

# **Liquidity Constraints and Non-market Clearing: A Recipe for Recessions?**

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## **Abstract**

In their ‘workhorse model of money and liquidity’, Kiyotaki and Moore (2008) show how credit shocks can affect current investment and future aggregate supply. Despite these fluctuations in investment, aggregate demand matches current supply via a flex-price ‘Pigou effect’ that changes the value of real balances and so consumption. If prices are not flexible enough to ensure continuous market clearing, however, a credit crunch may cause a recession. In particular, by switching from a flex-price to a fix-price characterisation of goods and labour markets, we find that demand failures can emerge after a liquidity shock. In short, a framework that combines elements of RBC optimisation with Keynesian fix-price economics, implies that financial factors can effect demand as well as supply.

## **INDICATIVE EARLY DRAFT**

### **Acknowledgements**

Peter Hammond

### **Introduction**

When, in *The Winter’s Tale*, Leontes king of Bohemia - maddened with jealousy - imprisons his wife Hermione and exiles their new-born daughter, the queen faints and her body is carried to a temple nearby. There it is visited from time to time by the contrite king -- a mute but lifelike statue contemplated in sorrow. But, when sixteen long years have passed and the banished daughter returns, the statue of Hermione comes to back life; and reconciliation is achieved.

Like the queen of Bohemia, the Keynesian policy paradigm of macroeconomic stabilisation has suffered in silence for quite some time. Discredited and discarded in the stagflation that followed the oil price shocks of the 70s and 80s, it has nevertheless been preserved in textbooks as a dumb memento from times past. For a new and seemingly successful paradigm has emerged and, for many years and in many

countries, there has been a Great Moderation of inflation. But now that this new paradigm is challenged by a severe global credit crunch – which it failed to predict and cannot explain - important questions arise. Will the theory of macro stabilisation be revived – and if so in what form? Can it be reconciled with the DSGE paradigm? These are what we discuss.

Woodford's masterly monograph on *Interest and Prices*, published in 2003, was the capstone of a decisive shift in monetary economics from looking at the quantity of money to the cost of borrowing (i.e. from Friedman back to Wicksell). This framework - the embodiment of the new paradigm – is, moreover, inspired by an over-arching vision: to create a new synthesis reconciling mainline macroeconomics with dynamic General Equilibrium, as practised by Real Business Cycle theorists in particular. Replacing the Keynesian IS curve by the inter-temporal Euler equation of a representative household with rational expectations is a potent symbol of this synthesis.<sup>1</sup>

The combination of optimising behaviour by a representative agent (RA) with model-consistent or rational expectations (RE) leads to the comforting conclusion that the economy is fundamentally stable: the risks to stability that Woodford discusses arise in the public sector - from unchecked public spending, for example, or inappropriate interest rate setting by the Central Bank.

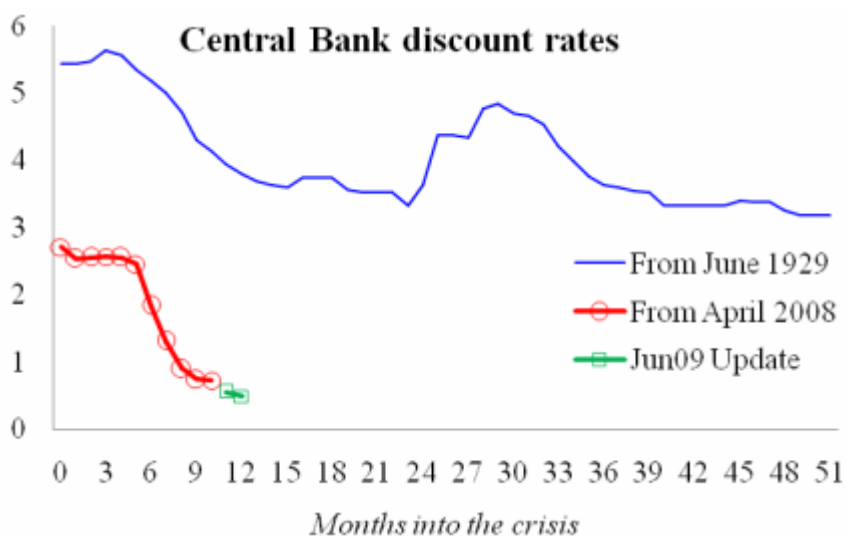
With the device of a representative agent ruling out the need for private sector financial intermediation, adding the Euler condition of inter-temporal efficiency may seem innocuous enough. But see where this has led. It means that, by courtesy of the DSGE paradigm, macroeconomics has effectively followed in the footsteps of General Equilibrium theory where – as in Debreu's *Theory of Value* - the static model of trade in goods and services is elegantly and effortlessly extended over time (and states) without regard to issues of asymmetric information, contract enforcement and default.

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<sup>1</sup> Effectively the Keynesian consumption function of the *General Theory* is replaced by the ' Ramsey Rule' published in 1928.

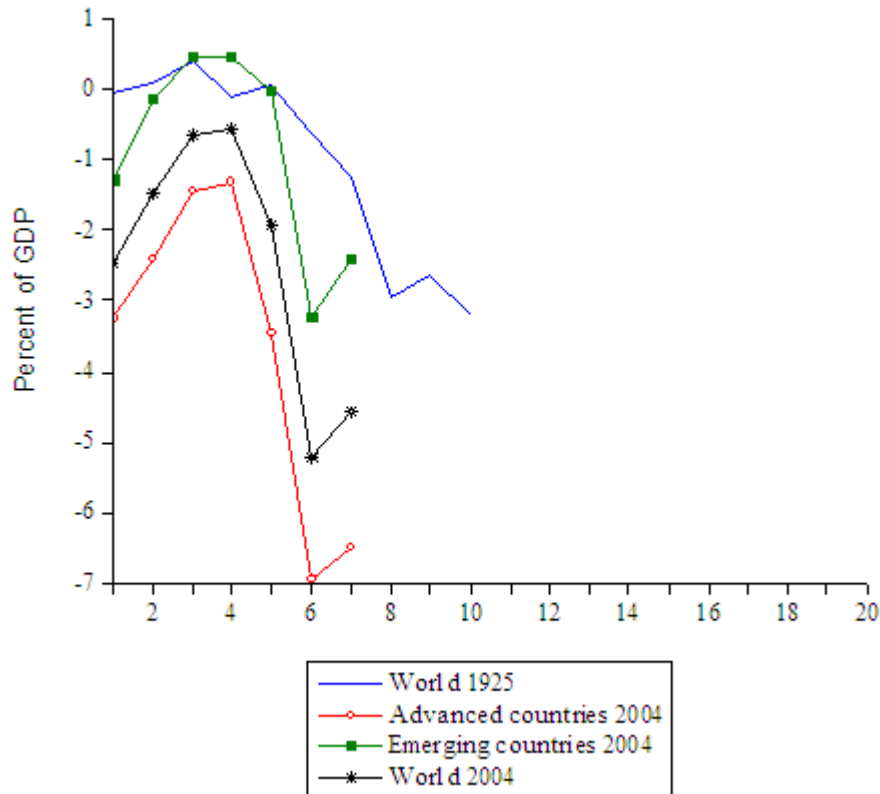
What if – heaven preserve us! – this feature should be the Achilles heel of dynamic General Equilibrium? What if - in the absence of collateral or other credible enforcement - the ‘core’ of the inter-temporal GE model is not sub-game perfect, as Peter Hammond (1979) put it? Well then - in his words<sup>2</sup> - Humpty Dumpty will have a great fall! But not just GE as we know it: so too the synthesis so carefully constructed by Woodford and his co-workers to be GE-compatible.

Does it matter? As credit crunch triggers global recession, the crucial role played by finance in oiling the wheels of the world economy has been demonstrated beyond reasonable doubt. In the view of some economic historians, indeed, “the world is currently undergoing an economic shock every bit as big as the Great Depression shock of 1929-302”. Eichengreen and O’Rourke (2009). “The good news” they add “is that the policy response is very different”; and they go on to quantify how much more sharply interest rates have been cut and fiscal deficits expanded than in the 1930s.



**Figure 1 Central Bank Discount Rates – Now and Then**

<sup>2</sup> While reflecting on Frank Hahn’s inaugural lecture ‘On the Notion of Equilibrium in Economics’



**Figure 2 Budget Surpluses and Deficits -- Now and Then**

These acts of monetary and fiscal stabilisation policy owe little if anything to the synthesis that DSGE symbolises. If it the new paradigm has failed to connect with these world-shaking macroeconomic developments, what are the alternatives? (Discussion of Curdia and Woodford to be added here.) In what follows we consider the reconstruction of monetary theory to include credit constraints offered by Kiyotaki and Moore (2008): and we suggest two significant modifications.

### **The Kiyotaki and Moore approach in outline**

As an **alternative to the representative agent assumption**, the key idea is that investors are *ex ante* identical, but only a fraction actually turn out have ideas that will generate investment in the next period. This is rather like the specification of Diamond and Dybvig (1983) in their classic paper on banking, where agents identical *ex ante* turn out to have patient or impatient consumer preferences. Here the application is to investment not consumption, but, as for Diamond and Dybvig, there is no insurance market to handle the risk (of needing cash).

**Rational expectations** prevail in the stock market; but **credit markets are far from perfect**. Firms face borrowing limits in terms of shares they can issue; and resale constraints on selling the shares of others (and there are no banks to supply loans). To ensure that investment opportunities are not wasted, firms therefore adopt precautionary strategies: in particular they hold money. Workers choose not to hold money and they cannot borrow: so **households are income constrained** with all wages are spent on consumption. Prices and wages are perfectly flexible and the markets for goods and labour both clear.

The constraints on inter-temporal arbitrage leads to a Hicksian type of analysis, where one looks at money and goods markets in the short run. Effectively there is an LM curve that determines the price level, and an IS curve that determines the real price of equity. But unlike Hicks, however, there is **continuous market clearing** and full employment.

One implication of these market imperfections is shown by imposing infinitely repeated deterministic and predictable shifts in productivity. The consumption-smoothing predicted by RBC is blocked by the credit constraints: real share prices adjust to ensure pro-cyclical investment, but the price level moves counter-cyclically – as one might expect under a flex-price model where the quantity of money is fixed and output fluctuates.

Of more immediate interest at this time are the effects of unanticipated liquidity shocks, modelled as stochastic changes in the resaleability constraint affecting firms investment. On such matters RBC models may be silent, but here unanticipated credit constraints cut investment and the real value of shares. But full employment prevails. “Because output is not affected with full employment,” we are told, “consumption increases to restore goods market equilibrium”. How so? As the price level falls and the real value of money increases, it seems that there’s a Pigou effect at work here increasing the consumption of entrepreneurs.

The modelling of stochastic credit constraints provides a rationale for the policy of Quantitative Easing being pursued on both sides of the Atlantic: state-contingent

Government intervention in the form of government open market purchases of illiquid equity is, they point out, just what is needed to offset an adverse liquidity shock. [What of the fact that most purchases by the Bank of England are of its own debt? Small purchases of corporate securities may, we are told, bulk large in the – much smaller - market for corporate debt. There may also be a ‘market-making’ effect at work where the entry of a big player eases the credit constraint itself, Tucker(2009)]

### **A potential criticism that can be left aside**

Before proceeding further, consider the obvious objection this approach ignores the potential role of banks in providing insurance. For this is precisely what Diamond and Dybvig showed in the case where consumers are *ex post* heterogeneous. As those authors also noted, however, while banks can offer insurance they can also suffer from spectacular coordination problems in the form of bank runs<sup>3</sup>. The explicit or implicit promise by the authorities to insure the banks themselves (FDIC guarantees or lender of last resort facilities) may, in turn, have perverse effects on banks incentives, Hellman, Murdock and Stiglitz (2000). Far from solving the problem facing investors, banks may make things worse – as they appear to have done under regulatory regimes operating with a ‘light touch’. In these circumstances, leaving banks out of the frame while looking at the impact of credit constraints seems a reasonable compromise.

### **Two key extensions.**

The replacing of a representative agent by heterogeneous investors and the addition of credit constraints on firms and households may be criticised as *ad hoc* changes to what is otherwise a standard inter-temporal RBC framework. There is no denying, however, that Kiyotaki and Moore have increased the explanatory power of the framework while retaining analytical tractability. *Ad hoc* though it may appear, the framework does nonetheless address the Hammond critique of DGE: here firms cannot borrow at will - and this has real consequences. The introduction of market imperfections has achieved another significant result – a precautionary role for money holding! [Compare this to money-in-the-utility-function! ]

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<sup>3</sup> For the view that the current credit crisis is largely a run on shadow banks, see Milne (2009).

These developments of the RBC framework are not to be underestimated. Compared to the introduction of arbitrary ‘wedges’ by McGrattan et al (2007), for example, they offer a structured enhancement of the existing paradigm<sup>4</sup>: so much so that Real Business Cycle theory must now change its name! But have they gone far enough?

Hicks would of course have approved of the precautionary demand for money and the within-period analysis of goods and money markets. But why assume perfect flexibility of wages and prices and continuous market-clearing? The answer surely lies in the rules of the academic game, where relaxing too many key assumptions of the paradigm at once is not seen as scientifically progressive<sup>5</sup>. To show that there is a role for government intervention - even with perfect flexibility of wages and prices and continuous market-clearing - will hopefully be seen in a different light.

From the perspective of macroeconomics rather than monetary theory, however, there is a different question worth posing: can the framework Kiyotaki and Moore have developed be used so as to achieve a synthesis between DGE and orthodox macroeconomics? This is, of course, the challenge that Woodford took up in writing his monograph at a time when inflation was seen as the central problem in macroeconomics: but, at a time of recession and unemployment and fears of deflation, one looks for a different synthesis.

This is question pursued in the next two sections. In the first section, where, we drop the assumption of flexible wages and prices, the result is immediate. A credit crunch will cut investment *and consumption*, so there will be underused resources. Since the impact of a liquidity squeeze can be seen in terms of its effects on aggregate demand and on portfolio balance, what emerges is a type of updated IS/LM analysis whose origins lie in RBC. By that token, the freeing of the financial constraints – by assumption or by policy act – may be expected to reverse the situation.

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<sup>4</sup> By way of reconciliation: is the account of a liquidity shock in KM not rather like the negative-productivity-shock-due-to-financial-factors discussed Chari et al.?

<sup>5</sup>This observation we owe to Jordi Gali.

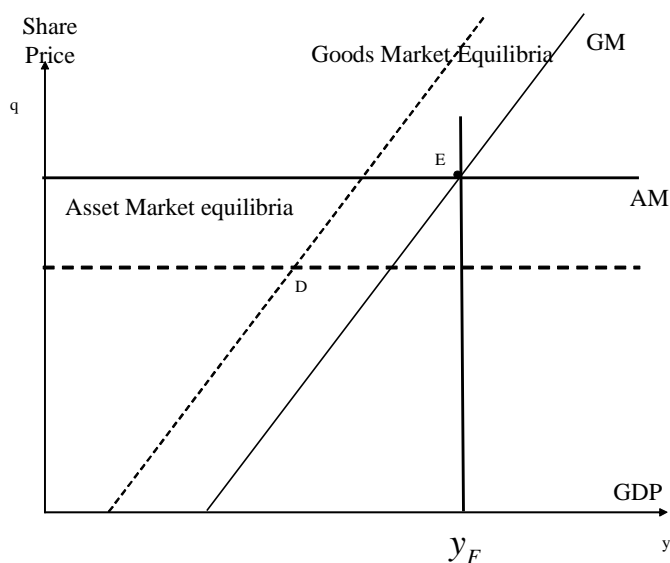
In the following section we drop RE.

**(A) Drop Market clearing**

**Fix price** so output fluctuates. Akerlof and Shiller, Bewley

The flex-price assumption of the workhorse model of Kiyotaki and Moore may be analytically convenient, but makes no claim to historical realism. The fit of the original Phillips curve to UK data 1861 -1913, provides empirical evidence for sticky prices under the Gold Standard for example<sup>6</sup> While New Keynesian macro-economists like Woodford choose to capture wage-price stickiness by Calvo contracts, which allow for revision in response to expected future events, for present purposes we adopt a simple fix-price perspective.

Macro-equilibrium and the effect of a liquidity shock: a brief sketch



Assuming money wages and prices are fixed, goods and labour markets may fail to clear (as in fix-price macroeconomics). In this case the two equations of the KM model will determine  $q$  and  $y$  (not  $p$  and  $q$ ), conditional on the credit constraints. It can be shown, as in Blanchard (1981), that the goods market line GM is increasing in

<sup>6</sup> As the breakdown of the Philips Curve in the 1980s suggests, price stability is surely regime dependent.

$q$ . What about portfolio balance? The AM equilibrium for Blanchard can slope up or down ('good news' and 'bad news' cases respectively). Let us, for the moment, take the intermediate case where it is horizontal: then macro equilibrium will be at E in the Figure.

Figure Macro-equilibrium and the effect of a liquidity shock

What of the effects of a negative liquidity shock? Since it tightens the financial constraints on firms who want to invest and since workers are income constrained (and there is no Pigou effect to stimulate consumption of owners), the impact is to shift GM to the left, as shown. As the desire to hold precautionary money balances rises for firms with tighter liquidity constraints, the curve showing Portfolio Balance may well move down as firms rate shares less (though there may be factors going the other way).

The prediction is therefore that a 'credit crunch' will lower the value of shares and cause a recession, see D. The antidote discussed by KM should work here too: Quantitative Easing in the form of an open market operation where the government supplies liquidity in exchange for corporate securities should ease liquidity conditions. (If this helps to create a market, Tucker 2009, it may help reverse the credit constraint at its source.)

-- formal analysis to be added.

**(B) Drop RE** in stock market: cf Abreu Brunnermeier, Laibson, Shiller

-- to be added

### **Two further extensions**

Add Calvo contracts and discuss inflation stabilisation using a Taylor rule as in Woodford. This will achieve some reconciliation there too. Only fiscal policy should now have real effects.

Add banking and moral hazard.

### **Conclusion**

It tempting to conclude that the workhorse model developed by KM does in fact supply a micro-founded framework for looking at stabilisation policy – so long as wages and prices are not flexible enough to ensure continuous market clearing. This has been shown, by examining a fix-price version of their model, subjected to financial shocks. The outcome is, we believe, superior to the current paradigm in that it includes credit markets and their imperfections. Pushing things further by adding asset mispricing provides added realism at a time when stock markets have fallen by half.

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