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*Abstract:* Allan Meltzer developed his model of the monetary transmission mechanism in research conducted with Karl Brunner. The Brunner-Meltzer model implies that the Federal Reserve would benefit from drawing brighter lines between monetary and fiscal policy actions, eschewing credit market intervention and focusing, instead, on using its control over the monetary base to stabilize the aggregate price level. The model downplays the importance of the zero lower interest rate bound and suggests a greater role for monetary aggregates in the Fed's policymaking strategy. Finally, it highlights the benefits that accrue when policy is conducted according to a rule rather than discretion.

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Allan Meltzer developed his model of the monetary transmission mechanism in a series of papers written, mostly with Karl Brunner, over a period of decades. Key contributions include Brunner and Meltzer (1968, 1972, 1976) and the additional articles collected in Brunner and Meltzer (1989). Brunner, Cukierman, and Meltzer (1980, 1983) stand out, too, for bringing Allan's ideas into direct contact with the rational expectations revolution. Since Brunner and Meltzer (1990, 1993) and Meltzer (1995) already survey this work, it would be redundant to simply summarize one or more of the papers in great depth here. Instead, this discussion is aimed at highlighting a few major themes that emerge from Allan's writing and research and drawing out some implications for monetary policymaking today.

The time seems right for a review of this kind. As the lingering effects of the Great Recession of 2007-09 continue to fade away, Federal Reserve officials now face the challenge of designing and implementing new monetary policy strategies to replace and improve upon those adopted under duress during the financial crisis and the unexpectedly long period of zero short-term interest rates that followed. This was a big part of Allan's research program, too: looking back at history and identifying, with the help of monetary theory, lessons from the past that could be put to good use in the future.

Underlying Allan's model of the transmission mechanism is a broader world view that all monetarists share: that the capitalist system, whatever its flaws, remains the most effective one for allocating scarce resources. According to this view, market prices adjust, in the long run, to keep the economy moving efficiently along a balanced growth path. Economic theory

emphasizes, however, that market prices are *relative* prices. The central bank's principal role and obligation within this system is to pin down the *absolute level of nominal* prices. The central bank accomplishes this by exploiting its monopoly over the supply of base money: currency in circulation plus bank reserves.

Anyone who recognizes the practical relevance of these basic ideas – known collectively as the *classical dichotomy* – is well on his or her way towards understanding the fundamental message of Allan's model. As Hetzel (2018) usefully points out, the finer details of this monetarist view find their clearest exposition in the New Keynesian model's "divine coincidence," according to which, by achieving and maintaining credibility for a policy aimed at stabilizing the aggregate price level first, the central bank also creates the most favorable environment within which the market economy can respond efficiently to shocks. The Brunner-Meltzer model has this implication, too, but differs from the New Keynesian framework in at least two important ways.

First, instead of a more mechanical scheme for staggered nominal price or wage setting, the slow of adjustment in nominal prices that allows monetary policy to have real effects in Allan's model stems from agents' imperfect information about the sources and persistence of shocks and the precise way those shocks propagate through decentralized goods, labor, and asset markets. Allan summarized this view as follows:

For a monetarist or classical economist, long-run neutrality of nominal impulses is an implication of rational behavior. However, before impulses are fully absorbed, relative prices and real output respond to monetary impulses. The reason is that households and businesses fail to anticipate or perceive correctly all of the future implications of past and current actions. From a monetarist perspective, one principal reason for the misperceptions that give rise to relative price changes is that time is required to distinguish permanent and transitory impulses and real and nominal impulses. These delays in correctly perceiving the duration or type of change are part of the costs of acquiring information. Contracting in nominal terms is one response to these uncertainties. (Meltzer 1995, pp.49-50).

Thus, Allan's model of the nominal rigidities that underlie, for example, the statistical Phillips curve relation that reflects short-run monetary nonneutrality combines elements of Lucas' (1972) misperceptions model with those of Mankiw and Reis' (2002) sticky information setup. From the passage above it is clear, however, that for Allan, real-world informational frictions are more widespread and complex than they appear in either of those, or other, more stylized models.

Second, Allan emphasized repeatedly, throughout all his work, that the monetary transmission mechanism involves the gradual but inevitable adjustment of many relative prices across many decentralized markets. He stressed this point, partly, by criticizing more popular Keynesian and New Keynesian models, which focus exclusively on the role of short-term interest rates in transmitting the effects of monetary policy through the economy. Along those lines, he wrote:

To a monetarist economist, this view of the transmission mechanism is overly restrictive and mechanical. A monetary impulse that alters the nominal and real stocks of money does more than change a single short-term interest rate or borrowing cost. Monetary impulses change actual and anticipated prices on a variety of domestic and foreign assets. Intermediation, the term structure of interest rates, borrowing and lending, and exchange rates respond. ... The use of a single short-term interest rate ... is a poor metaphor for the classical response of relative prices following a monetary impulse and the further adjustments that restore neutrality. (Meltzer 1995, pp.51-52).

The central role that Allan and Karl Brunner assign to patterns of relative price adjustment and the underlying problems of imperfect information suggests that the intellectual exchanges the two had with Armen Alchian – mentioned in Meltzer (2015, p.12) – must have influenced strongly their work on the transmission mechanism as well as their theory of monetary exchange expounded in Brunner and Meltzer (1971).

In Allan's view, a complete and more correct analysis of the monetary transmission mechanism requires detailed consideration of both the money and capital markets. Thus, in

Brunner and Meltzer (1990) and Meltzer (1995), the effects of monetary policy actions such as open market operations are analyzed by manipulating two curves in a diagram, reproduced in the top panel of figure 1, that measures the nominal interest rate along one axis and the real price of capital along the other. The “MM curve” describes combinations of these two relative prices consistent with equilibrium in the money market, while the “CM curve” does the same for the capital market. The MM curve slopes up, because an increase in the interest rate decreases the demand for money; with money supply unchanged, equilibrium can be maintained only if the price of capital rises, thereby lowering the expected return on capital and bringing the quantity of money demanded back in line with supply. Conversely, the CM curve slopes down, because an increase in the interest rate increases the demand for bonds, and with the supply of bonds unchanged, equilibrium can be maintained only if the price of capital falls, lowering the expected return on capital and bringing the quantity of bonds demanded back in line with supply.

The bottom panel of figure 1 then shows the initial effects of an open market purchase in the Brunner-Meltzer model. The MM curve shifts to the right: some combination of a lower interest rate and a higher price of capital is needed to induce market participants to hold the additional base money that is being supplied. At the same time, the CM curve shifts to the left. Because the central bank is buying up previously-issued government bonds, some combination of a lower interest rate and a lower price of capital is needed to make market participants willingly sell those bonds. The open market operation unambiguously lowers the nominal interest rate. Its effect on the price of capital is ambiguous in sign, but assumed by Brunner and Meltzer to be positive since “empirical studies suggest that open market purchases raise the asset price level” (Meltzer 1995, p.55).

Thus, Allan's analytic framework captures a richer set of behavioral responses according to which market participants substitute, not only between money and bonds, but across a much wider range of capital assets, following an open market operation. Through these substitution effects, the monetary policy action triggers changes in a spectrum of asset prices, not just the short-term interest rate, all of which spill over to the goods and labor markets, generating changes in real aggregate spending and employment in the short run and in nominal prices and wages in the long run.

The Brunner-Meltzer model therefore has implications that differ along many dimensions from those of more basic Keynesian and New Keynesian specifications. In both Keynesian and New Keynesian models, for example, Poole (1970) and Ireland (2000) show that the central bank can insulate output and the price level from shocks to money demand by supplying reserves elastically to peg the short-term nominal interest rate. Brunner and Meltzer (1990, pp.390-391) emphasize that this result does not carry over to their richer model. First, if the central bank increases the monetary base to hold the interest rate steady in the face of a shock that increases money demand, capital asset prices nevertheless fall, with a negative impact on aggregate demand. Figure 2 illustrates this result. In the top panel, the initial shock to money demand works to shift the MM curve to the left, putting upward pressure on the interest rate and downward pressure on asset prices. To stabilize the interest rate, the central bank must conduct an open market purchase that, in the bottom panel of figure 2, shifts the MM curve back to the right but also move the CM curve to the left. The interest rate holds steady, but capital asset prices still fall.

What's more, shocks to the demand for *credit* in the Brunner-Meltzer model also require an increase in base money to prevent the nominal interest rate from rising, but an open market

purchase following a shock of that kind works also to increase equity prices, with an expansionary effect of aggregate demand. In the top panel of figure 3, this shock – equivalent to an increase in the supply of bonds -- works initially to shift the CM curve to the right, putting upward pressure on the interest rate and asset prices. Once again, an open market purchase is needed to stabilize the interest rate, but as shown in the bottom panel of figure 3, this magnifies the previous increase in the capital asset price. Depending on the magnitudes of various elasticities of demand and on the relative size and frequency of the two types of financial-sector shocks, therefore, a policy strategy based on interest rate targeting via the elastic supply of base money may either stabilize or destabilize the economy.

Most importantly, by emphasizing that open market operations affect a wide range of relative prices in the money, bond, and capital markets, the Brunner-Meltzer model downplays the importance of the Keynesian liquidity trap and its modern reincarnation, the zero lower bound on nominal interest rates. In the Brunner-Meltzer model, expansionary open market operations still work to increase other capital asset prices, even after the short-term interest rate reaches its zero lower bound. And, through those additional channels, monetary policy continues to affect aggregate output and employment in the short run and the aggregate price level in the long run. Again, Allan explains:

... in Keynesian theory, a liquidity trap eliminates the effect of monetary impulses on the real economy. Once the interest rate reaches a minimum value, monetary policy becomes impotent; changes in the stock of money are absorbed by money holders at an unchanged interest rate. But this implication is false in monetarist analysis. Market interest rates are only one of the relative prices affected by monetary impulses. An increase in the monetary base would not lower the interest rate, but asset prices would increase. Relative price changes and their effects on spending would not be eliminated by a liquidity trap for interest rates. (Meltzer 1995, p.56)

Meltzer (2001) elaborates, by distinguishing the real and nominal effects of these policy-induced changes in relative prices at the zero lower bound from the more traditional, Haberler-Pigou-Patinkin real balance effect studied, for example, in a modern cash-in-advance framework by Ireland (2005). Meltzer (2001) also provides evidence that these effects were operative during several key episodes of United States monetary history – especially the recessions of 1937-38 and 1948-49 – when changes in the money supply had their predicted effects despite the persistence of very low nominal interest rates and spells of outright deflation. Finally, Meltzer (2001) provides another brief but convincing argument that monetary policy actions *must* have effects through their impact on a wider range of variables beyond money market interest rates, crediting Karl Brunner with the simple observation that

Monetary policy actions are effective and powerful in the less developed countries of Africa, Latin America, or Asia where there is no money market. Relative prices respond to monetary impulses in countries without central banks, and without money markets. There is more to the transmission mechanism than the models recognize. (Meltzer 2001, p.115).

Thus, the Brunner-Meltzer model provides at least a partial rationale for some of the actions that the Federal Reserve took during and immediately after the financial crisis of 2007-08.

According to the model, it makes sense that, after the federal funds rate reached its zero lower bound in December 2008, Federal Reserve officials shifted their attention to longer-term bond rates, mortgage rates, and equity prices to gauge the effects their policy actions were having on the United States economy.

But the Brunner-Meltzer model can also be used to critique important aspects of the Fed's “unconventional” policy actions during and since the crisis. Crucially, while the model



implies that the central bank *can* affect other asset prices while short-term interest rates are at their zero lower bound, it does not suggest that the central bank should deliberately tailor its open market purchases to as to influence the prices of specific capital asset prices, which would be determined more efficiently in the free market. The Federal Reserve, as our nation's central bank, is responsible for the conduct of monetary policy: control of the aggregate nominal price level through the open market exchanges of base money for United States Treasury debt. Fiscal policy, including decisions about the maturity structure of government securities held by the public and the actions, if any, that require direct intervention in private credit and capital markets, should remain the responsibility of Congress, in consultation with the President and the Secretary of the Treasury.

The Brunner-Meltzer model is very clear on this. It implies that the Fed could and should have continued to use conventional open market operations – purchases of Treasury securities using newly-created base money – to provide additional monetary stimulus during the financial crisis and the severe recession that following, with the specific aim of preventing the aggregate price level from falling persistently below the levels prescribed by the central bank's previously-announced two percent inflation target. Thus, to the extent that the Fed's three rounds of "quantitative easing" were directly at increasing the monetary base to prevent inflation from falling too far below target, those actions are fully justified by the model. Indeed, Allan himself viewed the effects of QE as providing evidence consistent with the Brunner-Meltzer model's implications:

As the QE programs at the Federal Reserve and other central banks showed, zero short-term interest rate did not prevent monetary expansion. The Federal Reserve purchased medium and long-term debt. Asset prices rose and the exchange rate depreciated, as our conclusion about liquidity traps implied. The so-called zero lower bound turned out to bind very little other than very short-term rates. (Meltzer 2015, p.11)

As implemented, however, QE also took on the features of a fiscal, or credit market, intervention, especially when the Fed expanded its purchases to include mortgage-backed securities. At that point, the Fed stopped acting like a central bank and started behaving more like a private financial institution, issuing its own short-term liabilities to make long-term loans, especially in the housing markets. And, likewise, the Fed's decision, in September 2011, to "twist" the yield curve by selling short-term assets and buying long-term bonds with no resulting change in base money, accomplished nothing more than the US Treasury could have done on its own, simply by modifying the composition of its outstanding debt. At the time, Allan observed:

Purchasing more than \$1 trillion of long-term mortgages is credit allocation. ... Selling Treasury securities to finance mortgage of other purchases is a fiscal operation. The monetary base doesn't change, and the purchase reduces the interest payment made to the Treasury. Selling two-year Treasuries to finance purchases of longer-term bonds also doesn't change reserves or money. It is debt management and should be left to the Treasury. (Meltzer 2012, p.255)

Meanwhile, the beneficial pure monetary affects that its QE programs might have had were curtailed, to a large extent, by the Fed's 2008 decision to begin paying interest on bank reserves at rates at – or even above – those offered by securities with similar risk and maturity characteristics. As the analysis in Ireland (2014) makes clear, paying interest on reserves at any positive rate shifts the curve linking banks' demand for reserves to the federal funds rate outward to the right. In theory, it acts as a shock to money demand, sending deflationary impulses through the economy. In the Brunner-Meltzer model, as noted above and shown in figure 2, this holds true even if the central bank fully accommodates the increase in reserves demand with a corresponding increase in supply. In retrospect, the Fed's interest-on-reserves policy was a mistake, which reinforced the deflationary pressures set off by flight-to-quality dynamics during and after the financial crisis, which similarly increased both banks' and the public's demand for safe and highly liquid monetary assets. As Allan explains:

By paying interest on excess reserves, policy encouraged the reserve accumulation. ... The Federal Reserve made a traditional error, an error repeated many times. They equated monetary expansion to the first-round effects on interest rates, exchange rates, and asset prices. They ignored any subsequent effects from growth of money and credit. A better policy would have expanded money and credit growth more and excess reserves less. That would have provided more stimulus and avoided the problem posed by more than \$2 trillion of excess reserves. (Meltzer, 2014b, p.148)

In hindsight, one must acknowledge that few if anyone anticipated the depth and duration of the Great Recession of 2007-09, or the prolonged period of time during which Fed interest rate policy would be constrained by the zero lower bound. Many features of QE, as well as other aspects of the Fed's policy response, had to be improvised under stress, within an environment marked by both political and economic turmoil. Looking forward, however, Federal Reserve officials now have the chance to design, more deliberately, a robust set of strategies that will help the central bank achieve its monetary policy goals more effectively, in both good times and bad. In general, the Brunner-Meltzer model points to a need for the Fed to delineate more clearly the boundaries between monetary and credit policies, along the lines suggested by Goodfriend (2014), working with Congress to clarify what the Fed can and cannot do to stabilize the economy and the financial system during the economic crisis. In particular, the Fed should return to a "Treasuries only" policy, according to which it eschews direct interventions allocating credit to any specific sector of the economy and focuses, instead, on its traditional monetary policy role of using open market operations to maintain a credible regime of stable prices in the long run.

The Brunner-Meltzer model also points to the possibility that the Fed could minimize future disruptions to its policy procedures caused by the zero lower bound through institutional arrangements that would allow it use its control over the monetary base to exert greater influence on the growth rate of broader monetary aggregates. Reconsidering or modifying its interest on

reserves policies and the associated reverse repurchase agreement programs it established for nonbank financial intermediaries could help in this regard. Along the same lines it should be noted that the Federal Reserve has, for many decades, largely ignored information about the effects of its policies conveyed by the monetary aggregates. In Allan's view, "monetary policy without money is a serious mistake" (Meltzer 2014a, p.525). But this is a mistake that might easily be corrected if, as suggested by Belongia and Ireland (2018), the Fed adopted a "two-pillar" strategy like the European Central Bank's. During normal times the growth rates of broad monetary aggregates could serve as a "cross check" against the more conventional macroeconomic analyses conducted at the Federal Reserve Board and in the research departments at the Federal Reserve Banks, to ensure that the Fed's interest rate policies remain consistent with its commitment to long-run price stability. But then, in times of crisis when interest rate policy may again be constrained by the zero lower bound, money growth could take on a bigger role, as a focal point for open market purchases intended to achieve the same, unchanging goals.

Finally, any discussion of Allan Meltzer's model of the transmission mechanism would be incomplete without mention of the need for the Fed to adopt and announce a specific, monetary policy rule to guide its meeting-by-meeting decisions. Allan's arguments in support of rules leaned heavily on his view that the rigidities that allow monetary policy to have real effects in the short-run reflect private agents' imperfect information about the economy. But they also drew on the related observation, made more forcefully in Meltzer (1987), that policymakers, too,

lack the full and timely knowledge that they would need to successfully fine tune the economy through purely discretionary policy actions. In more detail, Allan argued that:

Support for rules is related to five monetarist propositions: 1) neither the central bank nor private forecasters can predict output, employment, inflation or other variables with sufficient accuracy to damp fluctuations on average; 2) lags are not constant; neither government nor private forecasters can distinguish between permanent and transitory disturbances to levels and growth rates until sometime after they occur; 3) the response of particular relative prices to monetary and other impulses in any cycle may differ from previous cycles depending on initial conditions, the nature of the shocks and the policy rule that is followed; 4) the private sector damps fluctuations and returns to stability if undisturbed by unanticipated policy impulses; and 5) rules that are easily monitored reduce costs of information. (Meltzer 1995, p.69)

Meltzer (1987) describes a rule that, unlike Milton Friedman's (1960) prescription for constant money growth and more akin to the Taylor (1993) rule for setting the federal funds rate, adjusts the growth rate of the monetary base in response to changes in output growth and monetary velocity. Like both Friedman and Taylor, however, Allan emphasized the benefits that would accrue if the Fed conducted policy with reference to any sensible rule that would make its actions more predictable and easier for the public to understand and would allow policymakers to focus their attention on intermediate-term developments instead of short-term noise. With specific reference to the Taylor rule, for example, Allan noted that

The years when Volcker was chairman are one of the few periods in which the Federal Reserve was less influenced by short-term events. Volcker followed the successful disinflation by relying for guidance on a Taylor rule after 1985. His successor, Alan Greenspan, continued that policy until 2003. This produced the longest period in Fed history of price stability with relatively stable growth, and short, mild recessions. The period is known as the "Great Moderation." I believe that the reduction in fluctuations is mainly the result of a rule-based policy that focused more attention in the medium-term than on current data. (Meltzer 2014a, p.535)

"History has an important message for theory and policy," he went on to say (Meltzer 2014a, p.535). The message is that nothing prevents the Fed from recreating the

conditions for stable inflation and robust economic growth, today and in the future. The first and most important step in doing so is for the central bank to announce and consistently follow a specific monetary policy rule.

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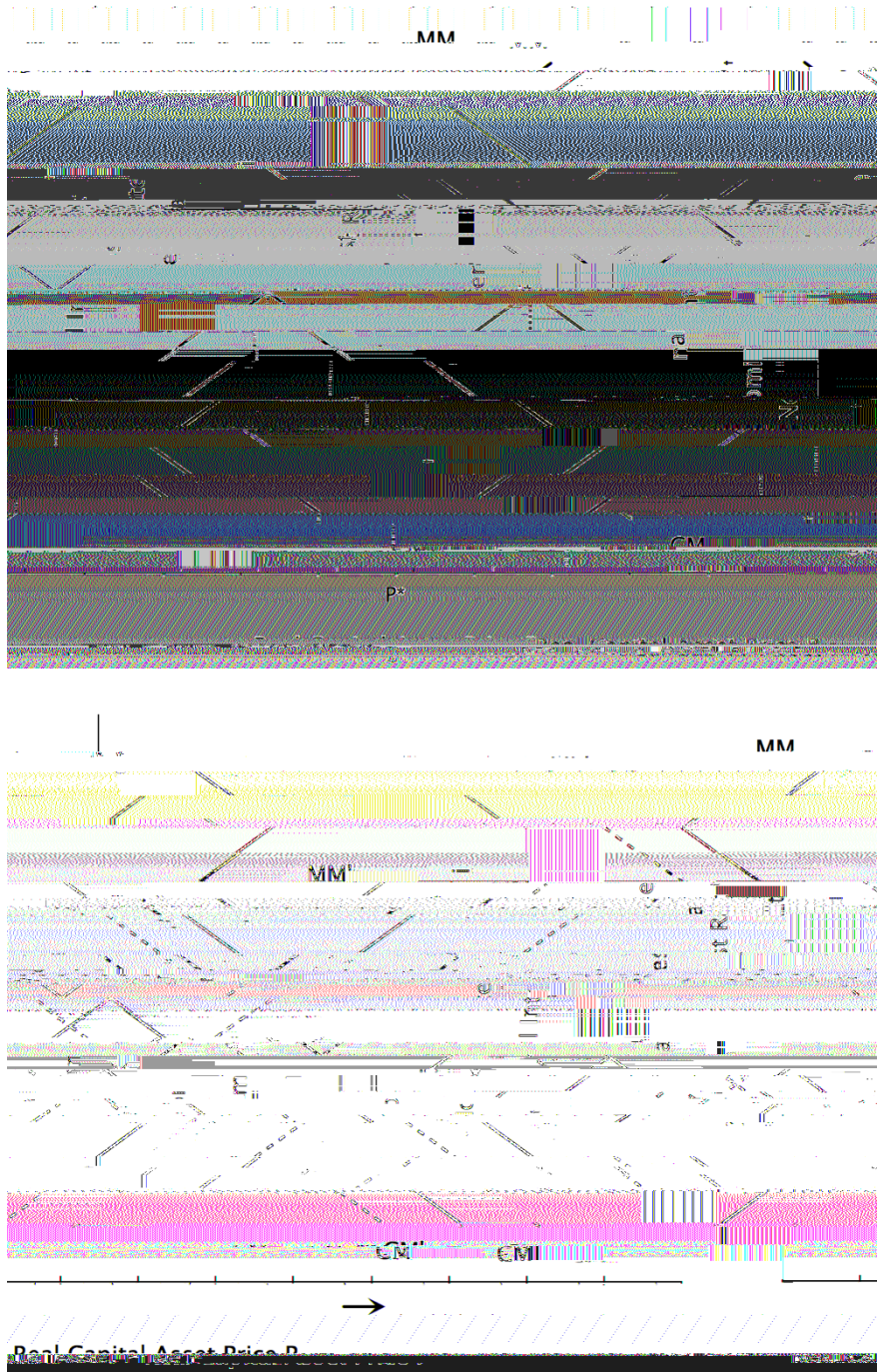


Figure 1. In the top panel, the upward-sloping MM curve and the downward-sloping CM curve intersect to determine the equilibrium nominal interest rate  $i^*$  and real price of capital assets  $P^*$ . In the bottom panel, an open market operation shifts the MM curve to the left and the CM curve to the right, lowering the interest rate and increasing the asset price.

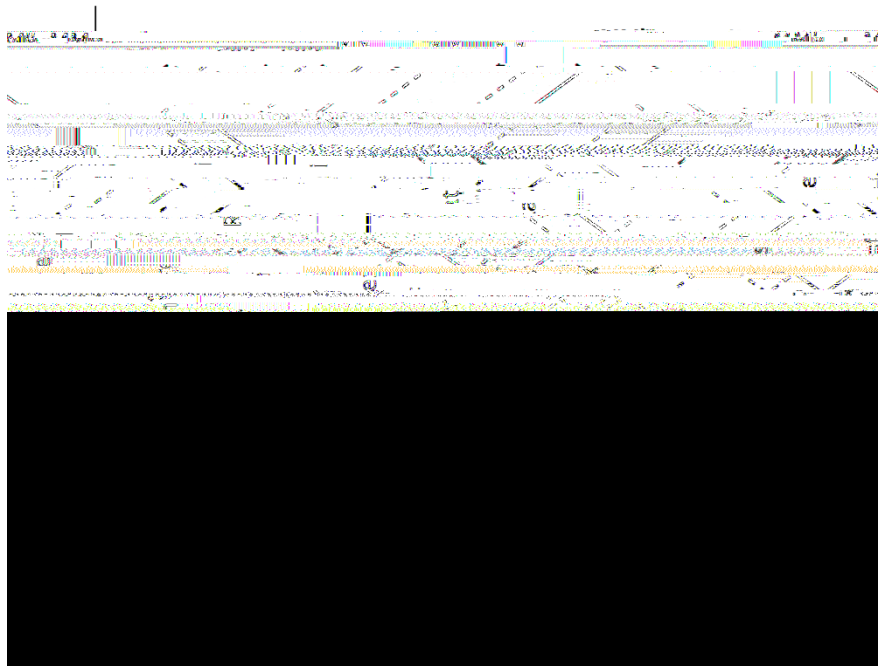
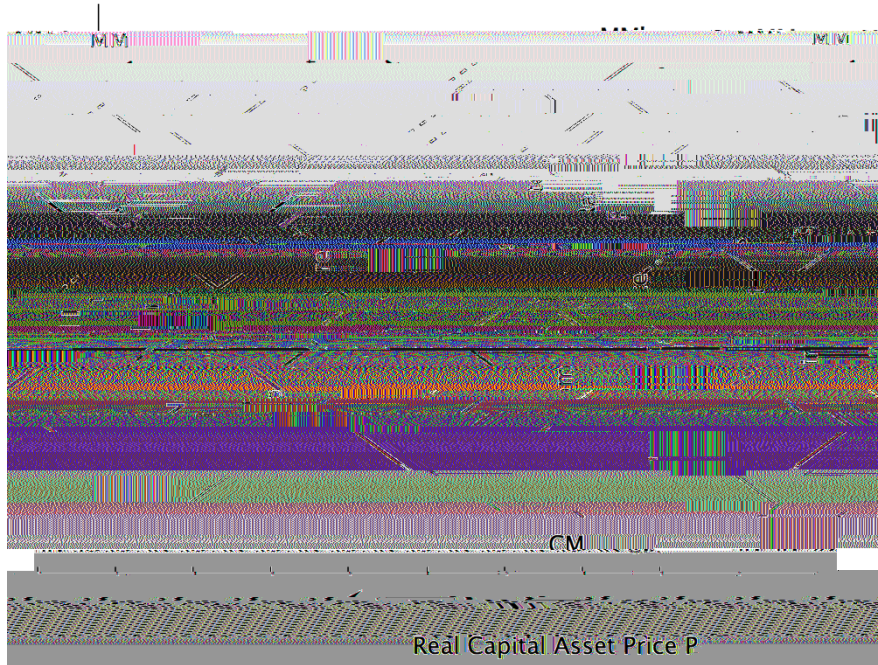


Figure 2. In the top panel, a shock that increases money demand puts upward pressure on the nominal interest rate and downward pressure on the asset price. In the bottom panel, the central bank conducts an open market operation to stabilize the interest rate, but the asset price still falls.

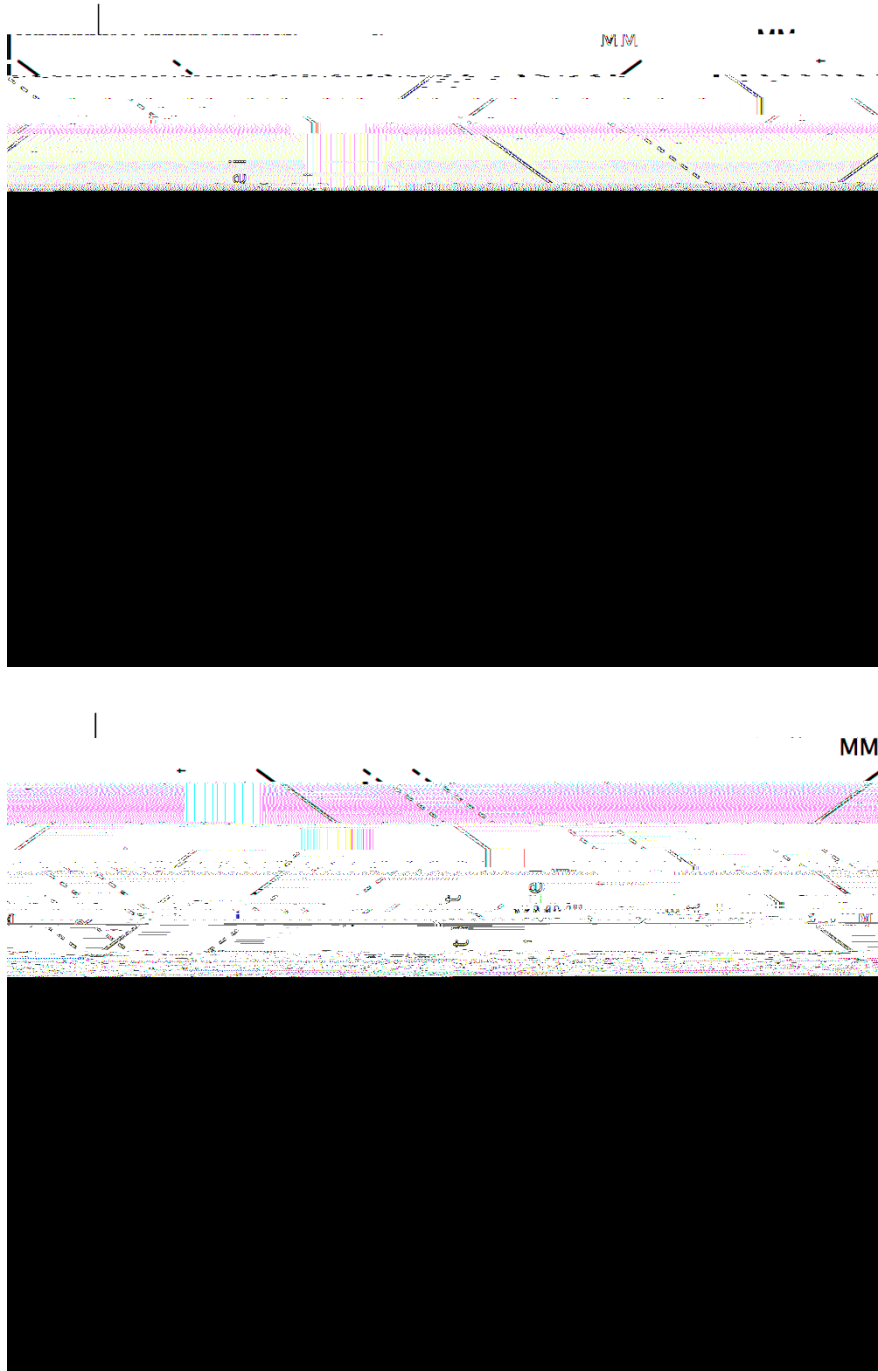


Figure 3. In the top panel, a shock that increases credit demand puts upward pressure on the nominal interest rate and the asset price. In the bottom panel, the central bank conducts an open market operation to stabilize the interest rate but, by doing so, magnifies the initial increase in the asset price.