LIQUIDITY DEFLATION AND SAFE ASSETS SHORTAGE
Some Microfoundations

Guillermo Calvo¹
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The current debate about slow recovery from the Great Deflation, accompanied by persistent threat of price deflation, has highlighted the relevance of liquidity as a necessary factor to ensure stability and growth. An important branch of the literature focuses on the Safe Assets (i.e., liquid assets which market values are highly resilient in terms of goods and services), and pays special attention to scenarios in which shortage of safe assets prevents achieving full employment and gives rise to other costly distortions. This situation is especially relevant when the Zero Lower Bound on safe assets interest rates, ZLB, is binding, and prices are downward inflexible (see Caballero, Farhi and Gourinchas 2016 and 2017).

This sounds highly plausible. However, for someone raised in conventional macroeconomic theory, safe-asset shortage is still quite puzzling. According to such theory, the central bank could easily fight off deflation by increasing the supply of safe assets (money supply in the conventional model). Moreover, if price deflation is triggered by unemployment, expansion of money supply (Quantitative Easing, QE, in current parlance) should be able to achieve full employment equilibrium without deflation. What causes money—especially money from reserve currency economies—to lose its punch, possibly making QE ineffective? This is an interesting theoretical question, which is also acquiring policy relevance, given that the Eurozone and Japan are still hovering around the ZLB, and market analysts are becoming increasingly skeptical about the effectiveness of QE.

The above issues are closely linked to the debate between Keynes and the ‘classics’ (as defined in Keynes 1936), especially the Pigou effect. According to the Pigou effect, increasing the supply of money or lowering the price level could restore full employment. The effectiveness of a price level fall can be ruled out by pointing to Fisher (1933) Debt Deflation. But the effectiveness of a rise in money supply stands firm, unless the demand for money is perfectly interest-elastic (the case emphasized in Keynes 1936). However, unbounded appetite for money (or, more realistically, liquid assets) as a rationale for the ineffectiveness of the Pigou effect is hard to defend in the context of the Great Recession. QE worked during the early phase of the Great Recession. Thus, failing to work now should reveal increasing pessimism about future output prospects, which is hard to square with present, albeit slow, recovery.

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These observations led me to explore the possibility that QE could start losing its punch for the sheer fact that the quantities involved are significantly larger than at the beginning of the Great Recession (e.g., US high-powered money is more than fourfold larger than in 2007). I have recently offered a rationale for the declining effect of QE by discussing examples in which the expansionary effect of increasing money supply is met by what I call Liquidity Deflation: a force that pushes liquidity in the opposite direction (Calvo 2016 a and b). I am afraid, though, that those examples might be overlooked, given that they are not built on sufficiently reassuring (for the average economist) microfoundations. This is the main objective of the present note.

For motivation, I will first briefly discuss two related scenarios in plain English. Then I will proceed to discuss the formal model. The formal model will allow us to discuss the mechanics of Liquidity Deflation in greater detail, and show under conventional assumptions that Liquidity Deflation could completely crowd out the liquidity-enhancing impact of an increase in money supply. Moreover, the model illustrates the risk of operating near the complete-crowd-out equilibrium. Under those conditions, even a slow-paced return to normality may bring about a sharp increase in prices. Stopping this from happening may necessitate large hikes in the policy interest rate. The latter could be highly disrupting if not fully anticipated by the market.

The model reaffirms standard results about the effectiveness of interest-rate policy, and shows that they hold, even though QE loses its punch. However, bringing externalities to the table reveals that the effectiveness of interest rates in the short run could be short-lived.

In the closing remarks I extend the analysis to Emerging Market economies, EMs, in which domestic assets could hardly be classified as safe. Arguably, however, the search for yield triggered by low-interest-rate of safe assets may have turned some EM assets safer (partly explained by higher turnover), helping to explain a noticeable downward trend in EM inflation, a phenomenon that reaches its climax in Israel where the central bank is struggling to stop deflation!

**Liquidity Deflation: Intuitive Scenarios**

1) Harking back to the pre-credit-card era, let us assume that carrying cash to the shopping mall saves shopping time (see Végh 1989). Time saved also depends on how much cash is held by the other mall customers. Given prices, the larger are the sums that the representative customer carries to the shopping mall, the longer are likely to be the lines at the cashier booth, increasing shopping time. This congestion effect is a Liquidity Deflation externality. Customers would be better off coordinating the sums of cash that each of them carries to the mall. However, in an 'atomistic' environment, customers would have incentives to hold more than the cooperative optimum. In the limit, cash over-accumulation may, at the margin, save no time to customers. Hence, Milton Friedman’s
thought experiment of throwing money from a helicopter may fail to increase aggregate demand because cashiers are packed with customers and operate at full capacity. If this situation is expected to persist over time, stores are likely to modify the payment system, and Liquidity Deflation may become less relevant, but it does not detract from its relevance in the short-run, especially during a low-probability recession episode.

2) Alternatively, and more in line with popular narratives of the Great Recession (see Gorton 2010), consider the case in which a highly liquid asset (e.g., US Treasury bond) is used as credit collateral. The collateral value of those bonds depends on the amount of goods and services that the US government could seize by, say, raising emergency taxes. Therefore, the value of Treasury bonds as collateral may decline (their 'haircut' may rise) as the real market value of Treasury bonds goes up. Moreover, beyond a certain point, a fall in the yield or greater quantity of Treasury bonds (as a result of higher US fiscal deficit) could fail to increase the liquidity of safe assets.

NB. The above examples assume that, in principle, the public ranks liquid government liabilities as safe assets. The realism of this assumption goes highly unquestioned in the macro and finance literature, especially for governments that issue reserve currencies. If pressed to justify the assumption, the usual answer relies on another assumption, namely, that in an emergency the government could grab hold of “real” goods and services, as in example 2 above (see Caballero and Farhi 2014). This rationale does not carry much weight for economies, like Japan and the US, that exhibit large fiscal deficits and humongous debt-to-GDP ratios. In Calvo (2016 b) I dig up an overlooked conjecture in Keynes (1936) that helps to rationalize the existence of a “real” backup for cash—and, hence, for any public sector cash-denominated liability—that relies on the existence of private sector contracts based on staggered sticky prices and wages. I labeled this conjecture the Price Theory of Money. It should be noted, though, that even this type of backup is not unbounded and, therefore, beyond a certain point QE will stop being effective.

**Liquidity Deflation: A Parsimonious Microfounded Model**

Suppose a standard infinite-horizon open-economy model in which instant utility index satisfies:

\[ U(c) - l, \tag{1} \]

where \( c \) stands for consumption, \( U' > 0, U'' < 0 \), and \( l \) is labor required to consume \( c \), e.g., shopping time (see Végh1989). I assume that shopping time increases with consumption and declines with the holdings of real monetary balances. The latter provide transactions services and thus save on shopping time. However, the effectiveness of money to provide those services declines as market holdings of real monetary balances increase, in line with the above examples. Thus, in this setup Liquidity Deflation is akin to a "congestion effect."
I assume that

\[ l = c - V(m + Z(m^e)) \]

where \( V \) is the timesaving function, \( Z \) is the Liquidity Deflation function and \( m \) and \( m^e \) are, respectively, the representative individual's holding of real monetary balances and market equilibrium real monetary balances (this is an atomistic environment; total population is normalized to 1). Individuals can single-handedly determine \( m \), but, since they are atomistic, are constrained to take \( m^e \) as given. Thus, \( m^e \) is a negative externality. Individuals do not internalize it despite taking \( m^e \) into account for determining optimal \( m \). The standard assumption in the literature is that \( Z' > 0 \), reflecting positive "network" effects (see, e.g., Uribe 1997). In the present case, \( Z \) is associated with "market congestion," a negative externality, which impairs the effectiveness of money as a timesaving device.\(^2\)

Plugging equation (2) into equation (1), assuming perfect foresight, homogeneous output, exogenous output endowment (constant over time) \( y \), and equality between the subjective rate of discount, \( \rho \), and the international real rate of interest, the following first-order conditions hold (at an interior solution, i.e., if \( c > 0, l > 0 \)):

\[ U'(c) - 1 = \lambda, \]

and

\[ V'(m + Z(m^e)) = \lambda i, \]

where \( i \) is the instantaneous nominal interest rate, \( \lambda \) is the Lagrange multiplier, which is constant over time and determined by equality between present discounted value of endowment and consumption (the initial backward looking wealth is assumed to be nil and that the government rebates seigniorage in the form of lump-sum subsidies). All of these assumptions are standard in monetary models aimed at highlighting fundamental monetary phenomena—in the present case Liquidity Deflation. Under these assumptions, if the rate of growth of nominal money supply, \( \mu \), is constant over time, it is easy to show that at equilibrium \( i = \rho + \mu \).

One can show that equilibrium consumption \( c = y \). Thus, by (3) and (4), we get

\[ \frac{V'(m + Z(m^e))}{U'(y) - 1} = i, \]

\(^2\) In the short run, Liquidity Deflation is likely to dominate the network effect, because the latter calls for additional time-consuming coordination, while the former works under the status quo ante (i.e., initial coordination conditions), no innovation is necessary.
which is a familiar expression, except for the term $Z(m^e)$. Solving for $m$ in equation (5), we get, at equilibrium where $m = m^e$, the following money-market equilibrium condition:

$$m + Z(m) = L(i, y), \ L_i < 0, L_y > 0. \ (6)$$

Therefore, transactions services, i.e., $m + Z(m)$, may increase with real monetary balances despite the Liquidity Deflation effect, but the model does not preclude the possibility that beyond a certain point transactions services decline. In the present model it is thus possible for equilibrium condition (6) not to hold: effective transactions services may fall below $L(i, y)$, despite prices being perfectly flexible. Under these conditions, QE would stop being effective. Notice that, even if Fisher (1933) Debt Deflation is not a problem, Liquidity Deflation would offset the higher liquidity produced by higher $m$. And, for the same reason, a one-and-for-all increase in nominal money supply will not work either. Notice that this phenomenon is observationally equivalent to the "liquidity trap" emphasized in Keynes (1936). The apparent voracity for real monetary balances of the private sector, however, is not due to infinite interest elasticity but to the fact that money supply is swallowed by a Liquidity Deflation "black hole"!

Interestingly, a rise in the nominal interest, $i$, through a rise in $\mu$ and, hence, higher inflation, could succeed in restoring equilibrium. However, in the more realistic case in which the policy interest rate applies to liquid assets (e.g., US Treasury bills), an increase in the policy interest rate would further increase the excess demand for money. To show it, consider the case in which $m$ is an interest-bearing asset, and let us denote the interest rate on $m$ by $i^m$. It is easy to show that the money-market equilibrium condition (6) would become:

$$m + Z(m) = L(i - i^m, y), \ L_{i-i^m} < 0, L_y > 0. \ (7)$$

Clearly, then, an increase in $i^m$ would exacerbate the excess demand for liquidity, increasing excess demand for money. This also helps to show that, if the ZLB is not binding, setting $i^m$ sufficiently low could restore money market equilibrium. The effectiveness of low-interest policy relies on making safe assets less attractive, a phenomenon that is akin to imposing an "inflation tax." In EMs, inflation tax has led to "currency substitution," a phenomenon that can be partly rationalized by network effects (see Uribe 1997). Therefore, a possible outcome of negative

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3 For a related model, see Calvo and Végh (1995). Variable $i^m$ could also be interpreted as central bank’s interest on reserves.

4 Notice the parallel between increasing inflation and increasing the "inflation tax" on liquid assets. Both could restore full employment. However, as will be argued below, this could be a pyrrhic victory that undermines the safety of safe assets.
Interest rates may be destruction of liquidity through network effects. This is admittedly a time consuming process (recall footnote 1), but, given the current mushrooming of digital means of payments, network effects may become operative much faster than in the past. Thus, negative interest rates may turn out to be a short-lived medication. Moreover, changing the configuration of means of payments could trigger a costly and disorderly transition.

Our discussion has focused on the limit case in which Liquidity Deflation completely emasculates QE. However, Liquidity Deflation is also relevant near the limit, where QE is still capable of increasing liquidity supply. For the sake of concreteness, let us write the left-hand side of equation (7) as \( m + \beta Z(m), \beta \geq 0 \), and consider the effect of a slight drop in parameter \( \beta \). If \( Z(m) < 0 \), the latter amounts to lowering the drag implied by Liquidity Deflation, and can be interpreted as a shift towards "normality." Since, by assumption, QE still works, being near the point where QE would be ineffective, implies that the derivative of \( m + \beta Z(m) \) with respect to \( m \) is positive but \( \approx 0 \). Hence, recalling that \( Z(m) < 0 \), one can easily show that a fall in parameter \( \beta \) implies a "large" contraction in equilibrium real monetary balances \( m \). Thus, for instance, if nominal money supply were exogenous, a fall in parameter \( \beta \) would bring about a "large" increase in the price level. If the latter were unwanted, then—given \( i \) (or, equivalently in this model, the rate of expansion of money supply \( \mu \))—the central bank would have to implement a "large" hike in money’s rate of return \( i^m \) (which could take the form of an equally "large" hike of the rate of return on banks’ reserves, recall footnote 2). This helps to rationalize the concern expressed by some analysts about the sharp turns that may lie ahead as a result of even a slow-paced return to normality. If not sufficiently anticipated by the market, a sharp rise in interest rates on liquid assets may seriously threaten the stability of the whole economy (financial and non-financial sectors alike).

**Closing Remarks.**

Having reached this point, the reader may be tempted to conclude that the above results are largely trivial. And I agree. However, I felt compelled to compose this note because what seemed trivial to me was not trivial to most of my interlocutors. If you ask your "representative" economist (especially prior the Great Deflation): "What happens after money supply displays a large increase in a short period of time?" the answer will likely be something like "prices will take a big jump." In symbols, a big increase in \( M \) will result in a big increase in \( P \). In contrast, the above discussion focuses on the possibility that a big increase in \( M \) will provoke a big fall in the "quality" of \( M \) — here identified as a big fall in the "liquidity of \( M \)." Thus, in a

\[\text{\footnote{Network effects are mentioned in Keynes (1936, Chapter 23, v) as he criticizes Silvio Gesell’s (1862-1930) stamped-money proposal. The latter is equivalent to charging a negative interest rate on money/liquidity (i.e., lowering \( i^m \) in the above model).}}\]
situation like that, a marginal increase in $M$ may have no effect on $P$ or in the "real value of $M/P$, adjusted for liquidity services."\(^6\)

Liquidity Deflation helps to rationalize safe-asset shortage. However, this phenomenon is unlikely to be as relevant in EMs. In the latter, financial assets have been akin to junk bonds in developed markets. Hence, it is not surprising that in the last twenty-five years, EM financial crises drove agents to flee domestic currency and cause sharp inflation spikes (see Calvo 2016, Chapters 6 and 7). Domestic liquidity contracted but there was no *excess demand* for liquid domestic assets, as in a safe-asset-shortage episode.

However, a long period of safe-asset shortage, like that in the wake of the Lehman crisis, may help to strengthen EM currencies and imbue them with additional liquidity resilience. Thus, for example, a search for yield (on liquid assets) may increase the liquidity of EM government liabilities in a select group of countries and help to lower their respective rates of inflation. Israel is an interesting case in point. In the 1980s Israel was a clear case of chronic high inflation, occasionally reaching staggering levels (e.g., over 350 percent in 1985). At present, however, Israel is struggling to stop *deflation!* Inflation has undershot its inflation target by a wide margin, and is dangerously teetering around zero. This could, of course, be due to prudent fiscal and monetary policy. But it is hard to discount the higher-liquidity-resilience hypothesis highlighted above. Israel is an extreme case but not unique. Since the Lehman crisis, inflation has fallen sharply in a good number of EMs that benefitted from large capital inflows, even though they are not exemplars of fiscal prudence.\(^7\)

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\(^6\) Keynes (1936, Chapter 19) was struggling to get rid of price/wage stickiness to explain involuntary unemployment. Liquidity Deflation would have helped. Question: Given the centrality that Liquidity Preference has in the *General Theory*, would Keynes have ranked Liquidity Deflation high together with Kahn’s multiplier?

\(^7\) An interesting question is: Will inflation flare up again in low-inflation EMs whose assets gained quasi-safety status if, for instance, capital starts to flow back to developed economies?
References


