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Remarks on Negative Interest Rates

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ABSTRACT

Negative nominal interest rates have been observed in several segments of financial markets. Being only partly a result of supply and demand and mainly enforced by the central banks, negative interest rates are getting more and more popular. While it is relatively easy to identify the reasons for this quite strange phenomenon, the consequences, especially the long-term consequences, are not too clear for both scientists and ordinary observers. This paper is an attempt to formulate some remarks on causes, evidence, and possible effects of negative interest rates. A warning is issued, with respect to monetary policy and financial stability.

Keywords: Negative Interest Rates, Monetary Policy, Unconventional Monetary Policy Instruments

INTRODUCTION

For about two years negative interest rates have been observed, not only for selected instruments, but also on whole financial markets segments. It seems that it is central banks that are responsible for it. The general idea behind negative interest rates is: they should support economic activity. Even if it happens, there is a lack of experience with such measures, and – as usual in such case – one should also consider negative side effects. The first and most straightforward is the shift of wealth from the creditors to the debtor – at first sight, a kind of abnormal phenomenon. There are many interesting topics related to negative interest rates: what are the reasons for negative interest rates; what are and will be the consequences of such rates for the economy in general and selected types of economic subjects in particular; how negative interest rates will influence savings, investments etc.; what will happen if after some time the interest rates return to the positive area?

There are relatively few scientific papers dealing with these topics. For preliminary considerations see Bech, Malkhozov [2016], Hannoun [2015].

This paper is an attempt to formulate some remarks. It is organized as follows. In the first section we look at the reasons for negative nominal interest rates. In the second section we show how negative interest rates are observed on the financial markets. The third section will concentrate on the consequences of negative interest rates for the economy.

THE RATIONALE FOR NEGATIVE INTEREST RATES

In the past negative interest rates have been observed, but not for broad financial instruments; they rather resulted from a very high demand for special assets, i.e. their possession was valuable enough to justify a payment for it. The current situation is different: negative interest rates are spread at least in some economy sectors.

The (negative) nominal interest rate (i) should be always confronted with inflation rate or better: with expected inflation rate (π). The difference is real interest rate (r):

$$r = i - \pi.$$

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If the nominal interest rate is negative (e.g. $i = –0,4\%$), as well as inflation (i.e. deflation), but it is higher in absolute terms (e.g. $\pi = –1\%$), the real interest rates equals +0,6%. One may say the "normal" conditions are restored (this situation is similar to nominal interest rate equal 2% and expected inflation rate 1.4%). The combination of "low (positive) interest rates and high inflation" could be bad for savers, but not as bad as "negative interest rates and high inflation". Please note that this is the goal of the central banks at the moment: "high inflation" may not be desirable, but 2% is commonly accepted, e.g. in the Eurozone and in Japan.

Let's look at five groups of reasons why we observe the negative (nominal) interest rates.

First, the negative interest may refer to a single financial instrument. Such situations have already been observed many years ago. One example may be a strong demand for a specific bond. The investor, who is obliged to return it, is ready to pay higher price or enter into a repo arrangement with negative interest (is ready to pay for borrowing it and is not expecting interest on money lent, as usually is the case). Or, the specific bond is requested as security in the following transaction. These are rather individual cases, however not a general phenomenon.

Negative yields on government bonds may be a result of safe haven effect (see below) but also of speculation. Consider a zero-coupon bond with face value 100 sold for 101. It makes sense, provided the investor expects the possibility of selling the bond to the central bank for more than 101 before maturity. The monetisation of sovereign debt is something that is expected from the central bank nowadays. Another reason for buying such bonds and selling them before maturity is when interest rates move deeper into negative territory following the time of purchase.

The second group refers to the countries whose currencies have an appreciation potential, namely Switzerland and Denmark. Negative policy rates were introduced to prevent strengthening the national currencies or to deter the speculators from opening long positions in these currencies. Both central banks applied negative interest rates on reserves of the banks. In Denmark the current account rate is zero, but the amounts above specified limit are subject to a "penalty" interest rate -0.65% charged for certificates of deposit in which the excessive amounts are converted. "The purpose of these limits is to prevent the build-up of large deposits that may immediately be used for speculation in interest-rate and exchange-rate changes if the krone is under pressure". The deposit rates have been negative since September 5, 2014 [www.nationalbanken.dk].

The case of Swiss National Bank (SNB) is slightly different, at least in technical terms. The Bank sets the target range for the three-month CHF ICE LIBOR rate, which obviously cannot be directly influenced. It has been negative since December 18, 2014 (-0.75% – -0.25%, and -1.25% – -0.25% valid since January 15, 2015) [www.snb.ch]. It should prevent the Swiss franc from strengthening, which could have negative consequences for the Swiss economy. The range is a kind of policy rate of the SNB.

From foreign investor's perspective, possession of such currency is a kind of insurance, and negative interest is an insurance premium: one is ready to accept a small loss if the possibility of substantial strengthening exists, especially when the exchange rate is fixed (DKK/EUR, CHF/EUR before January 2015). Similarly, about 40 years ago, in the world of high inflation and highly volatile exchange rates, foreigners massively deposited Swiss francs in Switzerland. The Swiss authorities posed high fees on their bank deposits, interpreted as negative interest.

Another motivation of investors selecting such currencies as CHF and DKK is the risk aversion. If one currency is not safe anymore (like EUR during the Greek crisis), other currencies may be regarded as safe haven, and a small loss (negative interest) is easily accepted.

The third group of reasons for negative interest rates is related to the current economic situation in many countries: very low growth, if any, and very low inflation, or even deflation. European Central Bank, Riksbank, and recently Bank of Japan have decided to move the policy rates below zero. The main aim of such ultra-low interest rate policy is to deter saving and encourage borrowing. In addition, the weaker currency should boost net exports, and hence growth and employment while lifting inflation through higher import prices, and avoid deflation. Lower interest rates should increase aggregate demand by lowering the cost of debt, induce new spending, and thereby reduce unemployment and again the threat of deflation.

The ECB moved its deposit rate into negative territory on June 11, 2014 (-0.10%), and later on September 10, 2014 (-0.20%), December 9, 2015 (-0.30%) and on March 16, 2016 (-0.40%) [www.ecb.int]. It has been flooding Eurozone with liquidity under its equivalent of US quantitative easing. The set of monetary policy decisions usually consisted of (a) changes to (lowering of) policy rates, (b) changes to asset purchase programmes, both in terms of amounts and eligible instruments, (c) launching new targeted longer-term refinancing operations, to strengthen the transmission of monetary policy by further incentivizing bank lending to the real economy. All these measures, and negative deposit rate in particular, were aimed at improving borrowing conditions for firms and households, as well as credit flows across the euro area (which corresponds to the positive effects for the real economy), while securing a return of inflation rates towards levels that are below, but close to, 2% as soon as possible (which means maintaining price stability over medium term). However, the ECB always stresses that the monetary measures must be supported by structural and fiscal policies [Draghi 2016].

Similarly, the Riksbank implemented negative interest rates on July 8, 2009 (deposit rate), till September 7, 2009, and later on July 9, 2014. But, the most important policy rate in Sweden is the repo rate: the interest rate that the monetary policy counterparties receive when they invest money with the Riksbank by buying Riksbank certificates or pay when they borrow money from the Riksbank through monetary policy repos. By changing the repo rate the Riksbank can control the overnight rate with intention of affecting inflation. In Sweden, the aim of monetary policy is to maintain price stability, which in the Riksbank's interpretation means that inflation should be 2%. This inflation target is regarded as nominal anchor for price setting and wage formation. Since February 9, 2015 the repo rate has been negative (-0.50% in April 2016), to safeguard the strength of the upturn in inflation. Other monetary measures have been the massive purchases of government bonds since 2015. The Riksbank's very expansionary monetary policy has helped to strengthen the economy and reduce unemployment, and has contributed to an upward trend in underlying inflation since the beginning of 2014 [www.riskbank.se].

Obviously, the central bank policies were and are the drivers of the negative interest rates, even if for different reasons. In every case the supply of reserve money was and still is huge. One might say: the monetary authorities flooded the banks with reserves and afterwards introduced penalty rates on it in order to force the banks to extend credit to the economy. In fact central banks actually addressed the wrong problem; it's not the supply side of the credit line that needs action, but the weak demand from the real economy. It seems that private companies and households have too much existing debt and do not want to borrow, while the banks have too much bad debt and don't want to lend more, at higher risk. They prefer to store liquid reserves at the central bank instead of extending risky credits.

Accordingly, financial intermediaries are not able invest money they obtain, and charge the supplier, which means negative interest rate.

The fourth group of reasons has its origin in law or regulations. For example, some institutional and passive investors are forced (by law or recommendations of the owners), to invest money in "safe" financial instruments or to diversify the portfolio. It concerns foundations, insurance companies, pension funds, and selected investment funds, among others. If they cannot find any suitable instruments with positive rate of return, they buy bonds, which generate predictable losses. In addition, investors are afraid of buying more risky assets and prefer "safe" government bonds, with a small loss, especially during turbulent times. Another reason, possibly not the most important one, is the increasing cost of regulation on the financial markets; the compliance departments are growing as a result of complex and extensive requirements of the regulators. In addition, there is a need for more liquid reserves, and the banks accept a small charge for it.

Fifth, negative interest rates may also be viewed as a result of the supply and demand for reserve money. What concerns supply: the unconventional monetary measures in the aftermath of the crisis of 2008 resulted in inflation of balance sheets of several central banks. The purchase of securities (e.g. USA) or foreign exchange (e.g. Switzerland) on the asset side was accompanied by a huge increase in monetary base. But, as mentioned examples show, not everywhere the negative interest rates for reserves were observed. On the demand side the need for reserves to fulfil the reserve requirements was weak, because the base for minimal reserves usually has not increased much, while available reserves a lot. E.g. in Switzerland for the period March 20 – April 19, 2016, the reserve requirement was 14,772 CHF million, while eligible assets 386,876 CHF million, of which sight deposits of the banks 380,091 and cash 6 784. Accordingly, the compliance ratio was 2,619% (!) [Important monetary policy data…, 2016, p. 2]. The demand for reserves for clearing purposes is usually not high, so the remaining reason might be the liquidity, "just in case". If so, the central bank policy could be to charge an interest for this situation, which is rather comfortable from the commercial banks' point of view. Or, alternatively, one may treat negative interest rate as a tax on (reserve) money. Usually these were the central banks, which supplied the huge reserves, and now they try to tax it by setting negative deposit rate, even if sometimes using tiered systems.

NEGATIVE INTEREST RATES ON THE FINANCIAL MARKET

We have shown that negative interest rates are obviously driven by central banks. As Bech and Malkhozov [2016] observe, "In the euro area and Switzerland, money market rates track the central bank deposit rate. In Sweden, money market rates closely follow the repo rate. In Denmark, the relationship has been somewhat less tight. On some days the tomorrow-next rate is close to the current account rate of zero, whereas on other days it is closer to (or even below) the certificate of deposit rate. This volatility results from a thin market, where on some days pricing can be driven by banks whose reserve holdings do not exceed their limit and earn a higher current account rate".

The policy rates were transmitted to the money markets, first of all to the overnight rates, which were passed through to other money market rates. Figure 1 illustrates it for several DKK interest rates. The general rule is: the shorter the time horizon, the stronger the influence of central banks on interest rates.

Negative interest rates have also been observed when investing in sovereign bonds. Government securities issued in Switzerland, Sweden, Denmark, but also several Eurozone countries (e.g. Germany) produce negative yields (table 1).

Table1. *Government bond yields in selected countries (as on May 19, 2016).*

Country, government bond	Yield (%)
Japan, 2 year	-0,23
Japan, 5 year	-0,20

Germany, 2 year	-0,51
Germany, 5 year	-0,35
Switzerland, 10 year	-0,29

Source: *www.bloomberg.com, www.snb.ch.*

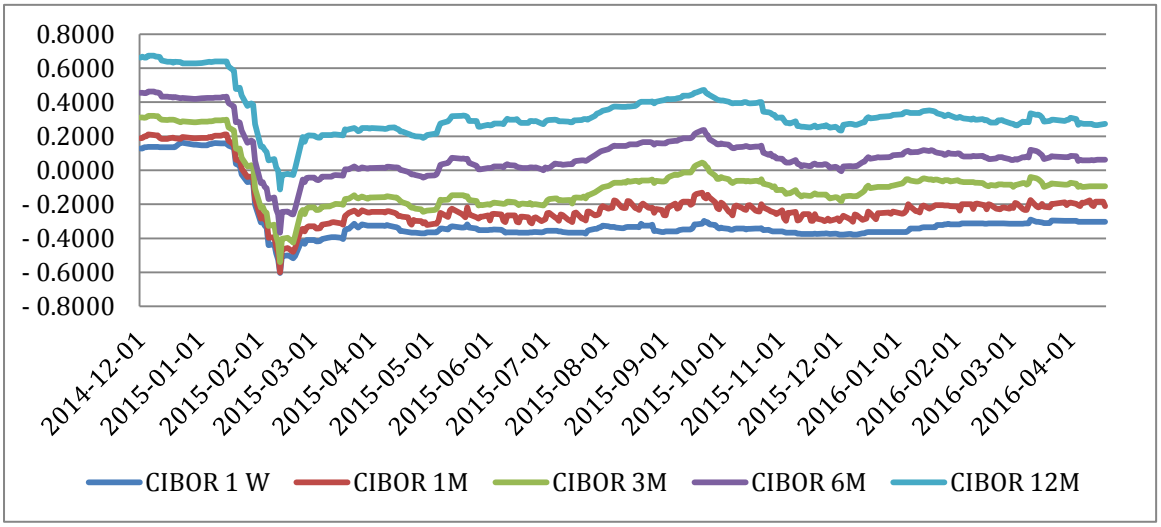

Fig1. *CIBOR for Danish krone, DKK (Dec. 1, 2014 - April 4, 2016).*

Source: *http://www.nasdaqomxnordic.com/obligationer/danmark/cibor (own presentation).*

CIBOR 1M	CIBOR 3M	CIBOR 6M	CIBOR 12M
0.1875	0.3100	0.4550	0.6625
0.1900	0.3100	0.4550	0.6675
0.2000	0.3075	0.4525	0.6625
0.2000	0.3100	0.4525	0.6625
0.2100	0.3200	0.4625	0.6725
0.2075	0.3200	0.4625	0.6725
0.2050	0.3175	0.4575	0.6675
0.2050	0.3175	0.4575	0.6675
0.1900	0.3050	0.4525	0.665
0.1850	0.2975	0.4325	0.645
0.1850	0.2950	0.4325	0.6375
0.1875	0.2975	0.4300	0.6375
0.1900	0.2975	0.4300	0.6375
0.1925	0.2975	0.4275	0.6325
0.1875	0.2950	0.4300	0.6375
0.1850	0.2825	0.4225	0.635
0.1950	0.2875	0.4250	0.6275
0.1875	0.2825	0.4200	0.6275
0.1875	0.2825	0.4200	0.6275
0.1900	0.2850	0.4225	0.63
0.1900	0.2850	0.4250	0.635
0.1950	0.2875	0.4250	0.6375
0.1925	0.2875	0.4250	0.635
0.2000	0.2900	0.4250	0.6375
0.2025	0.2925	0.4275	0.64
0.2025	0.2925	0.4275	0.64
0.2075	0.2950	0.4300	0.64
0.2100	0.2950	0.4300	0.64
0.2100	0.2975	0.4325	0.64
0.1725	0.2525	0.3950	0.61
0.1500	0.2325	0.3750	0.585
0.0625	0.1275	0.2825	0.4775
0.0575	0.1250	0.2850	0.4775

0.0600	0.1275	0.2800	0.485
0.0100	0.0725	0.2325	0.44
-0.0400	0.0225	0.1625	0.3775
-0.0375	0.0250	0.1675	0.385
-0.0375	0.0300	0.1750	0.3925
-0.0450	0.0200	0.1675	0.385
-0.1700	-0.1075	0.0550	0.27
-0.2850	-0.2200	-0.0750	0.14
-0.2675	-0.2150	-0.0700	0.14
-0.2900	-0.2425	-0.0975	0.12
-0.2950	-0.2500	-0.1050	0.1075
-0.3975	-0.3275	-0.1700	0.0575
-0.3925	-0.3200	-0.1600	0.065
-0.4500	-0.3900	-0.2300	0.0175
-0.4900	-0.4250	-0.2600	-0.0025
-0.6000	-0.5400	-0.3667	-0.1133
-0.4650	-0.4025	-0.2450	-0.0275
-0.4575	-0.3975	-0.2425	-0.02
-0.4650	-0.4075	-0.2500	-0.025
-0.4750	-0.4150	-0.2575	-0.025
-0.4800	-0.4250	-0.2600	-0.0275
-0.4575	-0.3850	-0.2275	0.01
-0.3500	-0.2475	-0.0975	0.15
-0.3450	-0.2325	-0.0550	0.195
-0.3600	-0.2575	-0.0700	0.1675
-0.3375	-0.2250	-0.0450	0.2
-0.3300	-0.2175	-0.0425	0.205
-0.3300	-0.2175	-0.0425	0.2025
-0.3425	-0.2325	-0.0550	0.195
-0.3425	-0.2325	-0.0575	0.1925
-0.3400	-0.2300	-0.0525	0.1925
-0.3200	-0.2150	-0.0375	0.2075
-0.3150	-0.2125	-0.0375	0.2075
-0.3125	-0.2125	-0.0375	0.2075
-0.3075	-0.2075	-0.0375	0.2075
-0.3050	-0.2025	-0.0300	0.21
-0.3075	-0.1975	-0.0275	0.21
-0.3125	-0.2000	-0.0300	0.2075
-0.3200	-0.2025	-0.0325	0.205
-0.2700	-0.1700	0.0050	0.24
-0.2600	-0.1675	0.0050	0.2375
-0.2500	-0.1675	0.0050	0.24
-0.2375	-0.1475	0.0225	0.2475
-0.2450	-0.1600	0.0150	0.24
-0.2575	-0.1650	0.0075	0.23
-0.2475	-0.1600	0.0100	0.2325
-0.2350	-0.1550	0.0175	0.2475
-0.2475	-0.1675	0.0100	0.2475
-0.2475	-0.1600	0.0125	0.245
-0.2450	-0.1600	0.0125	0.2475
-0.2450	-0.1575	0.0150	0.245
-0.2475	-0.1575	0.0125	0.2425
-0.2400	-0.1525	0.0200	0.245
-0.2400	-0.1550	0.0200	0.25
-0.2500	-0.1600	0.0175	0.2525
-0.2550	-0.1600	0.0175	0.245
-0.2700	-0.1700	0.0150	0.24
-0.2700	-0.1800	0.0025	0.2275
-0.2725	-0.1875	0.0000	0.2275
-0.2775	-0.2000	-0.0100	0.215
-0.3100	-0.2125	-0.0175	0.21

-0.3200	-0.2200	-0.0250	0.205
-0.2925	-0.2200	-0.0250	0.2025
-0.2975	-0.2250	-0.0275	0.2
-0.3000	-0.2300	-0.0350	0.1975
-0.3125	-0.2450	-0.0425	0.19
-0.3050	-0.2400	-0.0400	0.195
-0.3225	-0.2375	-0.0325	0.2075
-0.3150	-0.2325	-0.0300	0.215
-0.3150	-0.2275	-0.0250	0.215
-0.2975	-0.2025	0.0000	0.2475
-0.2500	-0.1725	0.0325	0.275
-0.2550	-0.1750	0.0350	0.2775
-0.2750	-0.1725	0.0425	0.2875
-0.2350	-0.1575	0.0575	0.3
-0.2250	-0.1475	0.0725	0.3175
-0.2550	-0.1475	0.0675	0.32
-0.2650	-0.1475	0.0700	0.3225
-0.2775	-0.1550	0.0650	0.32
-0.2175	-0.1525	0.0675	0.315
-0.2600	-0.1750	0.0425	0.29
-0.2767	-0.1800	0.0267	0.29
-0.2850	-0.2075	0.0050	0.255
-0.2725	-0.2025	0.0050	0.255
-0.2725	-0.2050	0.0075	0.26
-0.2650	-0.2000	0.0125	0.2675
-0.2950	-0.2025	0.0125	0.2625
-0.2575	-0.1950	0.0150	0.265
-0.2550	-0.1900	0.0225	0.275
-0.2600	-0.1950	0.0225	0.275
-0.2975	-0.1975	0.0175	0.27
-0.3050	-0.1950	0.0300	0.29
-0.2650	-0.1850	0.0350	0.3025
-0.2650	-0.1850	0.0300	0.2975
-0.2650	-0.1875	0.0275	0.2975
-0.3025	-0.1950	0.0200	0.3
-0.3075	-0.2050	0.0175	0.2875
-0.2725	-0.1975	0.0150	0.2775
-0.2725	-0.1950	0.0125	0.2775
-0.2775	-0.2000	0.0125	0.2775
-0.3050	-0.1925	0.0175	0.29
-0.3125	-0.2025	0.0175	0.29
-0.2800	-0.2000	0.0150	0.2875
-0.2775	-0.2000	0.0175	0.29
-0.3000	-0.2050	0.0050	0.275
-0.2933	-0.2067	0.0000	0.27
-0.2875	-0.1950	0.0175	0.285
-0.2525	-0.1775	0.0100	0.2925
-0.2500	-0.1700	0.0125	0.295
-0.2775	-0.1650	0.0400	0.2975
-0.2850	-0.1650	0.0375	0.295
-0.2975	-0.1775	0.0350	0.2875
-0.2600	-0.1750	0.0350	0.2875
-0.2625	-0.1775	0.0325	0.2875
-0.2925	-0.1750	0.0350	0.285
-0.2975	-0.1750	0.0350	0.2825
-0.3050	-0.1950	0.0350	0.2825
-0.2525	-0.1625	0.0500	0.2925
-0.2475	-0.1600	0.0550	0.2925
-0.2850	-0.1625	0.0575	0.295
-0.2850	-0.1550	0.0575	0.3
-0.2950	-0.1650	0.0550	0.3

-0.2425	-0.1475	0.0600	0.2975
-0.2425	-0.1450	0.0675	0.3025
-0.2650	-0.1300	0.0875	0.32
-0.2625	-0.1225	0.0950	0.3325
-0.2575	-0.1150	0.1025	0.3375
-0.2225	-0.1075	0.1100	0.3425
-0.2100	-0.1000	0.1150	0.35
-0.2250	-0.0925	0.1250	0.3575
-0.2225	-0.0875	0.1325	0.3625
-0.2200	-0.0800	0.1400	0.37
-0.1775	-0.0725	0.1450	0.375
-0.1800	-0.0725	0.1425	0.375
-0.2175	-0.0725	0.1425	0.3725
-0.2225	-0.0700	0.1425	0.3725
-0.2225	-0.0725	0.1425	0.3725
-0.1800	-0.0625	0.1475	0.375
-0.1825	-0.0675	0.1525	0.375
-0.2225	-0.0625	0.1525	0.3775
-0.2250	-0.0625	0.1525	0.385
-0.2325	-0.0700	0.1575	0.3975
-0.2050	-0.0600	0.1625	0.4025
-0.1950	-0.0600	0.1650	0.4025
-0.2200	-0.0600	0.1650	0.4025
-0.2225	-0.0575	0.1650	0.4025
-0.2200	-0.0550	0.1625	0.405
-0.2500	-0.0750	0.1500	0.3925
-0.2275	-0.0625	0.1600	0.4025
-0.2325	-0.0650	0.1575	0.41
-0.2625	-0.0650	0.1575	0.4125
-0.2650	-0.0625	0.1575	0.415
-0.2225	-0.0450	0.1675	0.42
-0.2150	-0.0375	0.1700	0.4175
-0.1950	-0.0250	0.1725	0.42
-0.2250	-0.0275	0.1725	0.4225
-0.2200	-0.0250	0.1800	0.425
-0.1925	-0.0200	0.1825	0.4275
-0.1850	-0.0125	0.1875	0.4375
-0.1850	-0.0125	0.1875	0.4375
-0.2025	-0.0125	0.1875	0.4425
-0.1950	0.0025	0.1950	0.445
-0.1475	0.0225	0.2125	0.455
-0.1400	0.0300	0.2200	0.4575
-0.1325	0.0450	0.2350	0.47
-0.1575	0.0400	0.2375	0.4725
-0.1650	0.0250	0.2150	0.455
-0.1450	0.0150	0.2050	0.45
-0.1600	-0.0075	0.1825	0.4425
-0.1875	-0.0325	0.1625	0.4225
-0.2225	-0.0500	0.1525	0.415
-0.2300	-0.0500	0.1525	0.4125
-0.1900	-0.0400	0.1575	0.41
-0.1975	-0.0450	0.1550	0.41
-0.2425	-0.0525	0.1500	0.4025
-0.2500	-0.0675	0.1400	0.3975
-0.2650	-0.0750	0.1300	0.3925
-0.2125	-0.0675	0.1300	0.395
-0.2075	-0.0625	0.1350	0.395
-0.2225	-0.0625	0.1375	0.395
-0.2300	-0.0625	0.1400	0.4
-0.2325	-0.0650	0.1425	0.4

-0.2075	-0.0625	0.1400	0.395
-0.2050	-0.0650	0.1350	0.3925
-0.2375	-0.0625	0.1400	0.395
-0.2400	-0.0625	0.1400	0.3975
-0.2425	-0.0675	0.1400	0.4
-0.2000	-0.0525	0.1450	0.4
-0.2175	-0.0800	0.1025	0.345
-0.2333	-0.0867	0.0900	0.34
-0.2400	-0.0900	0.0975	0.3375
-0.2450	-0.1000	0.0800	0.3275
-0.2475	-0.0950	0.0825	0.325
-0.2575	-0.1175	0.0700	0.3075
-0.2350	-0.1150	0.0675	0.31
-0.2825	-0.1250	0.0550	0.2925
-0.2975	-0.1400	0.0450	0.2775
-0.2500	-0.1350	0.0450	0.2775
-0.2500	-0.1350	0.0450	0.275
-0.2450	-0.1175	0.0600	0.2875
-0.2950	-0.1375	0.0375	0.26
-0.2925	-0.1450	0.0350	0.26
-0.2725	-0.1550	0.0225	0.255
-0.2575	-0.1475	0.0300	0.255
-0.2575	-0.1500	0.0250	0.2525
-0.2975	-0.1500	0.0250	0.2525
-0.2975	-0.1425	0.0350	0.2575
-0.2575	-0.1350	0.0400	0.2625
-0.2850	-0.1425	0.0325	0.2525
-0.2925	-0.1425	0.0325	0.26
-0.3000	-0.1425	0.0350	0.2575
-0.2950	-0.1425	0.0350	0.265
-0.2850	-0.1550	0.0275	0.2575
-0.2975	-0.1650	0.0150	0.25
-0.2875	-0.1575	0.0200	0.255
-0.2825	-0.1600	0.0150	0.2475
-0.3000	-0.1725	0.0025	0.235
-0.2825	-0.1825	-0.0050	0.2325
-0.2675	-0.1550	0.0225	0.2675
-0.2850	-0.1500	0.0250	0.2725
-0.2925	-0.1500	0.0250	0.2725
-0.3025	-0.1525	0.0225	0.27
-0.2600	-0.1525	0.0250	0.2675
-0.2625	-0.1525	0.0250	0.2675
-0.2925	-0.1300	0.0475	0.28
-0.2875	-0.1200	0.0500	0.2825
-0.2850	-0.1000	0.0650	0.3025
-0.2425	-0.0900	0.0775	0.3125
-0.2525	-0.1050	0.0675	0.305
-0.2875	-0.1000	0.0725	0.3075
-0.2525	-0.0975	0.0775	0.31
-0.2525	-0.0975	0.0750	0.315
-0.2475	-0.0975	0.0775	0.3175
-0.2550	-0.0925	0.0800	0.32
-0.2425	-0.0900	0.0875	0.325
-0.2550	-0.0775	0.0925	0.33
-0.2500	-0.0650	0.1050	0.34
-0.2375	-0.0525	0.1100	0.3425
-0.2000	-0.0525	0.1150	0.34
-0.2125	-0.0600	0.1050	0.3375
-0.2400	-0.0650	0.1075	0.3375
-0.2400	-0.0650	0.1075	0.3375
-0.2475	-0.0625	0.1100	0.3375

-0.2125	-0.0525	0.1150	0.345
-0.2075	-0.0475	0.1175	0.3475
-0.2250	-0.0550	0.1125	0.3525
-0.2200	-0.0525	0.1175	0.35
-0.2150	-0.0575	0.1150	0.3475
-0.2050	-0.0550	0.1075	0.345
-0.2050	-0.0550	0.1025	0.335
-0.2050	-0.0650	0.0975	0.325
-0.2075	-0.0575	0.0900	0.3175
-0.2075	-0.0575	0.0925	0.3225
-0.2075	-0.0575	0.1025	0.3275
-0.2100	-0.0650	0.0975	0.3225
-0.2125	-0.0600	0.0950	0.3075
-0.2125	-0.0575	0.1000	0.3075
-0.2375	-0.0650	0.0975	0.315
-0.2000	-0.0675	0.0850	0.3075
-0.2000	-0.0700	0.0800	0.305
-0.2000	-0.0700	0.0800	0.3
-0.2000	-0.0700	0.0800	0.2975
-0.2275	-0.0700	0.0850	0.305
-0.1975	-0.0725	0.0825	0.2975
-0.1950	-0.0725	0.0825	0.2975
-0.2025	-0.0750	0.0850	0.3
-0.2050	-0.0850	0.0750	0.2925
-0.2300	-0.0900	0.0750	0.295
-0.2000	-0.0950	0.0650	0.2875
-0.2025	-0.0875	0.0650	0.28
-0.2250	-0.0900	0.0700	0.28
-0.2275	-0.0825	0.0775	0.2925
-0.2300	-0.0825	0.0775	0.2925
-0.2200	-0.0825	0.0775	0.295
-0.2175	-0.0850	0.0725	0.29
-0.2250	-0.0850	0.0650	0.2775
-0.2125	-0.0850	0.0600	0.275
-0.2225	-0.0975	0.0600	0.2725
-0.1925	-0.0875	0.0650	0.265
-0.1950	-0.0850	0.0625	0.2625
-0.2275	-0.0750	0.0775	0.285
-0.2325	-0.0750	0.0750	0.2825
-0.2325	-0.0850	0.0800	0.285
-0.2025	-0.0775	0.0750	0.2825
-0.1750	-0.0400	0.1200	0.335
-0.2100	-0.0475	0.1125	0.325
-0.2175	-0.0525	0.1075	0.3275
-0.2150	-0.0625	0.0975	0.3225
-0.1975	-0.0725	0.0875	0.31
-0.2150	-0.0975	0.0650	0.285
-0.2175	-0.0850	0.0750	0.29
-0.1975	-0.0775	0.0825	0.2975
-0.1975	-0.0800	0.0800	0.2975
-0.1875	-0.0850	0.0775	0.29
-0.2050	-0.0850	0.0775	0.295
-0.1925	-0.0825	0.0775	0.2975
-0.1900	-0.0725	0.0850	0.3075
-0.1975	-0.0800	0.0825	0.3
-0.2050	-0.0975	0.0550	0.2675
-0.2100	-0.0900	0.0625	0.2775
-0.1900	-0.0975	0.0575	0.275
-0.1925	-0.0975	0.0575	0.2725
-0.1775	-0.0950	0.0575	0.2725
-0.2025	-0.0950	0.0600	0.2725

-0.2100	-0.0950	0.0575	0.2675
-0.1850	-0.0950	0.0600	0.265
-0.1850	-0.0950	0.0625	0.265
-0.1850	-0.0950	0.0625	0.27
-0.2100	-0.0950	0.0625	0.2725

The banks are so far reluctant to pass negative interest rates paid on reserve money to the customers, especially that this might encourage them to hoard cash. Alternative Bank Schweiz AG already charges the customers 0.75% for savings above 100,000 CHF [www.abs.ch].

CONSEQUENCES OF NEGATIVE INTEREST RATES: HOW DANGEROUS ARE THEY?

At first sight it is difficult to identify the negative macroeconomic effects of interest rates below zero. But it seems that central banks are learning by doing; their actions are not based on any theoretical considerations[1] and against common sense. It poses some threats for the whole financial system.

Especially the representatives of the Austrian school of economics are against such experiments. Unfortunately, it is outside of mainstream economic theory and sometimes referred to as "heterodox". One example of critique of negative interest rates is presented by Polleit [2015]. According to him, some economists have been arguing that the "equilibrium real interest rate" ("natural interest rate" or the "originary interest rate") has become negative, as a "secular stagnation" has allegedly caused a "savings glut"; a negative real interest rate is required for bringing savings in line with investment. From the viewpoint of the Austrian school, "negative equilibrium real interest rate" doesn't make sense at all. The originary interest rate is a category of human action, saying that acting man values goods available at present more highly than goods available in the future. In other words: future goods trade at a price discount relative to present goods. The originary interest rate is expressive of a value differential, which results from so-called time-preference. The term time-preference denotes that acting man prefers an earlier satisfaction of wants to a later satisfaction of wants. Time-preference is always and everywhere positive, and so is the originary interest rate. Central banks are in a position to push nominal, but also real, interest rates below zero ($i<0$, $r<0$), but these are not equilibrium rates [Polleit 2015].

One may identify several consequences of negative interest rates from the perspective of different parties.

- For the ordinary saver (natural person), negative interest rate works like a tax (or fee) paid for money storage, similar to safe deposit box. This is rather not justified when we consider that the bank liabilities (customer's deposits) are not fully backed by liquid assets (cash, reserves with the central banks). But possessing cash at home or even in a vault is quite risky and other banks will possibly try to charge their customers above a threshold, as shown above. What may happen when negative interest rates are really high in absolute terms, see point 6.
- For the corporation, the fee paid on their deposits might be a trade or business expense, which should generally be deductible. In fact, JP Morgan announced in February that the bank would charge its largest customers a fee for holding large cash balances with the bank.
- For the bank, the negative interest rates on reserves work like a tax, as already explained. These costs have to be somehow compensated. One possibility is to pass them to the depositors, but this may be risky, when the customers will withdraw cash. The profits of banks will decrease, and their competitive position, toward countries where negative interest rates were not introduced,

[1] For opposite opinion, see Ilgmann, Menner [2010, p. 1-20].

will be deteriorated. Financial intermediaries, not only private investors, may behave more risky to compensate the costs induced by central banks. If they fail, the losses will affect the whole financial system, and will mean a threat for the stability.

- From the central bank's point of view, a moderate tax on money adds an additional useful policy tool in case of a large deflationary shock. There are two dangers of this approach: the necessity to continuously lower the negative rates in time and the reaction of markets when the policy will be reverted in expectation of inflation.
- Negative interest rate, especially in the long term, would have negative consequence for asset managers. Especially pension programs and life insurers may be in danger, because they will not be in a position to cope with securing payments in the future. This is (and/or will be) a social problem, not just an individual's problem.
- From the point of view of general public, negative interest rates, especially when they refer to all savings, are counter-productive for the whole economic system. Should a central bank really succeed in making *all* market interest rates negative in real terms, savings and investment would come to a halt: as time preference and the originary interest rate are always positive, "capitalistic saving" (the accumulation of goods designed for improving the production process) would come to an end [Polleit 2015]. This opinion leads us to the next possible consequence:
- The extensive use of cash might be the rescue from negative interest rates for a single person or company, but not for all of them. No banking system will survive, if even a half of deposits gets withdrawn in cash. Unfortunately, the cash issuance is in hands of the state, and it is already known how to "solve" the problem. Already in the 19th century Gesell suggested issuing money for a limited duration, after which it must be exchanged for new bills; attempts to hold money thus result in it expiring and becoming worthless. For more details on Gesell's proposal see Ilgmann, Menner [2010]. Current proposals are three. The first, abolishing currency, ensures that all money (means of payment/media of exchange) consists of registered instruments on which the payment of positive or negative interest is trivially easy. The second, taxing currency, is a means of paying negative interest on currency, using which amounts to stamp scrip methods, even though more high-tech ways than physically stamping bank notes are now available as means of identifying currency notes as current on interest due. The third method decouples the numéraire function of currency from its means of payment/medium of exchange function and introduces a variable exchange rate between a unit of the one-period safe non-monetary security denominated in terms of the numéraire and the currency/means of payment. That exchange rate can either be set by the government or be market-determined. This permits the nominal interest rate in terms of the numéraire to be negative, even though the nominal interest rate in terms of the currency is subject to the zero lower bound. For details, see Buiter [2010]. In such a world a parallel currency could arise, beyond the influence of the state (foreign banknotes, gold, etc.). It would be used for storage of wealth and high value transactions.
- As Hannoun [2015, p. 9] correctly states, "imposing a tax on savers and providing a subsidy to borrowers is unlikely to result in higher global output or better living standards". The winners of the ultra-low interest rate policy will be the indebted economic agents, first of all: the governments. The losers will be savers, pensioners, and life insurance policy holders.
- Another very interesting consequence of negative interest rates is tax-related. Investing in financial instruments $1,005 and getting back $1,000 looks like a loss. The question arises, whether it may be compensated with profits from other investments and activities. On the other hand, the party, which gets $1,005 and agrees to pay back only $1,000, earns $5. This income will be most probably taxed. As usual, income is always taxed, and losses not always may be deducted from

(other) income. As one might imagine, there is little authority on negative interest for US federal income tax purposes. However, in a little-noticed change to certain regulations that were proposed in 2013 and finalised a year ago, the IRS (Internal Revenue Service) seems for once to be ahead of the curve. Under US tax principles, the excess of a debt instrument's issue price over its stated redemption price at maturity is treated as bond premium. A holder can elect to amortise this bond premium. The amortised premium offsets interest income on the bond. If there is unamortised bond premium at maturity (for example, if there is no interest on the bond against which to offset the premium), the holder would otherwise have a capital loss. The change in the regulations permitted holders to claim an ordinary loss for the unamortised premium.

To summarize: Negative interest rates were not able to stop the strengthening of the currency in consideration. Obviously, other currencies are perceived as less attractive or safe. The inflation expectations are in all cases low, and accordingly the goal of 2% inflation has not been reached. Last but not least, we have not observed an increased demand for goods / services (which could stimulate growth) or more risky assets like equities. Obviously, central banks have reached their limits; conventional instruments are sort of exhausted. Monetary policy cannot be a substitute for sustainable fiscal policy of the government and its structural reforms supporting competitiveness on international level. Economic growth and high employment can rather be achieved through better education, convenient conditions for running businesses, and fully competitive, not overregulated labour markets. Other methods, like abolishing cash, come from the Orwell world and hopefully will not be implemented.

SUMMARY

Negative interest rates are becoming more and more popular. A few central banks introduced them on (part of) reserves the commercial banks hold with them. The reasons were in general twofold: encouraging banks to lend more and increase the aggregate demand or/and make the home currency weaker or at least not allowing appreciation. Negative interest rates spread into the economy, step by step, making economic decisions harder and harder. Several potential consequences of negative interest rates have been presented. Some of them, e.g. suggested by the Austrian school of economic, might have dramatic consequences for the market economy. Or, in author's opinion, lead to an alternative payment system for large transactions and storage of value. Hopefully the authorities will not go far enough to produce such negative effects.

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