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Distribution and Capacity Utilization: conceptual issues and empirical evidence

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Abstract

This paper examines the relationship between the distribution of income and capacity utilization in the context of the Kaleckian model of growth and distribution. We provide an exposition of the underlying theory of wage- and profit-led growth. We emphasize the implications of possible non-linearities in the determination of the final equilibrium and why—because of them—a redefinition of the concept of wage- and profit-led economy is necessary. We estimate the demand and distribution schedule for the US economy using a 2SLS approach. Our findings confirm the hypothesis of a non-linear distribution schedule and therefore the need to redefine the concepts wage- and profit-led growth.

Keywords: Distribution, Utilization, Non-linearities

JEL Classification Codes: E11, E12, E21, E22, E25, E30

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1 Introduction

The current economic crisis stresses the need of understanding the relationship between distribution of income and aggregate economic performance. Besides understanding if and how the development of distribution of income in the past three decades contributed to the creation of this crisis, a more urgent question to be answered is what kind of policies should be adopted to face the prospect of stagnation and unemployment. So far the answer preferred by many mainstream scholars and policymakers seems to be in line with the conventional wisdom of the last thirty years and as a result there is further downward pressure on the wage income. However there is much reason to think that at this point a further decrease of the wages and the wage share would have adverse effects on economic activity and instead of solving the problem it would aggravate it.

The work of Michal Kalecki (e.g. 1971b) provides a useful way to tackle the issue of the relation of the distribution of income with aggregate economic performance, since it is explicitly constructed around it. Kalecki's writings have been the inspiration for an extensive literature. In its contemporary form, which we will present below, the Kaleckian model of growth and distribution has been developed by Rowthorn (1981), Taylor (1983, 1990, 2004), Dutt (1984, 1990), Amadeo (1986) and Bhaduri and Marglin (1990a,b)[1]. An interesting characteristic of the Kaleckian model (not found in all its versions) is that depending on the elasticity of investment and saving to distribution and capacity utilization, the effect of a change in distribution on effective demand can vary. Two different regimes can be distinguished: the so called *stagnationist*, *wage-led*, or *under-consumptionist* regime, where an increase of the wage share leads to an increase in demand and the *exhilarationist, profit-led* regime, where an increase of wages leads to a decrease in demand.

In the next section we present a brief theoretical background of this analysis. We are particularly interested in possible non-linearities of the distributive

[1]Among the intellectual descendants of Kalecki a special mention should be made to his close friend and associate Joseph Steindl (e.g. 1952). Kalecki's intellectual influence goes beyond the strand of the literature which is labeled today as (post-/neo-) Kaleckian. The degree of this influence can be understood in the preface of Joan Robinson's *The Accumulation of Capital* (1956). In the acknowledgments part, after she mentions her "debt to Keynes, Wicksell and Marshall" which is "the debt we all owe to our progenitors", she continues "Michal Kalecki, though a contemporary, comes into the same category".

schedule, since they can lead to multiple equilibria[2]. In order to trace the effect of the distribution on capacity utilization and vice versa in actual data, we have to solve the problem of their simultaneous determination and identify the different structures, which are hidden behind what we observe. As we explain in section 3 we employ the two stages least squares approach in order to identify the demand and the distributive schedules.

In section 4 we present the estimates about the slope of the demand and the distributive curves for the US economy. We also test the hypothesis of non-linear distribution for different levels of utilization. Our estimates show that the distributive schedule is U-shaped.

In the presence of a U-shaped distributive curve, because of the existence of two possible equilibria, the effect of a change in distribution on income crucially depends on what kind of equilibrium the economy is at and cannot be derived only through the examination of the reaction of demand to a change in distribution—or graphically through the examination of the slope of the demand curve in the *(utilization, wage share)* plane. In section 5 we restate the definition of wage- and profit-led economies. An economy is wage-led when a distributive change against the wage share leads to lower equilibrium capacity utilization. The definition coincides with the prevalent definition, which is associated with the slope of the demand curve, when the distributive schedule is linear.

Based on this definition, it is not hard to show that even if demand is led by profits, when the distributive schedule is U-shaped and the economy finds itself at low utilization levels, the economy is wage-led. A redistribution of income in favor of wage earners would lead to a better aggregate economic performance.

2 The Kaleckian Model of Growth and Distribution

2.1 The Demand Schedule

We shall initially consider the behavior of a closed economy without a government sector. The demand schedule is defined by the saving behavior of its

[2] Recent papers by Assous and Dutt (2010) and Tavani et al. (2010) also explore the implications of a non-linear distribution schedule.

members and the investment behavior of the firms. The total income of the economy is distributed between wages and profits. If we define ψ and π respectively as the wage and the profit share, Y and Y^* as output and potential output and finally $u = Y/Y^*$ as capacity utilization then total saving (normalized for the capital stock) is $S = S(\psi, u)$. An important assumption we make in accordance with the classical and Keynesian/Kaleckian tradition is that the saving propensity of the capitalists is higher than the saving propensity of the workers[3], therefore $S_\psi < 0$[4]. On the other hand, higher income and capacity utilization increase savings, so $S_u > 0$.

The investment (normalized for capital stock) function can be defined as $I = I(\psi, u)$ with $I_\psi < 0$ and $I_u > 0$. The first partial derivative explains the effect of a higher wage share on investment. For Kalecki, lower realized profitability (because of higher wages) means lower profit expectations, which have a depressing effect on investment. Moreover higher profitability allows the firm to finance a bigger part of its investment through internal funds and eases the access to the capital markets. The effect of higher utilization on investment is positive because firms want to hold excess capacity to face an unexpected rise in demand, so a higher degree of utilization will induce accumulation (Steindl, 1952). We can also think of this positive effect in terms of the acceleration principle.

It is worth mentioning that Kalecki was very skeptical of our ability to formalize the investment behavior of the firm or of an economy. This becomes obvious by the different investment functions he proposed over the course of his life. In the introduction to one of his last writings (1968) he says that "the determination of investment decision ... remains the central *pièce de résistance* of economics"[5]. Since the form of the investment function plays a crucial role in our results, we should keep this constraint in mind.

In a Keynesian/Kaleckian world demand drives the economy so excess in-

[3] A discussion of the differential saving propensity is provided in Bowles and Boyer (1995, p.152-154). They mention "Among all but economists, the proposition that the rich save a larger fraction of their income has come to be taken as a sociological fact of life requiring little explanation". They refer to different studies, which confirm this assumption. They also stress the difficulty of aggregate econometric studies to provide a consensus on this issue. Based on their estimations there is a statistically significant differential.

[4] The subscript stands for the partial derivative for this variable.

[5] This scepticism was shared by other members of the Keynesian tradition. For example Robinson (1962) when she discusses investment says: "We have not got far enough yet to put it into algebra".

vestment over saving increases the level of capacity utilization

$$\hat{u} = I(\psi, u) - S(\psi, u) \tag{1}$$

where the hat $(\hat{})$ is expressing the growth rate of a variable. At equilibrium saving equals investment: $\hat{u} = 0 \Leftrightarrow I(\psi, u) = S(\psi, u)$. The effect of a change in the distribution of income on capacity utilization is

$$\frac{du}{d\psi} = -\frac{I_\psi - S_\psi}{I_u - S_u} \tag{2}$$

The slope of this IS-curve on the (u, ψ)[6] space can be negative or positive depending on the signs of the numerator and the denominator.

Under the condition that saving is more responsive than investment to a change in output (the so-called *Keynesian stability condition*) the denominator is negative. The sign of the numerator depends on the relative magnitude of S_ψ and I_ψ. S_ψ is negative and I_ψ is also negative. If saving reacts more than investment to a change in the wage share ($|S_\psi| > |I_\psi|$) the numerator is positive and a redistribution of income against capitalists will tend to increase utilization. This is what is called a *stagnationist*, *wage-led*, or *under-consumptionist* economy. On the other hand, if the numerator is negative, we are under an *exhilarationist, profit-led* regime where redistribution in favor of the capitalists leads to higher output.

The addition of government and foreign sector is straightforward. Usually government expenditures, G, (normalized for the capital stock) act countercyclically, so $G = G(u)$ and $G_u < 0$. In terms of equation (2), this would tend to stabilize the demand schedule, by making the numerator more negative. Net Exports, NX, are a function of both u and ψ. NX_u is negative, since an increase in income increases imports. This would also tend to stabilize the demand schedule. On the other hand the sign of NX_ψ is not that clear. If the wage share increases because of a decrease in the markup and prices, NX_ψ would tend to be positive. If the increase of the wage share is due to an increase in wages then $NX_\psi < 0$, because of loss of competitiveness. Depending on the sign, this effect would add to the wage- or profit-led behavior of the economy[7].

It is straightforward to provide definitions for the wage- and profit-led de-

[6] u is the horizontal axis variable and ψ the vertical axis variable.

[7] A more explicit treatment of the foreign sector can be found in Krugman and Taylor (1978), Taylor (1983), Dutt (1984) and Blecker (1989) among others.

mand when the Keynesian stability does not hold. In that case the denominator in (2) is positive, so the demand is (unstable) wage-led if the numerator is negative (saving reacts less than investment to a change in the wage share) and vice versa. The Keynesian stability condition under certain conditions is not necessary for the dynamic system—defined by the demand and distributive schedule—to be stable. In fact in some cases it is necessary for demand to be unstable. Bhaduri and Marglin (1990a, p.165) write in that respect "the Keynesian Stability Condition, though standard in the texts is necessary for stability only in a model which abstracts from all determinants of equilibrium but the level of output, and in particular, one which abstracts from the impact of the distribution of income between wages and profits on investment and saving".

The distinction between wage- and profit-led regimes implies—against the conventional wisdom—that a redistribution of income in favor of wages can lead to a higher income level and utilization. However, the identification of the effect of a redistribution of income to the equilibrium level of utilization with the slope of the demand curve (as defined in equation 2) is "legitimate" only if we assume a linear distributive schedule. We make this point more explicit in section 5 below.

2.2 The Distributive Schedule

The distributive schedule expresses how output is distributed between wage and profit earners in the different phases of the economic cycle. By definition the wage share is equal to $\psi = \frac{\omega}{x}$, where ω is the real wage and x is labor productivity. This relation can be rewritten as

$$\hat{\psi}(\psi, u) = \hat{\omega}(\psi, u) - \hat{x}(\psi, u) \tag{3}$$

At equilibrium $\hat{\psi} = 0$. The effect of a change in capacity utilization on the distribution of income is

$$\frac{d\psi}{du} = -\frac{\hat{\omega}_u - \hat{x}_u}{\hat{\omega}_\psi - \hat{x}_\psi} \tag{4}$$

The question then is how real wage and productivity behave for different levels of capacity utilization. The answer to this question involves different approaches to the macroeconomic debate. In neoclassical economics with the assumption of a "well behaved" production function and by equating the real wage to the marginal productivity of labor, we have a downward sloping labor demand curve in the (u, ω) plane. Depending on the form of the production function the wage share increases, decreases or stays constant[8]. Still, one of the fundamental assumptions of neoclassical economists is that the real wage is decreasing as income increases. Keynes himself adopts this view in *The General Theory* by accepting the "first fundamental postulate *of the* [*neo*]classical theory of employment", a position which he later questions[9].

The Cambridge (UK) School of the early postwar period (for example Robinson, 1956, 1962) adopted a price setting behavior of the firm that increased the profit share as capacity utilization increased beyond its normal level. This behavior is part of a more general mechanism that leads the economy back to its *normal* utilization rate. Several scholars within the Keynesian tradition adopted this kind of price mechanism (Harcourt, 1972, Wood, 1975, Eichner, 1976, Kaldor, 1985 among others).

The implication of the approaches we just mentioned in terms of equation (4) is that the wage share decreases as utilization increases ($\frac{d\psi}{du} < 0$). In other words the distributive schedule has a negative slope in the (u, ψ) plane.

The experience of real economic activity has led many other economists to criticize this view. They argue that the real wages and the wage share increase as the economy grows and the level of capacity utilization increases. Among others, this position has been adopted by Barbosa-Filho and Taylor (2006), Bowles and Boyer (1988), Davidson (1972), Foley (2003), Garegnani (1992), Kurz (1994), Gordon (1995), Taylor (2004), Shapiro and Stiglitz (1984) and Goodwin (1967) who formalizes an argument set forth by Karl Marx (1976, ch. 25). Although the mechanics and the philosophy in some cases differ a lot, the common conclusion of all these works is that the real wage and the wage share increase as capacity utilization increases and the economy moves towards full employment. In terms of equation (4), $\frac{d\psi}{du} > 0$ and the distributive schedule has a positive slope in the (u, ψ) plane.

Obviously, as is recognized by some of the authors above (by Goodwin for example), for low levels of capacity utilization the wage share decreases as uti-

[8] For example under a Cobb-Douglas production function the wage share remains constant.

[9] As mentioned in Schor (1985) the adoption of the first postulate was criticized by Dunlop (1938) and Tarshis (1939), who claimed that the real wage is procyclical. Keynes (1939) replied that they "had seriously shaken the assumptions of the short-period theory of distribution" although "we should not be too hasty in our revisions".

lization increases, thus the slope of the distributive curve is negative. Therefore the curve has initially a negative and then a positive slope. An intuitive rationale behind this behavior of the distribution along the cycle is that at the beginning of the cycle we have productivity gains because of fixed costs the economy faces, thus the wage share decrease. As the economy grows these productivity gains fade ($\hat{x}_u$ becomes small) and at the same time the labor market becomes tighter, the bargaining power of the workers increases, the real wage increases ($\hat{\omega}_u > 0$) and thus the wage share tends to increase[10].

Kalecki emphasized the price setting behavior of the firm as the main determinant of income distribution (Kalecki, 9 40, 1954, 1971a,b). He summarized the factors that allow the firms to set prices over the unit prime cost with the term *degree of monopoly.* These factors include among others "concentration in industry" and "the significance of the power of trade unions"(1971b, ch.6)[11]. He believed that the wage share is constant during the cycle. However, his conclusions differ when he takes into account the salaries, which "because of their "overhead" character are likely to fall less during the depression and rise less during the boom". This implies a negative sloping distributive curve, if the wage share includes the compensation of the overhead labor. In his last paper, which was published posthumously, Kalecki (1971a) emphasizes the effect of class struggle on pricing and the distribution of income. He concludes "the day-by-day bargaining process is an important co-determinant of the distribution of national income". If the ability of the trade unions or the workers to restrain the mark-ups is higher for high levels of capacity utilization, these arguments combined establish a U-shaped distributive curve.

Figure 1 presents the wage share and capacity utilization for the US economy with data from the Bureau of Labor Statistics (details about the data are provided in the Appendix). We can see this U-shaped relationship between the wage share and utilization. At low levels of utilization the wage share decreases as utilization increases ($\frac{d\psi}{du} < 0$), while at high levels of utilization the wage share increases as utilization increases ($\frac{d\psi}{du} > 0$).

Figure 1 here

[10]Implicitly in this argument it is assumed that distribution is stable, that is the denominator in (4) is negative.

[11]A discussion of the pricing and distribution theory of Kalecki is provided by Basile and Salvadori (4 85, p. 259).

Finally, the distributive schedule can also be stable or unstable, depending on the sign of $\partial\hat{\psi}/\partial\psi$ or—equivalently—on the sign of $\hat{\omega}_\psi - \hat{x}_\psi$. If a higher wage share tends to decrease $\hat{\psi}$, the distributive schedule is stable. In this case, as we mentioned above, positive $\frac{d\psi}{du}$ is tantamount to $\hat{\omega}_u > \hat{x}_u$, that is, as utilization increases the growth rate of the real wage increases faster than productivity. However if the stability condition does not hold and $\partial\hat{\psi}/\partial\psi > 0$, a positive sloped distributive schedule means that the growth rate of the real wage increases faster than productivity as utilization increases. Respectively an unstable negative sloped distributive schedule means that the growth rate of the real wage increases slower than productivity as utilization increases. Taylor (2004, ch. 7) provides a comprehensive exposition of the different possible scenarios regarding the stability and the slope of the distributive schedule.

2.3 Equilibrium

The equilibrium level of distribution and capacity utilization is the outcome of the interaction of the demand and the distributive schedules, "the functional distribution of income and effective demand jointly determine economic activity" (Foley and Taylor, 2006). Diagrammatically we can picture this equilibrium as the intersection of the two curves. A non-linear distributive curve allows for multiple equilibria, as in figure 2. This possibility, as we mentioned already, has serious consequences for the definition of the profit/wage led behavior of the economy.

Figure 2 here

If demand and distribution present the same dynamic behavior around both equilibria—that is, if the sign of each of the partial derivatives $\partial\hat{u}/\partial u$ and $\partial\hat{\psi}/\partial\psi$ is the same around A and B—one of them is stable and the other unstable. Therefore, a dynamic adjustment process must be specified. In figure 2 if the distributive schedule is stable around A and B, the former is stable if the demand schedule is unstable around it (in this case Keynesian stability does not hold and investment reacts weakly to the changes in the wage share). On the other hand equilibrium B is stable if demand is also stable around it. Conversely, under the assumption of Keynesian stability, equilibrium A can become stable if the distributive schedule is unstable in its neighborhood. A brief discussion of these stability issues is provided in the Appendix.

3 Estimation of Demand and Distribution Schedules

The ambiguity of the impact of (re)distribution on demand and the investigation of distribution at different levels of utilization has been the source of a vast empirical literature over the last two decades. Notable contributions include Bowles and Boyer (1995), Gordon (1995), Barbosa-Filho and Taylor (2006), Stockhammer and Onaran (2004), Onaran and Stockhammer (2005), Naastepad and Storm (2006). A summary of the empirical literature up to the date of its publication and new empirical results can be found in Hein and Vogel (2007). More recent contributions include among others Stockhammer and Ederer (2008), Stockhammer et al. (2009), Hein and Vogel (2009) and Tavani et al. (2010). Several chapters in Chiarella et al. (2006) and Flaschel and Landesmann (2008) also contain relevant empirical contributions.

In this paper, our goal is to estimate the demand and the distributive schedule. The theoretical discussion above highlights two issues: i) the simultaneous determination of utilization and distribution and ii) the possible non-linearity of the two curves. Our approach focuses on these issues. With the exception of Gordon (1995) the literature so far has not addressed both issues simultaneously. The issue of endogeneity is either addressed with some variation of Vector Autoregression (VAR) method or is ignored. Non-linearities are also ignored or the non-linear behavior of the variables is not attributed to the distribution and/or demand curves themselves but to the dynamics around the equilibrium. For example Barbosa-Filho and Taylor (2006) explain the behavior of figure 1 as the dynamics à la Goodwin (1967) around the equilibrium of a stable downward sloping demand curve and an upward sloping distribution curve. An exception is the recent paper by Tavani et al. (2010), where attention is given to both the non-linear distributive curve and the dynamics around the different equilibria. Gordon on the other hand does not examine the possibility of multiple equilibria and tests the possibility of a non-linear distributive schedule only with the use of a quadratic regression (below we propose an additional method for testing for possible non-linearities).

We use the following specification for the demand and the distributive curve respectively:

$$Demand: \quad u_t = \beta_0 + \beta_1 u_{t-1} + \beta_2 u_{t-2} + \beta_3 \psi_t + \beta_4 gov + \epsilon_t \tag{5}$$

$$Distribution: \quad \psi_t = \beta_0 + \beta_1 \psi_{t-1} + \beta_2 u_t + \beta_4 x_t + \beta_5 D + \epsilon_t \tag{6}$$

where *gov* is the surplus/deficit of the government as a percentage of the GDP and D is a dummy variable which takes the value 0 for the years 1948-1960, -1 for the years 1961-1980, 0 for the period 1980-1990, 1 for the period 1990-2006 and 2 for the period 2007-2009. With this dummy variable we want to control for the changes in the political-economic environment on the behavior of distribution.

The simultaneous determination of distribution of income and capacity utilization means that there is not a clear-cut causal relationship between them. There are channels through which the causality runs from distribution to capacity utilization, while there are others through which the causality runs the other way[12]. This situation leads to the well-known simultaneity problem. This problem does not allow a straightforward explanation of our observations. We cannot be sure what conditions these data represent beyond our belief that the data represent equilibria. We do not know if they trace the demand-IS curve or the distribution schedule or their intersection, which seems more plausible. As a result of the simultaneity problem the residuals are correlated with the regressor, so a simple Least Squares Regression cannot be utilized, since one of its basic assumptions is not satisfied[13].

We tackle this problem by utilizing the two stage least squares method. We use labor productivity and lagged values of the wage share as instruments for the estimation of the demand curve and the surplus/deficit of the government as well as lagged values of utilization as instruments for the estimation of the distribution curve. In that sense, labor productivity and the lagged values of

[12]Many theoretical contributions to the literature as well as efforts to estimate the demand and the distribution curves have focused on the relation between the growth rate of GDP as the variable of aggregate economic performance and the profit rate or the growth rate of the wage share as the distributional variable. The use of the wage share and utilization is also common: see among others Barbosa-Filho and Taylor (2006), Stockhammer and Onaran (2004), Hein and Vogel (2007). The wage/profit share as opposed to the profit rate has the advantage of being i) more stationary, ii) easily decomposed into real wage and productivity and iii) able to isolate the effect of utilization on profitability (the profit rate increases as utilization increases even if the profit share remains constant). Lance Taylor pointed to these advantages in a discussion.

[13]We provide a more extensive discussion of this problem in the Appendix.

the wage share are "curve shifters" for the price-distribution schedule (and thus serve as instruments for the estimation of the demand curve)[14], while the surplus/deficit of the government and the lagged values of utilization are "shifters" of the demand schedule (and thus serve as instruments for the estimation of the distribution curve).

We test the validity of our instruments with various tests. The different tests as well as the tests for autocorrelation and heteroskedasticity and their results can be found in the Appendix.

We test possible non-linearities with two methods. First, we stratify our data based on the deviation of unemployment from its long run trend as an indicator for the level of economic activity. Unemployment being far higher than its long run trend is an indicator of an economy being in a recession and underutilizing its productive capacity. On the other hand unemployment being much lower compared to its long run trend is an indicator of an economy with a tight labor market and high utilization of its productive capacity. We choose the deviation of unemployment from its trend, rather than the level of unemployment itself because in the long run if unemployment persists the same level of unemployment expresses different levels of "tightness" and utilization of capacity (among others Rowthorn (1995) makes this point). In the US even if there has not been a dramatic upward shift of unemployment—like in most European countries—it is important to take into account the long run fluctuations of unemployment[15]. In that sense the labels high, medium, low and very low unemployment in tables 1 and 2 below do not refer to actual levels of unemployment but to deviations of unemployment from its long run trend. The size of the deviation for the stratification of the data was chosen based on the behavior of the distribution

[14] Gordon (1995) also uses technological innovation as an argument for his profitability function, which is a very similar construction to our price-distribution schedule. As we mentioned, Gordon is the only one in the literature so far who employs the 2SLS approach and uses the technological innovation as an instrument when he tries to estimate the components of his demand function. An objection that can be raised against the use of labor productivity as an instrument to estimate the demand curve is that productivity is correlated with demand. Among the scholars who have stressed this issue Verdoorn (1949) and Kaldor (e.g. 1957, 1961, 1966) are the most prominent examples. For the purpose of the present paper we assume the exogeneity of productivity in that respect. Econometrically, we test this assumption with the tests described and presented in the Appendix.

[15] We used the Hodrick and Prescott (1997) filter to derive the long run trend of unemployment. A simple examination of the data shows that the average level of unemployment in the US was around 4.5% in the 1950's and 1960's, 6.2% in the 1970's, 7.5 in the 1980's and 5.2% in the 1990's. More recently Tavani et al. (2010) also control for the long run trend of unemployment. We also ran the same regressions for different levels of unemployment. The main conclusions remain the same.

schedule and is the same for the regressions for both demand and distribution for reasons of consistency.

In the case of the distributive curve, following Gordon (1995), we also estimated a quadratic specification:

$$\psi_t = \beta_0 + \beta_1 \psi_{t-1} + \beta_2 u_t + \beta_3 u_t^2 + \beta_4 x_t + \beta_5 D + \epsilon_t \tag{7}$$

We utilize quarterly data for the United States Economy from the Bureau of Economic Analysis and the Bureau of Labor Statistics for the period 1948-I to 2009-IV. A detailed description of the data is provided in the Appendix.

Finally, before proceeding to the presentation of our results, we should mention that in our regressions we kept only the cyclical component of the wage share from the actual wage share series. The rationale behind this filtering goes back to the idea of the classical economists that the distribution of income—in the long run—is "exogenously" determined by forces related to the class struggle between workers and capitalists and the balance of power between them. For example, the redistribution of income against wages that has taken place over the last thirty years seems to be the result of this shift in the balance of power in favor of capitalists since the early 1980's and is exogenous at least in respect to our model. In this paper we would like to focus on the cyclical fluctuations of distribution, which as we already stressed are endogenous. Because of this focus on the cyclical fluctuations we also de-trended labor productivity and government surplus/deficit. Details about the de-trending of the series can be found in the Appendix.

4 Our Estimates

4.1 The demand schedule

In order to trace the effect of a change in the wage share on capacity utilization we estimate equation (5). We report the results in Table 1. In the first column we present the results for the whole sample, while in the second, third and fourth column we present the results for high, medium and low unemployment respectively.

Table 1 here

The government surplus coefficient has the expected positive sign. An increase in utilization is accompanied by an increase of the fiscal surplus (or a decrease in the deficit)[16].

In the first row of the table we can see the estimated coefficient for the wage share. Demand appears to be exhilarationist. An increase in the wage share depresses demand ($du/d\psi < 0$). If demand is stable this can be interpreted as investment reacting more than saving to a change in distribution ($|S_\psi| < |I_\psi|$).

In the second, third and fourth column we can see that the sign of the estimate does not change for different levels of employment. Interestingly (and counterintuitively) we find that at high levels of unemployment demand reacts more strongly to changes in distribution than at low levels of unemployment, that is, demand is more profit led for lower levels of utilization. A possible explanation for this behavior of demand could be that when the economy is depressed the Keynesian stability condition ceases to hold, therefore $I_u - S_u$ gets a small positive value. At the same time I_ψ becomes small in absolute value, so $I_\psi - S_\psi$ becomes positive. When the economy is depressed firms react more strongly to demand for their product and to news about the aggregate economic activity and less to changes in distribution (someone can think how much attention economists, firms and policy makers pay over the last three years to the various reports on employment and growth)[17].

Related to the above is the hypothesis that demand used to be *less* profit-led before in the early post-war period. It is well known that the thirty years after World War II, the Golden Age, combined a high rate of growth and increasing wage share. Bhaduri and Marglin (1990a) relate that to the memories of the Depression and the fear of a new one, which "inhibited business from responding to a high profit share with heavy spending on plant and equipment at least in the

[16]The coefficient is so small compared to the others because the cyclical component of the surplus/deficit is derived as the difference of the realized value of the series from its trend and not as a ratio like the other series.

[17]This is not the only interpretation for this kind of behavior of demand. If we assume that the reaction of investment and saving to utilization does not change for different levels of utilization ($I_{uu} = S_{uu} \approx 0$) the denominator in (2) also does not change, so it is investment that reacts more strongly to changes in distribution at low levels of utilization ($I_{\psi u} > 0$) or saving reacts less strongly ($S_{\psi u} < 0$). In this case the increase of the absolute value of $du/d\psi$ comes through an increase of the (absolute value of) the numerator in (2). Another explanation could be that it is $I_\psi - S_\psi$ that does not change and that $I_u - S_u$ remains negative but becomes smaller in absolute value for low levels of utilization (probably because the animal spirits of the entrepreneurs react more strongly to increases in utilization when the economy is depressed ($I_{uu} < 0$)). The econometric method we use does not provide answers about either the individual reaction of the different components of demand to distribution and utilization and therefore we cannot distinguish between these possibilities.

short run". In terms of our model above, that would mean that investment would react less than savings to a change in the wage share ($|S_\psi| > |I_\psi|$), so demand would react positively to an increase of the wage share ($du/d\psi > 0$). Another possible explanation for a higher $|I_\psi|$ are the political-economic conditions which prevailed the last decades of our sample. The period after the mid-1970s (or the early 1980s) has been marked by a great push on behalf of the capitalists to increase their (distributed) profits. The search for higher profitability on behalf of the owners of the firms might have increased the responsiveness of the firms to changes in distribution. Therefore, the underlying causes of the downwards pressures on the wage share (which are clear in figure 1) can also be related to a change of the behavior of investment and demand[18].

In the last three columns of table 1 we present the estimates for the equation (5) above for the period before 1960, before 1970 and after 1970 respectively. The hypothesis of *less* profit-led (or *more* wage-led) behavior is confirmed by our results. For the period before 1960 the estimate is positive (although not statistically significant), for the period before 1970 it becomes slightly negative (again not significant), while over the last forty years it becomes significantly negative.

4.2 The distributive Schedule

We also use the 2SLS method to estimate the distributive schedule. We estimate equation (6). We report the results in Table 2. In the first column we present the results for the whole sample, while in the second, third and fourth column we present the results for high, medium and low unemployment respectively. In the fifth column we present the results of the estimation procedure for very low unemployment. In the last column of the table we present the results of estimating the quadratic specification of equation (7).

Table 2 here

Labor productivity has the expected negative sign. An increase in productivity leads (*ceteris paribus*) to a decrease in the labor share. It is also interesting

[18]The political-economic conditions of the last three decades have been given several names. *Neoliberalism* and *financialization* are two popular names. More details can be found in the latest books of Dumenil and Levy (2011) and Taylor (2010) as well as in the literature on financialization (among others Stockhammer, 2004, Epstein and Jayadev, 2005, Orhangazi, 2008, Skott and Ryoo, 2008). We should also note that these explanations implicitly assume the Keynesian stability condition.

that D gets statistically significant negative values (except for high and medium unemployment). This shows that over the last three decades the profit squeeze takes place at a higher level of utilization, which is another indication of the shift in the balance of power between workers and capitalists.

The first column of the table confirms the profit squeeze hypothesis—the distributive curve has a positive slope—when we apply a linear estimation method. However in the second column we observe that the estimate is negative for low levels of employment and utilization. For medium levels of employment the estimate is positive (but not statistically significant). We could interpret that as the distribution curve being shallow for these levels of employment. Finally, in the fourth and fifth columns (low and very low levels of unemployment respectively) we see that for low levels of unemployment the profit squeeze becomes more acute and the wage share increases as utilization and employment increase. These estimates confirm the hypothesis of a U-shaped distribution curve.

Finally, the non-monotonicity of the distributive schedule is confirmed by the estimates of the quadratic specification which is presented in the last column of table 2. The level of utilization for which the slope of the curve changes according to the estimates is low ($u \approx 0.95$) and implies a similar behavior of distribution as in the previous columns of the table.

5 Wage- and Profit-Led re-examined

In the presence of a non-linear distributive curve the slope of the demand curve is not the only factor for the determination of the effect of a change in the distribution of income on capacity utilization. Therefore, we have to move one step ahead from the characterization of an economy as wage-led or profit-led based on the slope of the demand curve. An economy is wage led if an exogenous technological or distributive change against the wage share (a downwards shift of the distributive curve in the (u, ψ) plane) leads to a lower equilibrium level of capacity utilization. We can define a profit-led economy analogously.

This point can be made clearer with the help of figure 3, where a negative-sloped demand curve interacts with a U-shaped distributive curve (this is what the estimates of the previous section suggest for the US economy). Such a distributive curve leads to the existence of two possible equilibria, A and B. The former corresponds to low levels of capacity utilization and the downward sloping part of the distributive curve, while the latter corresponds to a high level of utilization and the upward sloping segment of the distributive curve.

Figure 3 here

As we mentioned in the previous section it is possible that when the economy is depressed the sign of the numerator and the denominator of equation (2) reverse. Even if in "normal" times the entrepreneurs care mostly about profitability and not utilization (so $|I_\psi|$ is high and $|I_u|$ is low) when the economy finds itself at very low utilization levels they would probably react much stronger to good news on utilization and not so much to profitability[19].

If distribution is stable and demand is unstable for low levels of utilization (around A) and stable elsewhere, both equilibria are stable[20].

The reaction to an exogenous change of the distribution depends on what equilibrium the economy is at. In the case of B, a change in distribution against wages, which is depicted with a downward shift of the distribution curve, leads to an increase in capacity utilization (the economy moves from point B to B'). The final result is identical to with the slope of the demand curve would predict.

Things are different if the economy finds itself at low utilization levels like A. A re-distribution of income against wages, even if the demand curve has a negative slope, leads to lower utilization, from point A to point A'. In this case the final result is the opposite compared to the one predicted by the slope of the demand curve.

Today, as a result of the recent and ongoing crisis the economy finds itself in the downward sloping part of the distribution curve. Figure 3 shows that in such a case a further decrease in the wage share would lead to even lower levels of utilization. A redistribution of income in favor of wage earners would lead to a better aggregate economic performance[21].

[19] More formally, as we explained in section 4.1 for low levels of utilization $|I_\psi|$ decreases and $|I_u|$ increases, the Keynesian stability condition ceases to hold ($I_u - S_u$ gets a small positive value) and I_ψ becomes small in absolute value ($I_\psi - S_\psi$ becomes positive). Under these conditions $\partial u/\partial\psi$ becomes more negative (as in our econometric results) but for different reasons than if we had assumed the Keynesian stability condition (i.e. if we had assumed that $I_u - S_u$ remains negative).

[20] Formally, equilibrium A could become stable under the Keynesian stability condition if the distributive schedule was unstable around it. That would also require $\hat{\omega}_u - \hat{x}_u$ to be positive.

[21] The interpretation of the current situation with an equilibrium like A of figure 3 has a shortcoming: it implies that an autonomous increase in demand would lead to a lower level of utilization and higher wage share, which does not seem very convincing right now. The

6 Conclusion

In this paper we examined the behavior of the demand side of the economy, as well as the forces that interact and codetermine the distribution of income. We used the Kaleckian model of growth and distribution as our theoretical foundation, which we subsequently tested. We analyzed how wage bargaining, the market power of firms, and the development of productivity frame the way income is distributed between capitalists and workers and together with the demand schedule lead to the market equilibrium. We explain under what circumstances the distributive schedule is not linear, but U-shaped.

We estimated econometrically the two schedules. The joint determination of utilization and distribution creates the problem of identifying the different structures behind our data. We use a two stages least squares approach. Our results provide answers to how demand and distribution of income is determined at different levels of capacity utilization. We find that demand reacts negatively to an increase in the wage share. On the other hand there is a positive reaction of the wage share to capacity utilization when we used a linear equation. When we allowed for a non-linear response we confirmed that the distributive schedule is U-shaped.

The non-linear shape of the distributive schedule leads to multiple equilibria. Therefore, a change of the distribution does not necessarily have the effect which is predicted by the slope of the demand schedule. We have to move one step further from the characterization of an economy as wage-led if the slope of the demand curve is positive and profit-led if it is negative. We provide an alternative definition; *an economy is profit-led when a distributive or technological change against the wage share leads to a higher equilibrium level of capacity utilization.* A profit-led economy is defined similarly.

Based on our estimations of the demand and distributive schedules and using the above definition we argue that an economy which finds itself at very low levels of utilization is *wage-led* and it would benefit from an increase in the wage share, even if demand is exhilarationist.

answer to this might lie in a change of the demand behavior. Probably for reasons similar to why the demand was wage-led in the early postwar period, the demand schedule is positive sloped (although the limited amount of data cannot confirm that). The depression is not a memory (like Marglin and Bhaduri claimed it was in the first postwar decades) anymore, rather a concrete reality, so it is possible that demand has a different behavior that we cannot find in the last three decades. In both cases if the demand is at a low utilization equilibrium an increase in the wage share boosts aggregate economic performance.

References

Amadeo, E. J. (1986). The role of capacity utilization in the long period analysis. *Political Economy*, 2(2):147–160.

Assous, M. and Dutt, A. K. (2010). Growth and Distributional Dynamics with Labor Market and Industrial Concentration Effects. unpublished working paper.

Barbosa-Filho, N. H. and Taylor, L. (2006). Distributive and Demand Cycles in the U.S. Economy-A Structuralist Goodwin Model. *Metroeconomica*, 57(3):389–411.

Basile, L. and Salvadori, N. (1984-85). Kalecki's pricing theory. *Journal of Post Keynesian Economics*, 7(2):249–262.

Bhaduri, A. and Marglin, S. (1990a). Profit Squeeze and Keynesian Theory. In Marglin, S. and Schor, J., editors, *The Golden Age of Capitalism: Reinterpreting the Postwar Experience*. Clarendon Press, Oxford.

Bhaduri, A. and Marglin, S. (1990b). Unemployment and the Real Wage: the Economic Basis for Contesting Political Ideologies. *Cambridge Journal of Economics*, 14(4):375–393.

Blecker, R. (1989). International Competition, income distribution and economic growth. *Cambridge Journal of Economics*, 14(3):395–412.

Bowles, S. and Boyer, R. (1988). Labor Discipline and Aggregate Demand: A Macroeconomic Model. *The American Economic Review*, 78(2):395–400.

Bowles, S. and Boyer, R. (1995). Wages, aggregate demand, and employment in an open economy: an empirical investigation. In Epstein, G. A. and Gintis, H., editors, *Macroeconomic policy after the conservative era*. Cambridge University Press, Cambridge, UK.

Chiarella, C., Franke, R., Flaschel, P., and Semmler, W., editors (2006). *Quantitative and Empirical Analysis of Nonlinear Dynamic Models*, Contributions to Economic Analysis, Amsterdam. Elsevier.

Cragg, J. G. and Donald, S. G. (1993). Testing Identifiability and Specification in Instrumental Variable Models. *Econometric Theory*, 9(2):222–240.

Cumby, R. E. and Huizinga, J. (1992). Testing the autocorrelation structure of disturbances in ordinary least squares and instrumental variables regressions. *Econometrica*, 60(1):185–195.

Davidson, P. (1972). *Money and the Real World*. MacMillan, London.

Dumenil, G. and Levy, D. (2011). *The Crisis of Neoliberalism*. Harvard University Press, Cambridge, MA.

Dunlop, J. (1938). The movement of real and money wages. *Economic Journal*, 48(191):413–34.

Dutt, A. K. (1984). Stagnation, income distribution and monopoly power. *Cambridge Journal of Economics*, 8(1):25–40.

Dutt, A. K. (1990). *Growth, Distribution and Uneven Development*. Cambridge University Press, Cambridge, UK.

Eichner, A. (1976). *The Megacorp & Oligopoly: Micro Foundations of Macro Dynamics*. Cambridge University Press, Cambridge, UK.

Epstein, G. and Jayadev, A. (2005). The Rise of Rentier Incomes in OECD Countries: Financialization, Central Bank Policy and Labor Solidarity. In Epstein, G., editor, *Financialization and the World Economy*. Edward Elgar Publishing, Northampton, MA.

Flaschel, P. and Landesmann, M., editors (2008). *Mathematical Economics and the Dynamics of Capitalism*, Frontiers of Political Economy, London. Routledge.

Foley, D. K. (2003). Endogenous Technical Change with externalities in a classical growth model. *Journal of Economic Behavior & Organization*, 52(2):167–189.

Foley, D. K. and Taylor, L. (2006). A Heterodox Growth and Distribution Model. In Salvadori, N., editor, *Economic Growth and Distribution*. Edward Elgar Publishing, Northampton, MA.

Garegnani, P. (1992). Some notes on Capital Accumulation. In Halevi, J., Nell, E. J., and Laibman, D., editors, *Beyond the Steady State: A revival of growth theory*. St. Martin's Press, New York.

Goodwin, R. M. (1967). A Growth Cycle. In Feinstein, C., editor, *Socialism, Capitalism and Economic Growth*. Cambridge University Press, Cambridge.

Gordon, D. M. (1995). Growth, Distribution, and the rules of the game. In Epstein, G. A. and Gintis, H., editors, *Macroeconomic Policy after the Conservative Era*. Cambridge University Press, Cambridge, UK.

Harcourt, G. C. (1972). *Some Cambridge Controversies in the Theory of Capital*. Cambridge University Press, Cambridge, UK.

Hayashi, F. (2000). *Econometrics*. Princeton University Press, Princeton, NJ.

Hein, E. and Vogel, L. (2007). Distribution and Growth reconsidered:empirical results for six OECD countries. *Cambridge Journal of Economics*, 32(3):479–511.

Hein, E. and Vogel, L. (2009). Distribution and Growth in France and Germany: Single Equation Estimations and Model Simulations Based on the Bhaduri/Marglin Model. *Review of Political Economy*, 21(2):245–272.

Hodrick, R. J. and Prescott, E. C. (1997). Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit and Banking*.

Kaldor, N. (1957). A Model of Economic Growth. *The Economic Journal*, 67(268):591–624.

Kaldor, N. (1961). Capital Accumulation and Economic Growth. In Lutz, F. and Hague, D., editors, *The Theory of Capital: Proceedings of a Conference held by the International Economic Association*, New York, NY. St. Martin's Press.

Kaldor, N. (1966). *Causes of the slow rate of economic growth of the United Kingdom: an inaugural lecture*. Cambridge University Press, Cambridge, UK. Reprinted in Kaldor (1978).

Kaldor, N. (1978). *Futher essays on economic theory*. Homes & Meier Pub., New York.

Kaldor, N. (1985). *Economics without Equilibrium*. M.E. Sharpe, Armonk, N.Y.

Kalecki, M. (1939-40). The Supply Curve of an Industry under imperfect competition. *Review of Economic Studies*, 7(2):91–112.

Kalecki, M. (1954). *Theory of Economic Dynamics*. Allen and Unwin, London.

Kalecki, M. (1968). Trend and the Business Cycle Reconsidered. *Economic Journal*, 78(310):263–276.

Kalecki, M. (1971a). Class Struggle and the Distribution of National Income. *Kyklos*, 24(1):1–9. Reprinted in Kalecki (1971b).

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

Keynes, J. M. (1939). Realtive movements of real wages and output. *Economic Journal*, Vol. 49(193):34–51.

Kleibergen, F. and Paap, R. (2006). Generalized reduced rank tests using the singular value decomposition. *Journal of Econometrics*, 133(1):97 – 126.

Krugman, P. and Taylor, L. (1978). Contractionary effects of devaluation. *Journal of International Economics*, 8(3):445–456.

Kurz, H. (1994). Growth and Distribution. *Review of Political Economy*, 6(4):393–420.

Marx, K. (1976). *Capital: A Critique of Political Economy, Vol. I.* Penguin Books, London, England. first publication date: 1867.

Naastepad, C. and Storm, S. (2006). OECD demand regimes (1960-2000). *Journal of Post Keynesian Economics*, 29(2):211–246.

Onaran, O. and Stockhammer, E. (2005). Two Different Export-oriented Growth Strategies: Accumulation and Distribution a la Turca and a la South Korea. *Emerging Markets Finance and Trade*, 41(1):65–89.

Orhangazi, O. (2008). Financialisation and capital accumulation in the non-financial corporate sector: A theoretical and empirical investigation on the US economy: 1973-2003. *Cambridge Journal of Economics*, 32(6):863–886.

Pagan, A. R. and Hall, A. (1983). Diagnostic tests as residual analysis. *Econometric Reviews*, 2(2):159–218.

Pasinetti, L. L., editor (1993). *Italian economic papers*, volume 2. Oxford University Press, Oxford, UK.

Robinson, J. (1956). *The Accumulation of Capital*. Richard D. Irwin Inc, Homewood, Illinois.

Robinson, J. (1962). *Essays in the Theory of Economic Growth*. The MacMillan Press, London.

Rowthorn, R. (1981). Demand real wages and economic growth. *Thames Papers in Political Economy*.

Rowthorn, R. (1995). Capital Formation and Unemployment. *Oxford Review of Economic Policy*, 11(1):26–39.

Sargan, J. D. (1958). The Estimation of Economic Relationships using Instrumental Variables. *Econometrica*, 26(3):393–415.

Schor, J. (1985). Changes in the cyclical pattern of Real Wages: Evidence from Nine Countries. *Economic Journal*, 95(378):452–468.

Shapiro, C. and Stiglitz, J. E. (1984). Equilibrium Unemployment as a Worker Discipline Device. *The American Economic Review*, 74(3):433–444.

Skott, P. and Ryoo, S. (2008). Macroeconomic implications of financialisation. *Cambridge Journal of Economics*, 32(6):827–862.

Staiger, D. and Stock, J. H. (1997). Instrumental Variables Regression with Weak Instruments. *Econometrica*, 65(3):557 – 586.

Steindl, J. (1952). *Maturity and Stagnation in American Capitalism*. Basil Blackwell, Oxford.

Stock, J. and Yogo, M. (2005). Testing for Weak Instruments in Linear IV Regression. In Andrews, D. and Stock, J., editors, *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*. Cambridge University Press, Cambridge, UK.

Stock, J. H., Wright, J. H., and Yogo, M. (2002). A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments. *Journal of Business and Economic Statistics*, 20(4):518–529.

Stockhammer, E. (2004). Financialisation and the slowdown of accumulation. *Cambridge Journal of Economics*, 28(5):719–741.

Stockhammer, E. and Ederer, S. (2008). Demand effects of the falling wage share in Austria. *Empirica*, 35(5):481–502.

Stockhammer, E. and Onaran, O. (2004). Accumulation, distribution and employment: a structural VAR approach to a Kaleckian macro model. *Structural Change and Economic Dynamics*, 15(4):421–447.

Stockhammer, E., Onaran, O., and Ederer, S. (2009). Functional income distribution and aggregate demand in the Euro area. *Cambridge Journal of Economics*, 33(1):139–159.

Tarshis, L. (1939). Changes in real and money wages. *Economic Journal*, 49(193):150–4.

Tavani, D., Flaschel, P., and Taylor, L. (2010). Estimated Non-linearities and Multiple Equilibria in a Model of Distributive-Demand Cycles. *International Review of Applied Economics*. forthcoming.

Taylor, L. (1983). *Structuralist Macroeconomics*. Basil Books, New York.

Taylor, L. (1990). Real and Money Wages, Output and Inflation in the Semi-Industrialized World. *Economica*, 57(227):329–353.

Taylor, L. (2004). *Reconstructing Macroeconomics: Structuralist Proposals and Critiques of the Mainstream*. Harvard University Press, Cambridge, MA.

Taylor, L. (2010). *Maynard's Revenge: The Collapse of Free Market Macroeconomics*. Harvard University Press, Cambridge, MA.

Verdoorn, P. (1949). Fattori che regolano lo sviluppo della produttivita del lavoro. *L' Industria*, 1:3–10. Reprinted in English as "On the Factors Determining the Growth of Labor Productivity" in Pasinetti (1993).

Wood, A. (1975). *A Theory of Profits*. Cambridge University Press, Cambridge, UK.

Wright, P. G. (1928). *The tarrif on Animal and Vegetable Oils*. MacMillan, New York, NY.

A The necessary conditions for stability

Equations (1)and (3) define a 2x2 dynamic system:

$$\begin{aligned} \hat{u} &= g(\psi, u) = I(\psi, u) - S(\psi, u) \\ \hat{\psi} &= h(\psi, u) = \hat{\omega}(\psi, u) - \hat{x}(\psi, u) \end{aligned} \tag{A.1}$$

The Jacobian matrix of this system around the steady state is

$$J = \begin{bmatrix} g_u & g_\psi \\ h_u & h_\psi \end{bmatrix} = \begin{bmatrix} I_u - S_u & I_\psi - S_\psi \\ \hat{\omega}_u - \hat{x}_u & \hat{\omega}_\psi - \hat{x}_\psi \end{bmatrix} \tag{A.2}$$

Note that the elements of the off-diagonal of the Jacobian are the numerators of equations (2) and (4) and the elements of the diagonal are the denominators. The necessary condition for the system to be stable is the trace of the Jacobian, $\tau(J)$, to be negative and its determinant, $\Delta(J)$, to be positive. That is $\tau = g_u + h_\psi < 0$ and $\Delta = g_u h_\psi - h_u g_\psi > 0$. Analogously, if $\tau(J) > 0$ and $\Delta(J) > 0$ the system is unstable while if $\Delta(J) < 0$ we have saddle path instability.

It is beyond the scope of this paper to give an exhaustive list of the different possibilities. However, we can give some examples. In the case of an equilibrium like B in figure 2, where both schedules are stable, the Jacobian is

$$J = \begin{bmatrix} g_u(-) & g_\psi(-) \\ h_u(+) & h_\psi(-) \end{bmatrix}$$

The signs in the parenthesis represent the sign of the respective element of the matrix. It is straightforward to see that the necessary conditions for stability are satisfied in this case. On the other hand, if both schedules are stable in an equilibrium like A, $h_u < 0$. In this case $\Delta < 0$, since the slope of the distributive schedule is bigger than the demand schedule and we have saddle path instability. If around equilibrium B, demand is unstable the Jacobian is

$$J = \begin{bmatrix} g_u(+) & g_\psi(+) \\ h_u(-) & h_\psi(-) \end{bmatrix}$$

The slope of the demand is smaller than the slope of the distribution curve so equilibrium is stable as long as $g_u < |g_\psi|$ or $I_u - S_u < |\hat{\omega}_\psi - \hat{x}_\psi|$.

The dynamic behavior of the system (A.1) in different cases can be examined analogously.

B Data

We derived most of our data from the U.S. Bureau of Labor Statistics[22]. We used the series (Real) Output [Id: PRS85006043], (Real) Output Per Hour [Id: PRS85006093], and Labor Share[23] [Id: PRS85006173]. We constructed the government surplus deficit with data from the National Income and Product Accounts Tables (NIPA) from the U.S. Bureau of Economic Analysis[24]. The surplus was calculated as the ratio of Net government saving [Table 3.1. Government Current Receipts and Expenditures] to Gross Domestic Product [Table 1.1.5. Gross Domestic Product].

We calculated utilization by applying the Hodrick and Prescott (1997) filter to the output series. We used 1600 as the value of the smoothing parameter λ. We kept the cyclical component of productivity (output per hour), government surplus and the wage share, with the same filter. In the case of the wage share we used a higher value for the smoothing parameter λ=1000000. The rationale behind this distinction is that the forces behind the long-run exogenous wage share are slower in nature and present lower variation. Our general conclusions do not change if we use the same λ for the wage share series too.

C Diagnostic Statistics

C.1 Tests of Instrument Validity

In the classical regression model the equation to be estimated can be written as

$$y = X\beta + \epsilon \tag{C.1}$$

where y is a $(n \times 1)$ vector with the data for the regressand, X is a $(n \times K)$ table with the data for the K regressors, β is the $(n \times 1)$ vector of parameters to be estimated and ϵ is the $(n \times 1)$ vector of residuals.

One of the basic assumptions of the model is the—so called—strict exogeneity, $E[\epsilon \mid X] = 0$. One of the implications of strict exogeneity is that the regressors are orthogonal to the error terms, $E[X'\epsilon] = \mathbf{0}$ (where $\mathbf{0}$ is a $(K \times 1)$ vector of zeros).

[22]The data can be found at `http://data.bls.gov/cgi-bin/dsrv?pr`
[23]The Wage/Labor Share can be seen in figure 1
[24]The data can be found at `http://www.bea.gov/national/nipaweb`

The simultaneous determination of the regressand and one or more of the regressors—which is usually called endogeneity—violates this assumption. As a result the estimators produced by the simple OLS estimation method are biased.

The solution to this problem is the use of instrumental variables. We can thus define a table of instruments Z with dimensions $(n \times L)$. In this case the IV estimate is

$$\hat{\beta}_{IV} = (Z'X)Z'y \tag{C.2}$$

For the instruments to be valid table Z must meet the following conditions: i) to be correlated with the regressors, ii) this correlation to be strong enough and iii) to be orthogonal to the error term. We provide a brief explanation of each of these conditions and the respective tests in the following sections[25].

C.1.1 Identification

The problem of identification is related with the sufficient conditions for the estimate $\hat{\beta}_{IV}$ to be unique. It is easy to show that this is equivalent with i) the rank condition of identification, that is the matrix $Z'X$ is of full column rank K and ii) the order condition for identification, that the number of predetermined variables is higher or equal to the number of the regressors, $L \geq K$.

The latter condition is satisfied in our regressions since always the number of instruments is higher than the number of endogenous regressors (which is equal to one with the exception of regression (Di-5)). We test the rank of the matrix with a statistic proposed by Kleibergen and Paap (2006). The null hypothesis of the test is that the equation is underidentified. We present the results of the test in table 3. We reject the null hypothesis in all thirteen of our equations.

Table 3 here

C.1.2 Weak Identification

We face the problem of weak identification when our instruments satisfy the order and rank conditions we just mentioned, but they are not correlated "strongly

[25] The first attempt to use instrumental variables was done by Wright (1928) in his attempt to estimate the elasticities of demand and supply. This is nowadays the standard textbook example for the endogeneity problem. Wright suggests the use of the "curve shifters", which he defines as "factors which (A) affect demand conditions without affecting cost conditions or which (B) affect cost conditions without affecting demand conditions". We restate this definition in the Appendix. A contemporary detailed discussion of the IV method can be found in Hayashi (2000, ch. 3).

enough" with the endogenous regressors. Stock et al. (2002) explain that in the presence of weak instruments the estimators are likely biased and hypothesis tests have large size distortions. In this case the "cure" (IV method) is probably worse than the "disease".

Different methods have been proposed to test the presence of weak identification. For example Staiger and Stock (1997) suggest the rule of thumb that instruments are weak if the first stage regression has an F-statistic less than 10. Stock and Yogo (2005) "offer another two alternative definitions of weak instruments. The first definition is that a group of instruments is weak if the bias of the IV estimator, relative to the bias of the ordinary least squares (OLS), could exceed a certain threshold b, for example 10%. The second is that the instruments are weak if the conventional α-level Wald test based on IV statistics has an actual size that could exceed a certain threshold r, for example $r = 10\%$ when $\alpha = 5\%$". They use the Cragg and Donald (1993) statistic. If there is only one endogenous regressor (as is the case in the twelve out of the thirteen regressions we perform) this statistic is simply the first stage F-statistic. Stock and Yogo tabulate their own critical values for the test. The null hypothesis of the test is that the instruments are weak. We present the test-statistic together with the critical values proposed (when they are available) in table 4.

Table 4 here

We reject the null hypothesis if the test-statistic exceeds the critical value. We can see that our instruments perform well in all cases according to both the rule of thumb of Staiger and Stock (1997) and the two alternative definitions of Stock and Yogo (2005).

C.1.3 Orthogonality

In all thirteen of our regressions the number of instruments is higher than the number of the endogenous variables. We can therefore test the hypothesis that the instruments are not correlated with the residual. We do that using the Sargan (1958) test. The null hypothesis of the test is that the instruments are not correlated with the error term. We present the test in table 5. We fail to reject the null hypothesis in all thirteen of our equations.

Table 5 here

C.2 Tests for Autocorrelation and Heteroskedasticity

In table 6 we present the results of the tests we performed for autocorrelation and heteroskedasticity. We use the Cumby and Huizinga (1992) test for autocorrelation and the Pagan and Hall (1983) test for heteroskedasticity. The null hypothesis is that there is no failure of autocorrelation and heteroskedasticity. We fail to reject the null hypothesis in all thirteen of our equations.

Table 6 here

Figures and Tables

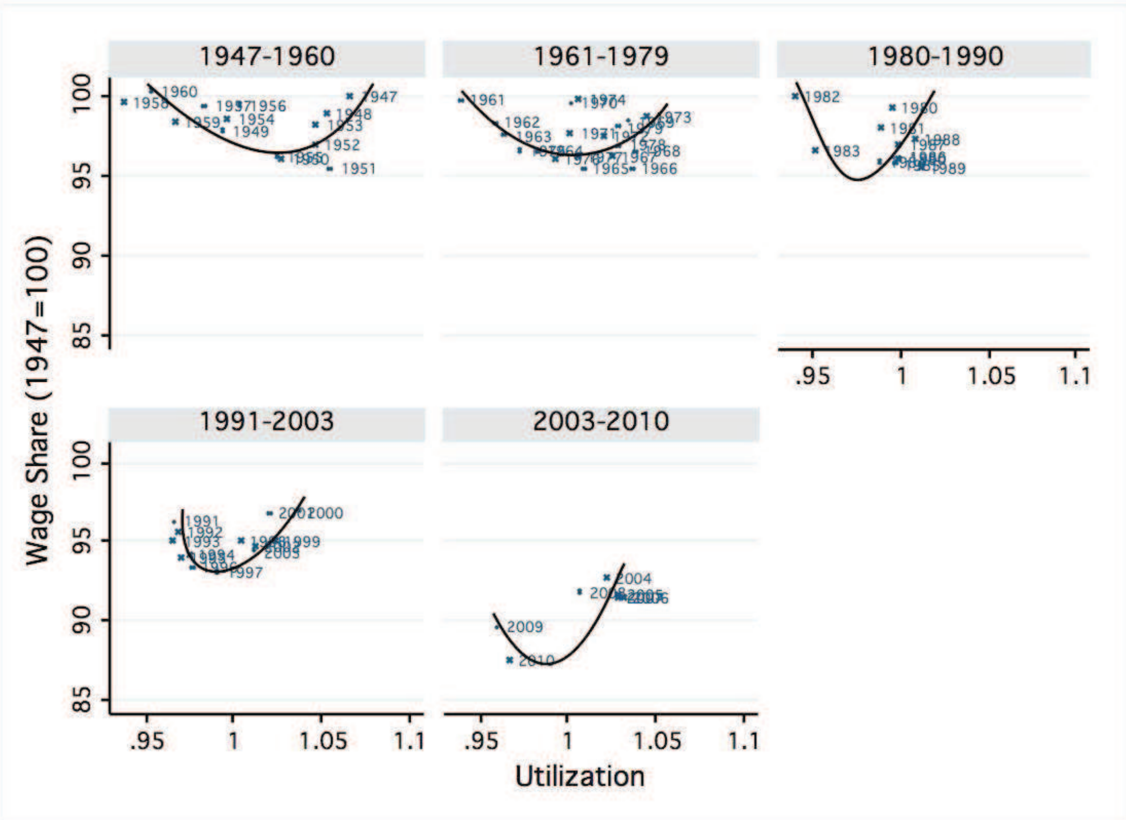

Figure 1: Wage share and utilization in the US for the period 1947-2010

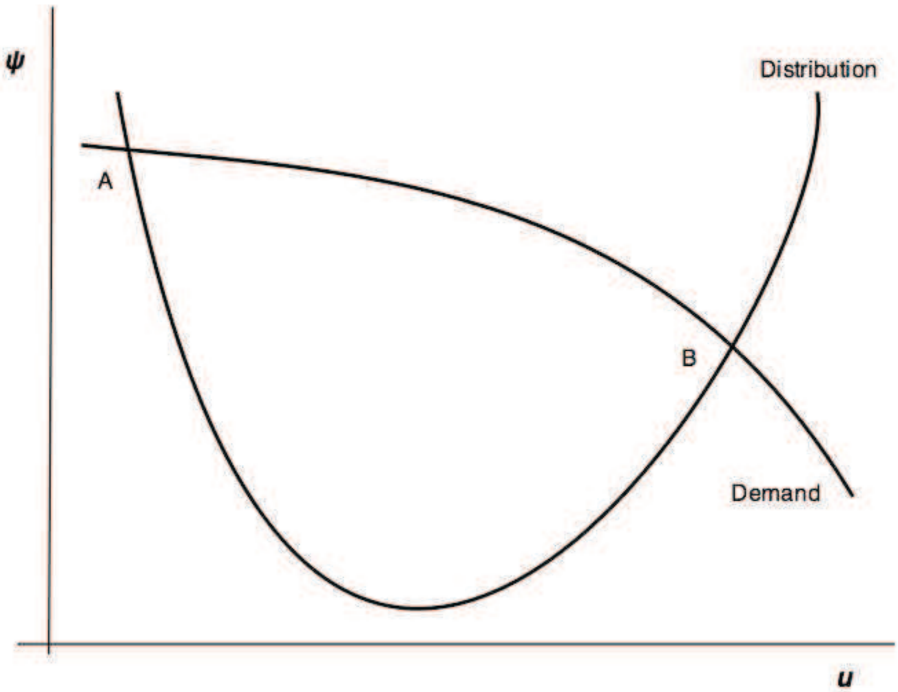

Figure 2: Multiple equilibria due to a U-shaped distributive curve

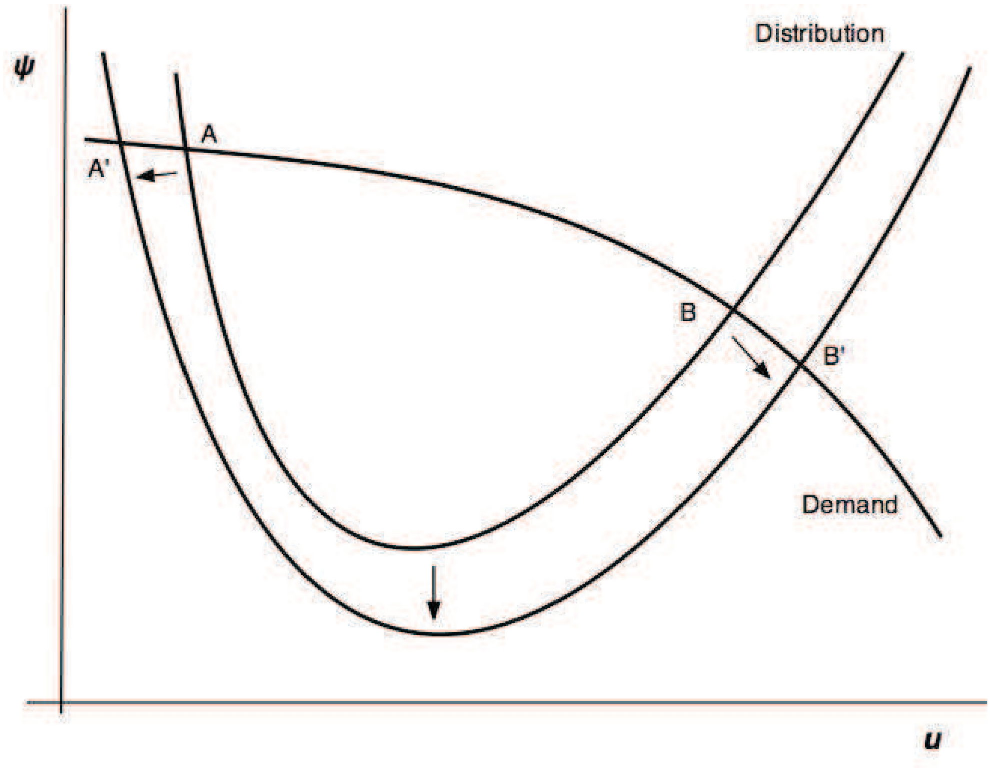

Figure 3: In the case of multiple equilibria the slope of the demand curve cannot always predict the effect of a change in distribution on capacity utilization.

	(De-1)	(De-2)	(De-3)	(De-4)	(De-5)	(De-6)	(De-7)
	Whole Sample	High Unempl.	Medium Unempl.	Low Unempl.	before 1960	before 1970	after 1970
ψ	**-0.232*****	**-1.262*****	**-0.364*****	**-0.115***	**0.128**	**-0.122**	**-0.239****
	(0.0538)	**(0.348)**	**(0.138)**	**(0.0651)**	**(0.177)**	**(0.0984)**	**(0.0941)**
u_{t-1}	0.951***	0.553	0.936***	0.932***	0.794***	0.850***	0.982***
	(0.0627)	(0.460)	(0.107)	(0.0855)	(0.159)	(0.108)	(0.0850)
u_{t-2}	-0.261***	0.171	-0.283***	-0.175**	-0.388***	-0.319***	-0.208**
	(0.0584)	(0.234)	(0.106)	(0.0869)	(0.131)	(0.0930)	(0.0818)
gov	0.00236***	0.0167***	0.00353***	0.00127*	0.00685***	0.00459***	0.00183***
	(0.000431)	(0.00485)	(0.000857)	(0.000655)	(0.00174)	(0.00109)	(0.000540)
constant	0.542***	2.628***	0.711***	0.360***	0.467***	0.589***	0.466***
	(0.0652)	(0.568)	(0.134)	(0.0769)	(0.171)	(0.118)	(0.105)
Observations	245	18	100	127	44	84	160
R^2	0.808	0.658	0.721	0.677	0.801	0.788	0.831

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 1: The 2SLS Estimates of the Demand Schedule, $u_t = \beta_0 + \beta_1 u_{t-1} + \beta_2 u_{t-2} + \beta_3 \psi_t + \beta_4 gov + \epsilon_t$

	(Di-1)	(Di-2)	(Di-3)	(Di-4)	(Di-5)	(Di-6)
	Whole Sample	High Unempl.	Medium Unempl.	Low Unempl.	Very Low Unempl.	Quadratic
u	**0.287*** **	**-0.263***	**0.113**	**0.341*** **	**0.628*** **	**-4.030***
	(0.0555)	**(0.151)**	**(0.0823)**	**(0.0937)**	**(0.218)**	**(2.411)**
u^2						**2.130***
						(1.213)
ψ_{t-1}	0.868***	0.382**	0.778***	0.757***	0.718***	0.827***
	(0.0427)	(0.187)	(0.0812)	(0.0556)	(0.111)	(0.0393)
x	-0.233***	-0.568***	-0.226***	-0.254***	-0.688***	-0.232***
	(0.0384)	(0.183)	(0.0464)	(0.0611)	(0.193)	(0.0357)
D	-0.00234***	-0.00129	-0.000182	-0.00250**	-0.00748**	-0.00460***
	(0.000809)	(0.00208)	(0.00129)	(0.00107)	(0.00331)	(0.00149)
Constant	0.0772	1.428***	0.336**	0.152*	0.334	2.301*
	(0.0790)	(0.320)	(0.157)	(0.0833)	(0.212)	(1.218)
Observations	244	18	100	129	45	246
R^2	0.661	0.894	0.696	0.730	0.748	0.710

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2: The 2SLS Estimates for the Distributive Schedule. In the first five columns we present the estimates for the linear equation $\psi_t = \beta_0 + \beta_1\psi_{t-1} + \beta_2 u_t + \beta_4 x_t + \beta_5 D + \epsilon_t$, while in the sixth column the estimates for the quadratic $\psi_t = \beta_0 + \beta_1\psi_{t-1} + \beta_2 u_t + \beta_3 u_t^2 + \beta_4 x_t + \beta_5 D + \epsilon_t$.

	(De-1)	(De-2)	(De-3)	(De-4)	(De-5)	(De-6)	(De-7)
Test-Statistic	105.4140	12.5550	37.0020	59.7120	10.5580	18.2110	26.4350
P-value	0.0000	0.0019	0.0000	0.0000	0.0144	0.0004	0.0000

	(Di-1)	(Di-2)	(Di-3)	(Di-4)	(Di-5)	(Di-6)
Test-Statistic	67.7710	13.4140	28.0000	52.7290	20.2850	108.0940
P-value	0.0000	0.0038	0.0000	0.0000	0.0000	0.0000

Table 3: Underidentification test. We use the Kleibergen and Paap (2006) rk LM statistic. $H_0:$ the equation is underidentified.

	(De-1)	(De-2)	(De-3)	(De-4)	(De-5)	(De-6)	(De-7)
Test-Statistic	145.4980	11.7280	27.6050	60.8640	19.2380	43.2310	31.7830
$b = 5\%$	13.9100			16.8500	13.9100	13.9100	13.9100
$b = 10\%$	9.0800			10.2700	9.0800	9.0800	9.0800
$b = 20\%$	6.4600			6.7100	6.4600	6.4600	6.4600
$b = 30\%$	5.3900			5.3400	5.3900	5.3900	5.3900

	(Di-1)	(Di-2)	(Di-3)	(Di-4)	(Di-5)	(Di-6)
Test-Statistic	30.3810	13.7230	14.5140	42.1710	20.0680	30.7000
$b = 5\%$	13.9100	13.9100	13.9100			15.7200
$b = 10\%$	9.0800	9.0800	9.0800			9.4800
$b = 20\%$	6.4600	6.4600	6.4600			6.0800
$b = 30\%$	5.3900	5.3900	5.3900			4.7800

(a) Test based on the desired maximal bias of the IV estimator relative to the OLS (b)

	(De-1)	(De-2)	(De-3)	(De-4)	(De-5)	(De-6)	(De-7)
Test-Statistic	145.4980	11.7280	27.6050	60.8640	19.2380	43.2310	31.7830
$r = 10\%$	22.3000	19.9300	19.9300	24.5800	22.3000	22.3000	22.3000
$r = 15\%$	12.8300	11.5900	11.5900	13.9600	12.8300	12.8300	12.8300
$r = 20\%$	9.5400	8.7500	8.7500	10.2600	9.5400	9.5400	9.5400
$r = 25\%$	7.8000	7.2500	7.2500	8.3100	7.8000	7.8000	7.8000

	(Di-1)	(Di-2)	(Di-3)	(Di-4)	(Di-5)	(Di-6)
Test-Statistic	30.3810	13.7230	14.5140	42.1710	20.0680	30.7000
$r = 10\%$	22.3000	22.3000	22.3000	19.9300	19.9300	21.6800
$r = 15\%$	12.8300	12.8300	12.8300	11.5900	11.5900	12.3300
$r = 20\%$	9.5400	9.5400	9.5400	8.7500	8.7500	9.1000
$r = 25\%$	7.8000	7.8000	7.8000	7.2500	7.2500	7.4200

(b) Test based on the desired maximal size (r) of a 5% Wald test of $\beta = \beta_0$

Table 4: Weak Identification test. H_0 : the instruments are weak. We reject H_0 if the test-statistic exceeds the critical value. In both cases $\alpha = 5\%$

	(De-1)	(De-2)	(De-3)	(De-4)	(De-5)	(De-6)	(De-7)
Test-Statistic	3.2780	0.4310	1.4970	4.5220	0.9910	1.9920	4.5210
P-value	0.1941	0.5114	0.2211	0.2103	0.6093	0.3694	0.1634
	(Di-1)	(Di-2)	(Di-3)	(Di-4)	(Di-5)	(Di-6)	
Test-Statistic	0.2750	1.565	3.325	1.687	0.827	4.5810	
P-value	0.8718	0.4573	0.1897	0.194	0.3631	0.3331	

Table 5: The Sargan (1958) test for over-identification. H_0 : the instruments are orthogonal to the error term.

				Autocorrelation			
	(De-1)	(De-2)	(De-3)	(De-4)	(De-5)	(De-6)	(De-7)
Test-Statistic	1.0279	0.0218	1.0384	0.6294	0.0511	0.0067	0.5588
P-value	0.3107	0.8827	0.3082	0.4276	0.8211	0.9349	0.4548
	(Di-1)	(Di-2)	(Di-3)	(Di-4)	(Di-5)	(Di-6)	
Test-Statistic	1.0273	0.0113	1.1461	0.0106	0.1614	0.0051	
P-value	0.3108	0.9152	0.2843	0.9179	0.6878	0.9430	
				Heteroskedasticity			
	(De-1)	(De-2)	(De-3)	(De-4)	(De-5)	(De-6)	(De-7)
Test-Statistic	5.5990	4.4730	5.7070	11.8740	1.7630	3.4720	5.6470
P-value	0.4696	0.7240	0.3358	0.1569	0.9401	0.7477	0.4638
	(Di-1)	(Di-2)	(Di-3)	(Di-4)	(Di-5)	(Di-6)	
Test-Statistic	8.9200	8.981	3.314	10.209	4.956	11.8990	
P-value	0.1781	0.1746	0.7685	0.1812	0.4212	0.2919	

Table 6: Tests for autocorrelation and heteroskedasticity. H_0 : there is no failure of autocorrelation and heteroskedasticity.