A 'static model of a dynamic process'
Underemployment equilibrium with flexible wages and prices

Angel Asensio

CEPN, Université Paris 13 – Sorbonne Paris Cité

July 2016

Prepared for '***The General Theory*** **and Victoria Chick at 80: A Celebration',** in collaboration with The Post-Keynesian Economics Study Group and the Association for Heterodox Economics, University College London, 11 July 2016.

John Maynard Keynes's invaluable contribution to economic theory was to conceive a method to analyse a system whose future is fundamentally uncertain. Subjective views regarding the future play a crucial role in Keynes's *General Theory* because, owing to ontological uncertainty and limited cognitive capacity, “there is no scientific basis on which to form any calculable probability whatever” [Keynes 1937a, p. 214]. The position of the system at any point in time, accordingly, results from the forces involved in the decisions the individual have made in accordance to their subjective views: “Or, perhaps, we might make our line of division between the theory of stationary equilibrium and the theory of shifting equilibrium—meaning by the latter the theory of a system in which changing views about the future are capable of influencing the present situation” (Keynes 1936, p. 293). In such a context, expectations may be deceived unpredictably, although they may be fulfilled sometimes (by chance rather than by an objective knowledge). This is the reason why, although the system that emerges from private and public decisions tends to some equilibrium position at any point in time, it is also subject to endogenous change in the subjective views regarding the future. Equilibrium in this sense is intrinsically dynamic, which raises difficulties compared with the orthodox definition of equilibrium.

In '*Macroeconomics after Keynes*', Victoria Chick pinpointed the essence of the method Keynes utilized to built his ‘shifting equilibrium’ theory (Chick 1983). The method consists basically in taking the views about the future – along with other variables such as wages and the capital stock – as given at a point in time. This allows to analyse the outcome of the individual decisions at any point in time, by means of a static - though 'shifting' - equilibrium model (Chick 1983, chap. 2 & 13). Hence the dynamics of the system can be analysed as the change in equilibrium produced over time by the effect of the changing views about the future and other explanatory variables. This was the subject of Victoria Chick's insightful presentation of *The General Theory* in terms of a static model of a dynamic process (also Kregel 1976).

To capture the very nature of Keynes's equilibrium, the conventional IS-LM model needs to be amended in two essential directions:

- to account accurately for the role of the subjective views about the future,

- to account for the destabilizing feedback involved in the competitive adjustment of wages and prices (Keynes 1936, Chapter 19).

Observe that the latter issue is not about the consequences of a decrease in the equilibrium money-wage over time, which cannot be dealt with if an equilibrium has not been identified first, it is about the existence of an equilibrium when competitive forces have a destabilizing effect on the effective demand.

> “If ... money- wages were to fall without limit whenever there was a tendency for less than full employment, ... there would be no resting- place below full employment until either the rate of interest was incapable of falling further or wages were zero. In fact we must have some factor, the value of which in terms of money is, if not fixed, at least sticky, to give us any stability of values in a monetary system” (Keynes 1936, p

303-304).

The formal representation proposed in the paper aims to capture the essential features of Keynes's *General Theory*. To do so, the IS and LM functions are first redefined to really account for the fundamental uncertainty and for the role of the subjective views about the future. Then, the resulting IS_K-LM_K framework is extended to allow for an endogenous determination of wages and prices that includes the destabilizing feedback effect on effective demand.[1] Because of the destabilizing feedback effect, some endogenous stabilizing forces are necessarily involved in equilibrium (workers resistance, union actions...), for otherwise the competitive pressure on wages would degenerate into disastrous outcome. This is the way endogenous institutional stabilizers operate to ensure the existence of a competitive equilibrium with unemployment in *The General Theory*. As Victoria Chick pointed out: "Keynes's system plainly does not assume that wages are fixed but rather gives reasons why they are unlikely to move and why (…) the unemployment may stabilise until something changes long-term expectations or the government acts" (Chick 1983, p 247).

The model, thereby, removes the shortcomings of the original 'pure static' IS-LM to allow for a static representation of a dynamic process, where money wages and price adjustment does not ensure full employment, and where weaker institutional support to wages (higher flexibility) makes things even worse.

1. Accounting for expectations in the IS and LM equations

Post-Keynesians hold that the 'IS-LM' model does not properly account for the ideas involved in *The General Theory*. Central to their critique is the lack of attention paid by the so called 'IS-LM model' to the fundamental uncertainty. Accounting for uncertainty has tremendous consequences with respect to decision making and market behaviour. In orthodox economics, demand and supply functions result from optimal decision making based on expectations that are determined by the individuals knowledge about the future. The future, it is assumed, is risky but not fundamentally uncertain, in the sense that the risks can be measured objectively and, therefore, are insurable. This amounts basically to neutralize the uncertainty, since insurance markets allow for perfect knowledge of the future consequences of the individual decisions. In this conceptual framework, the decision maker has all the information needed to make an optimal decision (maximizing expected utility).

Keynes's *General Theory*, on the other hand, recognizes that the future is fundamentally uncertain, that is to say, the risks involved in productive investment or portfolio decision making, for instance, cannot be measured objectively because the future is not predetermined and because of the real world complexity. As a consequence, insurance markets cannot neutralize uncertainty and decision makers do not have all the required information. Decision makers, therefore, cannot but form demand and supply plans in accordance with their subjective views about the future. Whereas in the orthodox economics, expectations and

1. The model proposed shares common features with Johnson (1978) and Jarsulic (1981) on this issue. I am grateful to Sebastien Charles who made me aware of those inspired works.

decision making are anchored in objective knowledge of the consequences, in such a way that subjective views neither are involved in rational plans nor in the resulting market equilibrium, in Keynes's theory, on the contrary, both the supply and demand plans and the resulting market equilibrium are necessarily rooted in the subjective views about the future:

> "A monetary economy, we shall find, is essentially one in which changing views about the future are capable of influencing the quantity of employment and not merely its direction. But our method of analysing the economic behaviour of the present under the influence of changing ideas about the future is one which depends on the interaction of supply and demand, and is in this way linked up with our fundamental theory of value. We are thus led to a more general theory, which includes the classical theory with which we are familiar, as a special case." (Keynes 1936, p xvi)

Regarding the IS function, investment, according to the *General Theory,* is pushed up to the point where the marginal efficiency of capital (which depends on the long-term expected return and is a decreasing function of the investment amount) is made equal to the market rate of interest. This entails that, for a given interest rate, aggregate investment will be higher or lower depending on the subjective long-term expectations (variable *E)*, which can be expressed formally as $I(r, E)$, $I'_r < 0$, $I'_E > 0$. Put differently, the investment level and the position of the curve in the locus (*I, r*) remain undefined if one does not consider the effect of the state of subjective expectations on investment together with the effect of the rate of interest. Hence, the goods market equilibrium equation results in a downward-sloping relationship between the level of output and the rate of interest (named IS_K curve), whose position in the locus (*Y, r*) of the IS-LM apparatus depends on the value of the subjective expectations. The higher *E*, the higher *Y* for each value of the rate of interest (figure 1).

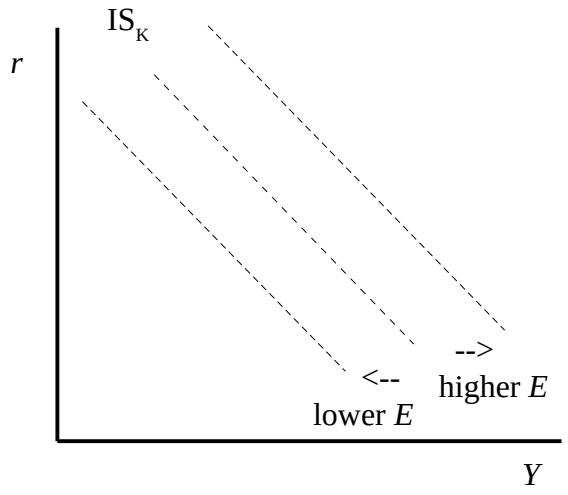

Figure 1. The IS_K function

Rmk. The IS_K function is flatter than the $I(r, E)$ function as a result of the multiplier effect: a lower interest rate is associated with higher equilibrium output, the latter resulting of both higher investment and higher induced consumption.

It is a limit of the conventional IS-LM model that subjective expectations are not explicitly accounted for in the investment function. Of course, it can be argued that expectations are encapsulated in the proper form of the function itself. For example, in the linear function : $I = a - b\ r$, where a and b are parameters of the function, I will be higher or lower, for a given r, depending on the value of a, or depending on the value of b. Subjective expectations, therefore, can be accounted for in the conventional investment function provided that the parameters are duly associated with the state of subjective expectations. However, in the orthodox IS-LM model, the parameters of the functions are not supposed to reflect subjective expectations; they are supposed to reflect the 'structural' determinants (accessible to objective knowledge), such as the marginal product of capital resulting from the existing technology in the case of investment decisions. One may therefore prefer an explicit accounting for the subjective expectations in the function.

The 'views about the future' also play a decisive role in the money-demand function, as they determine 'the state of liquidity-preference'. To account explicitly for the liquidity preference, the money-demand function of the conventional IS-LM model can be replaced with $M_d\ (Y, r, LP)$, $L'_Y > 0$, $L'_r < 0$, $L'_{LP} > 0$. For reasons similar to those discussed above, the demand for money and the position of the curve in the locus (M_d, r) cannot be determined if the 'state of liquidity-preference' is not taken into account: for each interest rate (given the level of income), the demand for money will be higher or lower depending on the state of liquidity-preference. Regarding the LM function, and limiting the discussion to the Keynes 'vertical' case (where the money quantity M is taken as given at a point in time)[2], the money market equilibrium equation is: $M = L\ (Y, r, LP)$, showing that the relationship between the income level and the rate of interest cannot be drawn irrespective of the 'state of the liquidity preference'. For each level of income, and given the quantity of money, the LM function exhibits higher or lower equilibrium interest rate depending on whether the liquidity preference is higher or lower respectively (figure 2).

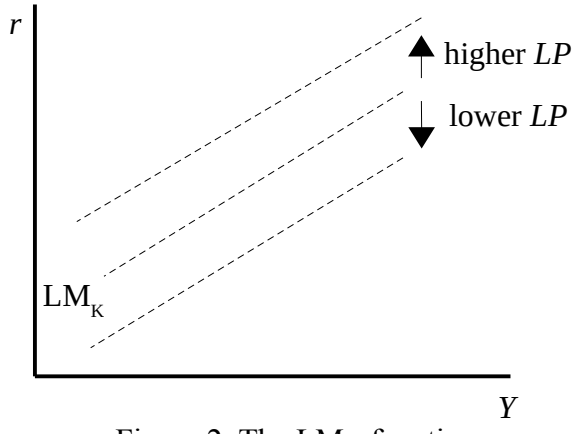

Figure 2. The LM_K function

2. It is shown in the appendix that the Keynes 'vertical' money supply at a point in time does not conflict with the post-Keynesian endogenous credit-money supply.

The 'IS_K-LM_K' model can be writen:

IS_K) $Y = \varphi\ (r, E, \ldots)$, $\varphi'_r < 0$, $\varphi'_E > 0$, where "..." stands for other variables influencing the aggregate demand (further discussed in the next section).

LM_K) $r = \psi\ (Y, M, LP)$, $\psi'_Y > 0$, $\psi'_M \leq 0$, $\psi'_{LP} > 0$

The important point is that neither IS, nor LM can be drawn if the views about the future are not given. But for a given state of the views about the future, the equilibrium is determined as shown in figure 3.

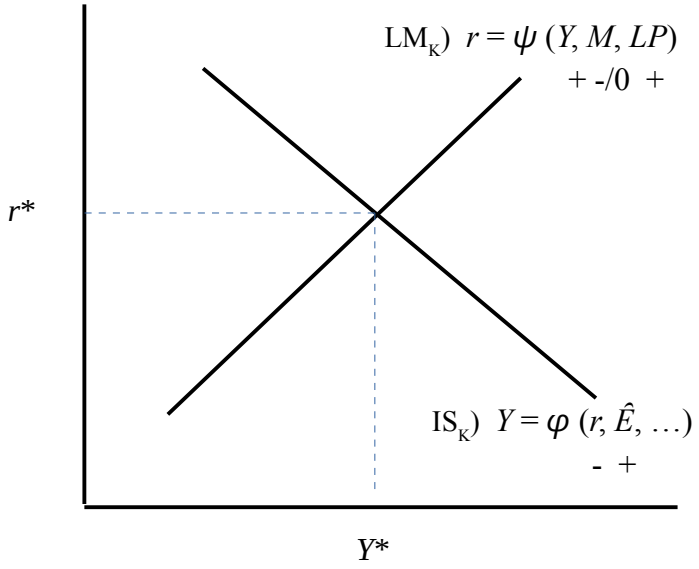

Figure 3. Keynes's equilibrium given the 'views about the future'

Note

LM_K curve: r is a positive function of Y, but for a given Y, the higher is M, the lower r (LM_K shifts downward), and the higher is LP, the higher r (LM_K shifts upward).

IS_K curve: Y is a negative function of r, but for a given r, the higher E, the higher Y (IS_K shifts to the right).

Substituting $r = \psi\ (...)$ into $Y = \varphi\ (...)$ to obtain Y^* as a function of the given variables of the model (LP, M, E,…), and then substituting Y^* into $r = \psi\ (\ldots)$, yields the equilibrium solution:

$Y^* = Y\ (M, LP, E, ...)$

$+/0\ \ -\ \ +$

$r^* = r\ (M, LP, E, \ldots)$

$-/0\ \ +\ \ +$

where "+", "-" and "0" refer to the sign of the partial derivatives.[3]

Contrasting with the orthodox IS-LM equilibrium, which therefore departs from Keynes's *General Theory* on its very essential feature, Keynes's equilibrium is deprived of any objective or 'structural' anchor; it depends, instead, on the subjective views regarding the future: the higher LP (LM_K upward), the higher r^* and the lower Y^*; the higher E (IS_K more to the right), the higher Y^* and the higher r^*. As a result, the equilibrium dynamics analysis should consider the possible change in the views about the future caused by any change in the context. For instance, an increase in the quantity of money does not decrease the rate of interest if the liquidity preference raises in the same time, owing to lack of confidence about central bank's capacity to lower the interest rate effectively (ΔLP effect on LM_K compensates for the ΔM effect). To obtain a decrease in the rate of interest, authorities must increase the quantity of money while holding the liquidity preference more or less unchanged, which supposes the central bank be capable of changing the public expectations as to what the future rate of interest will be (Keynes 1936, p 201 et seq.). Another example is given by the multiplier effect: a fiscal stimulus shifts the IS_K function rightward, but the final impact also depends on the way the fiscal stimulus operates on the schedule of the marginal efficiency of capital. The multiplier effect will be magnified if the fiscal stimulus strengthens the firms long-term expectations. In the same vein, a fiscal policy aimed at reducing the public deficit may have unexpected deflationary effects owing to the magnified multiplier.

2. A synthetic formal representation of Keynes's 'shifting equilibrium'

Having accounted for the role of the subjective expectations and liquidity preference with respect to the determination of income at a point in time, we must now consider how wages and prices are involved in the determination of the effective demand and income level. This is the purpose of *The General Theory* chapter 19, where Keynes relaxes the 'given wages' simplification to discuss the effect of a flexible wage. Chapter 19 provides detailed discussion (including a critique of the classical theory of unemployment in the 'most formidable presentment in which it has been advanced' by Professor Pigou) according to which, except in certain circumstances, the effective demand is positively related to wages and prices (not negatively as in the orthodox approach). The IS_K function, accordingly, can be completed as:

$$IS_K)\ Y = \varphi\ (r, \hat{E}, p, A)$$
$$\qquad\qquad\quad -\ +\ +\ +$$

3. The partial derivative $\psi'_M \leq 0$ actually means that, given the money demand function, an increase in the money quantity diminishes the rate of interest provided the latter has not reached a minimum value, where it no longer responds to a money-supply stimulus. This is because everyone in the market is convinced that the rate of interest cannot decrease below that minimum value, so that an increase in the money quantity (LM shifts downward) would be offset by an increase in the liquidity-preference (LM shifts upward) owing to the fears of a future interest rate increase that a departure below the minimum value would trigger.

where "A" stands for other variables influencing the aggregate demand (such as public and private autonomous expenditures) and $\hat{E}$ reflects the long-term subjective expectations net of the effect of the price level (p).[4] For the sake of simplicity, the partial derivative with respect to the price level is aimed at capturing the effect of both a change in nominal wages and the related change in nominal prices (further discussed below).

Observe that the LM_K function is not affected by the price level *per se*, contrasting with the conventional view that a decrease in prices raises the real value of the money quantity (shifting the LM curve to the right). This is because the LM_K function reflects the money supply and demand equality expressed in nominal terms, so that a price decrease operates through a lower Y on the demand side of the money market, with the result that the rate of interest goes down.[5] As for the real cash balance effect, there is no doubt that Keynes, although using different wording, explicitly considered the 'real wealth' effects associated with a price decrease on both the debtors and the asset holders expenditures (Keynes 1936, pp 262 & 264), but these effects are likely to make things worse by lowering the propensity to consume in aggregate (which is captured in the IS_K function).

To capture formally the destabilizing effects of the wages and prices reaction to unemployment, the model requires two additional equations. Regarding the determination of prices, and assuming a competitive context (which is likely to deliver full employment according to the orthodox economics, and therefore cannot be suspected of being biased towards Keynes's conclusion), we have:

$$PS_K)\ p = w / f'_N$$

where w is the nominal wage, and $f'_N > 0$ is the marginal product of labour ($f''_N < 0$).

This is the condition under which firms find it most profitable to produce Y (which thereby turns out to be the point of effective demand). It is worth noticing that a decrease in Y – therefore in N – has a negative effect on p for two kinds of reasons: the first one is the decreasing marginal product of labour; the second one is the pressure on w that may result from higher unemployment. The price setting equation accordingly can be expressed as:

$$PS_K)\ p = \phi\ (w, Y)$$
$$\qquad\qquad + \ +$$

4. The level of wages and prices at a point in time influences the investors long-term subjective expectations if and when it is supposed to be higher or lower compared with the future level, which amounts to a lower or higher marginal efficiency of capital respectively (Keynes 1936, p 263). Prices also influence the aggregate demand through the distributive effects mentioned in *The General Theory* Chapter 19.

5. This is the so called 'Keynes effect', which may not be sufficient for full employment owing, on the one hand, to the difficulty of reducing the rate of interest below a certain figure and, on the other hand, to the fact that even if the rate of interest was zero, the other determinants of the effective demand – such as long-term expectations or autonomous expenditures – might not be strong enough as to achieve full employment.

Regarding the determination of wages, let us assume that the labour market equilibrium wage at a point in time result from a balance of competitive forces related to the level of unemployment and of institutional forces (workers resistance, trade unions action, labour market regulation…, the "reason why [wages] are unlikely to move" in spite of the competitive pressure, as emphasized by Victoria Chick). Wages accordingly are a negative function of unemployment (here measured in terms of 'output gap' as $Y_f - Y$), and a positive function of a variable named "*IC*" (institutional context), reflecting some kind of institutional support to wages.

$$WS_K)\ w = \vartheta\,(Y_f - Y, IC),\ IC \geq 0,\ Y_f > Y > 0$$
$$\qquad\qquad\qquad\quad -\quad +$$

Observe that if $IC = 0$, the nominal wage at any point in time is only determined by the labour market competitive forces (through which the institutional context also operates, though not in the same way as 'IC'). Otherwise ($IC \geq 0$), the nominal wage receives kind of an institutional support which tempers the competitive effect. This kind of institutional support should not be seen as a cause of unemployment or unemployment persistence, as $IC = 0$ is not a sufficient condition for full employment in *The General Theory* (it is likely to make thing worse actually). Institutional support to wages, instead, is aimed at preventing a disastrous outcome when the feedback of wages and prices decreases on effective demand is not a stabilising one – as in the orthodox theory, but a destabilising one, as suggested in *The General Theory* chapter 19 (although *The General Theory* is general enough to account for the stabilising case under the special conditions discussed in chapter 19).

Substituting $w = \vartheta\,(\ldots)$ into the price setting equation yields an integrated 'wage-price setting' equation:

$$WPS_K)\ p = \theta\,(Y, Y_f, IC)$$
$$\qquad\qquad\quad +\ -\quad +$$

The feedback effect of the wage-price setting on the effective demand is obtained by substituting $p = \theta\,(...)$ into IS_K, which delivers a flexprice IS function:

$$IS\text{-}WPS_K)\ Y = \kappa\,(r, Y_f, IC, \hat{E}, A)$$
$$\qquad\qquad\quad -\ \ -\ \ +\ +\ +$$

Substituting $r = \psi\,(...)$ into $Y = \kappa\,(...)$ to obtain Y^* as a function of the given variables of the model (LP, M, Y_f, IC, $\hat{E}$, A), and then substituting Y^* into $r = \psi\,(...)$ yields the equilibrium solution (figure 2):

$$Y^*\,(LP, M, Y_f, IC, \hat{E}, A)$$
$$\quad -\ +/0\ -\ +\ +\ +$$

$$r^*\,(LP, M, Y_f, IC, \hat{E}, A)$$
$$\quad +\ -/0\ -\ +\ +\ +$$

And substituting Y^* into $p = \theta\,(\ldots)$ yields:

p^* (LP, M, Y_f, IC, $\hat{E}$, A)
- +/0 - + + +

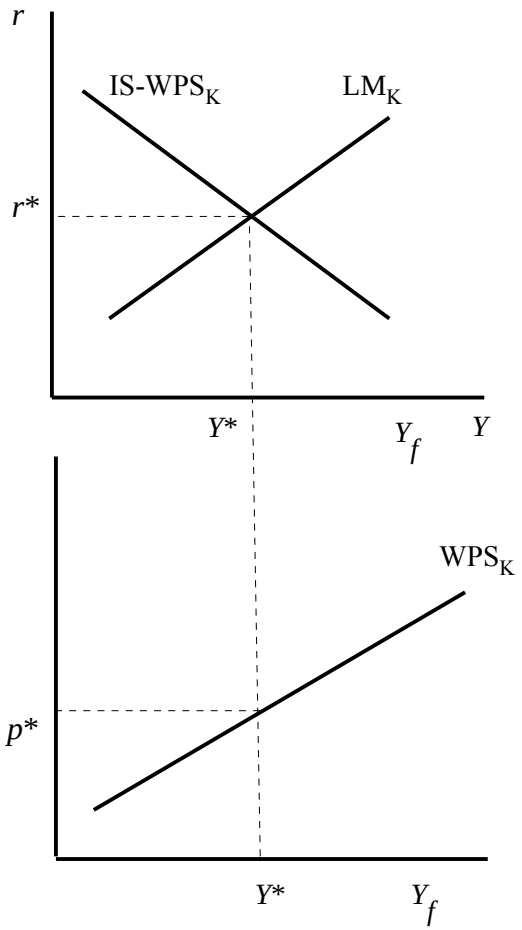

Figure 4. Keynes's equilibrium with flexible wages and prices

The equilibrium solution (Y^*, r^*, p^*) here is influenced by both the subjective views about the future and the competitive and institutional forces involved in the setting of wages and prices. It turns out that, owing to the perverse feedback effect on effective demand in the model, flexible wages and prices do not work in a stabilising but rather in a destabilising manner. The higher the elasticity of wages with respect to unemployment, the lower the equilibrium level of wages and prices, and the higher the unemployment rate.[6] Wages rigidity therefore should not be viewed as inimical to full employment. Perfect flexibility, on the other hand, makes the system chaotic under the conditions assumed in the model.

Those conditions are ordinary (whereas the conditions under which flexibility would be

6. Higher wage flexibility entails both a stronger slope of the WPS curve and a shift to the left of the IS curve (for a given interest rate, the equilibrium output is lower because of the feedback effect); furthermore, the slope of the IS curve becomes flatter (changes in r involve stronger output changes owing to the stronger elasticity of wages). The result is lower p^*, Y^* and r^*.

beneficial are quite specific). This is the reason why institutional support to wages is so important, especially in case of a strong wage elasticity. Figure 5 shows the effects of a weaker institutional support, which results in lower Y^*, p^*, and r^* (assuming constant $\hat{E}$ and LP, which is open to further analysis...).

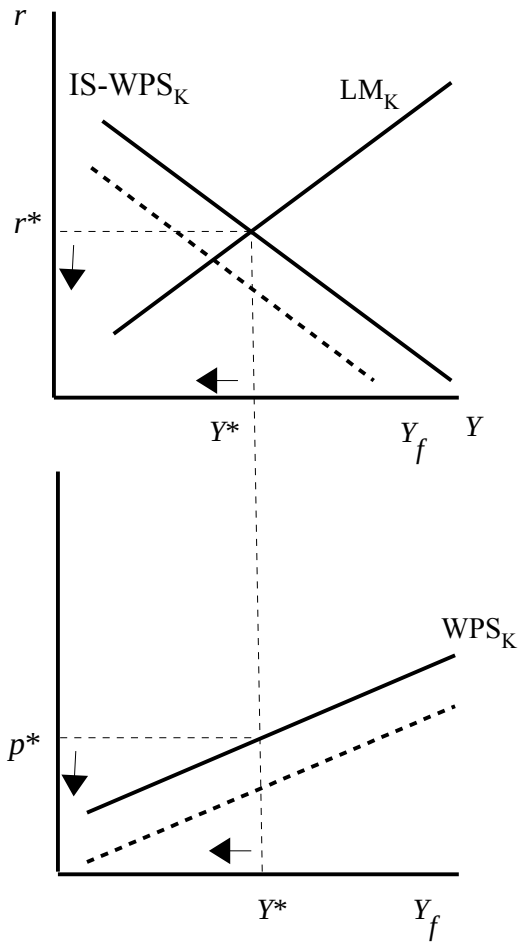

Figure 3. Weaker wage support

Conclusion

The crucial aspect of *The General Theory* that was ignored in the orthodox version of the IS-LM model is the fact that, owing to the fundamental uncertainty that deprives expectations of an objective anchor, the investment and money-demand functions cannot be determined independently of the subjective views about the future, and move according to them. This entails that the position of the investment and money-demand curves, and, thereby, the equilibrium interest rate and output level corresponding to the intersection of the IS_K and LM_K curves, depend and shift according to the subjective views about the future.[7] The model

7. A further difficulty, in dynamic analysis, arises to the extent that a change in, say the money quantity, moves the interest rate in a way which depends on the possible effect of that change on the liquidity preference and money demand function, which typically is ignored in the mainstream

proposed in this paper accounts explicitly for this proper feature of Keynes's *General Theory*. It also accounts for the perverse feedback effect of prices and wages flexibility with respect to the level of effective demand. Contrary to the orthodox flawed understanding of *The General Theory*, Keynes's equilibrium is not a fix-price one, although the consequences of the price adjustment may not be the one expected in orthodox theory. While Walrasian economics is incapable of making sense of the notion of a *competitive* equilibrium with unemployment, as competitive forces are essentially stabilising and remove all inefficiencies in a system with no fundamental uncertainty, in Keynes's *General Theory* there is no inner inconsistency in the notion of a *competitive* equilibrium with unemployment, to the extent that endogenous institutional stabilizers such as workers resistance, unions action and labour market regulation compensate for the potentially destabilizing market forces at any point in time. This is the profound signification of the Keynes notion of wages stickiness. Uncertainty, thereby, entails both a richer and more realistic definition of competitive (flexprice) equilibrium

References

Chick, V. (1983), Macroeconomics after Keynes, Cambridge, MA: MIT Press.

Jarsulic, M (1981), Unemployment in a Flexible Price Competitive Model, *Journal of Post Keynesian Economics*, 4, no. 1, 32-43.

Johnson, I.C (1978), A Revised Perspective of Keynes's "General Theory", *Journal of Economic Issues*, 12, no. 3, 561-582

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

Keynes, J.M. (1937a), "The General Theory of Employment", *The Quarterly Journal of Economics*, 51, no. 2,. 209-223.

Keynes, J.M. (1937b), "The "Ex-Ante" Theory of the Rate of Interest." *The Economic Journal* 47, no. 188, 663-669.

Kregel, J. A. (1976), "Economic methodology in the face of uncertainty: the modelling methods of Keynes and the Post-Keynesians", *The Economic Journal*, 86(342) (June), pp. 209–25.

Appendix on endogenous money and the liquidity preference theory

This appendix shows that there is no essential contradiction between the post Keynesian approach to endogenous money and Keynes's liquidity preference theory. To start with, the credit market is depicted (section 1) where credit-money is endogenously supplied through the flow of new loans, given the rate of interest. Then the market for liquidity-money is considered (section 2), where the total supply of money is not simply the additional quantity

utilisation of the IS-LM model. More generally, exogenous changes may have some impact on expectations and liquidity preference that must be considered to avoid hasty conclusions.

of money resulting from current credit operations (flow), but the total stock of money resulting from the present and past loans and repayments (stock). The liquidity-money market equilibrium condition shows formally that full accommodation of the credit-worthy demand for loans and Keynes's liquidity preference theory are complementary.

1. Credit market and the flow of credit-money

This section focuses on the credit-worthy demand for bank-loans which endogenously determines the banks supply, so that the market clears spontaneously whatever the level of the rate of interest.[8]

Credit-worthy demand for loans

Let's suppose that the credit-worthy demand for credit (C_d) at any point in time, that is, the demand for loans meeting the banks definition of credit-worthiness at that time, is an increasing function of the aggregate output firms have decided to produce at that time (Y) and a decreasing function of the rate of interest (r).

$C_d = L_0(Y, r), L_{0Y}' > 0, L_{0r}' < 0$

Since the aggregate output is a positive function of the aggregate autonomous demand (A), of the long-term expectations that feed the inducement to invest (E), and a negative function of the rate of interest (r), it follows that the credit-worthy demand curve is negatively sloped in the locus (r, C_d):

$Y(r, E, A), Y_r' < 0, Y_E' > 0, Y_A' > 0 \Longrightarrow dC_d/dr = L_{0Y}' dY/dr + L_{0r}' < 0$

Supply of bank loans

In a competitive modern banking system, banks accommodate the credit-worthy demand for loans at the prevailing rate of interest. Since this behaviour holds whatever the interest rate, we have:

$C_s \equiv C_d(r, E, A), \forall\ r > 0$

So that:

$dC_s / dr = dC_d / dr < 0$

It turns out that the loan-supply curve at a point in time (C_s) is not horizontal nor positively sloped, for it is the same curve as the demand for loans at that time, that is, a decreasing function of the rate of interest. The higher the interest rate, the lower the demand for loans,

8. 'The' rate of interest here refers broadly to the price paid by borrowers to lenders for all kind of contracts (whatever the maturity, risk...). As banks and non-bank lenders compete with one another, it is assumed that 'the' rate of interest rates applies to both the bank and non-bank loans.

and the lower the credit supply.

Observe that the decreasing credit-money supply does not alter the reasoning in terms of full accommodation of the credit-worthy demand for loans, which is central to endogenous money theory. It only shows, contrasting with the widespread opinion, that full accommodation of the credit-worthy demand for bank loans does not entail a horizontal (nor a positively sloped) supply curve at a point in time.

2. Liquidity-money market and the total stock of money

Bank loans create the deposits that feed the existing stock of money continuously, meanwhile loan repayments tend to reduce it. Therefore, the flow of deposits created at point in time is only one part of the existing stock of money at that time[9]. This section shows that, while full accommodation of the credit-worthy demand for bank loans makes it impossible that the supply and demand differ from one another, this does not hold in the liquidity-money market where money is considered a liquid asset competing with non-money assets in agent's portfolio. This is the reason why the rate of interest plays a role as an endogenous adjustment variable in the liquidity-money market.

Money supply

The quantity of money in existence at a point in time, which is the total money supply at that time, is not merely the difference between the flows of money injected and withdrawn into and from circulation at that time, it is the difference between the sum of the past and present injections and the sum of the past and present withdrawals, including the central bank operations in markets. Therefore, the money supply at a point in time is a stock that may differ considerably from the deposits resulting from the net flow of credit money injected through credit operations and loan repayments at that time.[10]

Although the total quantity of money is not the same as the flow of credit-money supplied, it is not independent, however, for additional deposits resulting from bank-loan operations influence continually the stock of money. As a result, the total quantity of money is a decreasing function of the rate of interest at any point in time, for it is geometrically the sum of the previously created quantity of money and of the current flow at any point in time.

Formally, the total money supply is the sum of the previously created money M_0 (net of

9. 'Structuralist' and 'horizontalist' models, unfortunately, use to overlook that important point.

10. 'Circuitists' use to think within a production period in such a way that –under normal conditions- the money injected through the financing of productive operations is withdrawn at the end of the period when firms repay the loans to the banks (reflux). In this paper, it is admitted that the banks also provide finance for long-term investments that are not supposed to be repaid at the end of a single production period. Hence at any point in time (for example, at the end of a single production-period), the quantity of money in circulation depends on the difference between the current and past bank loans and the current and past loan repayments (it also depends, of course, of the central bank operations in markets).

repayments, including current repayments) and of the current credit supply:[11]

$M_s = M_0 + C_s = M_0 + L_0(\mathrm{I}, r)$

It follows that the total supply of money is a decreasing function of the rate of interest, the slope of which is the same as the slope of the credit-supply curve:

$M_{sr}' = L_{0Y}' \mathrm{d}Y/\mathrm{d}r + L_{0r}' = C_{sr}' < 0$

Demand for liquidity-money

The demand for money at a point in time includes a demand for 'active' balances related to transactions (including planned transactions in the case of the Keynes 'finance motive'), and a demand for precautionary and speculative 'inactive' balances.[12] The demand for money at a point in time (stock) therefore is a broader notion compared with the demand for deposits resulting from the demand for credit at that time (flow).

The transaction demand for money involves both the credit-worthy demand for additional bank-loans (L_0), since bank-loans are underwritten with the aim of doing transactions, and the part of "L_1" which comes under the transaction motive (referring to Keynes's notation in the *General Theory*). The total demand for money therefore is:

$M_d = L_0(Y, r) + L_1(Y) + L_2(r),\ L_{1Y}' > 0,\ L_{2r}' < 0$

It is worth noting that the relationships involved in L_1 (precaution and transaction motive) and L_2 (speculation motive) depend on the state of the liquidity preference and, therefore, are subject to potential shifts. Furthermore, the demand for money at a point in time is a decreasing curve the slope of which is flatter than the slope of M_s:

$\mathrm{d}M_d/\mathrm{d}r = L_{0Y}' \mathrm{d}Y/\mathrm{d}r + L_{0r}' + L_{1Y}' \mathrm{d}Y/\mathrm{d}r + L_{2r}' < \mathrm{d}M_s/\mathrm{d}r = \mathrm{d}C_s/\mathrm{d}r = \mathrm{d}C_d/\mathrm{d}r = L_{0Y}' \mathrm{d}Y/\mathrm{d}r + L_{0r}'$

This is because a higher rate of interest makes the total demand for money lower through a lower L_0 (demand for additional loans), but also through lower L_1 and L_2, while it only impacts on the total money supply through the lower supply of additional loans. In other words, a lower rate of interest impacts on M_s through a higher demand for loans only, while it makes the total demand for money higher because of the transaction-motive (including those transactions financed by additional bank loans), the precaution-motive and the speculation-motive.

11. For convenience, it is assumed that M_0 also reflects the central banks current injections/withdrawals of money through market interventions.

12. "The demand for liquidity can be divided between what we may call the active demand which depends on the actual and planned scales of activity, and the inactive demand which depends on the state of confidence of the inactive holder of claims and assets' (Keynes 1937b, p 665). The 'finance motive' is a motive for holding money in the 'interval between planning and execution' of an investment (Keynes 1937b, p 665).

Liquidity market equilibrium

As a result of having a different slope, the total money demand and the total money supply curves intersect each other for some level of the rate of interest. Hence, for values of the rate of interest below the intersection of the demand and supply curves, competitive forces would push the rate of interest upward, as demanders would compete with one another because of the lack of liquidity. On the contrary, for values of the rate of interest above the intersection, competitive forces would push down the rate of interest. As a result, competitive forces tend to equalize the demand and supply for liquidity at any point in time:

$M_0 + L_0(Y, r) = L_0(Y, r) + L_1(Y) + L_2(r)$

Which simplifies as:

$M_0 = L_1(Y) + L_2(r)$

It transpires therefore that, although banks fully accommodate the credit-worthy demand for credit-money, the liquidity-money market equilibrium equation is the same as in *The General Theory*. This is because the effect of the supply and demand for bank loans on the total supply and demand for money offset each other whatever the rate of interest. This shows formally that full accommodation of the credit-worthy demand for loans and Keynes's liquidity preference theory are complementary.