CONJONCTURE

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The Fed: the global lender of last resort

p.2

Pressure on dollar liquidity created an urgent need for action from the US Federal Reserve (the Fed). Assuming its role as the global lender of last resort - the consequence of its position as the issuer of the international trade and reserve currency - the Fed reactivated the permanent or temporary swap agreements that it established with 14 other central banks in 2008. In order to extend the reach of its dollar supply, the Fed has also created a repo facility for the central banks of countries that do not have dollar swap agreements. The high fees charged, however, will limit take-up, depriving the markets of what could be a significant calming influence.

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Preparing for leaner pensions

p.10

In the coming decades, the European countries will be confronted with rising costs related to population ageing. Based on very optimistic assumptions, simulations carried out by the EU's Economic Policy Committee suggest that these costs are manageable. Persons that enter the workforce now are unlikely to retire under the same conditions as those who retire at the moment. The transition to leaner public pension schemes calls for accompanying measures such as incentives to remain longer in the labour force and inducements to better prepare retirement. In particular, the authorities could inform employees regularly about their pension rights and encourage them to increase their retirement savings.

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The bank for a changing world

The Fed: the global lender of last resort

Céline Choulet

Pressure on dollar liquidity created an urgent need for action from the US Federal Reserve (the Fed). Assuming its role as the global lender of last resort - the consequence of its position as the issuer of the international trade and reserve currency - the Fed reactivated the permanent or temporary swap agreements that it established with 14 other central banks in 2008. In order to extend the reach of its dollar supply, the Fed has also created a repo facility for the central banks of countries that do not have dollar swap agreements. The high fees charged, however, will limit take-up, depriving the markets of what could be a significant calming influence.

"The dollar is our currency, but your problem." This famous line, from Treasury Secretary John Connally following the Nixon administration's unilateral decision to pull the dollar out of the Bretton Woods system in 1971, has probably never seemed less apposite.

The extreme financial tensions triggered by the Covid-19 pandemic resulted, in March, in a flight to the dollar, upsetting the dollar financing markets in the process. The higher dollar funding costs[1] both for advanced economies (Japan, Eurozone, Switzerland, the UK) and emerging economies (South Korea, China, Malaysia, Peru) reflected the increasing scarcity of the greenback. A recent study by the Bank for International Settlements (BIS)[2] set out the underlying reasons for the dollar's soaring value. In particular, it contrasts increased dollar refinancing needs for institutional investors[3] (insurance companies, pension funds, asset managers), especially in Asia, with the drying up in the supply of dollars from banks[4] and market intermediaries. In recent weeks, the dollar appreciation[5] and the drawing down of off-balance-sheet credit lines has reduced banks' abilities to offer currency risk hedging services, whilst the prime US money market funds, the traditional providers of dollar financing on the commercial paper market, experienced massive withdrawals.

Under normal circumstances, when a bank registered outside the USA and without access to the Fed's refinancing lines[6] needs dollars, either on behalf of a client (dollar loan, currency risk hedging) or on its own account (acquisition of a dollar-denominated asset, hedging a currency risk), it will turn to the market. It can issue debt (either secured or not) in dollars, or enter a currency swap (currency versus the dollar) on the foreign exchange (FX) swap markets[7]. In periods of pressure on the dollar financing markets, it can turn to the central bank of its country of registration. To supply dollar liquidity, the central bank can either draw from its currency reserves (dollars directly, or another currency which it can then use in an FX swap) or monetise dollar-denominated assets that it holds (by selling them or putting them in repo) – or, where it has a reciprocal agreement with the Fed, it can draw against an agreed dollar swap line.

Assuming its role as the global lender of last resort[8] - the consequence of its position as the issuer of the international trade and reserve currency - the Fed reactivated the permanent or temporary swap agreements that it established with 14 other central banks in 2008. So far, the central banks that have been the biggest borrowers of dollars from the Fed have been the Bank of Japan (BoJ) and the European Central Bank (ECB). In practice, the drawing down of central bank dollar swap lines contributes to a very large extent to the financing of US resident banks.

Complementing these liquidity swaps between central banks (which will have the effect of reducing demand for dollars on the FX swap markets), the relaxation of leverage constraints on US banks could also help ease tensions in the dollar financing markets (by increasing the dollar supply coming from banks and from hedge funds and asset managers who will benefit from easier access to broker-dealer liquidity). In order to extend the scope of its response to the need for dollar liquidity, the Fed has introduced some completely new measures. These give foreign central banks the option of putting their Treasuries portfolios into repo. The Fed thus stands ready, for the first time, to assume, to a certain extent, its role as the dealer of last resort on a global level. The high fees charged for this last facility, however, will limit take-up, depriving the markets of what could be a significant calming influence.

[1] According to BIS figures, outstanding amounts on the FX swap and forward markets have doubled over the past ten years: at the end of June 2019 they stood at USD 60,000 bn. In the vast majority of cases (90%), the dollar was one of the two currencies traded (rising to 96% for swaps between dealers). The dollar therefore has a much greater significance in the swap markets than would be suggested by its weight in global trade or in official currency reserves.

[2] S. Avdjiev, E. Eren and P. McGuire (2020), *Dollar funding costs during the Covid-19 crisis through the lens of the FX swap market*, BIS Bulletin

[3] Portfolios of dollar-denominated assets held by institutional investors have expanded rapidly over the past ten years.

[4] Since the financial crisis of 2007-2008, the pressure on margins from low interest rates and new regulatory requirements have cut into the banks' abilities to offer currency risk hedging services. See B. Erik, M. Lombardi, D. Mihaljek and H. S. Shin (2020), *The dollar, bank leverage and real economic activity: an evolving relationship*, BIS Working Papers, n°847

[5] See V. Bruno and H.S. Shin (2015), *Cross-border banking and global liquidity, Review of Economic Studies*, vol. 82, n°2

[6] Foreign banks with subsidiaries or branches in the USA can through these structures, borrow in dollars through the Fed's discount window, or take advantage of certain debt securities purchase programmes (notably the Commercial Paper Funding Facility) or lending facilities (notably the Primary Dealer Credit Facility) that are open to institutions holding an account with the Fed.

[7] See footnote n°35, Box 2

[8] E. Carré and L. Le Maux (2018), *Financial globalisation and dollar swap lines: the Federal Reserve and the European Central Bank during the 2007-2009 crisis*, hal-01933930

How swap agreements between central banks work

A foreign exchange swap between two central banks incorporates, as with a swap between two private counterparties, a commitment to reverse the exchange at some pre-agreed future date and price. This facility allows a central bank to obtain dollars, without drawing on its own official reserves. The liquidity raised in this way can then be lent by the borrowing central bank to local commercial banks. In establishing this system, the Fed assumes the mantle of international lender of last resort, whilst the foreign central banks take on, to a certain extent, the role of the dealers of last resort in their local markets.

The creation of central bank money following the drawing down of swap lines

Box 1 shows, in the form of simplified double-entry accounts, the main accounting effects of a central bank drawing on a swap line and providing dollar liquidity to commercial banks in its jurisdiction. Before it matures, a dollar swap has the effect of expanding the Fed's balance sheet and increasing the monetary base.

The first stage sees the Fed give the foreign central bank a certain quantity of dollars in exchange for the equivalent amount of the foreign currency based on the exchange rate at the time of the transaction. The Fed undertakes to hold the currency received (neither lending nor investing it) until the swap matures. It recognises the quantity of dollars loaned to the foreign central bank as an asset and recognises as a liability the quantity of foreign currency received from the foreign central bank. The foreign central bank makes matching entries to its liabilities, with respect to the debt to the Fed (the dollars borrowed) and its assets in the form of its deposit with the Fed (currency deposited).

In the second stage, the foreign central bank makes a dollar loan to a commercial bank under its jurisdiction. The credit risk is borne entirely by the foreign central bank, which has sole control over the list of eligible financial institutions, the type of financing allocated, the list of assets acceptable as collateral and the haircuts applied. This loan results in a transfer of cash from the foreign central bank's deposit account with the Fed to the correspondent bank (responsible for the settlement of dollar transactions) of the foreign commercial bank borrower (step 3 in Box 1). Drawing against the swap line therefore results in an increase in central bank reserves of depository institutions in the USA[9] (which form part of the monetary base[10]).

When the swap matures, the Fed and the foreign central bank make a second exchange of currencies, in the opposite direction, at the exchange rate in force at the time of the initial transaction[11]; this wipes out the central bank reserves initially created. The foreign central bank pays to the Fed interest in an amount equal to the interest it earned on its tender operations.

Lending conditions correlate to market conditions

The conditions for lending the dollar liquidity received vary from one central bank to the next. In the euro zone, funds are allocated through a tender process at a predefined fixed interest rate; all applications are satisfied. Liquidity is made available through a securities repo arrangement; discounts are applied to the market value of collateral used.

Some central banks also make regular margin calls to cover the risk of loss of value of the securities provided as collateral or to cover exchange rate risks (an increase in the value of the dollar over the term of the swap). In the euro zone, for example, collateral is revalued on a daily basis and margin calls to cover currency risk are made on a weekly basis. These provisions help reduce the risk borne by the central banks and establish a form of market discipline. However, by their nature they increase the sensitivity of the borrowing of commercial banks to any deterioration of market conditions.

A monetary and financial tool

Initially, central bank swap agreements had a purely monetary function. They were used solely for the purposes of intervening in the currency markets. The swap agreements established in 2008, however, were distinctive, not only for their unprecedented scale, but also by their nature, which was essentially financial. Since then, they have provided a tool to help protect financial stability by facilitating access to dollars and thus reducing the risk of a fire-sale of dollar-denominated assets. In practice, they contribute to a very large extent to the funding of US resident banks (see below).

Back in 2008-2009, the triggering of swap lines, to complement emergency loans and the debt security purchasing programmes[12], helped reduce the risk of a cut-price sell-off by foreign commercial banks of their portfolios of US mortgage-backed securities, and thus helped to protect the financing of the American economy. The run on the liabilities of US money market funds with constant net asset value caused a drying up of the market for commercial paper, which such

[9] As the loan from the foreign central bank to a local commercial bank is, in reality, simultaneous with the drawing down of the swap line, the increase in the foreign central bank's deposits with the Fed is not visible in the statistics. Thus, at 22 April, the Fed's outstanding swap transactions (on the asset side of its balance sheet) were USD 409.7 bn, whilst foreign central bank deposits (liabilities) were only USD 16.3 bn. Because of the simultaneous nature of lending operations, an increase in the Fed's outstanding swaps finds its real counterparty in an increase in the reserves of resident banks held by the Fed.

[10] The monetary base includes notes and coins and depository institutions' reserves at the central bank.

[11] The two counterparties make margin calls, receipts from which are booked to a separate account in the event of a depreciation of either currency before the swap matures. See IMF, *Recording of Central Bank Swap Arrangements in Macroeconomic Statistics*, Statistics Department

[12] Emergency loans introduced under the Term Auction Facility (TAF) and the programme of purchasing commercial papers (Commercial Paper Funding Facility, CPFF) also allowed foreign banks to refinance themselves in dollars from the Fed. 65% of loans under the TAF went to the US subsidiaries or branches of foreign banks. 60% of the commercial paper purchased under the CPFF was issued by the US subsidiaries of foreign banks. See United States Government Accountability Office (2011), *Federal Reserve System : Opportunities exist to strengthen policies and processes for managing emergency assistance*, GAO-11-696

Box 1: The creation of central bank money following the drawing down of a central bank swap line

A European bank wishing to make transactions in a foreign currency (for example in dollars) must hold an account with one or more 'correspondent' banks, registered in the country that issues this currency (one or more US banks for dollar transactions). Let us assume that a European company (EUR Company), a client of a bank established in the euro zone (EUR Bank), wants to settle a bill for 100 currency units denominated in dollars and issued by one of its US suppliers (USD Company). The EUR Bank has an account with a US correspondent bank, the USD Bank. For the purposes of simplicity, we have assumed that the USD Company also has an account with the USD Bank. Let us further assume that the EUR Bank's account with the USD Bank does not contain the funds to cover the transaction and that the supply of dollars on the FX swap markets has dried up. The EUR Bank turns to the ECB to obtain the dollar liquidity it needs to settle its client's invoice. The ECB will draw on the swap line that it has with the Fed in order to provide the necessary funding to the EUR Bank. To simplify the example we have assumed full and total parity between the two currencies, 1 euro = 1 dollar (this simplifying assumption is clearly not relevant in the event of disruption in the swap markets but does not alter the accounting entries set out below); we have also ignored the effect of interest payments on the loans taken out.

Stage (1): The Fed records the loan to the ECB as an asset (dollars loaned to the ECB) with a matching liability to the ECB (dollar equivalent of euros deposited by the ECB). The ECB makes matching entries to its liabilities, with respect to the debt to the Fed (the euro equivalent of the dollars borrowed) and its assets in the form of its deposit with the Fed (the euros deposited with the Fed).

Stage (2): The ECB lends dollars to the EUR Bank and credits its current account with this amount (EUR Bank reserves with the ECB).

Stage (3): The EUR Bank gives an instruction to the ECB to transfer the sums to its dollar account held with its US correspondent bank (the USD Bank). The central bank reserves created in the euro zone when the ECB's loan is made are immediately eliminated by this transfer. In the books of the USD Bank, the EUR Bank's account is a client account, known as the Loro account. The EUR Bank records in its books a mirror account of its deposits with the USD Bank, known as the Nostro account. In this example, a credit balance is added to the EUR Bank's account with the USD Bank (Loro account, a liability of the USD Bank); a debit account of the same amount is registered in the USD Bank's account with the EUR Bank (Nostro account, an asset of the EUR Bank). The transfer made by the ECB (on behalf of the EUR Bank) is accompanied by a transfer of cash from the ECB's deposit account with the Fed to that of the USD Bank (responsible for the settlement of dollar amounts for the borrowing EUR Bank). Thus, a loan of dollar liquidity from the Fed to the ECB, under a swap agreement, results in an increase in US resident banks' deposits with the Fed (in their role as correspondent banks).

Stage (4): The EUR Bank instructs the USD Bank to debit its account for the amount indicated by its customer (the EUR Company) in favour of the beneficiary (the USD Company): the USD Bank debits the EUR Bank's account and credits the account of the USD Company. The EUR Bank, meanwhile, debits the deposit account of the EUR Company.

On completion of the swap, the exchange of currencies in the reverse direction eliminates the central bank reserves initially created. For the sake of simplicity, let us assume that the swap markets are once again accessible. The EUR Bank exchanges euros for dollars on the swap markets and instructs its counterparty to transfer the amount to its dollar account with the USD Bank. Once its account has been credited it instructs the USD Bank to transfer its dollar holdings to the ECB. The elimination of its debt to the ECB is accompanied by a transfer of cash from the USD Bank's deposit account with the Fed (elimination of reserves) to that held by the ECB (rebuilding the ECB's deposit account). On completion of the swap, the respective credits and debits of the Fed and the ECB, created when the swap line was drawn down, are eliminated.

Fed

Asset	Liability
(1) Swap line (USD loan to the ECB) +100	(1) ECB account (EUR deposits) +100
	(3) ECB account (EUR deposits) -100
	(3) USD Bank reserves +100

Balance sheet size: +100

ECB

Asset	Liability
(1) Account with the Fed (EUR deposits) +100	(1) Swap line (USD borrowed from the Fed) +100
(2) Loan to EUR Bank +100	(2) EUR Bank reserves +100
(3) Account with the Fed (EUR deposits) -100	(3) EUR Bank reserves -100

Balance sheet size: +100

USD Bank

Asset	Liability
(3) Reserves at the Fed +100	(3) EUR Bank deposit account +100
	(4) EUR Bank deposit account -100
	(4) USD Company deposit account +100

Balance sheet size: +100

EUR Bank

Asset	Liability
(2) Reserves at the ECB +100	(2) ECB loan +100
(3) Reserves at the ECB -100	
(3) Deposit account at USD Bank +100	
(4) Deposit account at USD Bank -100	(4) EUR Company deposit account -100

Balance sheet size unchanged

funds provide with liquidity, thus closing the traditional route to dollar access for European and Swiss banks in particular. Outstanding dollar swap lines peaked at USD580 billion in December 2008, and represented nearly a quarter of the Fed's balance sheet between October 2008 and January 2009 (Chart 1). The ECB, BoE and SNB between them accounted for nearly 95% of the dollar liquidity loaned by the Fed (80% for the ECB alone). Ultimately, the dollar liquidity made available by the Fed to foreign central banks, then distributed to local commercial banks, was eventually re-lent to US resident banks. Between 17 September and 31 December 2008, in particular, the total value of outstanding currency swaps against the dollar increased by USD 490 billion. Over the same period, US resident banks (US registered banks and the US branches of foreign banks) took on more than USD 500 billion in additional net debt from affiliated entities registered abroad (parent companies, subsidiaries or branches – Chart 2)[13].

The Fed reactivates its dollar offering through swap lines

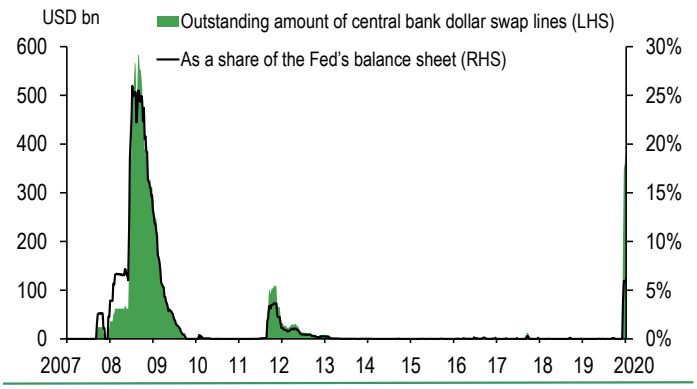

Chart 1 Source: Federal Reserve (H.4.1)

Dollar swap and financing of US resident banks

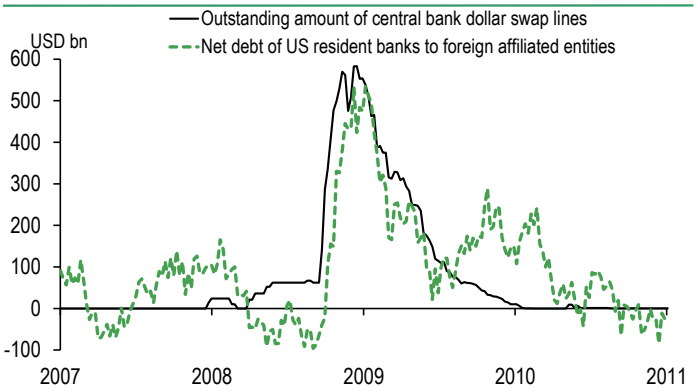

Chart 2 Source: Federal Reserve (H.4.1& H.8)

[13] The net debt of banks established in the US (US banks and US subsidiaries of foreign banks) to foreign-registered affiliated entities increased by more than USD 100 bn whilst the net credits of US subsidiaries of foreign banks relative to foreign affiliated entities fell by more than USD 400 bn. For an analysis of the net debt accumulated by US-resident banks with foreign-registered affiliates since the beginning of the 2000s, see C. Choulet (2015), *QE and bank balance sheets: the American experience,* BNP Paribas, Conjoncture, July-August 2015

Liquidity swaps for some, repos for the rest

As in 2008, the Fed has focused on establishing swap agreements with foreign central banks issuing the main currencies useful in financing US institutions, major financial centres and/or those of major trading partners. Since the end of March, drawings against these arrangements have eased pressure on certain FX swaps (the dollar against the euro, yen, sterling and the Swiss franc)[14]. A relaxation of leverage constraints on US banks could also help ease the pressure. The creation of the FIMA repo facility (for foreign central banks that do not have swap agreements with the Fed) will, however, only bring benefits if the associated costs are reduced.

The Fed reactivates its dollar offering…

On 15 March, the Fed and five central banks -- the ECB in the euro zone, BoE in the UK, BoJ in Japan, SNB in Switzerland and BoC in Canada -- agreed to reduce the cost of their reciprocal swap agreements (to OIS+25bp) and opened the possibility, on a weekly basis, of 84-day dollar loans (in addition to the existing 7-day arrangements which have been in place since 23 March 2020)[15]. On 19 March, the Fed also announced the creation of temporary swap agreements (for at least 6 months) with an expanded list of central banks. This list is identical to that put in place in 2008, but the potential transaction volume has been doubled. The central banks of Australia (RBA), Brazil (BCB), South Korea (BoK), Mexico (BdM), Singapore (MAS) and Sweden (Riksbank) can draw on lines of up to USD 60 billion each. The central banks of Denmark (DanNB), Norway (Norges B) and New Zealand (RBNZ) can draw on lines of up to USD 30 billion each.

The BoJ is the main counterparty for the Fed's swap agreements

On 23 April, drawings of dollar liquidity from the Fed had reached USD 432.3 billion (Chart 3). Half of the total took the form of borrowing dollars against yen; one third was in dollars against euros. Two observations can be made. First, as in 2008, a large proportion of dollar liquidity lent by the Fed to foreign central banks (+USD 378 billion between March, 11 and April, 15), then distributed to non-resident banks, has eventually been re-lent to resident banks, as shown by the increase in their net debts to affiliated entities located abroad (+USD 336 billion)[16]. Swap lines are used as substitutes to the discount window. Second, the position of foreign central banks towards the Fed has to be appreciated in net terms. The copious requirement for dollar refinancing at Japanese banks and institutional investors warrants the high level of the BoJ's participation in the scheme. However, the BoJ is probably also one of the main counterparties in the Fed's Foreign

[14] IMF (2020), *Global Financial Stability Overview : Markets in the time of COVID-19*, Global Financial Stability Report, April 2020

[15] Since October 2013, the network of swap lines agreed between the Fed, the ECB, BoE, BoJ, BNS and BoC has been permanent and unlimited.

[16] A means to avoid the stigma associated with the use of the discount window

Reverse Repo Pool (FRRP)[17]. Data about Japan's official reserves, as published by the Ministry of Finance, show that the volume of the BoJ's deposits "with foreign central banks and BIS" was USD127.2 billion at end-March. These figures are not sufficiently granular to evaluate in detail the level of cash that the BoJ has deposited with the Fed, particularly under FRRP. However, the very similar paths (at least between 2014 and 2019) taken by total BoJ deposits with foreign central banks from Japanese national statistics, and outstanding amounts under the FRRP facility on the Fed's balance sheet, suggest that the BoJ represents a major counterparty for the Fed (Chart 4).

The BoJ, the main borrower of dollars from the Fed

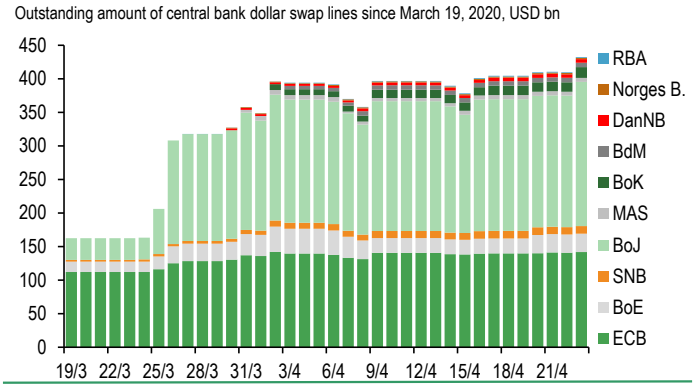

Chart 3 Source: Federal Reserve Bank of New York

The BoJ, the main counterparty in the Fed's FRRP ?

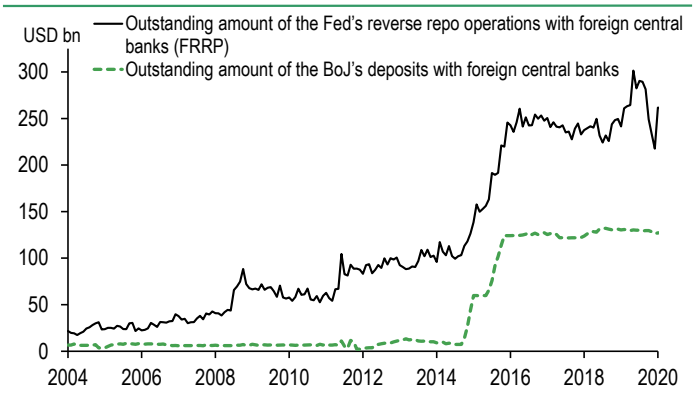

Chart 4 Source: Fed, Japanese Ministry of Finance

If this interpretation of the data is correct, it would suggest that at the end of March the BoJ had borrowed nearly USD 175 billion in dollar cash from the Fed under swap agreements (USD 215 billion on 23 April), whilst at the same time lending it the equivalent of USD 127 billion under FRRP. Theoretically, drawing against a swap line is neutral for the borrowing central bank as the cost is entirely borne by the borrowing commercial bank and the profit is received by the Fed, provided always that the borrowing commercial bank does not default. It is likely that the Fed's remuneration of FRRP[18] is still sufficiently generous[19] to offset the exposure to credit risk taken on by the BoJ.

Easing of leverage constraints should help boost the supply of dollars

Complementing these liquidity swaps between central banks (which will have the effect of reducing demand for dollars on the FX swap markets), a number of regulatory relaxations could also help ease tensions in the FX swap markets (by increasing the dollar supply). The relaxation of the leverage requirement for custodial banks (such as Bank of New York Mellon, State Street and Northern Trust) could have a particularly significant effect[20]. This rule[21], introduced on 1 April 2020, excludes from the definition of their leverage exposure (the denominator of the Basel leverage ratio) a proportion of the excess reserves held with the central bank[22]. This exclusion covers not only deposits with the Fed, but also those with central banks in other OECD countries. Assuming that the gain on dollar loans on the FX swap markets exceeds the remuneration differential on excess reserves, this relaxation could encourage big US banks specialising in security custody and management services to transfer their excess reserves from the Fed (stimulated by the quantitative easing programme) to their deposit accounts with other central banks, thus increasing the availability of dollars on the FX swap markets.

The relaxation in the leverage constraints for very big banks, introduced by the Fed on 2 April 2020[23], could work in the same way. For the period up to 31 March 2021, this change allows US Bank Holding Companies and Intermediate Holding Companies [24] subject to the Supplementary Leverage Ratio [25] to exclude from their leverage exposure reserves held at the Fed and Treasuries. This relaxation seeks, in particular, to reduce the balance sheet constraints faced by primary dealers (the subsidiaries of these big groups), whose portfolios of Treasuries have grown constantly. The exclusion of Treasuries

[17] Through the FRRP, the Fed puts securities into overnight repo with foreign central banks, which lend it cash in return.

[18] The Fed does not provide regular information on the interest rate paid on the FRRP facility. It only provides for each year the average rates for the first quarter, first half and first nine months when it publishes its (unaudited) quarterly financial statements. Its (audited) annual financial statements, by contrast, contain no information on the average annual rate. Reconstituting the rates offered allowed us to highlight very attractive rates on the facility from mid-2018 to September 2019. See C. Choulet (2019), *The Fed's new role under Basel 3*, BNP Paribas, EcoFlash, October 2019

[19] The Federal Open Market Committee, which oversees monetary policy, announced a cut in the rate on the FRRP facility last December, a cut that seems to be reflected in the fall in outstandings between end-September 2019 and end-February 2020.

[20] Z. Pozsar (2020), *US Dollar Libor and War Finance*, Credit Suisse, Global Money Notes #29

[21] Department of Treasury, Office of the Comptroller of the Currency, Federal Reserve System, Federal Deposit Insurance Corporation (2019), *Regulatory Capital Rule: Revisions to the Supplementary Leverage Ratio to exclude certain central bank deposits of banking organizations predominantly engaged in custody, safekeeping, and asset servicing activities*, Final rule, November 2019

[22] In accordance with section 402 of the Economic Growth, Regulatory Relief, and Consumer Protection Act (EGRRCPA), passed into law in May 2018.

[23] Federal Reserve System (2020), *Regulatory Capital Rule: Temporary exclusion of US Treasury securities and deposits at Federal Reserve Banks from the Supplementary Leverage Ratio*, April 2020

[24] US subsidiaries of foreign banks

[25] Those with consolidated assets of over USD 250 bn

should allow dealers to make greater use of repo loans[26] (with private counterparties or the Fed) and to make higher volumes of repo loans to hedge funds and asset managers, which are significant suppliers of dollars, alongside US banks, on the FX swap markets[27].

...and extending its scope

To ensure broader access to dollar liquidity, the Fed announced on 31 March that it had created a repo facility for foreign central banks and international monetary authorities with a FIMA account at the Federal Reserve Bank of New York (Foreign and International Monetary Authorities Repo Facility). Since 6 April, and for at least 6 months, foreign central banks can place the US Treasuries they hold into a repo arrangement with the Fed in exchange for dollar liquidity[28]. Transactions are on an overnight basis and are charged at the rate on reserves (IOR, which has been 0.1% since 16 March), plus a premium of 25 basis points. No limit on the amount has been specified, but requests must be approved by the Fed.

The effect of the FIMA repo facility on the Fed's balance sheet

In common with the reverse repo transactions between the Fed and foreign central banks (FRRP), these repo transactions are made through US correspondent banks. The Fed recognises, as a balance sheet asset, a credit against the foreign central bank that has put securities into repo, and credits the same amount, as a liability, to the current account of the commercial bank that is acting as an intermediary for the transaction (reserves with the Fed). The latter then credits, in its own books, the dollar deposit account of the foreign central bank. As with the swap deals and repo transactions carried out with primary dealers, this repo facility will swell the Fed's balance sheet and increase the monetary base. Through these transactions, however, the Fed does expose itself to a market risk (from a fall in the value of Treasuries), which seems minimal given the purchases of Treasuries that it is also making under the quantitative easing (QE) programme.

A structure that is too costly to bring benefits

The opening up of this access to dollar liquidity for many countries (particularly emerging economies) that do not have bilateral swap agreements with the Fed aims to reduce the risk of a fire-sale of Treasuries[29] (to meet domestic demand for dollar financing or to ease pressure on the foreign exchanges). In February 2020, foreign central banks held USD 4,260 billion in US Treasury securities[30], one-quarter of the USD 16,000 billion of marketable Treasuries. Japan (USD 1,268 billion) and China (USD 1,092 billion), taking all economic agents together (official and not, financial and not), are the US federal government's two biggest creditor economies. There are many statistics for the holdings of foreign central banks of securities issued by the US and/or denominated in dollars[31]. Unfortunately, however, they do not provide a national breakdown of holdings of Treasuries. In addition, they are updated relatively infrequently. The change in the value of Treasuries that foreign central banks put in custody with the New York Fed does give a rough[32] order of magnitude of their likely sales of securities (Chart 5): this shows that portfolios shrank by USD 150 billion between 26 February and 22 April.

Offloading

Outstanding amount of Treasuries held in custody at the Fed of New York for foreign official and international accounts, USD bn

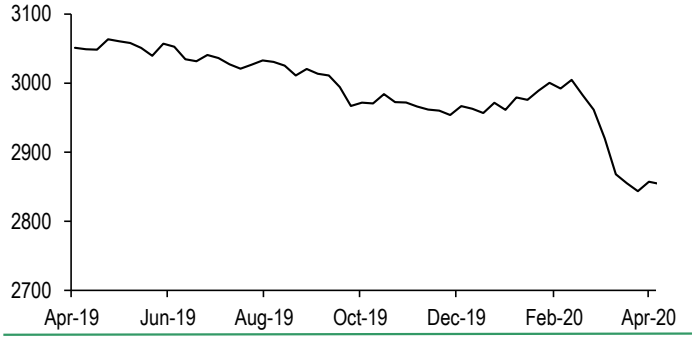

Chart 5 Source: Federal Reserve (H.4.1)

For the time being, the high cost of this repo facility has discouraged foreign central banks from taking advantage of it[33]. By charging at a rate of IOR+25bp, the Fed implicitly treats this as a quasi-swap line (charged at IOR+25bp), whereas in fact it remains a repo facility. By way of comparison, the median lending rate on private repo markets, the SOFR, was 0.02% on average in April; meanwhile, for repo transactions with primary dealers, the Fed charges only the IOR rate (of 0.1%). Reducing the cost of this facility would, however, bring benefits. It would do more than just meet the main purpose of this facility: to give foreign central banks that do not have swap agreements with the Fed the ability to provide low-cost dollar liquidity to their national economies. It would also help ease tensions on the FX swap markets. Used more widely, the FIMA repo facility would help reduce repo borrowings by foreign central banks from dealers, and particularly US dealers. As with the relaxation of the leverage constraint on dealers, this would free up room on dealers' balance sheets to allow financing of hedge funds and asset managers and thus help boost the supply of dollars on the FX swap market.

[26] This exclusion should also help primary dealers absorb the deluge of Treasury issues made with a view to financing the US stimulus package.
[27] C. Borio, R. McCauley and P. McGuire, *FX swaps and forwards: missing global debt?*, BIS Quarterly Review, September 2017
[28] The same discounts apply as applied at the discount window.
[29] For an analysis of the considerable disruption to the Treasuries market in mid-March, see A. Schrimpf, H.S. Shin and V. Sushko (2020), *Leverage and margin spirals in fixed income markets during the Covid-19 crisis*.
[30] https://ticdata.treasury.gov/Publish/mfh.txt
[31] There are eleven data series.
[32] This figure has the advantage of being published weekly. However, it only shows a share of the Treasuries held by foreign central banks (those held in custody at the FRBNY). It is also based on the principle of legal ownership: securities sold (acquired) temporarily through a repo (reverse repo) arrangement are excluded (included).
[33] On 22 April (the most recent figures available at the time of writing), outstanding repos by foreign central banks with the Fed were nil (having been just USD1 million on 8 April).

***

Dollar refinancing has acquired a much greater importance than it had in 2008. This is due to the rapid growth in dollar debt outside the US over the past decade (Box 2) and the nature of the indebted parties. In 2008, stress on dollar liquidity was attenuated by the financing of troubled banks, the purchasing of assets or debts held on the balance sheets of highly indebted financial institutions. Today, other mechanisms seem to be required. By slamming the brakes on global economic activity, the current crisis has directly weakened the real economy. Constraints on the production and delivery of products, resulting from the unprecedented lockdown measures introduced in nearly all countries, have increased the dollar working capital requirements of non-financial firms, which are exposed to each other through global supply chains and in many cases are highly dependent on market financing [34]. It seems clear that the swap and repo arrangements introduced by the Fed and other central banks will only be fully effective if they are backed by local measures to postpone fiscal charges, guarantee loans or purchase debts.

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Completed on 24 April 2020

[34] Z. Pozsar and J. Sweeney (2020), *Covid-19 and Global Dollar Funding*, Credit Suisse, Global Money Notes #27

Box 2: A massive hidden debt

The scale of dollar debt owed by economic actors resident outside the USA is very hard to quantify, as part of this debt is raised on the derivatives markets (FX swaps[35], currency swaps and outright forwards) and thus recorded off balance sheet. However, FX swaps, currency swaps and forwards differ from other types of derivative contracts: they entail a debt obligation for the full face value of the contract. On maturity of an FX swap, the full notional amount of the contract must be repaid, rather than just its fair value (cost of replacing the position). Borrowing dollars on these markets therefore represents a form of 'hidden debt', as described by Borio, McCauley and McGuire (2017)[36].

From an economic point of view, an FX swap is comparable to a repo agreement. Like repo operations, FX swaps are essentially secured loans (cash against securities for the former, currency against currency for the latter) coupled with a commitment to repurchase the collateral at an agreed price on maturity. However, their accounting treatment is different. A repo agreement increases the size of the borrower's balance sheet. This results from the fact that the securities submitted in a repo arrangement stay on the borrowers' balance sheet. The borrower's liabilities increase by the amount borrowed under the repo, and its assets by the cash received (or the asset acquired using this loan). Conversely, a swap has no effect on the borrower's balance sheet: the currency borrowed simply replaces the local currency put into the swap. In other words, the repo form of secured loan creates additional debt, which is not true of the swap form, due to its nature as a derivative instrument[37]. Granted, this hidden debt serves to hedge currency risk, which in principle helps maintain financial stability. However, it exposes borrowers to increased liquidity risk in periods of market stress: positions are renewed on a very short cycle (sometimes a week or just a few days), whilst the maturity of the hedged assets is generally longer.

Based on BIS statistics[38], Borio, McCauley and McGuire (2020)[39] estimated that the total outstanding dollar debt on the FX swap and forward markets of non-US banks stood at USD 30,000 billion at the end of June 2019[40], more than double their gross dollar-denominated balance sheet debt of USD 13,000 billion. Non-US and non-bank dollar debt (non-banking financial companies and non-financial agents) on these markets stood at USD 18,000 billion (compared to USD 11,900 billion of dollar-denominated debt on balance sheets). Foreign central banks are very active on the FX swap and forward markets: the central banks of South Korea, Singapore, Japan and Thailand in particular are net lenders of dollars against their own currencies on the forward markets[41], or against other currencies (yen or euro) in the case of the central banks of Australia[42] and China[43].

[35] A foreign exchange swap consists of a double currency transaction: an exchange of currencies at the spot rate and a forward exchange in the reverse direction at a pre-agreed exchange rate. A currency swap is similar to an FX swap, except that the two parties agree to exchange both principal and interest payment streams over a longer term. A forward contract is an agreement to exchange currency on a future date at an agreed exchange rate (the forward leg of an FX swap). FX swaps are the derivative of choice for hedging currency risk (75% of transactions), ahead of forwards (22%) and currency swaps.

[36] Borio, McCauley and McGuire (2017)

[37] Another reason relates to the definition of control, which in the case of cash requires the control of the cash itself, but in the case of securities relates to the corresponding cash flows. A repo gives rise to a transfer of the legal ownership of the securities used, but not their economic ownership; they therefore remain on the balance sheet of the borrower of the cash.

[38] A. Schrimpf and V. Sushko, *Sizing up global foreign exchange markets*, BIS Quarterly Review, December 2019

[39] C. Borio, R. McCauley and P. McGuire, *Foreign exchange swaps: Hidden debt, lurking vulnerability*, VOX CEPR Policy Portal, February 2020

[40] The market-making activities of major banks (accumulating short and long positions on the same security) and the dollar's status as an international currency (a European institution wishing to invest in an asset denominated in Thai baht will trade euros for dollars and then dollars for baht) automatically increase these figures.

[41] Borio, McCauley and McGuire (2017)

[42] Borio, McCauley and McGuire (2017)

[43] Pozsar and Sweeney (2020)

Preparing for leaner pensions

Raymond Van der Putten

In the coming decades, the European countries will be confronted with rising costs related to population ageing. Based on very optimistic assumptions, simulations carried out by the EU's Economic Policy Committee suggest that these costs are manageable. Persons that enter the workforce now are unlikely to retire under the same conditions as those who retire at the moment. The transition to leaner public pension schemes calls for accompanying measures such as incentives to remain longer in the labour force and inducements to better prepare retirement. In particular, the authorities could inform employees regularly about their pension rights and encourage them to increase their retirement savings.

Over the past decade, Europe's pension regimes have been successful in meeting their social objectives. The relative income position of old-age pensioners has markedly improved. Between 2005 and 2018, the at risk of poverty rate for those aged more than 65 year declined by 7 points in the EU and is even well below that of the overall population in many of the member states.[1] In 2018, the poverty rates for the elderly are lowest in Denmark (9.6%) and France (9.9%).

However, population ageing provides an enormous challenge to the sustainability of the European public pension systems. As the public pensions are financed by pay-as-you-go systems (PAYG), the rising pension burden has been increasingly shared among less numerous cohorts.

In this study, we concentrate on pension adequacy for future pensioners. Following pension reforms, already implemented or to be expected, public pension entitlements are likely to be less generous for them. Many workers are not aware that they might retire in future on the less favourable conditions than those that are currently leaving the labour market. Better information should be given to them in order to adapt savings to their expected retirement pension.

Financial consequences of population ageing

The European public pension systems are based on a PAYG system. It is an intergenerational contract, whereby those in activity pay for those in retirement. They are willing to do that as they expect that future generations will pay for them once they retire. The contract does not only bind current generations of pensioners and workers, but also generations not yet active or even those not yet born.

The importance of the public pension regimes in Europe are well illustrated in chart 1. In many European countries, public pension schemes are virtually the only source of income for the elderly population. In the English-speaking countries and the Netherlands, the public pension regime is only a basic pension, which is supplemented by mandatory or voluntary private schemes.

Income source of people 66+, % of disposable revenue

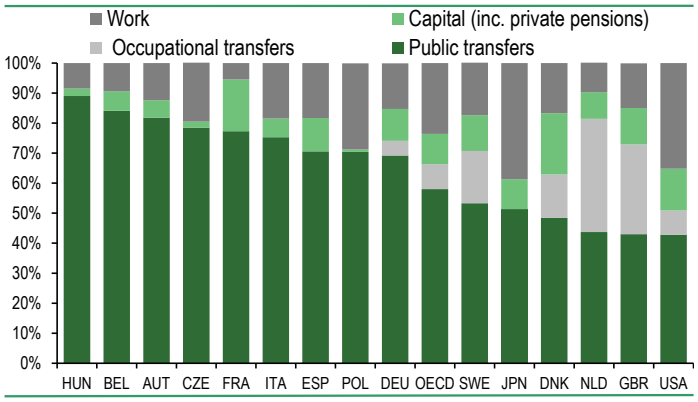

Chart 1 Source: OECD

The public pension systems have been successful in reducing dramatically poverty among the elderly in the EU countries (chart 2).

At risk at poverty: individuals aged 65 and older

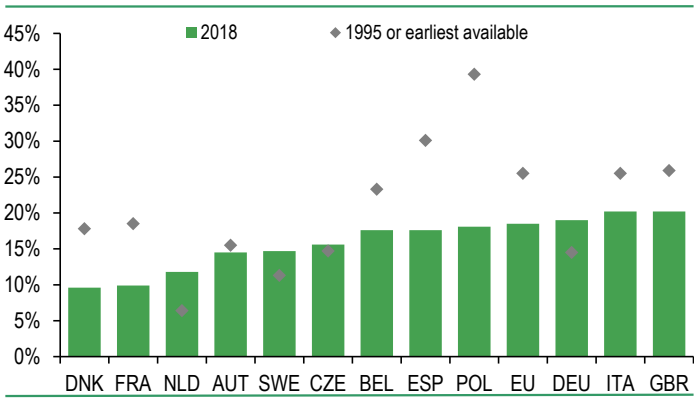

Chart 2 Source: Eurostat

In some countries, mainly in the EU-15, the income position of the elderly is even better than for the working-age population aged between 25 and 54 (chart 3).

[1] The at-risk-of-poverty rate is defined at the percentage of the population living in a household whose income falls short of the poverty threshold, put at 60 % of national median equilised disposable income, i.e. taking into account differences in household's size and composition

The situation has also improved in central and eastern Europe. As a result, elderly people have become more independent and many of them are able to enjoy retirement in reasonable comfort.

At risk of poverty rate : 65+ compared with prime-age workers (25-54)

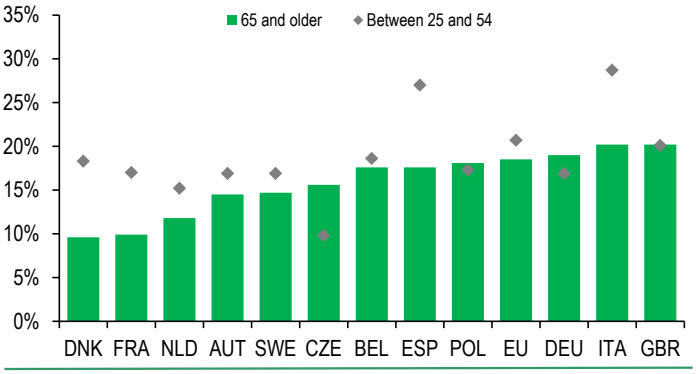

Chart 3 Source: Eurostat

A major threat to the pension system is the rise of the old-age dependency ratio over the next 30 to 40 years. According to Eurostat's long-term demographic projections, the number of working-age people per pensioner will halve by the year 2050 going from 3.5 to 1.8 at EU level. The demographic effect of the post-war baby boom will start decreasing at around 2030 and is expected to disappear not earlier than the middle of the century.

An intergenerational contract is rather fragile and could break down if current workers expect receiving only small pensions in return for their contributions. In that case, working generations would resist paying these high contributions, which would send the pension system crashing down. Hence, it is important that legislators keep an eye on the long-term sustainability of the pension system. However, knowing the resistance of the population against pension reforms, governments are usually rather reluctant to embark on such a project. In fact, in an unfunded system, governments do not reap the rewards of such reforms. On the contrary, it is tempting for them to improve on pension promises, as they do not cost anything in the short-run.

Insight in the economic consequences of population ageing can be gained from the 2018 Ageing Report of the EU's Economic Policy Committee (see table 1, page 16).[2] The report presents different scenarios using the Eurostat population projections and assumptions concerning a set of exogenous macroeconomic variables covering the labour force, labour productivity and real interest rates. The projections are policy neutral, i.e. all the voted policies are included. In order to capture country specific circumstances, the projections for pensions were run by the Member States using their own national model.

In the baseline scenario, the age related spending – public pensions, health care and long-term care - is projected to increase moderately from 19.6% of GDP in 2016 to 21.4% of GDP in 2070, largely due to increased spending on health care and long-term care. Public pension spending in the EU, the main focus of this article, is projected to rise from 11.2% in 2016, peak around 2040 at 12% of GDP, before declining to 11% of 2070. From this perspective, the financial consequences of population ageing look manageable. This is the case not only for the EU as a whole, but also for the individual member states.

However, there are large risks associated to this central path. Even small deviations from the assumptions could result in a significant derailment of public finances in the long-term. One of the crucial assumptions is that related to productivity growth. The European scenarios assume that total factor productivity growth will increase from 0.5% in the period 2016-2020 to 1% from 2040 onwards. The choice of this relative high productivity rate maintained over 50 years is not explained.

It is questionable if the past provides some guidance for future productivity growth. In case of heightened uncertainty, a more prudent productivity assumption would have been warranted. It is true that we probably have not exploited yet all the advantages of digitalisation of the economy. On the other hand, some authors have warned that population ageing could weigh on productivity growth.[3] Secondly, climate change is likely to weigh on the world growth prospects in the coming decades. Productivity growth is likely to slow due to the implementation of strict environmental regulations.[4] In addition, the negative effects of climate change on growth are likely to weigh on productivity growth[5]. To test the sensitivity of this crucial assumption for the results, simulations are also made using a slightly lower total factor productivity growth rate (0.8%). In this scenario, the total pension costs could end up 0.8 points of GDP higher.

In addition, even though only adopted reforms have been included, for some countries these policies may result in socially undesirable results, which make it likely that the rules will be amended in future.

For example, some EU countries have linked the pensionable age to life expectancy. As a result, the normal retirement age for somebody entering the labour market in 2018 at 20 year will be around 70 in Denmark, the Netherlands and Italy. It is unlikely that this can be implemented as general rule.

Moreover, in some countries, cost savings are achieved by increasing the difference between the average pension and the average wage, the so-called benefit ratio. This ratio is affected by the legal framework concerning the calculation of the pension, the so-called replacement rate, and indexation rules. On average, the benefit ratio would diminish gross public pension expenditure by 3.3% points of GDP. In France, the benefit ratio could even decline by close to 5 points between 2016 and 2070 due to indexation of pension benefits to consumer prices instead of wages. The relative decline of pension benefits compared to average wages implies that the poverty risk of the retired population is set to

[2] The 2018 Ageing Report: Economic and Budgetary Projections for the EU Member States (2016-2070)

[3] Maestas, Nicole, Kathleen J. Mullen, and David Powell, *The effect of population aging on economic growth, the labor force and productivity*, No. w22452, National Bureau of Economic Research, 2016

[4] Kozluk, Tomasz, and Vera Zipperer. *Environmental policies and productivity growth*, OECD Journal: Economic Studies 2014.1 (2015): 155-185

[5] Kahn, M. E., Mohaddes, K., Ng, R. N., Pesaran, M. H., Raissi, M., & Yang, J. C. (2019), *Long-term macroeconomic effects of climate change: A cross-country analysis* (No. w26167), National Bureau of Economic Research

increase. The deterioration of the income position of the elderly corresponds with OECD calculations of actual and future replacement rate (chart 4).

Gross replacement rate from mandatory schemes
(full career average male earners after labour market entry at age 20)

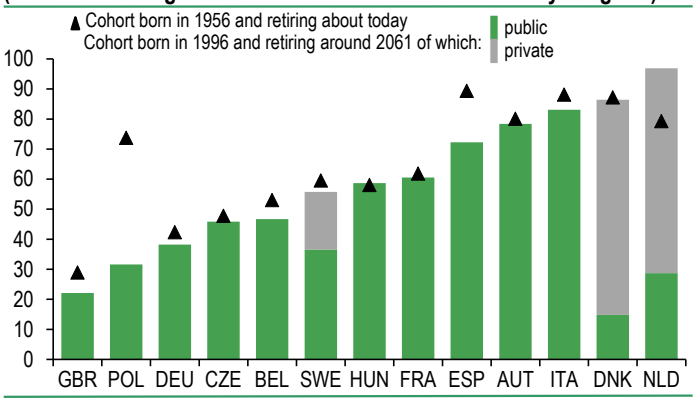

Chart 4 Source: OECD

Macro and micro savings behaviour

The European projections suggest that the financial consequences of population ageing are manageable, but that the income position of the elderly is likely to deteriorate as a result of the projected or anticipated pension reforms. An important question is how workers will react to changes in generosity of pension earnings. Will it induce them to work longer or do they prefer to increase their savings and quit the labour market at the earliest possibility?

The traditional economic approach is the life-cycle theory of consumption developed by Franco Modigliani. [6] His idea was that forward looking economic agents operating in perfect markets will rationally plan their consumption over their lifetime in order to maximize lifetime utility. During their years in activity, they will save sufficiently in order to maintain, in combination with their pension benefits, their consumption levels in retirement.

Modigliani's life cycle model predicts a link between household savings and the age composition of the population. At a macro level, there is indeed ample evidence that countries with more elderly populations, which save less or even use their savings for their expenditure, tend to have lower savings rates[7]

However, using micro data, age-specific savings behaviour seems quite at odds with the predictions of the life cycle model. Poterba shows that age-specific personal saving rates in the G7 countries are positive for all age groups.[8] The savings rate for those older than 64 is higher than 15%, which is actually only exceeded by those between 50 and 64. Households do not seem to run down their savings in retirement. Moreover, many workers nearing retirement do not have substantial savings and income from public pensions is their main income source.

His results were earlier confirmed for the Netherlands.[9] In that study, it is shown that most households only have small savings to provide a buffer in the case of adverse events. Consumption is fully financed through social security and income from mandatory pension schemes. In the case of households with substantial savings, there is little evidence of decumulation of wealth. It suggests that that the bequest motive is important for the wealthier households.

David Miles suggests that the high savings rate that is reported in these micro studies might be partly related to the way it is calculated.[10] Normally, the saving rate is calculated by savings over income. Assume that a retired person has two sources of income, pension income which is a constant annuity at level P and income from other sources Y_t.

Assuming that a fraction of income is consumed, one could write:

$$C_t = \alpha(P + Y_t)$$

In this case the savings rate is 1-α

The annuity is calculated by means of a mortality table so that at the end of the person's life all assets would be depleted. Miles' true savings rate takes into account the (notional) decline of the person's assets until his death. Consider plausible values (α=0.85, the interest rate r = 0.04) and assume that the person is only 10 years from his death. The conventional savings rate is 0.15. However, once we assume that the person has completely used his assets by the time of his death, the corrected savings rate is -28%. The closer the person is to the hour of death, the higher the decumulation of assets and the lower the savings rate. Five years before his death, the corrected savings rate is -44%.

Miles studied the question in the context of funded retirement assets. In most of Europe, the pension schemes are unfunded. It does not change the analysis fundamentally. The value of pension assets in a funded scheme can be viewed as the present value of the income stream from the assets and future contributions. [11] It is evident that this value fluctuates with interest rate expectations, stock price indices etc. Public pension received from a PAYG system could be similarly valued as the present value of the pension benefits. Also the present value of PAYG pensions fluctuates, although less than that of funded schemes. However, to the extent that a PAYG system is debt-financed, the effect of interest rate fluctuations nets out: when rates decline, the net present value (NPV) of future payments increase but borrowing costs decline as well, enabling the public sector to cope with the higher NPV. Depending on the indexation rule, wage and price developments could play a role.

[6] For a good overview see Deaton *Franco Modigliani and the life-cycle theory of consumption*, BNL Quarterly Review, vol. LVIII, nos 233-234, June-September 2005, pp. 91-107
[7] See for example Wong, B., & Tang, K. K. (2013), *Do ageing economies save less? Evidence from OECD data*, International Journal of Social Economics
[8] Poterba, J. M. (Ed.). (2007), *International comparisons of household saving*, University of Chicago Press
[9] Alessie, R., Lusardi, A., & Kapteyn, A. (1995), *Saving and wealth holdings of the elderly*, Ricerche Economiche, 49(3), 293-314
[10] Miles, David. *Modelling the impact of demographic change upon the economy*, *The Economic Journal* 109.452 (1999): 1-36
[11] Nowadays, most privately funded schemes are defined contribution schemes, in which the person's future pension depends on the amount put into the fund and the fund's investment performance. By contrast, the public PAYG systems are defined benefit schemes, in which the fund guarantees a benefit related to the salary earned.

A major uncertainty is the possibility that the government can change the rules in particular for budgetary reasons.[12]

Longer working or increasing savings

Micro data are a rich source of information for studying savings and a wealth of data of age clusters. However, as they only are available for relatively short time spans, they are of limited use in analysing the macroeconomic consequences of population ageing. In this case, overlapping generations models, first introduced by Auerbach and Kotlikoff, are a more promising alternative for policy analysis.[13] By using plausible values for the parameters, the transmission channels of policies that deal with population ageing can be analysed and the robustness of the results tested.

Oliveira Martin et al. use simple overlapping generations models for some OECD countries including Germany and France.[14] The baseline assumes that no policy changes are introduced. To keep the pension systems balanced, pension contributions have to be raised. In France, the replacement rate remains fixed at 64% and the contribution rate doubles to around 40% by 2050.[15]

The base scenario serves as reference for two alternative reform scenarios. In the first reform scenario, the retirement age is gradually increased, roughly in line with the increase in longevity. Replacement rates remain the same and the contribution rates are adapted to keep the pension regimes balanced. In this scenario, the contribution rate has still to rise but to a lesser extent. In France, the contribution rate is set to increase by around 6 points to 28% of taxable revenue. Percentagewise this represents a very considerable increase. In Germany, contribution rates remain around the same level reflecting the less generous German pension regime. Due to the increase in the retirement age, labour force participation increases, resulting in a decline in the capital–labour ratio.

In the second reform scenario, the contribution rates are frozen and the replacement rates are gradually reduced for new retirees. Both in France and Germany, the replacement rate would drop by more than 20 points in the long-term compared to the base scenario, to around 37% and 30%, respectively. As workers are forward-looking, they are increasing their savings to maintain their consumption in retirement. As a result, long-term interest rates continue to decline.

In terms of GDP, the base scenario or no-reform scenario is the worst. Because of the increase in contribution rates, in particular in France, Germany and Japan, workers in these countries increasingly prefer leisure to working. As a result, GDP per capita declines in these countries relative to the one in the US. The two reform scenarios demonstrate that policies that aim for increasing the retirement age or improve pension saving are best in softening the impact of ageing on growth. In the latter case this is due to the positive impact of lower long-term interest rates on growth.

How much do we need in retirement?

A major question is how much is needed in retirement. In the case of the US, the estimates of replacement rate vary between 65% and 85% of preretirement income. A recent study by Ghilarducci, Papadopoulos and Webb assumes a replacement rate target of 85 percent for workers earning below USD 40,000, a 75 percent target for workers earning between USD 40,000 and USD 115,000, and a 65 percent target for workers earning more than USD 115,000.[16]

US social security replaces around 43% of the pre-retirement income of workers earning less than the median, implying that these workers need 42% of their earnings from retirement savings to reach the 85 percent target mentioned in Ghilarducci et al. As about 50% do not have any retirement plan, they have a high risk of falling into poverty. Even in the case of low income earners with retirement plans, these plans replaces only 14% of pre-retirement income in the case of only a defined contribution scheme and 24% in the case of a defined benefit scheme. This is insufficient to arrive at the 85% target replacement rate for this income group.

A typical assumption in these studies is that the person wants to maintain a constant level of consumption. In a highly interesting study, Scott, Shoven and Slavov question this assumption.[17] In an earlier study, the same authors already argue that the target replacement rate should be adjusted in response to low returns and low wage growth. They argue that a fall in the rate of return on safe assets implies a substantial hit to wealth accumulation. This wealth effect lowers optimal consumption both for the rest of the working career and in retirement. For the case that personal time preferences remain unchanged, future consumption becomes more expensive relative to current consumption, as you need more assets today, which will accumulate with the lower risk-free rate to be able to finance future spending. This would encourage bringing forward consumption, resulting in lower saving. This is contrary to the often heard argument that workers should save more in order to maintain their standard of living in retirement.

Life cycle models often make the simplified assumption of maintaining consumption constant in retirement. However, such behaviour may not be optimal for retirees. Some researchers have found that consumption in early retirement tends to exceed sustainable consumption and declines rapidly afterwards. An important reason is the low level of (real)

[12] In Greece, public pensions were drastically cut as pre-condition for receiving aid from the European Commission, the ECB and the IMF.
[13] Kotlikoff, L. J., & Auerbach, A. (1987), *Dynamic Fiscal Policy*. Cambridge University Press. For an application for France see, Raymond Van der Putten, *Saving for retirement*, BNP Paribas Conjoncture, July-August 2014.
[14] Martins, J. O., Gonand, F., Antolin, P., & Maisonneuve, C. de la, Yoo, K.-Y.(2005), *The impact of ageing on demand, factor markets and growth* (No. 420), OECD Economics Department Working Paper
[15] Contrary to the EU Ageing Report, the OECD study leaves the parameters of the pension regimes at their actual values and do not take into account already voted policy changes.
[16] Ghilarducci, T., Papadopoulos, M., & Webb, A. (2017), *Inadequate retirement savings for workers nearing retirement*, Schwartz Center for Economic Policy Analysis and Department of Economics, The New School for Social Research, Policy Note Series
[17] Scott, J. S., Shoven, J. B., Slavov, S. N., & Watson, J. G. (2020), *Can Low Retirement Savings Be Rationalized?* (No. w26784), National Bureau of Economic Research

interest rates. It implies that the market return to patience, i.e. the real interest rate, is zero or even less. As almost anybody prefers to consume now rather than tomorrow, consumption will be downward sloping over time.

A second reason is the risk of mortality and serious health problems. Many lifecycle models do not incorporate these risks and allow the agent to run down his assets till the end of his life. In reality, mortality and health risks increase with age. As the end of life is uncertain and certain kinds of consumption, such as holidays, might be limited in future by health constraints, people might be tempted to bringing consumption forward, thus steepening the negative slope of consumption of people in the retirement years.

Annuities and reverse mortgages are possible solutions for overcoming the risk of assets depletion before dying. However, annuities are quite expensive because of adverse selection. In calculating the price of the annuity, the insurer that is taking on the longevity risk, reckons that buyers are in relative good health and that their average life expectancy is superior to the average of their age group. Moreover, the payout of the annuity, a constant amount until the holder's death, does not necessarily correspond with the optimal consumption pattern of a retiree. As the person gets older, personal consumption might be limited by health problems, while medical expenses are, in general, covered by insurance.

Finally, the lack of retirement savings may be attributed to the generosity of the social security system. Hubbard *et al.* find that under uncertainty, asset-based means tested social-insurance programmes depress saving for two distinct reasons.[18] First, by lifting the uncertainty in the case of adverse events such as large medical expenses, the social programme decreases the need for household to build up precautionary savings. Second, households with sufficient assets disqualify for these programmes and, in the case of a bad event, have to pay the costs of these expenditures themselves. This can be perceived as heavy wealth tax.

Preparing for retirement

The interesting question is how the active population is prepared for the changes already implemented and those to come. How many young people that actually enter the labour market are conscious that their pension might be less generous than those for preceding generations?

According to the 2016 AVIVA Consumer Attitude Survey conducted in several European countries, half of those not yet retired are worried that they will not have enough money at retirement. However, only a third is taking steps to amend it. Among the strategies mentioned are regularly setting money aside and taking out a private pension, the latter in particular in Ireland and the UK. Also many respondents –around 30% in Italy, France and Spain - expect to use their home for retirement income, despite being a less liquid asset. In addition, an increasing number of elderly are working beyond the legal retirement age. More than half of the respondents in the AVIVA survey declare that they have continued to work as they needed the money. As a result, after having declined for several decades, the effective retirement age started to rise again in the OECD (chart 5).

Average effective age of retirement

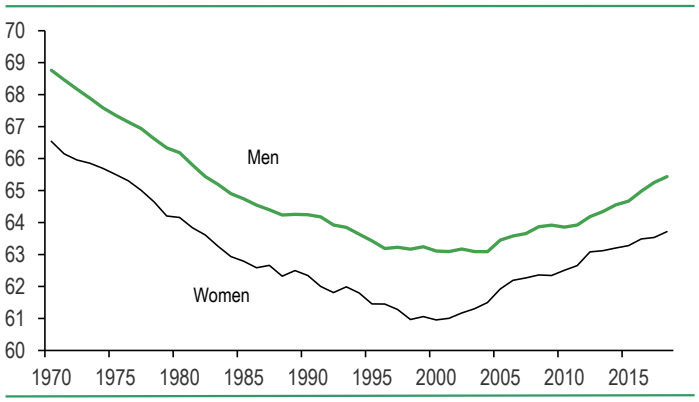

Chart 5 Source: OECD

Several studies indicate that retirement savings could be considerably increased through information and financial education. In Germany, as of 2005, the public pension administration has been sending out annual letters to individuals older than 27 to inform them about their expected pension payments. A group of researchers studied the reaction of employees on receiving the letter by exploiting the savings difference between 26 and 27 year-olds.[19] As a result of the information letter, the 27 year-olds indeed stepped up their saving. The full increase does not materialise immediately, as people have to collect information concerning the best way to increase their savings. The researchers did not find evidence that the increase in private retirement savings was crowding out other forms of saving.

Research in the US confirms that providing more information about their post-retirement income is a good way for boosting retirement savings. Esther Duflo and Emmanuel Saez report an experiment at a large university.[20] The university provides a complementary Tax Deferred Account plan (TDA). In order to boost participation, the university organises an annual fair. It is clear that those who attend the fair are also those who are most likely to sign up or change their benefit choices. Duflo and Saez selected a random sample of employees not yet enrolled in the TDA and sent them an invitation letter promising a USD 20 reward for attending the fair. It turned out that these individuals were three times as likely to attend the fair as those in the control group. Moreover, control individuals that worked in the same departments as those who received the invitation letter were twice as likely to attend the faire as those in other departments, even though they did not receive the USD 20 award. This shows the importance of peer effects.

[18] Hubbard, R. G., Skinner, J., & Zeldes, S. P. (1995), *Precautionary saving and social insurance*, Journal of Political Economy, 103(2), 360-399

[19] Dolls, M., Doerrenberg, P., Peichl, A., & Stichnoth, H. (2018), *Do retirement savings increase in response to information about retirement and expected pensions?* Journal of Public Economics, 158, 168-179

[20] Duflo, E., & Saez, E. (2003), *The role of information and social interactions in retirement plan decisions: Evidence from a randomized experiment*, The Quarterly journal of economics, 118(3), 815-842

Many US companies offer pension plans to their employees. In the past, employees had to explicitly sign up for the plan. Despite the considerable benefits for the participants in terms of tax-free savings, many failed to do it because of the administrative work involved, typically filling out a short form. Nowadays, automatic enrolment has become the rule. This has been a remarkable success. In one plan studied by Madrian and Shea, participation rates for newly eligible workers increased from 49% to 86%.[21] However, most participants joined at a modest saving rate, around 3% of income and didn't adjust this subsequently. As a result, many employees retire with inadequate pensions.

Richard Thaler and Shlomo Benartzi designed a scheme, called 'Save More Tomorrow' in which the savings rate is automatically adjusted.[22] In this scheme, participants commit in advance to allocate a portion of their future salary increases toward retirement savings. It is a nice application of behavioural finance. The programme has been very successful in increasing retirement savings. 'Save More Tomorrow' may have helped approximately fifteen million Americans significantly boost their savings rate.

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According to the 2018 EU ageing report, the financial consequences of population ageing are manageable. Public pension is projected to rise from 11.2% in 2016, peak around 2040 at 12% of GDP. However, the macroeconomic assumptions look rather optimistic. In particular, the scenarios assume that total factor productivity growth will be around 1% in the long-term. Under more prudent assumption, the costs of population ageing could substantially increase as a percentage of GDP.

In addition, the European scenario assumes some drastic reforms, which have already been voted but are unlikely to be fully implemented. In particular, in some countries, the legal retirement age could increase to around 70. Moreover, the scenario assumes a substantial relative decline of the average pension compared to the average salary. In some countries, the risk at poverty among pensioners, i.e. receiving less than 60 % of national median equivalised disposable income, could substantially increase without additional measures.

Nevertheless, even if the already voted measures cannot be completely applied, one should assume that state benefits for future pensioners will be substantially lower than those that currently retire. In order to prevent that large groups of pensioners will be at risk of poverty, this transition should be better accompanied.

In the first place, it is important that people are incentivised to remain longer in the labour force. In that respect, European firms can learn from experiences in other OECD countries such as Japan or the US.

In the second place, employees should be encouraged to better prepare their retirement. In particular, the authorities could inform employees regularly about their pension rights. In Germany, all employees of 27 and older receive this information each year from the pension authorities. The earlier employees are informed, the more time they have to increase their personal savings.

Finally, in countries where personal pension schemes exist, employees should be encouraged to take out such a scheme. In some countries, employers already offer their employees a pension scheme as default option. If employees want to opt out, they have to take action. However, often the contributions to these schemes are rather low. Employees should be encouraged to regularly increase their contribution. The Save More Tomorrow scheme is a good example of a well-functioning savings scheme in the US, which can also be applied in Europe.

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[21] Madrian, B. C., & Shea, D. F. (2001). *The power of suggestion: Inertia in 401 (k) participation and savings behavior*. The Quarterly journal of economics, 116(4), 1149-1187.
[22] Thaler, R. H., & Benartzi, S. (2004). Save more tomorrow™: *Using behavioral economics to increase employee saving*. Journal of political Economy, 112(S1), S164-S187.

EU 2018 Ageing report: base scenario

	Public pensions % of GDP		Benefit ratio(*)		Effective retirement age	
Country	2020	2070	2020	2070	2020	2070
AUT	13.9	14.3	50.5	38.9	62.6	63.7
BEL	12.6	15.0	42.3	40.4	63.4	64.3
BGR	9.1	10.9	29.6	30.1	63.4	64.4
CYP	10.2	12.4	58.2	40.8	64.1	67.7
CZE	8.1	10.9	38.0	37.3	62.3	63.5
DEU	10.3	12.5	42.0	35.5	64.5	65.5
DNK	9.3	8.1	40.6	34.5	65.6	68.0
ESP	12.3	10.7	55.1	37.6	65.3	66.4
EST	7.8	6.4	34.6	19.9	64.6	65.0
FIN	13.8	13.9	53.1	46.1	63.6	67.8
FRA	15.0	11.8	49.6	35.9	62.6	64.5
GBR	7.7	9.5	28.4	28.5	64.7	65.8
GRC	13.4	10.6	64.2	41.6	62.9	68.1
HUN	10.4	6.8	31.2	17.8	61.8	63.9
HUN	9.0	11.2	37.1	32.7	62.8	65.1
IRL	5.1	6.6	26.3	26.8	65.2	66.0
ITA	15.6	13.9	60.7	46.3	66.2	68.4
LTU	7.0	5.2	33.1	19.3	62.5	64.0
LUX	9.0	17.9	53.8	52.4	60.3	60.3
LVA	6.8	4.7	22.8	12.1	63.6	65.2
MLT	7.8	10.9	47.6	39.3	61.8	63.3
NLD	7.0	7.9	32.9	34.0	65.2	68.3
POL	11.1	10.2	44.8	22.9	62.9	62.9
PRT	13.6	11.4	57.9	34.0	65.4	66.4
ROU	7.3	8.7	31.9	26.0	63.2	63.3
SVK	8.3	9.8	44.4	38.4	61.8	67.2
SVN	11.0	14.9	30.1	31.0	62.6	62.6
SWE	7.6	7.0	36.2	22.1	65.0	65.0
EU	11.1	11.0	42.0	32.9	64.2	65.6
EA	12.3	11.9	43.0	33.5	64.4	66.0

*average pension as % of average gross wage

Table 1 Source: European Commission

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