

Economic Research:

Negative Interest Rates: Why Central Banks Can Defy "Time Preference"

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Assets (A) = Reserves (R) + Government Deposits (GD) + Banknotes (BK)

Or in change terms as:



Rearranging shows what determines changes in the level of reserves:

$$\Delta R = \Delta A - \Delta GD - \Delta BK$$

Three, and only three, things influence the level of reserves:

(1) Assume:

$$\Delta A = \Delta GD = 0; \text{ then } \Delta R = -\Delta BK.$$

Reserves go down when banknotes in circulation go up (and vice versa). The reason is simple: When you take \$100 out of an ATM, the bank has to debit its account at the central bank for that amount. After all, the money the bank gives you is a liability ("debt") of the central bank, and the bank has to take that money out of its account at the central bank for it to be able to give the money to you.

(2) Assume:

$$\Delta A = \Delta BK = 0; \text{ then } \Delta R = -\Delta GD.$$

Reserves go up when government deposits at the central bank go down (and vice versa). The reason is simple: When the government hands over more money to the public than it takes in (runs a budget deficit), the public has more money in their bank accounts by just that amount, which is a liability of the bank, and that liability is matched on the asset side of the bank's balance sheet by an increase in its deposits with the central bank. But, if the government is running a budget deficit, which is the normal and desirable case because that is one of the two main ways in which money is created in modern economies (3), how does it have any money in its account at the central bank to run down? Easy: it issues bonds. When the government issues bonds, it takes money from the public (the same money it created when it ran the deficit); its deposits at the central bank go up by that amount, and reserves go down.

(3) Assume:

$$\Delta GD = -\Delta BK = 0; \text{ then } \Delta R = \Delta A.$$

Reserves go up when the central bank acquires assets (and vice versa). The reason is simple: Unlike you and I, a central bank can create ("print") money out of thin air. If this sounds a lot like QE, it's because it is. The basic equation

of QE is:

$$\Delta R = \Delta A$$

It is also the basic equation of monetary policy in normal times.

How does all of this allow the central bank to set interest rates? The central bank, at any point in time, can control the amount of reserves (deposits) the banks hold with it. By observing the effect of the two other factors (the public's demand for banknotes and the government's transactions with the public), the central bank knows (roughly) the level of reserves that will obtain and can add or subtract from that at will by adjusting its asset holdings (in the textbooks, fancily termed "open market operations"). The central bank's control over the aggregate amount of reserves gives it control over the short-term interest rate at which banks lend reserves to, and borrow reserves from, one another. Banks need reserves because that is how money (cash) gets into the economy, and because the central bank requires banks to hold a certain amount (called "minimum reserve requirements").

Because the central bank can always determine the aggregate amount of reserves, it can also determine the interest rate in the interbank market for those reserves. Prior to the financial crisis, central banks generally did not pay interest on reserves. But, even so, they could control the short-term interest rate, by carefully adjusting the aggregate amount of reserves around the amount implied by total minimum reserve requirements, draining reserves if the interest rate was lower than their target policy rate and adding reserves if it was higher.

But central banks can also control the short-term interest rate by setting the interest rate they pay on reserves at a rate different from zero, instead of adjusting the amount of reserves to be in line with minimum reserve requirements. This is useful when the central bank is doing QE because, under QE, the level of reserves is far in excess of minimum requirements (there are "excess reserves" in the system), and these excess reserves would otherwise force the short-term interest rate to zero (or very close to it); after all, what bank that already has too many reserves (because it is on the receiving end of QE) would want to borrow more at a positive interest rate only to have to keep these on deposit at the central bank at a zero interest rate? Only one that was operating in a distressed environment and was either facing severe counterparty risk or susceptible to a run on its liabilities.

Why Negative Rates Come So Unnaturally

When a central bank lowers its policy rate, it is aiming to lower borrowing costs in the real economy. The short-term (overnight) interest rate in the interbank market for central bank money is not very important in and of itself, but the term structure theory of the yield curve teaches that the central bank can and does influence the longer-term interest rates that borrowers in the real economy respond to via market expectations for the future path of the policy rate. So, for instance, if the central bank could convince market participants that it is going to hold the short-term interest at zero for an extended period, say for three years, interest rates along the yield curve out to three years should fall close to zero (the so-called "term premium" will keep rates somewhat positive), and interest rates beyond that point on the yield curve will also be lower than otherwise because they will incorporate the effect of the flattened yield curve out to three years.

Rather than setting the short-term rate at zero, what if the central bank makes it negative? Will interest rates in the real economy become negative too? The answer, in general, is no.

It is useful to think of four kinds of interest rates, and consider these in turn.

The first is the interest rate the central bank applies to reserves. As we have seen, because the central bank can force banks to hold reserves, it can also implement a negative interest rate. In principle there is no limit on how negative this interest rate could go, although at some point the implied tax would probably kill off the banking system!

interest rates (e.g., finance companies that warehouse large amounts of cash in heavily fortified premises and issue receipts, and checking and other settlement services, on those "deposits").

A third interest rate is the lending rate that banks charge their borrowers. If banks were able to borrow at a negative rate, conceivably banks might be prepared to lend to some borrowers at a negative interest rate, as long as the spread between the deposit and lending rate was sufficiently positive. But given that deposit rates cannot go more than marginally negative because of the flight to cash and competitive forces in a world of positive real rates of return, banks will hardly be willing or able to lend at negative rates.

A fourth interest rate is the lending rate that people or nonbanks with cash on hand can charge for the use of their money (such as through peer-to-peer lending or crowd-sourced microfinance). Again, the strategy of keeping the money on hand (as cash or a zero interest rate deposit) dominates the strategy of lending it at a negative interest rate.

somewhat confusingly, the third component the "macro add-on"); and

- Apply a negative 10 bps interest rate to the rest (the BOJ calls this the "Policy Rate Balance").

By construction, the total amount of current account balances held by financial institutions equals the sum of the Basic Balance, the Macro Add-on Balance, and the Policy Rate Balance. When the BOJ announced the new policy framework, it did not give any estimates of the breakdown of the total into these three components as of today, but logically the Policy Rate Balance, to which a negative rate is to applied, must be quite small. This is because, as per the central bank balance sheet identity analyzed earlier, total current account balances today should roughly equal total minimum reserve requirements plus the excess reserves created by QQE and by the BOJ's lending programs.

True, two other things can influence the amount of current account balances: changes in banknotes in circulation and changes in government deposits at the central bank. But banknotes in circulation tend to increase over time and, thus, are a net drain on reserves (6). If anything, this would cause the Policy Rate Balance today to be a negative amount! And the impact of changes in government deposits on reserves over time tends to be neutral because the issuance of government debt, which drains reserves, offsets the reserves created by the government running a budget deficit in the first place.

Over time, the BOJ's QQE will create a lot more excess reserves, and under the formula announced by the BOJ, if nothing else changes, these excess reserves will show up as increases in the Policy Rate Balance and attract the negative interest rate. The BOJ will be "forcing" banks to hold more reserves and taxing them for the "privilege" at the same time! But that is where the third component (the "macro add-on") of the Macro Add-on Balance cleverly comes in: The BOJ is saying that excess reserves will increase, and as they do, it will reassign a portion from the negative interest rate bucket to the zero interest rate bucket. In effect, the BOJ can do its sums and calibrate the "macro add-on" to make the Policy Rate Balance as small as possible--thus minimizing the negative impact of the negative interest rate policy on bank profitability--while ensuring that the marginal excess reserves being created are charged a negative interest rate.

As it happened, the BOJ subsequently announced on Feb. 3, 2016, its estimates of the breakdown of the three categories to which the respective interest rates would be applied and some guidance on how these might change in the future (7). Specifically, the Basic Balance currently is about ¥210 trillion, the Macro Add-on Balance is about ¥40 trillion, and the Policy Rate Balance is about ¥10 trillion. Thus, only about 4% of total current account balances would attract the negative interest rate.

However, as the BOJ is adding to the monetary base at the rate of ¥80 trillion per year, unless something changes, the Policy Rate Balance stands to increase at that rate. To offset that, the BOJ announced that: "taking account of conditions such as those of short-term money markets in Japan after the introduction of the negative interest rate, the Policy Board will decide on the frequency as well as the amount of adjustments in the Macro Add-on Balance in the future." The BOJ has confirmed that, as explained above, as it expands the monetary base, thus automatically adding to the Policy Rate Balance, it can reduce the Policy Rate Balance by adjusting the size of the Macro Add-on Balance as necessary.

The BOJ is putting store in the fact that it is only at the margin that negative interest rates need to operate in order to have a broader financial market easing effect. Here is how the BOJ explains its thinking:

"A negative interest rate is expected to exert its intended effects on financial markets even under the multiple-tier system where a negative interest rate is applied partially. Transaction prices in financial markets (e.g. interest rates, stock prices, and exchange rates) are determined by marginal losses or gains made in a new transaction. Although a negative interest rate is not applied to the total outstanding balances of current accounts, costs incurred with an increase in the current account balance brought by a new transaction will be minus 0.1 percent if it is applied to a marginal increase in the current account balance. Interest rates and asset prices will be determined in financial markets based on that premise."

The BOJ has its QQE on auto-pilot to buy ¥80 trillion of Japanese government bonds (JGBs) per year. Think of a Japanese bank that holds JGBs. When it sells JGBs to the BOJ, it receives excess reserves in exchange, and these excess reserves, or some of them, stand to earn minus 10 bps at the BOJ. In the same way that previously the price of JGBs would have had to adjust (upwards) to compensate banks for the fact that they would be exchanging JGBs yielding, say 80 bps (roughly where JGBs yields were when the BOJ introduced QQE) for central bank money yielding 10 bps, presumably JGBs yields will have to adjust further (downwards) to compensate banks for the fact that now they will be exchanging those JGBs for negatively yielding reserves.

In his press conference, Governor Kuroda emphasized that the intent of the scheme was to push down interest rates across the yield curve by pushing the anchor rate into negative territory. Not surprisingly perhaps, the 10-year JGB yield halved from around 23 bps to around 10 bps on the day of the announcement and fell below 5 bps in trading the next day. Indeed, after the BOJ's announcement, JGB yields across the yield curve went into negative territory, even out as far as nine years (e.g., at the time of writing, the five-year JGB yields are minus 10 bps). Negative rates across the yield curve are observed in the bond markets of other countries where central banks have implemented negative interest rate policy, such as Switzerland and Germany.

It might be thought that one way banks could avoid the negative interest rate on Policy Rate Balances would be to hold all, or virtually all, of those balances as vault cash (assuming they had big enough vaults and the interest costs saved more than covered the cost of operating them). But it is the BOJ that hands over the banknotes to the banks and allows one form of its liabilities (reserves) to be converted into another (banknotes). Cleverly, the BOJ has headed off that little ploy at the pass by announcing that any significant increases in cash holdings by financial institutions will be deducted from the Macro Add-on Balance, removing any incentive for banks to try to avoid the minus 10 bps interest rate by moving from reserves into vault cash.

The BOJ's negative interest rate scheme is a little different from the negative interest rate schemes being implemented by the four European central banks (8); hats off to the BOJ for being quite ingenious here and adding some tweaks to yet another unconventional monetary policy innovation.

lend their reserves to anyone other than other banks with reserve accounts at the BOJ (9). The easy way to understand that point is to return to the basic central bank balance sheet introduced earlier: There is no role for bank lending to (directly) influence the level of reserves, implying that banks cannot just take their reserves and convert them into bank credit to the private sector.

To the BOJ's credit, in its announcement, it did not claim that "Quantitative and Qualitative Monetary Easing with a Negative Interest Rate" was intended to work in this way; nor did Governor Haruhiko Kuroda in his press conference. Rather, the emphasis in the communication was on the effect that the policy was intended to have on "[exerting] further downward pressure on interest rates across the entire yield curve." A more technical explanation, but one not likely to inspire exciting copy, might have focused on the "portfolio rebalance effect" of QE and negative interest rate policy: When the central bank disturbs the equilibrium structure of the private sector's financial portfolio by taking out one set of assets and supplying a different set in exchange, asset prices adjust in order to restore equilibrium and do so in a way that further eases financial conditions.

Here is how the portfolio rebalance effect would work in this case. Before the central bank cuts the interest rate on part of the reserves that it "forces" financial institutions to hold, the whole yield curve is in equilibrium, in the sense that bond prices along the yield curve have adjusted such that no individual holder of reserves (yielding 10 bps in the BOJ's case) would want to swap out of those reserves into any other asset. Now have the BOJ cut the interest rate on a portion of reserves to minus 10 bps. Bond prices will have to go up across the whole of the yield curve to restore equilibrium, in the sense of making financial institutions indifferent between holding reserves yielding minus 10 bps and holding bonds of the respective various maturities (10).

How much monetary easing effect is the BOJ's policy likely to have? On the surface, one could argue not very much. After all, thanks to QQE, the Japan yield curve is already very flat: 10-year JGB yields, which were around 80 bps before the launch of QQE, were already around 20 bps before the latest move. A few basis points more yield curve compression, while providing some additional monetary stimulus, is hardly likely to be a game changer in an economy that has proved doggedly resistant to nearly 20 years of reflationary policies, including the most recent three years of "throw caution to the winds" QE.

One potentially important channel is the exchange rate. Indeed, the yen depreciated about 2% on the news. The European central banks that have implemented negative interest rate policy appear to have done so partly to stem

By wheeling out another piece of artillery in its fight and by pledging to "cut the interest rate further into negative territory if judged as necessary," the BOJ is doubling down on its "can do" and "will do whatever it takes" stance. If you are trying to end a 20-year deflation, and deflation expectations are stubborn, every little bit of monetary easing counts. The only worrying factor is that the governor held sway this time with an even narrower margin than in December (12): five policy board members in favor and four against. On the other hand, it may be taken as a measure of Governor Kuroda's fortitude and self-confidence that he was prepared to push ahead even in the face of what was almost unprecedented opposition from policy board members (13).

Some observers might see the BOJ's latest move as an act of desperation in the face of continued failure to achieve its goal of ending deflation and securing low stable inflation (of around 2%). After all, when the BOJ launched QQE in April 2013, Governor Kuroda communicated the expectation of achieving the 2% target in about two years, which would have been around mid-2015, yet the latest headline inflation reading is 0.2% year-on-year. The BOJ is now forecasting that the 2% target will be met in the first half of financial year 2017, more than four years after the launch of QQE.

But, as the BOJ points out, the collapse in oil prices, a relative price shift that is clearly beyond any central bank's control, has put severe downward pressure on headline inflation, an effect that eventually will wash out of the data and likely reverse. The latest reading for CPI inflation, excluding fresh food and energy, is 1.3% year-on-year, compared with -0.8% when QQE began.

Patience and persistence by the BOJ is likely to pay off.

The Evolution Of Monetary Policymaking As Decentralized Peer Learning

Since the Global Financial Crisis erupted in 2008 and triggered the Great Recession and ushered in a period of secular macro deleveraging, the major central banks of the world have progressively implemented all manner of "unconventional" monetary policy measures. There are now five major central banks implementing some form of negative interest rate policy. Two of those central banks are also implementing full-fledged QE. The Federal Reserve has made one interest rate hike, but it continues to have a balance sheet with a stock of QE on it to the tune of more than \$3 trillion. Similarly the Bank of England, while not having raised interest rates yet, maintains a much enlarged balance sheet, thanks to its earlier five rounds of QE. Several major central banks have experimented with various forms of forward guidance too.

When future historians look back on this period, they will likely describe a world in which the major central banks all experimented with new forms of monetary policy easing and learned from one another in the process, as one central bank after another pioneered new policy innovations and others adopted and adapted them, some rapidly, others with long lags. Disentangling cause and effect in the process of cross-fertilization and adaptation will be no simple feat.

There is nothing new in this of course: The 20 years or so preceding the financial crisis were ones in which similar cross-fertilization of ideas and practice occurred, as what become known as "flexible inflation targeting" became the orthodoxy of central banking, before it was confronted by the ghost of Hyman Minsky (14).

It is my compelling sense that this process of cross-pollination of policy learning and institutional evolution is far from over. The journey into uncharted monetary waters continues.

Related Research

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- The Fed Is Continuing, Not “Ending,” Quantitative Easing, Nov. 4, 2014
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- Step Into The Boardroom: The FOMC’s 2008 Post-Lehman Transcripts, March 7, 2014
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- “Hawk” And “Dove” Labels Are For The Birds, July 29, 2013
- Rethinking Monetary Policy: Lessons And Reminders From The Great Financial Crisis, April 3, 2013

Endnotes

(1) In its initial move, the Swedish Riksbank cut its deposit interest rate to minus 25 bps. The ECB cut its deposit facility interest to minus 10 bps. The Danish central bank cut its interest rate on certificates of deposit to minus 5 bps. The Swiss National Bank imposed an interest rate of minus 25 bps on sight deposits account balances, above a given exemption thresholds, with the aim of targeting the three-month LIBOR rate in the -0.75% to 0.25% range.

(2) See my article, "Some Thoughts On Monetary Policy And Central Banking," published Sept. 18, 2015, for more details.

(3) The other way money is created is via bank credit creation. The act of a bank making a loan, in balance sheet terms, is the act of it simultaneously creating an asset (the loan) and a liability (a deposit). Deposit money, defined as

balances as of Jan. 20, 2016, of ¥6.7 trillion and ¥24.5 trillion, respectively) and the Funds-Supplying Operation to Support Financial Institutions in Disaster Areas affected by the Great East Japan Earthquake (having an outstanding balance combined with Funds-Supplying Operations against Pooled Collateral of ¥6.9 trillion).

(6) For instance, banknotes outstanding totaled ¥83.4 trillion when the BOJ started QQE (April 2013) and now total ¥94.8 trillion.

(7) This was added as an eighth question to the Q&A on "Quantitative and Qualitative Monetary Easing with a Negative Interest Rate" the BOJ released when it announced the policy change on Jan. 29, 2016.

(8) The ECB's main refinancing rate, its traditional policy rate, is 5 bps, and the interest rate on its deposit facility (essentially the rate pertaining to excess reserves) is minus 30 bps. The interest rate on the Riksbank's main policy rate, the repo rate, is minus 35 bps. The interest rate on current account deposits paid by the Danish central bank (Danmarks Nationalbank) is currently 0%, and its rate on certificates of deposits (CDs) is minus 65 bps. Banks are limited in the amount of current account deposits they can hold; above this limit, current account deposits are converted into CDs. Danmarks Nationalbank uses the interest paid on CDs, which are auctioned weekly, as its main policy rate. The Swiss National Bank targets a three-month LIBOR rate in the range of minus 25 bps to minus 1.25%.

(9) For a detailed exposition of this point, see my article "Repeat After Me: Banks Cannot And Do Not "Lend Out" Reserves," published Aug. 13, 2013.

(10) For more on the way the portfolio balance effect works as a process of a central bank-perturbed equilibrium being restored, see my article "A QE Q&A: Everything You Ever Wanted To Know About Quantitative Easing," published Aug. 7, 2014.

(11) For instance, when the Swiss National Bank introduced negative interest rates on Dec. 18, 2014, it stated: "The introduction of negative interest rates makes it less attractive to hold Swiss franc investments, and thereby supports the minimum exchange rate."

(12) The Introduction of Supplementary Measures for Quantitative and Qualitative Monetary Easing in December last year passed six votes to three.

(13) To my knowledge, the only other cases of four policy board members voting against the governor were the Oct. 31, 2014, expansion of QQE and the Oct. 31, 2008, decision to cut the policy rate by 20 bps to 30 bps. In the latter case, with only eight policy board members holding office at the time, the vote was 4 to 4, with then-Governor Shirakawa using his casting vote in favor.

(14) See Hyman Minsky, 1986: *Stabilizing An Unstable Economy* (New Haven, CT: Yale University Press); 1982: *Can "It" Happen Again? Essays on Instability and Finance* (Armonk, NY: M.E. Sharpe).

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