

# Money Market and FOREX Analysis with Time Paths: Two Examples

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## Abstract

This presents two examples that utilize all the tools developed so far: money market analysis, FOREX analysis and the resultant time paths. The two cases considered are: (1) an increase in real GDP, and (2) a permanent increase in the nominal money supply.

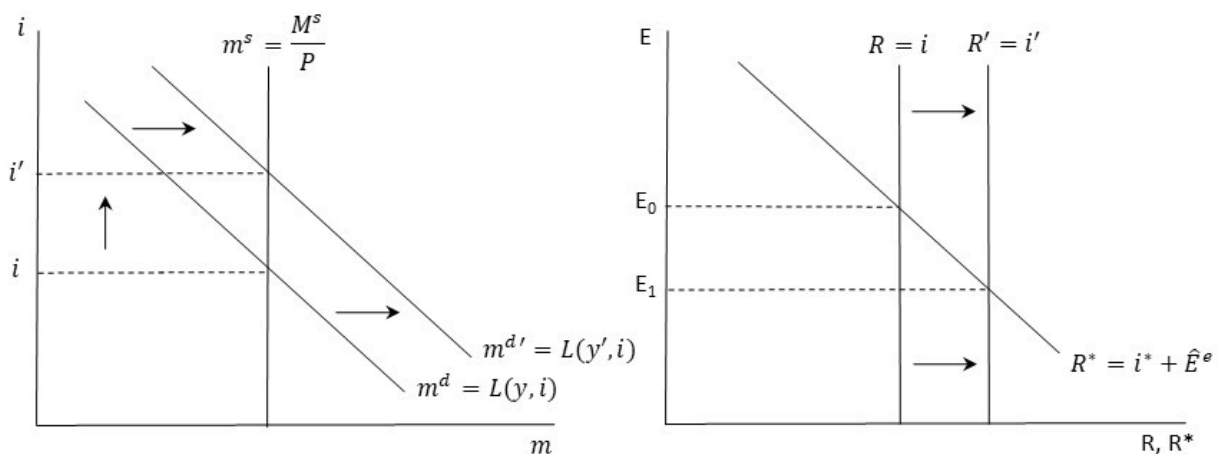
## 1 The Two cases explained

We will consider two cases that allow you to use all the tools developed so far. In each case the procedure is the same. First something happens in the money market. This moves the nominal interest rate. Then we take that information to the FOREX market and move curves to determine the movements in the exchange rate. Finally, we trace out the time paths of all the variables involved.

### 2 Case One: an increase in real GDP

Let's begin by considering the simplest example, an increase in real GDP. This will increase money demand in the money market, pushing interest rates up. The increase in interest rates leads to an increase in domestic returns in the FOREX market, pushing the exchange rate down (i.e., appreciating the domestic currency).

#### 2.1 Static diagrams



An increase in real GDP leaves everyone in the economy with more income and hence demanding more goods and services. They need to use money to buy the goods and services, so they naturally increase their demand for real money balances. In the aggregate economy, there is only a fixed supply of actual money (dollar bills in the USA) and so there is higher demand for a fixed supply. This higher demand bids up the value of each dollar bill and hence raises the cost of obtaining money. That is, it pushes up the nominal interest rate. Probably the most intuitive way to think of this is to imagine

everyone going out trying to obtain extra dollar bills by taking them out of their bank accounts. The banks need that money, however, because they use people's deposits to lend to other people. So banks have to offer a higher and higher interest rate on their accounts to convince people to leave their money in the bank. In the end, as is shown in the diagram, the higher demand for money didn't lead to more money, it just led to higher interest rates and the same amount of real money in the economy. The higher domestic return increases global demand for the domestic currency because global investors would like to move money into the domestic economy to take advantage of the higher returns. This effort and increased demand for domestic currency strengthens the value of the currency which is reflected in the drop in the nominal exchange rate which is, as a reminder, the domestic price of foreign currency.

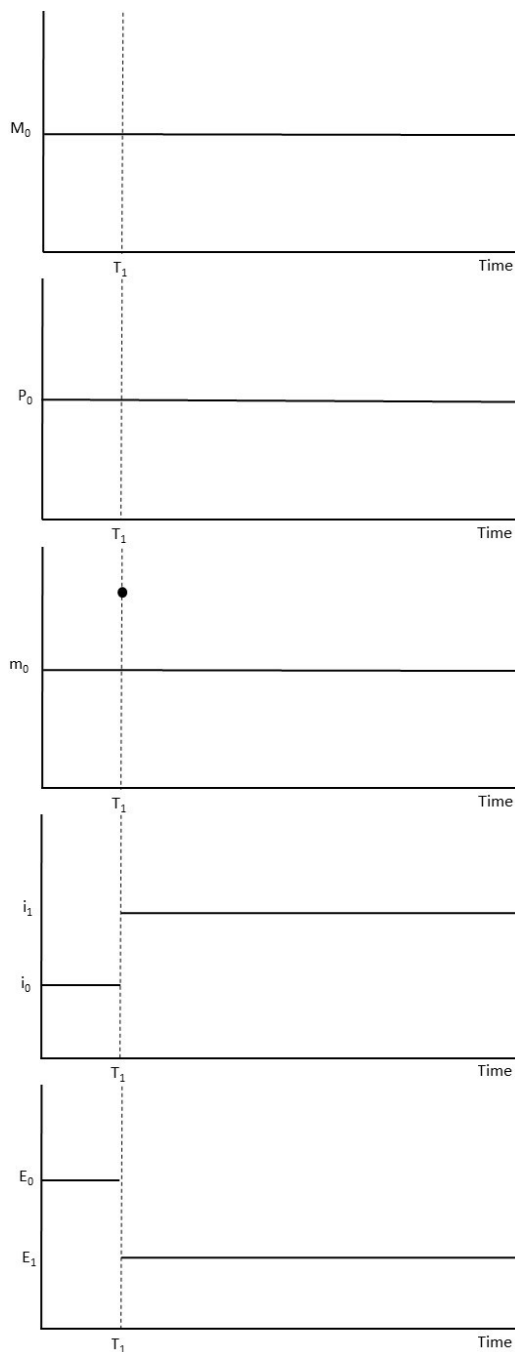
## 2.2 Time Paths

The time paths tell the same story in a slightly more dynamic way. Technically they are just tracing each variable that was already moved in the diagrams above. But they tell a bit of a story and I find it helpful to organize them in the following way: nominal money supply, price level, real money, nominal interest rates, and the nominal exchange rate. This is because (a) most of the action starts in the money market, often with a change in policy, i.e., a change in  $M^s$ , and (b) starting with  $M$ , then  $P$ , makes  $m$  easier since it's just  $m = M/P$ . As a final note, keep in mind that technically, the graphs are "natural log of  $M$ ", "natural log of  $P$ ", and "natural log of  $m$ " so that slopes translate into percentage changes. But we drop the natural log for simplicity's sake.

Going through the time paths in order. First, there was no change in the nominal money stock, therefore the first panel shows no change. Second, there was also no change in the price level, hence it too is flat. The third panel is essentially flat as well, but I've added a single dot to remind us that money demand increased. If even for a moment before interest rates adjust, that means there's a brief instance of higher real money demand than real money supply.

The fourth panel shows that the interest rate rose when real money demand increased and then remained higher permanently. This drove a decline in the nominal exchange rate, as shown in the final panel, which is also permanent.

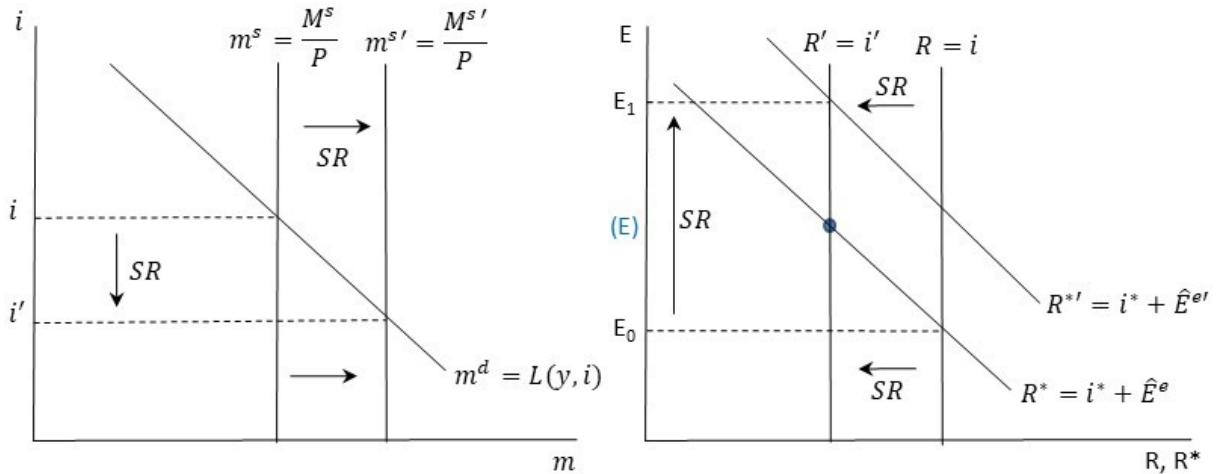
The increase in money demand is the easiest case because very few variables change and the changes are permanent. There is essentially no difference between the short- and the long-run. All changes either happen (or not) and then remain.



### 3 Case Two: an increase in the nominal money supply

Next consider the case of an increase in the nominal money supply. This will now generate a short run response and a long run adjustment as prices adjust.

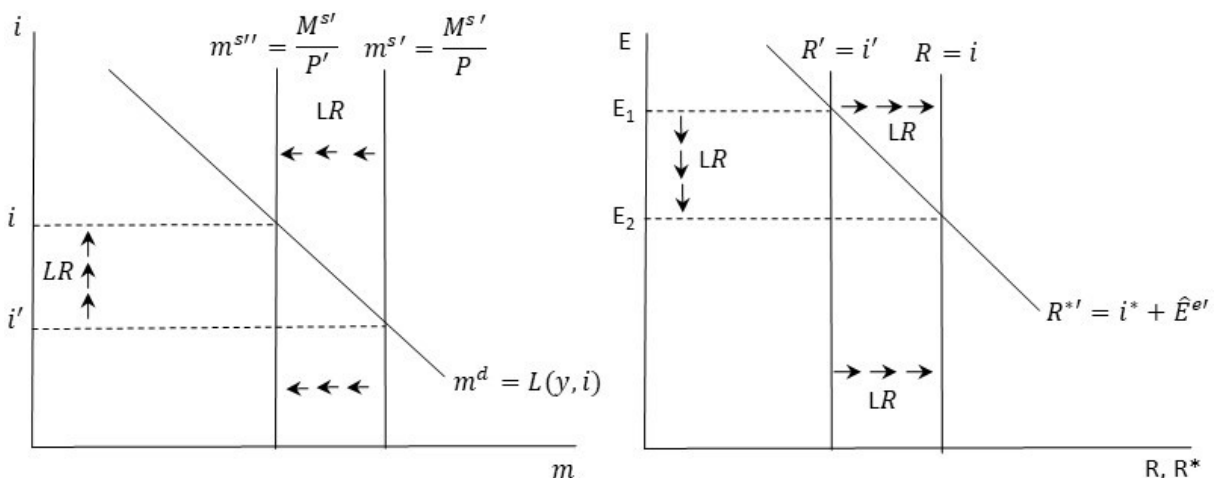
#### 3.1 Short run: static diagrams



The immediate effect of an increase in the nominal money supply is to increase the real money supply and push interest rates down. Demand for money hasn't changed but suddenly there is an extra supply of money flooding the market. This glut means banks don't have to offer as high an interest rate to encourage people to leave their money in the banks since the extra money in the market.

The drop in the interest rate lowers the domestic returns for all global investors and hence lowers demand for the domestic currency. This alone increases the nominal exchange rate (to  $E$  on the diagram). But because all participants in the market know an increase in the money supply will eventually lead to higher inflation, they build higher future inflation into their expectations now, increasing the  $\hat{E}^e$  component of foreign returns,  $R^*$ , shifting that curve to the right in the diagram. This pushes the exchange rate even higher to  $E_1$ .

#### 3.2 Long run: static diagrams



The long-run looks quite different though. As every individual attempts to spend their extra cash, they all find that fundamentally nothing changed in the economy. So there's not been a boom in capital or technology or labor or anything leading to an actual increase in production. As a result,

every consumer just has more cash but the same number of goods are on the shelves. As everyone tries to collectively spend their extra money, all they do is push prices up. Since the price level is on the denominator of  $M^s/P$ , this increase in the price level shifts the real money supply curve back to its original position, completely undoing the effect of the initial increase in nominal money.

In the FOREX market this slow return of the domestic interest rate to its original level means that the domestic return line,  $R$ , shifts rightward slowly. The foreign return line,  $R^*$ , doesn't move again since foreign interest rates are unchanged and market participants built inflation expectations into their calculations already. This means that the exchange rate falls to  $E_2$  as domestic returns rise.

### 3.3 Time Paths

Here is where the time paths are much more informative about what's happening. The first panel shows the increase in the nominal stock of money. This was the policy change by the domestic central bank that sets all the pieces into motion. The second panel shows the effect of this when the price level is slow to adjust. Yes, prices will eventually rise by the amount of the money added to the economy, but it takes time to work through the system. As a result, prices begin to rise initially but don't reach their new, higher level for awhile.

The first two panels combine to tell us what's happening to real money balances in panel three. Since real money is just nominal divided by the price level,  $m = M/P$ , it is clear that real money must jump upward upon impact of the increase in the nominal money stock. As prices slowly rise, the real money level slowly declines until it is eventually back to its original level.

The diagram in short run and long run traces the path of the interest rate. What's not clear in the diagram, but comes out in the time path is that interest rates jump downward but then slowly crawl back up. Again, this is because the money supply change hits immediately but the price level adjustment takes time.

Finally, the exchange rate panel displays a classic "overshooting" pattern. This is due to the initial shift in expectations. Again, on impact of the change the exchange rate jumps upward. But the jump happens for two reasons and is thus "twice as high" as it would otherwise be. The first jump is due to the domestic returns suddenly dropping and the second jump is due to the expectations of future inflation shifting the foreign return line as well. As a result, the exchange rate initially jumps over its new long-run level and slowly declines down to it as prices slowly adjust bringing domestic returns back to their original level.

