



Mattress Money

Students sometimes ask if saving in the form of placing cash under a mattress can decouple the link between saving and investment. This paper provides a discussion of this question for students who are in the early stages of their principles of macroeconomics course.

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1. Introduction

On several occasions, I have received the question below from students in principles of macroeconomics classes:

“If an individual saves by making bank deposits, then the bank can lend to a firm who invests. However, if an individual saves by storing cash in a mattress, that cash never reaches a firm who wants to invest. If there is no investment to match the saving, then saving and investment cannot be equal, right?”

The purpose of this article is to provide students with an answer to the question raised above. My belief is that this is a fairly common question; however, I have not seen any textbook that discusses it. A Google search turns up a single result on the topic, from Wikipedia:

“... increased saving does not always correspond to increased investment. If savings are stashed in or under a mattress, or otherwise not deposited into a financial intermediary such as a bank, there is no chance for those savings to be recycled as investment by business.” (<https://en.wikipedia.org/wiki/Saving>, accessed on July 20, 2016).

This statement nicely describes what I will call “the paradox of mattress money.” Unfortunately, its conclusion is incorrect.

2. Saving and Investment

In my principles of macroeconomics class, the question at hand arises in the context of an introduction to saving and investment. This topic is covered early in the course; in particular, it precedes textbook chapters that introduce money, the banking system, the money supply process, and monetary policy. It also precedes any discussion of Keynesian macroeconomics.

In most principles texts, the treatment of savings and investment makes two key points. The first concerns national income accounting. Specifically, national income accounting identities (for a closed economy) imply that national saving is equal to investment. Beginning with this identity:

$$Y = C + I + G$$

and defining saving as:

$$S = Y - C - G$$

we infer that:

$$S = I$$

This is the first key result which is, of course, true by definition.

The text then considers how levels of saving and investment are determined in equilibrium. Savers (households) and investors (firms) interact in the “market for loanable funds.” In this market, the real rate of interest will rise or fall to assure that the separately formulated plans of savers and investors will be consistent in equilibrium—planned saving will be equal to planned investment. This is the second key result.

While students often confuse the two key points, there is an important distinction between them. The national income accounting identities imply that actual saving must always be equal to actual investment. The second result applies to equilibrium situations, and implies that planned saving will equal planned investment. Of course, in a disequilibrium situation, planned saving and planned investment can diverge. In such a case, unplanned changes in inventories will still preserve the national income accounting identity.

3. The Student’s Question

Now let us return the student’s question. Suppose that an individual receives income and decides to save by placing money under a mattress rather than by making a bank deposit or purchasing a bond. Saving occurs since some income is not used for current consumption. However, the cash in the mattress seemingly never reaches the market for loanable funds, and the link between saving and investment appears to be short-circuited. This is the paradox of mattress money.

One possible response to the student is to note that if someone saves more and does so by hoarding cash, then firms will see sales decline. Inventories will build, and the unplanned addition of inventories will provide an increase in investment to match the increase in saving. This response may satisfy students and also has the virtue of not being completely incorrect.

However, this response is really a deflection of the question. A sudden change in saving behavior can produce the result described above regardless of whether added saving takes the form of hoarding cash in a mattress, making a bond purchase, or making a bank deposit. The proposed answer therefore fails to address the specific question about saving in a mattress.

To give a better answer, we should recognize that the student is really asking about the consequences of a change in the form of saving, not a change in the amount of desired saving. For this revised question, the answer offered above is clearly unsatisfactory. Since there has been no change in desired saving, there should be no direct change in planned consumption nor should there be unplanned inventory investment. But funds available for investment seem to have been diverted from the market for loanable funds.

Several examples below will help to resolve the paradox. In providing an explanation, I will initially be making three key assumptions. First, aggregate output will be assumed to be constant. Second, all money is in the form of currency. Third, the total quantity of money is fixed. The fixed output assumption is a natural one to make. In my class, students have just learned that output is determined by technology and available resources by way of an aggregate production function. Neither technology nor resources have changed as a result of cash hoarding, so it is reasonable that output should be unchanged. Further, since students have not yet been introduced to any detailed discussion of the money or the banking system, a focus on the simplest possible monetary environment is warranted. These assumptions place the discussion in the context of a “classical” macroeconomic model. In a later section, I discuss some extensions to a Keynesian macroeconomic environment.

A. Example 1

Suppose that Saeed receives income of \$1,000 this month. He consumes \$800 and saves \$200. Further, suppose that Saeed uses the \$200 to purchase a bond issued by Corporation A. In effect, Saeed is lending \$200 and Corporation A is borrowing \$200 in the market for loanable funds.¹ The firm uses the cash to purchase equipment, so investment is also equal to \$200. We clearly see that Saeed's saving is channeled into the corporation's investment. In the market for loanable funds, the real rate of interest will be at a level that assures that the plans of all savers and investors, including those of Saeed and Corporation A, are consistent. We have just covered the usual textbook scenario.

B. Example 2

Now suppose that Saeed again saves \$200, but he does so by placing cash under his mattress instead of purchasing a bond. Since Saeed earned \$1,000 and consumed \$800, we know that his saving is \$200. The paradox is that the \$200 of saving has not reached Corporation A.

Recall that we have assumed that the stock of money is fixed. This implies that if Saeed is holding more money, someone else must be holding less. Moreover, Corporation A is still looking to sell a \$200 bond. Suppose that another individual, Manal had been holding some cash, but is indifferent to holding \$200 of cash or a \$200 bond issued by Corporation A. Manal purchases the bond and sends \$200 to Corporation A. Corporation A now has the funds it needs to carry out its planned investment of \$200. Saeed is saving \$200 and Corporation A is investing \$200, so saving is equal to investment. Moreover, Manal's reduced money holding matches Saeed's increased money holding, as is required by the fixed money stock assumption.

One might ask if Manal has increased her saving, since she has purchased a bond. Fortunately, the answer is no—Manal has exchanged one asset (money) for another (bonds), but she has not deferred any additional income from consumption to saving. Manal has simply facilitated the movement of resources from Saeed to Corporation A by altering her portfolio.

C. Example 3

There is an alternative way to describe the outcome in the previous example. Suppose that Saeed proceeds in two steps. First, he earns \$1,000 and uses \$200 to buy the Corporation A bond, exactly as in Example 1. In doing so, he is making a decision about saving. Then, he decides he would really rather hold money than the bond—this is a decision about portfolio allocation. So he agrees to trade his \$200 bond to Manal, who gives him the cash. Again, Saeed saves \$200, Corporation A invests \$200, and Manal has rearranged her portfolio. Total holdings of money equal the fixed supply. The implications for saving and investment are the same in all three examples: saving remains equal to investment.

4. More Questions?

At this point I normally end my classroom response. However, students might still have

¹ The same transaction could also be accomplished via a financial intermediary. In that case, Saeed would make a bank deposit, and the bank would provide a loan to Corporation A.

some questions. It seems that Manal stepped in to rescue us from the paradox of mattress money with no particular private motive. We have noted that if Saeed holds \$200 more wealth in the form of money, then someone must be holding \$200 less. However, just because someone must hold less money does not tell us why someone will step up and volunteer to hold less money. If Manal was happy with the division of her assets between money and bonds before she was approached by Saeed, she might decline his offered exchange.

So, what makes others willing to hold less money when Saeed holds more? At this point in the course, this is a difficult question to answer. However, it is possible to sketch an answer for a persistent student, and I would proceed as follows. By holding cash in his mattress, Saeed has reduced the amount of cash that is circulating throughout the economy in pursuit of goods—a smaller quantity of money is now chasing the same quantity of real output. This puts downward pressure on the average level of goods prices. But with goods prices lower, individuals like Manal find that they can hold smaller amounts of cash and still complete their normal transactions. Because of this, they will be happy to hold less cash when Saeed holds more.

Later in the course, when students have studied the money supply process and more complex macroeconomic models, an alternative motive for Manal to hold bonds instead of cash will emerge. Saeed's action will cause a drop in the money supply and an increase in the interest rate, which in turn will make holding bonds more attractive relative to holding money. More discussion of this process follows in later sections of this paper.

5. A Mirror Image Paradox

We can also address a mirror-image paradox. In the following example, we ask whether money printing by a central bank might permit firms to invest without requiring households having to save.

A. Example 4

Suppose that Corporation A wishes to invest. Just as it is about to issue a \$200 bond to finance its investment, the central bank prints \$200 in cash and awards it to the company as a prize.² Now, it seems, the company has funds for investment, but no one needs to save! Does investment exceed saving?

To resolve this paradox, we can tell a story that is analogous to the one presented above. First, suppose that Corporation A obtains \$200 for investment by selling a bond to Manal. Manal is saving \$200 and Corporation A is investing \$200. This is the standard story.

Now suppose that the central bank awards a \$200 prize to Corporation A, who immediately buys the bond back from Manal. Notice that investment is still the same at \$200. Manal is still saving \$200, but instead of holding a bond she has increased her holdings of money. Because the stock of money has increased, someone must be holding more money, and in the example it is Manal.

Again, a persistent questioner might ask why someone like Manal would volunteer to hold more money. Following our earlier logic, with more cash in circulation, we have more dollars

² For simplicity, I am considering what amounts to a "helicopter drop" of money. This conceptual device has been employed by Milton Friedman, Ben Bernanke, and many others.

chasing a given quantity of goods, and the price level will rise. Individuals will want to hold more money to complete their normal transactions, so someone will be willing to hold the added money.

6. Fractional Reserve Banking

So far, I have assumed that all money takes the form of cash. Later in the principles course, students will learn that demand deposits are money, and that money can be created or destroyed by banks in a fractional reserve banking system. In this setting, when an individual diverts cash to the mattress, the supply of money falls and the volume of bank lending contracts. However, since bank lending provides a channel for saving to reach investors, the paradox of mattress money resurfaces.

Of course, saving must remain equal to investment and our earlier argument can be reconstructed in a world with fractional reserve banking. I will present this argument in Example 5. In doing so, I will continue to maintain the classical assumption that output is fixed.

A. Example 5

For this example, assume that banks have a required reserve-to-deposit ratio equal to 0.20 and that banks hold no excess reserves. Initially, households hold all money in the form of demand deposits. However, Saeed decides that he wishes to move some funds out of his bank account and instead hold cash. Specifically, he withdraws \$200 from Bank A and places it under his mattress. Note that he is not changing the amount he saves; he is simply choosing to move wealth from his bank account to the pile of cash under his mattress.

Bank A, having lost deposits, finds itself in need of reserves. Its reserves have fallen by \$200 and its required reserves have fallen by only \$40; this leaves Bank A \$160 short of its requirement. Bank A can remedy its reserve shortfall by withdrawing a line of credit to Corporation X, which currently has a loan balance of exactly \$160. I assume that Corporation X then issues and sells a \$160 bond to Bertram so that it can repay its loan to Bank A.

How does Bertram pay for the bond? He writes a check for \$160 on his account at Bank B. This means that Bank B has lost a \$160 deposit. Required reserves at Bank B fall by \$32, leaving the bank \$128 short of its reserve requirement. To remedy the shortfall, Bank B then withdraws a line of credit to Corporation Y, who currently has a loan balance of exactly \$128. To pay off its loan balance, Corporation Y sells a bond for \$128 to Charlie.

Events continue to follow in a repeated manner. Charlie pays for his bond with a check written on his account at Bank C; Bank C finds itself short of reserves and withdraws a line of credit to Corporation Z; Corporation Z issues and sells a bond to pay off its loan, and so on. Deposits and lending both contract in conventional fashion as the money multiplier works to decrease bank lending and the supply of money.

When Saeed withdraws cash from the bank he is not reducing his saving, he is just changing the form in which he saves. However, banks are no longer channeling his saving to investment. Even worse, it appears that the workings of the money multiplier cause total lending to fall by more than Saeed's initial withdrawal. Now the paradox of mattress money is amplified by the money multiplier!

Fortunately, the paradox is again illusory. In the example, each bank loan that disappeared was replaced by the sale of a bond. Apart from Saeed himself, individuals hold more bonds and less money, but they do not change their saving. Firms fund investments by issuing bonds instead of borrowing from banks, but they do not change the amount that they invest.

The only remaining question is whether individuals would readily agree to hold less money and more bonds. The answer parallels that given before. Because the money supply has contracted, someone must hold less money. Because the reduced money supply puts downward pressure on the price level, individuals are willing to hold less money.

I will spare the reader an analysis of the mirror image paradox (previously considered in Example 4 above) in an environment with fractional reserve banking environment. In that example, the central bank printed money to directly fund a firm's investment. As one would guess, the result of this thought experiment will be that printing money does not cause investment to differ from saving.

7. Keynesian Macroeconomics

Thus far the analysis has been framed in the context of a classical macroeconomic framework in which output is constant and prices are flexible. This makes the argument simpler, especially when the topic of saving and investment is presented early in the course. However instructors should think about how the analysis would change in a Keynesian world. This section is therefore written primarily for instructors, not for students who are unfamiliar with the Keynesian model.

I will consider two scenarios for the Keynesian model analysis. In the first scenario, the central bank permits increased cash holding to decrease the money supply. In the second scenario, the central bank keeps the interest rate unchanged, which means that it must undertake open market operations to offset the change in the money supply.

A. Scenario 1

In a Keynesian context, increased cash-holding by Saeed reduces the supply of money, as it did in Example 5. Prices are slow to fall in the Keynesian environment, and with sticky prices, the rate of interest must rise to equate quantities of money demanded and supplied. This rise in interest rates also induces individuals to hold more bonds (and less money). As in the earlier examples, it is the willingness of individuals (other than Saeed) to hold more bonds that resolves the paradox. Firms can continue to invest as long as there are buyers for their bonds.

The primary complication of the Keynesian model comes because a higher interest rate reduces planned investment. With the reduction in planned investment, output and income will fall, which also causes saving to fall. The interest rate must adjust to equilibrate both the goods and money markets, so the reductions in investment and saving will be equal to each other. Although Saeed's action causes both investment and saving to change, they change by equal amounts, and the equality of saving and investment is preserved.

It is useful to note that it was not Saeed's diversion of cash to the mattress that directly reduced saving in the Keynesian model. Rather, the money supply reduction caused a higher interest rate, which caused a decline in output, which caused the decline in saving. We should also note that in the long run, when prices fully adjust, the outcomes in the Keynesian model

would replicate those described earlier for a classical model.

B. Scenario 2

In today's real world, central banks primarily target interest rates. This permits a very simple resolution of the paradox in a Keynesian setting. When Saeed chose to hold more cash in Scenario 1, this created pressure for the interest rate to rise. Now we suppose that the central bank intervenes to prevent the interest rate increase; it can do this by purchasing the bond that Saeed no longer wishes to hold. This action precisely offsets Saeed's move, and keeps both the rate of interest and the money supply unchanged. Saeed is still saving and the firm still sells its bond (now to the central bank), and therefore it still receives funds for investment.

This answer is so simple that an instructor might consider making it the first answer to give to students. I chose not to, for two reasons. First, at this point in the course, students are not yet equipped to understand why there is pressure for the interest rate to rise, nor will they understand how an open market operation can relieve that pressure. Second, a good answer should not require that the central bank adopt a particular operating procedure. A good student could always ask the follow-up: "What if the central bank doesn't target the interest rate?"

8. Summary and Conclusion

The loanable funds market channels saving to investment. When that market is in equilibrium, planned saving must equal planned investment. However, if individuals save by storing money in a mattress, it seems that there is no mechanism for saving to be channeled into investment. I call this the paradox of mattress money. This paper provides a resolution to the paradox for students of principles of economics.

The essence of the argument is that loanable funds that are displaced by increased cash holding by some individuals are replaced in equal amount by loanable funds (bond purchases) from those who have been induced to hold less money. In a classical macroeconomic environment with output held constant, aggregate saving and investment are unchanged and the equilibrium in the market for loanable funds is undisturbed. The only changes are to holdings of money and bonds in individuals' portfolios. The argument is also extended to a Keynesian environment in which increased cash holding causes a money supply reduction and changes to both interest rates and income in the short run.

References

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Appendix A – More Questions for Classroom Discussion

The issue of saving in the form of cash is not just a common one, but also one with real-world relevance. Grant (2015) and Kane (2015) can serve as the basis for an extended discussion of saving in a mattress that goes beyond the saving-investment relationship explored in this paper.

Below I list some questions that an instructor can ask after students have read the articles, along with some answer notes:

1. Why have more people been saving by accumulating cash since 2008?

One article suggests that Americans are less likely to trust banks following the financial crisis in 2008. Another reason is that the opportunity cost of holding cash has fallen in a period with extremely low interest rates.

2. Can you think of any reason that millennials are especially likely to save cash in a secret hiding place?

I would speculate that millennials have become very accustomed to paying for goods with debit or credit cards. Often individuals who wish to save devise tactics to constrain their own consumption. Since cash in a mattress is difficult to quickly access, it may be a way to protect one's saving from the urge to spend, which is very easy with a debit card.

3. What is deposit insurance?

Bank deposits are insured up to \$250,000 in the United States by the Federal Deposit Insurance Corporation. This means that the large majority of bank deposits are safe, even when a bank fails.

4. Why is saving in a mattress more costly when inflation and interest rates are high?

The interest rate represents an opportunity cost of holding cash, so high interest rates imply that holding cash is more costly. If inflation is high, cash loses its purchasing power in terms of buying goods. This means that holding cash is costly compared to holding assets whose values grow with inflation.

5. Storing large amounts of cash in a hidden place is probably a bad idea. Why?

As noted in the answer to the preceding question, cash does not earn interest and its purchasing power declines when prices rise. Moreover, holding cash is risky because of the possibility that it could be stolen or destroyed in a fire or natural catastrophe, or it could simply be lost.

6. While accumulating one's life savings under a mattress is probably a bad idea, holding a small amount of cash in a secure hiding place might be a good idea. Why?

Holding a modest amount of cash is probably a good idea. Natural disasters or massive cyber-attacks have the potential to shut down banking systems and credit card networks, so that electronic payments would be difficult to make. Under these circumstances, it would be helpful to have some cash. There is an intrinsic difference between holding a modest amount of cash for an emergency and using a mattress to store savings that accumulate over one's working lifetime.