Keynesian Models of Deflation and Depression Revisited: Inside Debt and Price Flexibility

Abstract

This paper extends Tobin's (1975) Keynesian analysis of deflation to include a range of additional channels through which deflation exacerbates Keynesian unemployment. The paper provides further theoretical reasons why downward price level adjustment may not solve the Keynesian problem. These arguments challenge the received wisdom that Keynes' *General Theory* is a special case resting on downwardly rigid prices and nominal wages. This conventional wisdom has led many economists to recommend policies promoting downward flexibility. These policies have created an environment in which deflation is more likely, giving new relevance to Keynesian analysis of deflation.

Key words: deflation, liquidity trap, Fisher debt effect, price flexibility

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I The revival of deflation

Thirty years ago deflation was considered an historical anachronism, a relic of economic history. Yet, in the 1990s Japan began a decade long slow deflation, and in the last recession of 2001 the U.S. economy also flirted with deflation This revived danger of deflation prompted current Federal Reserve Chairman Ben Bernanke to give a major policy speech (2002) addressing the economic dangers of deflation. In that speech Bernanke stressed that the Fed was committed to preventing deflation and had the tools to do so. Moreover, Bernanke revisited the subject a year later (2003) in an article titled "Why the world's central bankers must become more vigilant about falling prices." Deflation has therefore again become a real possibility, and is also now a real policy concern.

The revival of deflation invites renewed theoretical appraisal of the phenomenon. In a seminal paper published thirty years ago, the late James Tobin (1975) explored the logic of Keynesian analysis of recessions and depressions. The current paper uses Tobin's theoretical framework to further explore the Keynesian approach to deflation.

The paper shows how Tobin's framework can provide a comprehensive analysis of deflation. This analysis shows why downward price level adjustment may be unable to solve the Keynesian problem of unemployment. As such, Keynes' (1936) *General Theory* cannot simply be dismissed as a special case resting on downwardly rigid prices and nominal wages.

The paper makes a number of innovations. First, it incorporates the impact of nominal interest rate floors and the liquidity trap. These have traditionally been examined in the context of comparative static price level analysis, but they are also deeply relevant to the analysis of deflation.

Second, the paper introduces inter-temporal expenditure substitution effects, whereby agents delay expenditures to take advantage of lower future prices. In terms of the familiar ISLM model, this introduces an IS channel for deflation that complements the Tobin – Mundell effect that operates via the LM.

Third, the paper introduces inside-debt effects associated with Irving Fisher's (1933) debt – deflation hypothesis. This serves to unite Tobin's (1980) comparative static price level analysis of the Fisher debt effect with his analysis of deflation.

Fourth, the paper expands Tobin's model so that it addresses question of is increased price flexibility stabilizing. The model confirms other research showing that increased price flexibility can be destabilizing.

Finally, the paper closes with a policy section. The received wisdom is that Keynes' analysis was predicated on downward price rigidity, and this has led many economists to recommend policies promoting price flexibility. Over time, adoption of such policies has made for a new environment in which deflation is more likely. This gives contemporary policy relevance to the analysis in Tobin's 1975 paper showing that deflation may aggravate the problem of Keynesian (demand deficient) unemployment.

II The Tobin model of deflation and depression

A particular strength of Tobin's model is its clear demarcation between the effects of deflation (falling prices) and reductions in the price level. This distinction is illustrated in Figures 1.a and 1.b. Figure 1.a shows a reduction price level, while Figure 1.b shows deflation that generates a continuously falling price level.[1] Deflation does over time generate a lower price level, but in addition it generates expectations of falling prices and lower future prices. The strength of the Tobin model is that it captures the effects of both a lower price level and expectations of falling prices.

The static piece of the model consists of an augmented ISLM model given by

$$(1)\ y = E(\overset{-}{i-\pi^e}, \overset{+}{M/p}, \overset{+}{G})$$

$$(2)\ M/p = L(\overset{-}{i}, \overset{-}{\pi^e}, \overset{+}{y})$$

where y = level of income, E(.) = aggregate demand function, i = nominal interest rate, π^e = expected rate of deflation (which is positive in the case of inflation), M = nominal money supply, p = price level, G = government and other autonomous expenditures, and L(.) = real money demand function.[2] Signs above arguments are the assumed signs of partial derivatives.

Equation (1) is the goods market clearing condition, and has output equal to AD. AD depends negatively on the expected real interest rate, and positively on the real money supply reflecting the operation of the Pigou (1943) real balance effect.

Equation (2) is the money market clearing condition, and has real money supply equal to real money demand. The demand for real money balances depends positively on deflation (negatively on inflation) reflecting the Tobin - Mundell effect. Expected deflation increases the demand for real money balances. This is because deflation

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[1] This distinction between deflation and price level reduction has parallels with the distinction in monetary theory between the neutrality and super-neutrality of money.

[2] Throughout the paper the analysis is conducted under the assumption of a fixed nominal money supply. If the nominal interest rate is fixed the nominal money supply is endogenous. This leaves the conclusions of the analysis unchanged. Indeed, a fixed nominal interest rate amplifies the adverse effects of deflation because the nominal rate does not fall, which raises the real interest rate. Endogenous money with a fixed nominal interest rate is therefore analogous to a policy imposed liquidity trap, which is examined in section III.

increases the real value of money balances, thereby prompting agents to shift the composition of their portfolios towards money. The nominal interest rate reflects the opportunity cost of holding money, and represents the return from holding other assets. Expected inflation reflects the own cost of holding money and represents the own return on money holdings.[3]

Combining equations (1) and (2) yields a general reduced form given by

$$(3)\ y = E(\overset{-}{i}(\overset{-}{\pi^e}, \overset{-}{M/p}, \overset{+}{y}) \overset{+}{-\ \pi^e}, \overset{+}{M/p}, \overset{+}{G})$$

An increase in the rate of deflation lowers AD and output because it increases money demand, leading to higher nominal and real interest rates. A lower price level increases AD and output via the Keynes real money supply and Pigou real balance effects.

The two static equilibrium conditions are supplemented by three dynamic equations of adjustment that govern the evolution of the state variables – output, inflation, and inflation expectations. The dynamic adjustment equations are given by:

$$(4.a)\ g_y = \overset{+}{A}(E - y) \qquad A_1 > 0$$

$$(4.b)\ \pi = \overset{+}{B}(y - y^*) + \pi^e \qquad B_1 > 0$$

$$(4.c)\ g_{\pi e} = \overset{+}{C}(\pi - \pi^e) \qquad C_1 > 0$$

where g_y = rate of change of output, π = actual inflation, $g_{\pi e}$ = rate of change of inflation expectations, and y^* = full employment output. Equation (4.a) is an output adjustment equation, and has output responding positively to excess demand. Equation (4.b) is a natural rate Phillips equation in which inflation is determined as a function of the output gap and inflation expectations. Equation (4.c) determines the adjustment of inflation expectations according to an adaptive principle.

[3] The general equilibrium microeconomic rationale for including inflation as a separate argument in money demand is discussed in Tobin and Brainard (1968) and Tobin (1969).

An important feature of the model is that it describes an economy with a natural rate of unemployment. This can be seen from equation (4.b), the Phillips equation, which has a full employment level of output, y^*. The economy is supposed to gravitate to y^* via the process of price adjustment if the economy is stable. The existence of a full employment level of output is therefore not the issue. The macroeconomic question is whether the process of general price level adjustment can restore full employment in the face of aggregate demand weakness that causes unemployment.

The long run steady state equilibrium is given by $y = y^*$, $p = p^*$, and $\pi^e = 0$. Appropriate substitution and manipulation, combined with linearization around steady state equilibrium values, yields the following set of linearized adjustment equations:

$$\begin{array}{l} (5.a) \\ (5.b) \\ (5.c) \end{array} \begin{vmatrix} g_y \\ \Delta p \\ g_{\pi e} \end{vmatrix} = \begin{vmatrix} \overset{+\,+}{A_1[E_y - 1]} & \overset{+\,-}{A_1 E_p} & \overset{+\,-}{A_1 E_{\pi e}} \\ \overset{+\,+}{B_1 p^*} & 0 & \overset{+}{p^*} \\ \overset{+\,+}{C_1 B_1} & 0 & 0 \end{vmatrix} \begin{bmatrix} y - y^* \\ p - p^* \\ \pi^e - 0 \end{bmatrix}$$

Following Tobin (1975), the condition for stability is $p^* E_p + C_1 E_{\pi e} < 0$. The term E_p reflects the strength of the Pigou and Keynes money supply effects, while the term $E_{\pi e}$ reflects the strength of the Tobin-Mundell effect. Stability requires that the Pigou and Keynes effects dominate the Tobin-Mundell effect.[4]

The terms C_i and $E_{\pi e}$ are critical for stability, and the larger their absolute value the greater the likelihood of instability. The term C_i captures the speed of adjustment of deflation expectations, while the term E_3 captures the sensitivity of AD to deflation expectations. If adjustment is rapid and AD is very sensitive to deflation expectations, the Tobin – Mundell effect will be large, and hence potential instability.

[4] The stability condition is taken from Tobin (1975). Bruno and Dimand (2006) have recently produced a manuscript that formally derives this condition.

Equations (5.a) – (5.c) provide an analytical understanding of the model's stability. This can also be understood through graphical representation. Equation (3) can be represented as a set of iso-AD contours drawn in $[\pi^e, p]$ space, as is done in Figure 2. The slope of the contours is obtained by differentiating equation (3) with respect to p and π^e, yielding

$$\delta p/\delta\pi^e = [E_i i_{\pi e} - E_i]/[E_i i_{M/p} + E_{M/p}]M/p^2] > 0 \quad \text{if } \; E_i i_{\pi e} - E_i > 0$$

The condition $E_{\pi e} = E_i i_{\pi e} - E_i > 0$ ensures that the Tobin-Mundell effect holds so that higher inflation lowers the real interest rate, or alternatively that higher deflation raises the real interest rate. The positive slope of the iso-AD contours reflects the competition between the Keynes and Pigou effects versus the Tobin – Mundell effect. A lower price level increases AD via the Keynes and Pigou effects, so that holding AD constant calls for a stronger Tobin-Mundell real interest rate effect operating via more rapid deflation expectations. Lower iso-contours are associated with higher levels of AD, so that $AD_1 > AD_0$. The logic is that a lower price level, holding deflation expectations unchanged, increases AD via the Keynes and Pigou effects.

Figure 3 shows a set of iso-AD contours with three different price adjustment paths. One path has prices falling infinitely fast with no impact on deflation expectations. This path corresponds to what Tobin terms Walrasian price adjustment, and AD increases along this path so that the economy moves toward full employment. This price adjustment effect can be captured in the ISLM model, and corresponds to the case where a lower price level shifts both the IS and LM schedules down through the Pigou real balance and Keynes money supply effects respectively. Along this path, deflation expectations are zero because the price level jumps instantaneously from its initial level to its new equilibrium level and remains unchanged thereafter..

The middle price path has prices falling and deflation expectations initially rising and then falling back to the equilibrium value of zero. This path also leads to higher iso-AD contours, so that the economy again moves toward full employment. However, for any given price decline the increase in AD is smaller than the Walrasian case because deflation expectations increase, and this increases money demand and real interest rates via the Tobin – Mundell effect. Along this price path the term $C_1E_{\pi e}$ (the potential cause of instability) is dominated by the term p^*E_p.

The third price path has prices falling and deflation expectations continuously rising. Now, the economy is moved to an iso-AD contour with a lower level of AD so that the economy is further away from full employment. This is the case where deflation is destabilizing. The reason is that the Tobin-Mundell effect now dominates the Pigou and Keynes effects.

III Nominal interest rate floors and the liquidity trap

The Tobin model can be modified to incorporate the impact of nominal interest rate floors and the "liquidity trap." In the liquidity trap the nominal interest rate is stuck at its floor level of i_F. The trap may occur due to adverse asset price and interest rate expectations that make holding money attractive (Keynes, 1936, p.207), or it may be the result of intermediation costs combined with the zero floor to nominal interest rates (Keynes, 1936, p.208). Either way, there is a nominal floor at or slightly above zero, below which the nominal interest rate cannot fall.

The economic significance of the trap is that increases in the rate of deflation no longer generate offsetting declines in the nominal interest rate through price level effects on the real money supply.[5] With nominal interest rates trapped at their floor, deflation has the effect of raising real interest rates. This liquidity trap effect on real rates operates in addition to the Tobin – Mundell interest rate effect, and it strengthens the adverse impact of deflation on AD.

The incorporation of a liquidity trap increases the likelihood of instability. A critical parameter for stability is the magnitude of E_p. Absent a liquidity trap, this is given by $E_p = [E_i i_{M/p} + E_{M/p}]M/p^2$. After incorporating a liquidity trap this expression becomes $E_p = E_{M/p}M/p^2$, which is smaller in absolute value, therefore increasing the likelihood of instability. A second critical parameter is the magnitude of $E_{\pi e}$, which absent a liquidity trap is given by $E_i i_{\pi e}$ - E_i. After incorporating a liquidity trap it becomes $-E_i$, which is larger in absolute value, therefore also increasing the likelihood of instability as determined by the stability condition. The economic logic of these two changes is that the liquidity trap eliminates the expansionary Keynes real money supply effect and strengthens the contractionary Tobin-Mundell effect.[6]

The impact of the liquidity tap is graphically depicted in Figure 4. Once deflation reaches a rate of minus i_F, equal to the interest rate floor, further acceleration in the rate of deflation results in one-for-one increases in the real interest rate. As a result the iso-

[5] The interest rate benefit of a lower price level, resulting from the Keynes money supply effect, is blocked by the liquidity trap.
[6] Groth (1993) examines the Tobin model without a Pigou effect or inside debt but with a non-linear money demand, and finds that non-linearity increases proclivity to instability. His findings are a rediscovery of the liquidity trap. As the price level falls, the real money supply increases. However, non-linearity of money demand means that the interest rate decline is smaller, thereby shrinking the Keynes money supply effect on aggregate demand and increasing the likelihood of instability.

AD contours are kinked at i_F and become steeper. The slope of the iso-AD contours in a liquidity trap is given by

$$\delta p/\delta\pi^e|_{\text{liquidity trap}} = - E_i/[E_{M/p}]M/p^2 > [E_i i_{\pi e} - E_i]/[E_i i_{M/p} + E_{M/p}]M/p^2]$$

Terms involving changes in the nominal interest rate go to zero since the nominal interest rate cannot change. The absolute value of the numerator is unambiguously larger, and the value of the denominator is unambiguously smaller. The economic logic for the steepening of the iso-AD contour is that deflation now has a stronger adverse impact on AD via the real interest rate, and this calls for a larger price level decline (Pigou real balance effect) to maintain a constant level of AD.

The significance of the liquidity trap is that it increases the likelihood of deflationary instability. As shown in Figure 3, the steepening of the iso-AD contours at the kink means that some price adjustment paths that would earlier have carried the economy to a higher iso-AD contour and full employment, no longer do so. Along these paths a falling price level initially raises AD, but once the economy hits the liquidity trap zone, further movement along the price adjustment path generates falling AD.

IV Consumption and investment spending delay effects

The liquidity trap focuses on the implications of nominal interest rate floors in the presence of deflation. Another consequence of deflation is that it gives agents an incentive to delay consumption and investment expenditures in order to benefit from lower future prices. This is the channel whereby expectations of lower future prices operate. The microeconomics of expenditure delay effects have been explored in an earlier paper by Neary and Stiglitz (1983). They have also been revisited by Krugman (1998).

Consumption and investment spending delay effects can be readily included in the ISLM model by re-specifying the goods market clearing condition as follows

$$(1.a)\ y = E(\overset{-}{i-\pi^e}, \overset{+}{\pi^e}, \overset{+}{M/p}, \overset{+}{G})$$

The one change is the introduction of the expected rate of deflation as a separate argument in the AD function, with increases in the expected rate of deflation (negative inflation) lowering AD. The logic is that agents extrapolate future prices based on their deflation expectations, thereby giving rise to inter-temporal substitution effects that reduce current spending.

This inclusion of deflation expectations in the AD function remedies a failing in the standard ISLM model that dichotomizes and treats as independent portfolio stock choices and spending flow decisions. Spending, saving and portfolio allocation decisions are all part of a unified utility maximization problem and are taken simultaneously. This means that arguments influencing money demand (e.g. deflation) must also influence flow goods demands.[7]

The static economics of spending delay effects are easily illustrated in the familiar ISLM diagram. Inclusion of spending delay effects mean that deflation now operates on both the IS and LM schedules. Not only is there an upward shift in the LM schedule owing to the Tobin – Mundell effect, but there now is also a downward shift in the IS schedule owing to expenditure delay effects. The net result is to increase the contractionary effects of deflation.

[7] This analytic shortcoming of the conventional ISLM model is emphasized by Tobin (1982) in his end-of-period multi-asset ISLM model in which portfolio stock and spending flow decisions are part of a unified choice decision. That means arguments that enter asset demand functions must also enter flow expenditure functions.

Expenditure delay effects also impact the stability properties of the model by changing the critical parameter $E_{\pi e}$. After incorporating spending delay effects $E_{E\pi e}$ becomes $E_i i_{\pi e} - E_i + E_{E\pi e}$, where $E_{E\pi e}$ is the consumption and investment expenditure delay effect of deflation expectations. The entire expression is larger in absolute value, therefore increasing the likelihood of instability according to the stability condition.

This proclivity to increased instability can again be understood in terms of the iso-AD contour diagram. Expenditure delay effects steepen the slope of the iso-AD contours, and the slope is now given by

$$\delta p/\delta\pi^e = [E_i i_{\pi e} - E_i + E_{E\pi e}]/[E_i i_{M/p} + E_{M/p}]M/p^2] > 0 \quad \text{if} \;\; E_i i_{\pi e} - E_i + E_{E\pi e} > 0$$

The economic logic behind the steepening of slope is that deflation expectations have an additional negative impact on AD owing to consumption and spending delay effects. Maintaining the level of AD for any given rate of deflation expectations therefore requires a lower price level. Steepening the iso-AD contours then makes instability more likely. Some price adjustment paths that were previously stable can become unstable with the addition spending delay effects.

Consumption and investment spending delay effects can then be combined with liquidity trap effects. Both effects work in the same direction, and both steepen the slope of the iso-AD contours. In terms of Figure 3, adding spending delay effects steepens the iso-AD contours, which further increases the likelihood that deflation is destabilizing.

V The Fisher debt effect

All of the above analysis assumes that a lower price level has a positive effect on AD owing to the Pigou real balance and Keynes money supply effects. Fisher (1933) emphasized the adverse effect of lower prices on debtors via increased real debt burdens, which can then lower AD because debtors have a higher propensity to spend than do creditors.

The Fisher debt effect, operating through the price level, has been analyzed in Tobin (1980) and Palley (1999). Its impact is readily captured in the ISLM model as shown in Figure 5. A lower price level shifts the LM downward (the Keynes effect), but it also shifts the IS downward if the Fisher debt effect dominates the real balance effect. If the IS shift is sufficiently strong, AD and output fall. Moreover, if the economy is at the nominal interest rate floor, then AD and output always fall since there is no Keynes money supply effect to shift the LM schedule.

The incorporation of a Fisher debt effect dramatically changes the model. Inclusion of inside debt changes the AD function, which is now given by

$$(1') \quad y = E(\overset{-}{i-\pi^e}, \overset{+}{\pi^e}, \overset{+}{M/p}, \overset{-}{D/p}, \overset{+}{G})$$

where D = level of nominal inside debt. The partial derivative with respect to nominal debt, E_D, is negative reflecting the Fisher debt effect. Recall, that the stability condition for the model is $p^*E_p + C_1E_{\pi e} < 0$. The Fisher debt effect changes the parameter E_p which becomes $[E_i i_{M/p} - E_{M/p}]M - E_D D\}/p^2$. This makes E_p smaller in absolute value, making instability more likely. Indeed, E_p can even become positive, in which event the economy is unambiguously unstable.[8]

Once again the issues of stability can be analyzed with the help of the iso-AD diagrams. Combining equation (1') with equation (2) then yields

[8] The current specification models inside debt in terms of real debt, D/p. A second possibility is in terms of debt service burdens, $V = i(p,..)D/p$. Because a lower price level can lower the nominal interest rate, the Fisher debt effect requires $\delta V/\delta p < 0$. Alternatively, debt must be fixed rate. A third specification is in terms of the debt service-to-income ratio, $i(p,..)D/py$. In this case, the economy is likely to be even more prone to deflationary instability. This is because deficient demand leads to both price deflation) and output contraction, and this amplifies the Fisher debt effect by decreasing both p and y.

(3’) $y = E(i(\overset{--}{\pi^e}, \overset{-}{M/p}, \overset{+}{y}) - \overset{+}{\pi^e}, \overset{+}{\pi^e}, \overset{+}{M/p}, \overset{-}{D/p}, \overset{+}{G})$

Totally differentiating with respect to π and p yields the slope of the iso-AD contour, which is given by

$\delta p/\delta\pi^e = [E_i i_{\pi e} - E_i + E_2]/\{[E_i i_{M/p} + E_{M/p}]M + E_D D\}/p^2 \gtrless 0$

where $E_i i_{\pi e} - E_i + E_2 > 0$ and $\{[E_i i_{M/p} + E_{M/p}]M + E_D D\} \gtrless 0$

There are two cases to be considered. The first is when the Fisher debt effect does not dominate the Pigou and Keynes effects. The second is when it does dominate.

Case 1. If the Fisher debt effect is non-dominant then $[E_i i_{M/p} + E_{M/p}]M + E_D D > 0$ and the iso-AD contour remains positively sloped. However, since $E_D D < 0$, inclusion of a Fisher debt effect means that the denominator is smaller and the absolute value of the derivative is larger, so that the slope of the iso-AD contour is larger. The reason for steepening of the iso-AD is that lower prices have a smaller stimulating impact on AD owing to the negative Fisher debt effect. This means that any increase in deflation expectations (which lowers AD) needs a larger decrease in the price level to hold AD constant along the iso-contour. A steeper slope in turn means that the set of stable price adjustment paths shrinks. The existence of inside debt effects therefore renders the economy more prone to instability. Moreover, the likelihood of instability depends on the level of inside debt, D, which enters in the expression for the slope of the iso-AD contour.

Case 2. If the Fisher debt effect, $E_D D$, dominates the Pigou and Keynes effects then $[E_i i_{M/p} + E_{M/p}]M + E_D D < 0$. In this case the slope of the iso-AD contours changes and becomes negative. Since a lower price level now has a negative impact on AD, maintaining a constant level of AD calls for lower expected deflation. In addition to reversing the slope of iso-AD contours, the Fisher debt effect also reverses their rank ordering so that higher iso-contours are associated with lower levels of AD. The logic is that a lower price level raises debt burdens and lowers AD so that a lower rate of deflation is needed to induce a more expansionary Tobin – Mundell effect.

Figure 6 shows the case where the Fisher debt effect dominates and iso-AD contours are negatively sloped. In this case, price deflation is unambiguously unstable, with all price adjustment paths leading to lower iso-AD contours. Even when there is Walrasian-style instantaneous price adjustment with the price level falling without any impact on deflation expectations, the economy still moves to a lower iso-AD and the process of price adjustment remains unstable.

VI Is increased price flexibility stabilizing?

In the 1980s there was a flurry of interest in the question of whether increased price flexibility is stabilizing. In particular, two important papers by De Long and Summers (1986) and Caskey and Fazzari (1987) explored this issue, and both concluded that increased price flexibility could be destabilizing. These price flexibility concerns can also be incorporated in the Tobin framework.

Price flexibility can be identified with the function B(.) in equation (4.b) that determines the sensitivity of inflation to the output gap. Recall the condition for stability is $p^*E_p + C_1E_{\pi e} < 0$. The partial derivative B_1 does not appear in this condition, implying that the degree of price flexibility is irrelevant for the stability of the system. As originally constructed, the Tobin model therefore has nothing to say about the degree of price flexibility. The implication is that increased price flexibility will not undermine stability. Consequently, if the system is stable, increased price flexibility is desirable as it will speed up the return to full employment equilibrium.

The reason why price flexibility does not matter in the Tobin model is that expectations are purely adaptive, and that means current developments regarding prices do not affect behaviors regarding either money demand or spending.

This weakness in the model can be remedied by introducing what can be termed near rational adaptive expectations. According to this specification agents are not only concerned about the expected level of inflation, but are also concerned about the direction in which inflation expectations are headed. This adds an additional piece of important information. Such a formulation results in the following re-specification of the ISLM equations:

$$(1'')\ y = E(\overset{-}{i-\pi^e}, \overset{+}{M/p}, \overset{+}{g_{\pi e}}, \overset{+}{G})$$

$$(2'')\ M/p = L(\overset{-}{i}, \overset{-}{\pi^e}, \overset{-}{g_{\pi e}}, \overset{+}{y})$$

The changes are that money demand and expenditures now depend on how fast inflation expectations are changing, as captured by the term $g_{\pi e}$. Combining equations (1'') and (2'') then generates a reduced form given by

$$(3'')\ y = E(\overset{-}{i}(\overset{-}{\pi^e}, \overset{-}{g_{\pi e}}, \overset{-}{M/p}, \overset{+}{y}) - \overset{+}{\pi^e}, \overset{+}{M/p}, \overset{+}{g_{\pi e}}, \overset{+}{G})$$

If inflation expectations are rising ($g_{\pi e} > 0$), this further reduces money demand and further lowers the nominal interest rate. In effect, it strengthens the Tobin-Mundell effect. Additionally, higher rising inflation gives agents an incentive to bring forward their consumption and investment expenditures to avoid higher future prices. These enhanced

Tobin – Mundell and expenditure delay effects work in the opposite direction when there is deflation.

The dynamics of the model remain governed by equations (4.a) – (4.c). Substituting (3”) into (4.a), and using a linear approximation for $g_{\pi e} = C_1B_1\pi^e$, the dynamic model can be linearized around its steady state equilibrium values to yield:

$$\begin{array}{lllllll}
(5.a') & |g_y\ | & & |\overset{+\ +}{A_1[E_y-1]} & \overset{+\ -}{A_1E_p} & \overset{+\ +\ \ +\ +\ +}{A_1[E_{\pi e}+E_gC_1B_1]}| & [y-y^*] \\
(5.b') & |\Delta p\ | & = & |\overset{+\ +}{B_1p^*} & 0 & \overset{+}{p^*}\quad | & [p-p^*] \\
(5.c') & |g_{\pi e}\ | & & |\overset{+\ +}{C_1B_1} & 0 & 0\quad | & [\pi^e-0]
\end{array}$$

The new steady state condition is then given by $p^*E_p + C_1[E_{\pi e}+E_gC_1B_1] < 0$. The Tobin – Mundell effect ($E_{\pi e}$) is now augmented by a near rational adaptive expectations effect ($E_gC_1B_1$) that reflects whether the rate of deflation is accelerating or decelerating. The term in the square parentheses is now larger and more positive, making it more likely that the stability condition is not satisfied. Now, both the sensitivity of inflation expectations and the sensitivity of inflation to the output gap matter, and they feed through in a compound fashion.

The economic logic is simple. The more flexible are prices, the greater the current response of deflation to a shock. This deflation response is then picked up through the near rational adaptive expectations mechanism to augment the Tobin - Mundell effect and the expenditure delay effect.

VII Conclusion: rethinking macroeconomics and macroeconomic policy

The above analysis has extended Tobin’s (1975) Keynesian model of recession and depression to include nominal interest rate floors, consumption and investment expenditure delay effects, the Fischer debt effect, and increased price flexibility effects.

Tobin's framework provides a tractable model for comprehensively dealing with the phenomenon of deflation, and identifies the analytical conditions in which deflationary price adjustment is destabilizing.

Not only does the analysis have significant theoretical implications, it also sheds light on important current policy concerns expressed by Federal Reserve Chairman Ben Bernanke (2002, 2003). Deflation is a problem in credit-money economies, and the likelihood of instability increases with the level of inside debt.

Beyond this, there is a deeper policy reason for addressing deflation. Modern macroeconomics starts with the claim that Keynes' (1936) analysis of recession and depression represents a special case conducted under conditions of downward price and nominal wage rigidity.[9] The belief that such rigidities are the cause of macroeconomic unemployment remains a core tenet of modern macroeconomics, and research continues to focus on the causes and impacts of rigidities.

Such rigidities may well exist and be of interest in their own right. However, a Keynesian analysis of recession and depression shows that removing them would not resolve the problem of deficient demand, and might even amplify it. Nominal rigidities may in fact be the only way of anchoring a monetary production economy as suggested by Keynes (1936, Chapter 19):

> "To suppose that a flexible wage policy is a right and proper adjunct of a system which on the whole is one of laissez-faire, is the opposite of the truth (p.269)."

[9] This position was articulated by Modigliani (1944), and became received wisdom with the neo-Keynesian synthesis and the Keynesian fix-price general dis-equilibrium paradigm launched in the 1970s (Barro and Grossman, 1970; Malinvaud, 1977). This paradigm in turn prompted a shift in macroeconomic research toward providing micro-founded explanations for downward price and nominal wage rigidities.

At the policy level, the identification of downward price and nominal wage rigidities as an obstacle to full employment has promoted policies fostering downward price and nominal wage flexibility. Thus, the New Deal and post-Word War II set of institutions that fostered downward rigidity have been gradually eroded and replaced by a set of arrangements that foster flexibility, and there is now accumulating evidence that deflation stands to be a feature of future economic downturns.

From a Keynesian standpoint, such policy is misguided. Lack of downward price and nominal wage flexibility is not the problem, and enhanced flexibility actually amplifies the problem in modern economies with extensive nominally denominated financial liabilities. Downward rigidities are a stabilizing feature in monetary economies.

Instead, a monetary economy needs relative price and nominal wage flexibility that is implemented in an environment of gently rising prices. Relative price flexibility allows individual markets and sectors to clear, while upward price level drift avoids the problem of deflation and the Fisher debt effect.

The Keynesian price adjustment conundrum is that market forces do not produce such a pattern. In recessions there are no market forces generating upward drift of prices and nominal wages, and pressure is downward. This feature provides macroeconomic justification for such institutions as trade unions and minimum wages that work against deflation. However, for the past thirty years, policy has worked to restore downward price and nominal wage flexibility, slowly eroding these institutions. This erosion may have gone sufficiently far to restore 19th century style deflations as a feature of future business cycle downturns.

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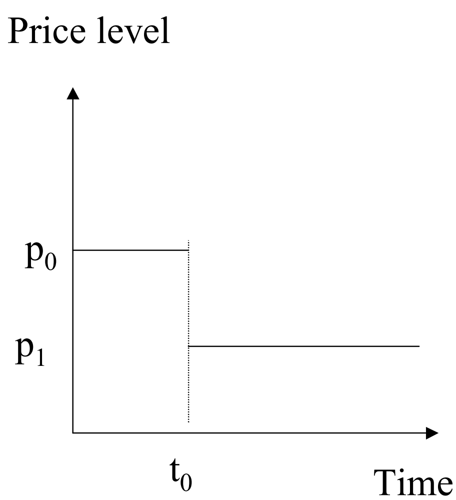

Figure 1.a. Price level reduction

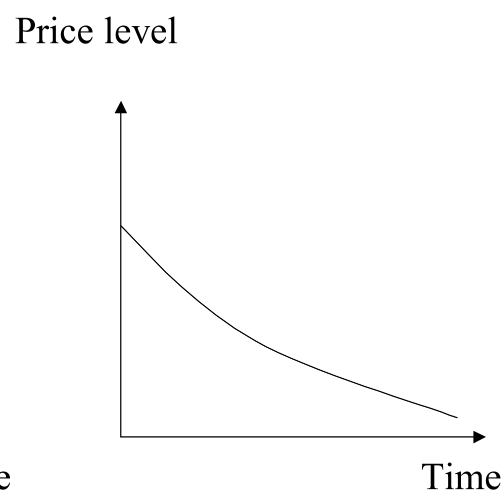

Figure 1.b. Deflation

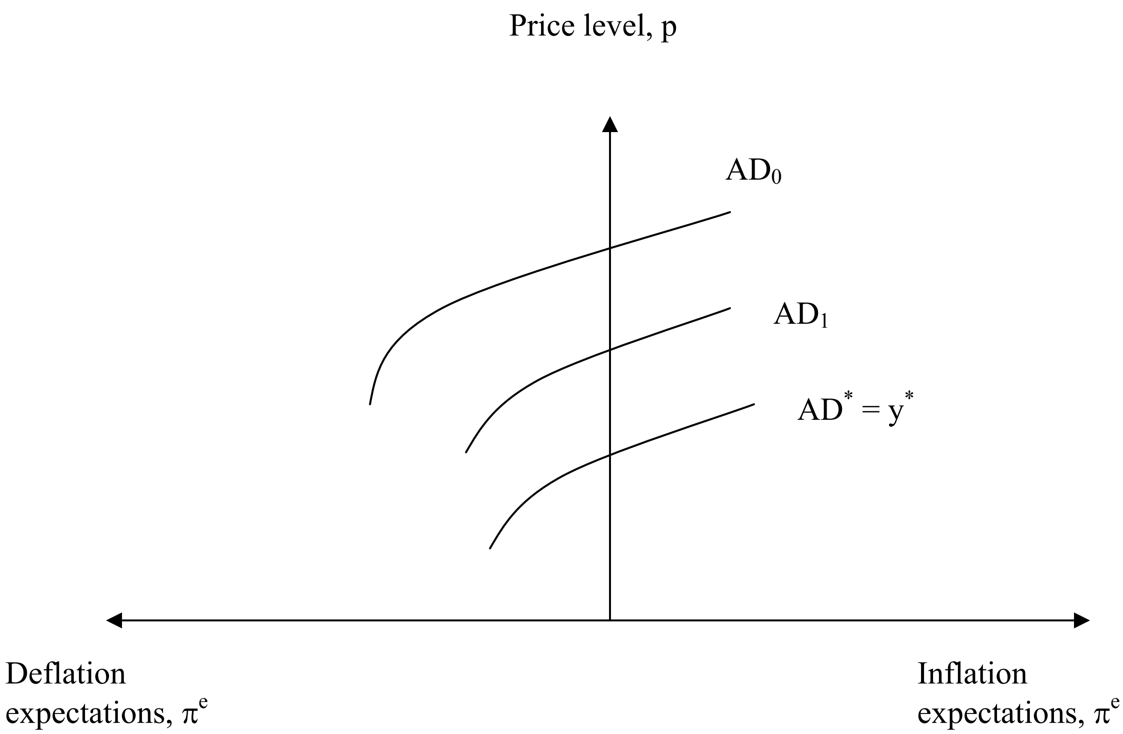

Figure 2. Iso-AD contours in Tobin's model of recession and depression in which there is a positive Pigou and Keynes effect. $AD_0 < AD_1 < AD^*$.

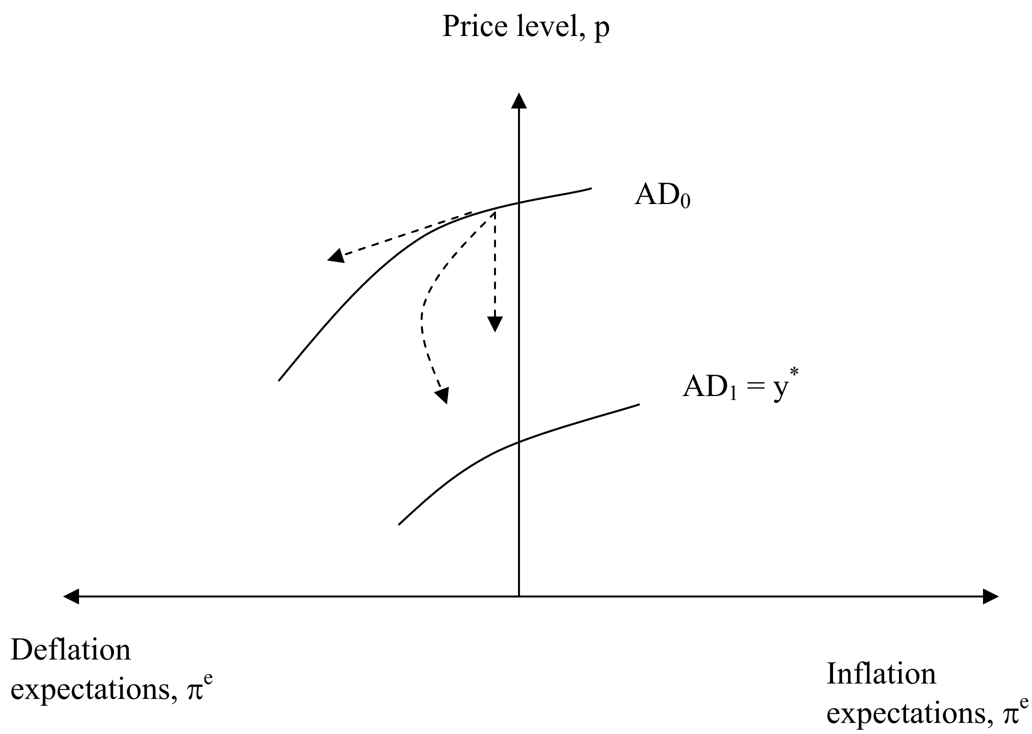

Figure 3. Three different price adjustment paths. AD increases along the two steep paths where the price level falls rapidly with little impact on deflation expectations. AD falls along the third path. $AD_0 < AD_1$.

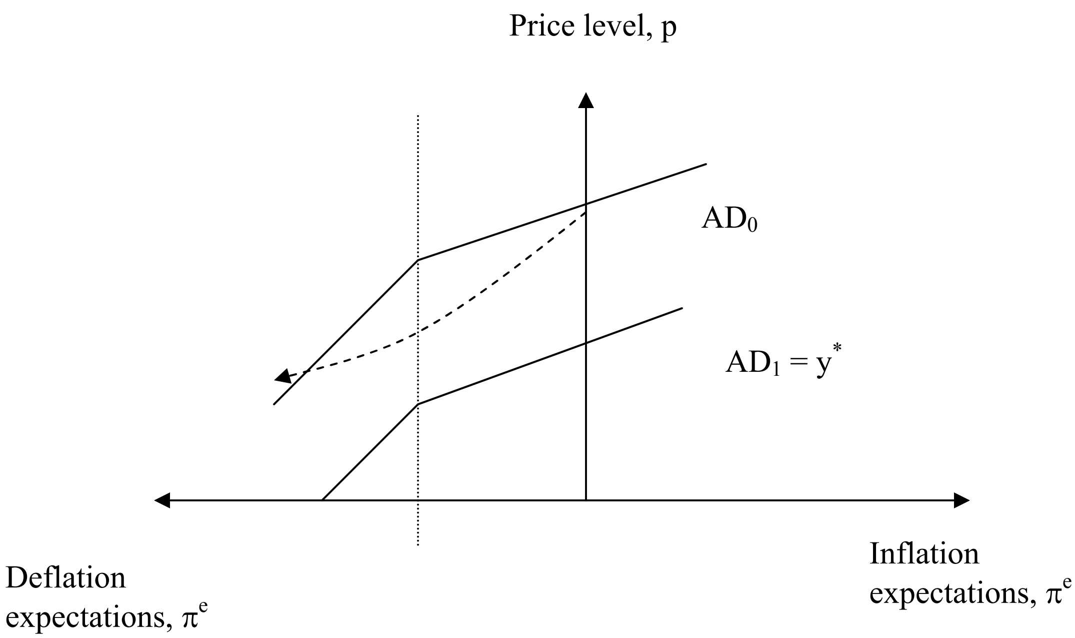

Figure 4. The liquidity trap at $-i_F$ results in a kinked iso-AD contour. As a result, price adjustment paths that initially increase AD can lower AD and become unstable on entering the liquidity trap. $AD_0 < AD_1$.

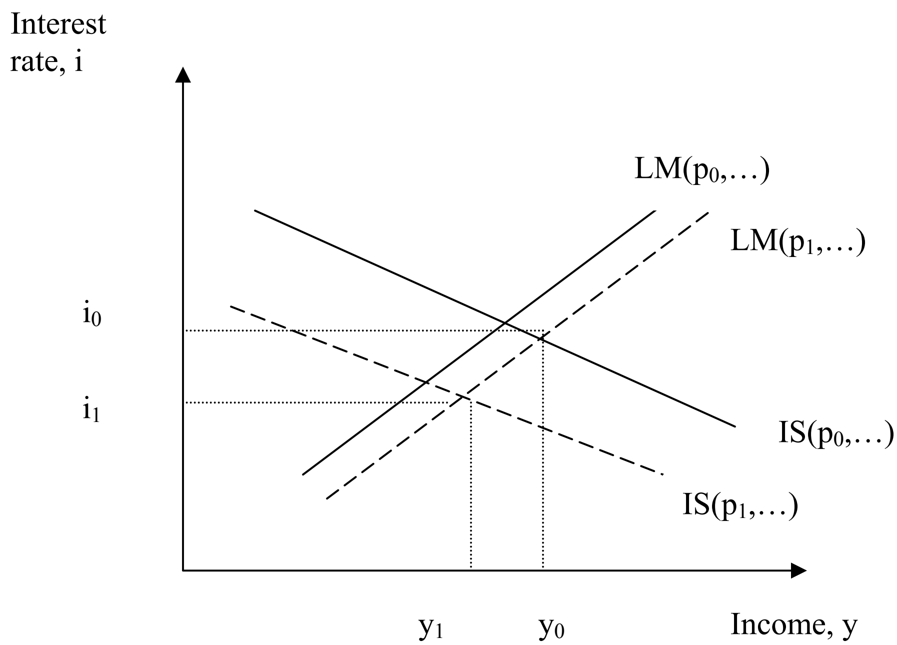

Figure 5. The effect of a lower price level ($p_0 > p_1$) in the ISLM model when the Fisher debt effect dominates the Pigou and Keynes effects.

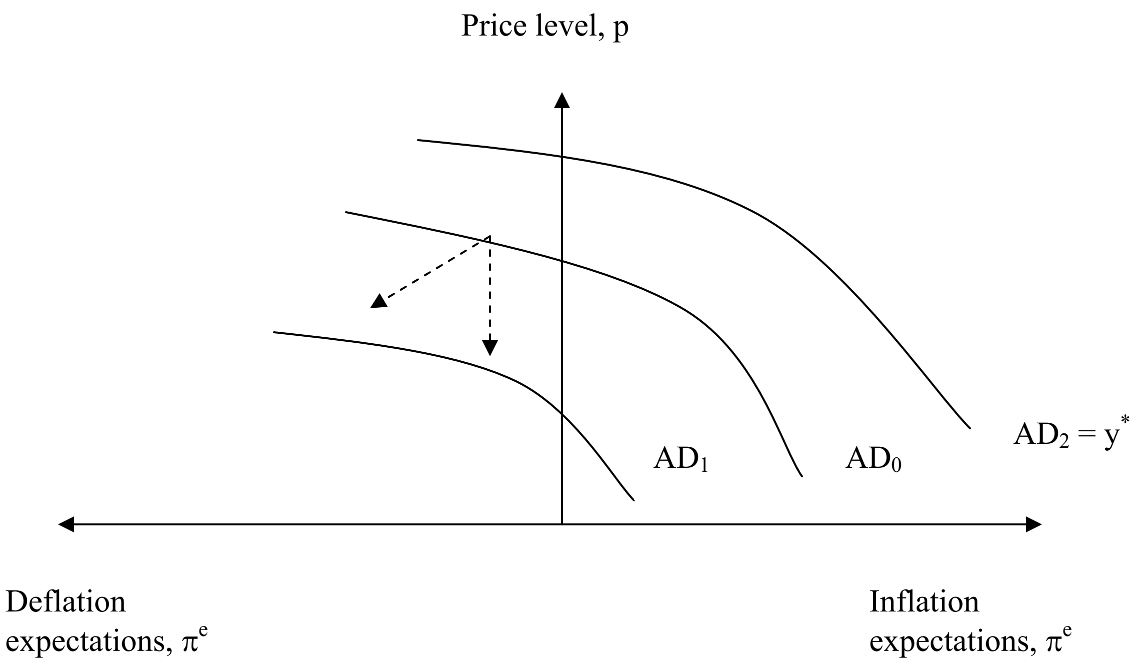

Figure 6. Iso-AD contour map when the Fisher debt effect dominates the Pigou and Keynes effects. $AD_2 > AD_0 > AD_1$.