 209-223).

This statement looks quite extraordinary in the context of what Keynes wrote in *The General Theory* and the subsequent papers explaining it. In the opinion of a specialist in complex systems,

Mark Newman, this statement looks like something written not in the 1930s, but half a century later. That in a complex system the cause of all other causes is the factor which is most prone to sudden and wide fluctuation is an idea that for Newman would hold if the widely fluctuating factor considered to be causative has fluctuations which are correlated with the thing that it is supposed to be causing. "If it is uncorrelated then it matters little how widely fluctuating it is—it's still just noise," but "I would surely say that it is strong correlation that signals (but does not prove) causation, rather than the mere amplitude of fluctuation (...); as a general rule of thumb, there may be something to Keynes' statement. In practice it may work out quite well if one routinely looks to the most widely fluctuating variables for causative influence."[9]

Using Keynes statement as a rule of thumb, then we should look not to investment but to profits as the variable in the system which is both correlated with aggregate output and has the widest oscillations. But profits, the "bottom line," which are such a major issue in the world of business (Shaikh 2004, 371-380; Mattick 2011; Norris 2008) are very rarely mentioned in modern investigations on the business cycle. To a large extent and leaving aside sociological determinants of what economists investigate and support, this can be attributed to the influence of John Maynard Keynes and Milton Friedman and their followers in their rejection of the "empiricist" and "atheoretical" views of Mitchell and Tinbergen.

In a commanding work paradoxically forgotten today, *Controlling Factors of Economic Development,* Harold Moulton commented in 1949 on business cycle theories based on the role of profits in the economy:

> A very different type of explanation of depressions is built upon the fact that capitalistic business enterprise is conducted in response to the profit motive. Since business commitments are undertaken in the hope of profits, if anything happens which seriously reduces or even threatens to reduce profit margins, business commitments are quickly curtailed and depression ensues (...) This line of interpretation does not offer much hope of any easy remedy. Depression appears as an inevitable outgrowth of the conditions which developed in the preceding boom period.

10. A concluding forecast

As I mentioned, for most of the 19th century a consensus existed that the commercial crises were periodical with a cycle 10-year long (Mills 1868, 5-40). Then in the late 19th century and early 20th century, crises clearly occurred at irregular intervals, and Wesley Mitchell concluded that business

[9] From an email sent by Mark Newman to me, 6/13/2012. Newman is Professor of Physics at the University of Michigan, Ann Arbor, and external faculty member of the Santa Fe Institute. He is known for his contributions to the fields of complex networks and complex systems, for which he was awarded the 2014 Lagrange Prize.

cycles were an irregular phenomena that, in duration, "vary from more than one year to ten or twelve years" (Burns and Mitchell 1946). Certainly the "cycle" is irregular, it is hard to disagree with Mankiw that it does not follow a regular and predictable pattern. It is also true however that during the past two centuries recessions have recurred with a periodicity which has certain limits. For instance, in the past 40 years business-cycle downturns occurred in the mid-1970s, early 1980s, early 1990s, at the turn of the century and in 2008-2009. I have argued elsewhere (Tapia Granados 2014) that all these were actually crises of the world economy which were also visible as recessions of many national economies, the US economy among them. These five crises that can be individualized by misnaming them First Oil Crisis (mid 1970s), Second Oil Crisis (early 1980s), Eastern Europe Crisis (early 1990s), Asian crisis (early 2000s) and Great Recession (2008-2009) were separated by intervals which fit well in the duration of the business cycle according to Mitchel, "from more than one year to ten or twelve years." More important, *each of these recessions started at a time when profits of US corporations—which probably are a good proxy for profits worldwide—were falling, as they had reached a peak at least one or two years earlier*. Thus peaks in the share of profits before taxes are observable in 1973 before the First Oil Crisis, in 1978 before the Second Oil Crisis, in 1988 before the Eastern Europe Crisis, in 1997 before the Asian Crisis, and in 2006 before the Great Recession (Figure 2).

The findings of this paper show that a major regularity of the US economy is that movements in profits are followed by movements in investment in the same direction, and movements in investment are followed by movements in profits in the opposite direction. These two mechanisms put together are sufficient to generate a cycle. Indeed, from econometric analyses a number of authors have concluded that the US economy is profit-led (Barbosa-Filho and Taylor 2006, 389; Rada and Taylor 2006, 487-500; Mohun and Veneziani 2008, 107-130). In a recent analysis of OECD countries, economists of the Bank of International Settlements have found a major role of profits determining investment and low levels of profitability as cause of sluggish economic growth in recent years (Banerjee, Kearns, and Lombardi 2015).

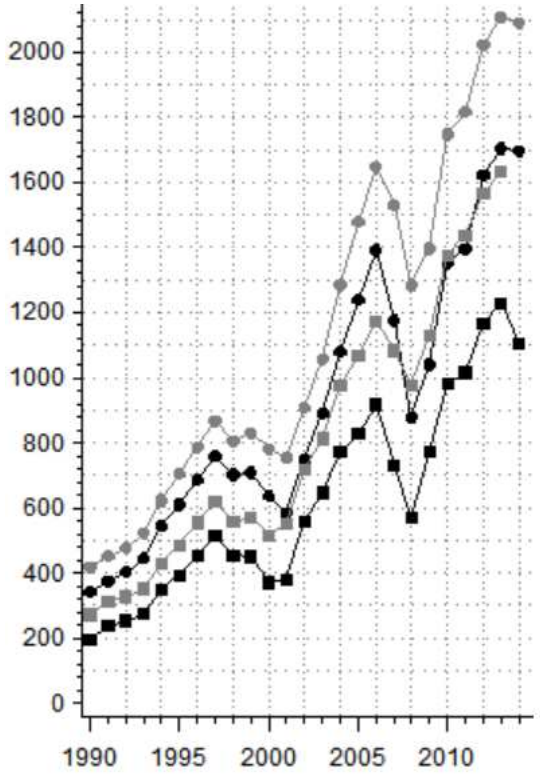
As I write this on May 2015, it has been 7 years and a half since the start of the Great Recession dated December 2007 by the NBER. If recessions occur with the rough regularity that they had in the past two centuries, when rarely more than a decade passed without one, we are getting close to the time of a new one. On the other hand, and more important, profits of US corporations have recently stagnated and started to decline after growing since 2008. According to recently reported NIPA data, profits had a peak in 2013 (Figure 2). Corporate profits before taxes which between 2012 and 2013 increased 4.2% from $2.02 trillion to $2.10 trillion dropped 0.8% to $2.09 trillion in 2014.

Table 10. Consumption, business investment, profits after taxes (domestic industries) and government expenditure, observed values (2010-2014) and forecasted values (2015-2024). Numbers are first differences of log-transformed values (in 2009 dollars), so they can be interpreted as rates of growth

Year	Cons.	Invest.	Prof.	Govern. expend.
2010	2.3	0.3	22.9	2.9
2011	2.6	6.8	1.5	-0.9
2012	1.8	6.7	12.0	-0.9
2013	2.1	2.6	3.8	-1.0
2014	2.3	5.9	-12.3	0.8
Forecasted values				
2015	0.0	0.5	-7.2	-0.2
2016	-0.4	-1.6	-0.6	0.4
2017	-0.2	-1.3	1.9	0.3
2018	0.0	-0.3	1.5	0.1

Considering just domestic industries, corporate profits before taxes dropped 0.5% in 2014 after rising 5.4% in 2013, while profits after taxes dropped 10.3% in 2014 after gaining 5.4% in 2013 (Figure 13). There are also reports that indicate poor profits of hedge funds in 2014 (Stevenson 2015, B1), which suggests low levels of average profitability in the global economy.

Figure 13. Corporate profits before taxes (dots) and after taxes (squares) of all corporations (gray lines) and domestic industries (black lines), billion dollars



Source: NIPA tables 1.10 and 1.12, accessed April 2015.

If, as in past decades, falling profits are followed by decreasing investment, a recession will very likely occur soon. Considering the results of statistical models, the "regularity" of the business cycle, the fact that profits are falling, and the present condition of the other parts of the world economy it can be concluded with some confidence that a recession of the US economy will occur in the next few years. Equations [1] to [4] can be used to provide forecasts for the following years. They are presented in Table 10. Forecasted declines of business investment by 1.6%

and 1.3% in 2016 and 2017 are substantial, but even more substantial are declines of 0.4% and 0.2% in consumption, as the only other years in the sample 1929-2014 in which consumption growth was negative were 2009, 1938, and 1930–1933.

Of course, these forecasts are based in models that predict just a fraction—60% or 70% in the best of cases—of the variation of business-cycle series, so they cannot be given much credibility re magnitude and timing of the next recession. But they allow for forecasting a recession that will likely occur in the next few years and will likely be an important one. A further reason to make the prediction less confident is that all the previous numerical analyses in this paper refer to the US economy, when the real unit to analyze is actually the economy of the world, which now is a full organic unity. Analyses of variables pertaining to a large fraction of the world economy as the US economy may allow for important insights in the dynamics of the system, but they cannot provide a full picture of it, and for the moment, many factors related to the world economy are unmeasured and unknown. Considering all this I may quantify the degree of confidence in my prediction by using Bayesian terminology, so that my priors are 80% that a recession will start in 2015 or 2016, 90% that it will occur no later than 2018, and 99% that it will occur before the end of the decade. As in the mid-1970s, early 1980s, early 1990s, 2001 and 2008, it will be very likely a world economic crisis, and given the enormous volumes of debt now present in the world economy, the precarious situation of banks in many countries, the weak or negative economic growth in many European countries, the chronic problems of the Japanese economy, and the rapid deceleration during the past three years of most so-called emerging economies like China and other BRICS, it is to be expected that this recession may be as great or even greater than the Great Recession. I agree with David Andolfatto on that.

Something that tends to make the prediction of recession in the next few years less likely is the fact that oil prices have been now falling for many months. It is known that peaks in the price of oil occurred immediately before the recessions of the mid 1970s, early 1980s, early 1990s, 2001 and 2008 (Hamilton 2009, 215-267). Indeed these “oil shocks” have been proposed by James Hamilton as the exogenous shocks that cause recessions and that RBC authors never identified (Parker 2007) (p. 80-81). But increases in oil prices previous to recessions of the world economy seem to a large extent an endogenous phenomenon, part of a general increase in prices of raw materials generated by the rising global demand during expansions (Kilian 2009, 267-278; Stuermer 2014). It is not inconsistent with

the view that an endogenous fall of profitability is the key determinant of recessions to consider that particular factors at particular times may trigger the crisis. The contemporaneity of the political breakdown of the Soviet bloc and the world crisis of the early 1990s is not an accident, indeed the precipitous drop of exports to the USSR was a key factor leading the economy of some countries like Finland to a deep recession at that time. While the causal loop between profits and investment mines the ground, by dampening profits, increases in the prices of energy and raw materials during the boom brings closer the tipping point in which profits stagnate and then drop, thus leading to drops in investment and a general downturn. Consequently, falling prices of energy tend to uphold profits, promote consumption and stimulate the economy at large. That can be a major factor for the maintenance of present conditions in international markets, so that the world economy could continue for a while muddling through in the seemingly never ending aftermath of the Great Recession. That oil prices have been falling because the demand for oil is low in a world economy which is presently anemic, almost nobody disagrees. What is less clear is to what extent falling prices of energy can stimulate the economy delaying the world recession that will eventually occur. My glass ball is not better than that.

To my knowledge, this is the first investigation of the business cycle using DAGs. I am quite sure it will not be the last.

Acknowledgements

This text has benefitted from conversations with Roland Zullo, from the teaching skills of Felix Elwert, and from comments of Michael Roberts and Paul Mattick. The usual disclaimers apply.

References

Acemoglu, Daron, V. M. Carvalho, A. Ozdaglar, and A. Tahbaz-Salehi. 2012. The network origins of aggregate fluctuations. *Econometrica* 80 (5): 1977-2016.

Andolfatto, David. In defense of modern macro theory. 20152015]. Available from andolfatto.blogspot.com.

Banerjee, Ryan, Jonathan Kearns, and Marco Lombardi. 2015. (Why) Is investment weak? *BIS Quarterly Review,* March.

Barbosa-Filho, Nelson H., and Lance Taylor. 2006. Distributive and demand cycles in the US economy: A structuralist Goodwin model. *Metroeconomica* 57 (3): 389.

BEA. National economic accounts, NIPA tables. in Bureau of Economic Analysis, U.S. Department of Commerce [database online]. Washington, DC, 2009]. Available from http://www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N.

Bernanke, Ben S. Remarks on the great moderation by governor ben S. bernanke at the meetings of the eastern economic association, washington, DC, february 20, 2004. 2004Available from http://www.federalreserve.gov/BOARDDOCS/SPEECHES/2004/20040220/default.htm

Bhaduri, Amit, and Stephen Marglin. 1990. Unemployment and the real wages: The economic basis for contesting political ideologies. *Cambridge Journal of Economic*s 14: 375-93.

Boldrin, Michele, and Michael Horvath. 1995. Labor contracts and business cycles. *The Journal of Political Economy* 103 (5) (Oct.): 972-1004.

Bronfenbrenner, Martin. 1969. *Is the business cycle obsolete?* New York: Wiley-Interscience.

Burns, Arthur F. 1954. *The frontiers of economic knowledge*. New York: Princeton University Press.

Burns, Arthur F., and Wesley Clair Mitchell. 1946. *Measuring business cycle*s. New York: National Bureau of Economic Research.

Butler, Eamon. 2010. The financial crisis: Blame governments, not bankers. In *Verdict on the crash: Causes and policy implications*, ed. Philip Booth. London: Institute of Economic Affairs.

Cassidy, John. Interview with Eugene Fama. 2010 Available from http://www.newyorker.com/online/blogs/johncassidy/2010/01/interview-with-eugene-fama.html.

Elwert, Felix. 2013. Chapter 13 - Graphical causal models. In *Handbook of causal analysis for social research*, ed. S. L. Morgan, 245-272. Dordrecht: Springer.

Foley, Duncan. 2010. *The political economy of post-crisis global capitalism. Paper prepared for the economy and society conference at the University of Chicago, December 3-5, 2010.*

Friedman, G., F. Moseley, and C. Sturr, eds. 2009. *The economic crisis reader: Readings in economics, politics, and social policy from Dollars&Sense*. Boston: Economic Affairs Bureau/Dollars&Sense.

Gabaix, Xavier. 2011. The granular origins of aggregate fluctuations. *Econometric*a 79 (3): 733-72.

Godwin, R. M. 1964. Econometrics in business-cycle analysis. In *Business cycles and national income.*, ed. Alvin H. Hansen. 2nd ed., 417-468. London: George Allen and Unwin.

Greenspan, Alan. 2005. Remarks by Chairman Alan Greenspan at the Adam Smith Memorial Lecture, Kirkcaldy, Scotland, February 6, 2005. Available from www.federalreserve.gov/boarddocs/speeches/2005/20050206/.

Gujarati, Damodar N. 2003. *Basic econometrics*. 4th ed. New York: McGraw-Hill.

Haberler, Gottfried. 1960. *Prosperity and depression: A theoretical analysis of cyclical movement*s. 4th ed. Cambridge: Harvard University Press.

Hamilton, James. 2009. Causes and consequences of the oil shock of 2007-08. *Brookings Papers on Economic Activity* Spring: 215-67.

Hamilton, James D. 1988. A neoclassical model of unemployment and the business cycle. *Journal of Political Economy* 96 (3): 593.

Heckman, J., and R. Pinto. 2015. Causal analysis after Haavelmo. *Econometric Theory* 31 (1): 115-51.

Heutel, Garth, and Christopher J. Ruhm. 2013. Air pollution and procyclical mortality. *NBER Working Paper* 18958.

Hsiao, C. 1987. Identification. In *The New Palgrave — A dictionary of economics*, eds. John Eatwel, Murray Milgate and Peter Newman. Vol. 2:714-715. New York: Macmillan.

Huntington, Ellsworth. 1920. *World-power and evolution*. New Haven: Yale University Press.

Ionides, E., Z. Wang, and J. A. Tapia Granados. 2013. Macroeconomic effects on mortality revealed by panel analysis with nonlinear trends. *Annals of Applied Statistics* 7 (3): 1362-85.

Kalecki, Michael. 1954. *Theory of economic dynamics*. London: George Allen & Unwin.
Keynes, John Maynard. 1937. The general theory of employment. *Quarterly Journal of Economic*s 51(2): pp. 209-223.
———. 1936. *The general theory of employment, interest, and mone*y. London: Macmillan.
Kilian, Lutz. 2009. Coment on Hamilton's "Causes and consequences of the oil shock of 2007-08". *Brookings Papers on Economic Activit*y Spring: 267-78.
Klein, Philip A. 1997. Growth cycles. In *Business cycles and depressions: An encyclopedia*, eds. David Glasner, Thomas F. Cooley, 289. New York: Garland.
Knoop, Todd A. 2004. *Recessions and depressions: Understanding business cycle*s. Westport, Conn.: Praeger.
Koopmans, Tjalling C. 1947. Measurement without theory. *Review of Economic Statistic*s 29 (3): 161-72.
Lucas, Robert E. 2003. Macroeconomic priorities. *American Economic Revie*w 93 (1): 1-14.
———. 1977. Understanding business cycles. *Carnegie-Rochester Conference Series on Public Polic*y 5: 7-29.
Malinvaud, Edmond. 1966. *Statistical methods of econometric*s. Rand McNally, Chicago.
Mankiw, Gregory. 2010. Economic view: A call for humility - Trying to tame the unknowable. *New York Time*s, March 26, 2010, sec Business.
———. 2009. *Principles of macroeconomic*s. 5th ed. Mason, OH: South Western.
Marx, Karl. 1977. *Capital - A critique of political economy [1867]* (vol. I, transl. by B. Fowkes). New York: Vintage Books.
Matthews, Robin C. O. 1959. *The business cycl*e. Chicago: University of Chicago Press.
Mattick, Paul. 1974. *Economic crisis and crisis theor*y. White Plains, NY: Sharpe.
Mattick, Paul, Jr. 2011. *Business as usual: The economic crisis and the failure of capitalis*m. London: Reaktion Books.
Mill, John Stuart. 1846. *A system of logic, ratiocinative and inductive: Being a connected view of the principles of evidence and the methods of scientific investigatio*n. New York: Harper.
Mills, John. 1868. On credit cycles and the origin of commercial panics. *Transactions of the Manchester Statistical Societ*y Session 1867-68: 5-40.
Minsky, Hyman P. 2008. *Stabilizing an unstable economy [1986*]. New York: McGraw-Hill.
Mitchell, Wesley C. 1951. *What happens during business cycles: A progress repor*t, ed. Arthur F. Burns. New York: National Bureau of Economic Research.
Mitchell, Wesley Clair. 1913. *Business cycle*s. Berkeley: University of California Press.
Mohun, Simon, and Roberto Veneziani. 2008. Goodwin cycles and the US economy, 1948-2004. In *Mathematical economics and the dynamics of capitalism: Godwin's legacy continued*, eds. Peter Flaschel, Michael Landesmann, 107-130. New York: Routledge.
Moore, Geoffrey Hoyt, and National Bureau of Economic Research. 1961. *Business cycle indicator*s. Princeton N.J.: Princeton University Press.
Morgan, Mary S. 1990. *The history of econometric idea*s. Cambridge: Cambridge University Press.
Morgenson, Gretchen. 2015. Despite federal regulation, C.E.O.-worker pay gap data remains hidden. *New York Time*s, April 10, 2015, 2015.
Moulton, Harold Glenn. 1949. *Controlling factors in economic developmen*t. Washington: Brookings Institution.
Neftci, Salih N. 1978. A time-series analysis of the real wages-employment relationship. *The Journal of Political Economy* 86 (2, Part 1): 281-91.
Nolt, James H. 2014. *International political economy - The business of war and peac*e. New York: Routledge.
Norris, Floyd. 2008. Profit data may explain U.S. gloom. *The New York Time*s, August 1, 2008, 2008.
Ohanian, Lee E. 2008. Back to the future with Keynes. *Federal Reserve Bank of Minneapolis Quarterly Revie*w 32 (1): 10-6.
Osiatynski, Jerzy, ed. 1991. *Collected works of Michal Kalecki. Volume II: Capitalism: Economic dynamic*s. Trans. C. A. Kisiel. Oxford: Clarendon Press.
Parker, Randall E., ed. 2007. *The economics of the Great DDpression: A 21st century look back at the economics of the interwar er*a. Cheltenham, UK: Edward Elgar.
Pass, C., B. Lowes, L. Davis, and S. J. Kronish. 1991. *The Harper-Collins dictionary of economic*s. New York: Harper.

Pearl, Judea. 2015. Trygve Haavelmo and the emergence of causal calculus. *Econometric Theor*y 31: 152-79.
Pearl, Judea. 2000. *Causality: Models, reasoning, and inferenc*e. New York: Cambridge University Press.
Pigou, A. C. 1927. Wage policy and unemployment. *The Economic Journa*l 37 (147): 355.
Rada, Codrina, and Lance Taylor. 2006. Empty sources of growth accounting, and empirical replacements à la Kaldor with some beef. *Structural Change & Economic Dynamic*s 17 (4): 487-500.
Robinson, Joan. 1979. *The Generalisation of the general theory, and other essay*s. London: Macmillan.
Ruhm, C. J. 2007. A healthy economy can break your heart. *Demograph*y 44 (4) (Nov): 829-48.
Schumpeter, Joseph Alois. 1954. *History of economic analysi*s. New York: Oxford University Press.
Schwartz, Anna J. 2010. Origins of the financial market crisis of 2008. In *Verdict on the crash: Causes and policy implications*, ed. Philip Booth. London: Institute of Economic Affairs.
Shaikh, Anwar. 2004. The power of profit. *Social Researc*h 71 (2): 371-80.
Sherman, Howard J., and David X. Kolk. 1997. *Business cycles and forecastin*g. New York: Addison-Wesley.
Sims, Christopher A., and Tao Zha. 2006. Does monetary policy generate recessions? *Macroeconomic Dynamics* 10: 231-72.
Sims, Christopher A. 2012. Statistical modelling of monetary policy and its effects – Nobel Memorial Prize Lecture. *American Economic Review* 102 (4): 1187-205.
———. 1972. Money, income, and causality. *American Economic Review* 62 (4): 540-52.
Stevenson, Alexandra. 2015. Hedge funds took bad '14 all the way to the bank. *The New York Times*, May 5, 2015.
Stuermer, Martin. 2014. *150 years of boom and bust: What drives mineral commodity prices*. Presented at the Philadelphia 2014 Meeting of the American Economic Association.
Tapia Granados, J. A. 2014. *From the oil crisis to the Great Recession: Five crises of the world economy*. Paper presented at the ASSA-AEA 2014 Meeting, Philadelphia.
———. 2013. Does investment call the tune? Empirical evidence and endogenous theories of the business cycle. *Research in Political Economy* 28: 229-59.
Tinbergen, Jan. 1950. *The dynamics of business cycles: A study in economic fluctuations (translated from the Dutch and adapted by J. J. Polak)*. Chicago: University of Chicago Press.
———. 1939a. *Statistical testing of business-cycle theories: Volume I - A method and its application to investment activity*. Geneva: League of Nations.
———. 1939b. *Statistical testing of business-cycle theories: Volume II - Business cycles in the United States of America 1919-1932*. Geneva: League of Nations.
Tobin, James. 1970. Money and income: Post hoc ergo propter hoc? *The Quarterly Journal of Economics* 84 (2): 301-17.
Veblen, Thorstein. 1932. *The theory of business enterprise*. New York: Scribner.