

Aggregate and Distributive Effects of Unconventional Monetary Policies

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July 2018

Proceedings of the workshop “Aggregate and Distributive Effects of Unconventional Monetary Policies” hosted by the Council on Economic Policies, the Swiss National Bank and the Study Center Gerzensee in November 2017

ABSTRACT

In response to the financial crisis, central banks adopted a range of unconventional monetary policies (e.g. asset purchase programs, forward guidance, negative policy rates). How do these measures translate into output growth and inflation? Do they increase income and wealth inequality? This paper provides answers to these questions based on the research presented at a workshop hosted by the Council on Economic Policies, the Swiss National Bank and the Study Center Gerzensee on “Aggregate and Distributive Effects of Unconventional Monetary Policies” in November 2017. It describes three new channels by which asset purchase programs impact aggregate output and inflation (the public transfers channel, the risk redistribution channel and the collateral value channel) and three new channels through which they redistribute income and wealth between households and firms (the loss transfer channel, the Cantillon effect channel and the firms funding conditions channel). The note also discusses the effectiveness of forward guidance and negative interest rates in influencing aggregate economic conditions and examines the possible effects of helicopter drops, a measure that central banks should consider as alternative unconventional monetary policy in the future.

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1 INTRODUCTION

In response to the financial crisis, central banks in major economies have adopted a whole range of new measures to influence monetary and financial conditions. These measures include asset purchase programs¹, forward guidance and negative policy rates. Whether unconventional measures delivered the expected outcome is still subject to debate. Critics of unconventional monetary policies argue that they did not generate growth or reduced unemployment in the magnitude, and at the speed, initially anticipated by central banks. They also claim that unconventional measures failed to bring inflation back to central banks' target levels. The distributive impact of asset purchase programs has raised public concerns too: there are serious worries that such programs increased inequality by pushing up asset prices and favoured households with higher income and wealth.

Against this background, the Council on Economic Policies, the Swiss National Bank and the Study Center Gerzensee co-organized a workshop on "[Aggregate and Distributive Effects of Unconventional Monetary Policies](#)" on November 9-10, 2017, in Gerzensee, Switzerland. The event brought together researchers from academia, central banks and non-academic institutions to better understand the transmission channels from unconventional monetary policies to the economy and their impacts on the distribution of income and wealth. This note builds on the results presented on this occasion but is not intended to give an exhaustive report of all the issues addressed during these two days. The conclusions remain those of the author and might not reflect the views of the institutions represented in the workshop.

The research presented in the workshop highlighted three new channels by which asset purchase programs impact the economy on aggregate: the public transfer channel, the risk redistribution channel and the collateral value channel (see Section 2.1). These three channels add to the two channels traditionally mentioned by central banks to explain how their asset purchase programs affect the economy – i.e. the direct pass-through and the portfolio rebalancing channel (see, e.g., ECB 2015). The *public transfer channel* relies on the transfer schemes in place between the central bank and the treasury. Different transfer schemes induce different impacts for the same asset purchases. Through the *risk redistribution channel*, the central bank can actively dampen balance sheet recessions with asset purchases by reallocating risk across households. Finally, asset purchase programs also influence the value of households' collateral through the *collateral value channel*. With asset purchases, the central bank can affect the value of assets that households can pledge and thus influence their access to credit.

¹ Central banks use different terms for their asset purchases. The Federal Reserve (Fed) refers to it as large-scale asset purchases, the European Central Bank (ECB) as asset purchase programs, the Bank of England (BoE) and the Bank of Japan (BoJ) as quantitative easing programs and the Bank for International Settlements (BIS) as balance sheet policies. In this note, we use the ECB's terminology.

In addition to their aggregate effect, asset purchase programs also have redistributive effects. Several channels through which asset purchases impact income and wealth distributions have been highlighted in the literature.² Three new channels were discussed at the workshop: the loss redistribution channel, the Cantillon effect channel³ and the firms funding conditions channel (see Section 2.2). The *loss redistribution channel* occurs when losses stemming from a central bank's asset purchases are passed to the treasury and ultimately redistributed to households through fiscal policy. The *Cantillon effect channel* describes how, through a cascade of trades, purchases of specific assets by central banks increase their relative price more than the one of other assets and thus increase the relative wealth of their owners more than of others – even if the money injected by the central bank eventually reaches all households. Asset purchase programs also impact the distribution of output across firms by generating better funding conditions for some firms than for others via the *firms funding conditions channel*. To our knowledge, it is the first time that the distributive impact of asset purchases on the composition of output is highlighted. Finally, the last part of this section presents empirical evidence of the impact of asset purchase programs on income distribution in the United States and Japan.

The research presented at the workshop also addressed other unconventional monetary policies. Section 3.1 takes a closer look at forward guidance, an unconventional monetary tool currently at the heart of central bank policies. With forward guidance, central banks provide information about their future monetary policy intentions and, by doing so, influence financial and economic decisions today. Research presented at the workshop shows that, when agents have heterogenous outlooks about future economic conditions, the power of forward guidance is significantly muted.

Section 3.2 focuses on negative interest rates. It shows that, when the economy is in a liquidity trap, asset purchase programs are less able to influence the inflation rate. In that case, negative rates on central bank reserves is a tool that can allow central banks to regain control over inflation.

Section 3.3 discusses helicopter drops, an alternative to the unconventional monetary policies implemented so far. Theoretical research presented at the workshop shows that helicopter drops can help regain control over inflation when the economy is in a liquidity trap and that they can constitute a better option for central banks than open-market operations to stimulate the economy when the aggregate demand depends on the level of liquidity in the economy.

² See, e.g., Monnin (2017) for a survey of these channels.

³ This channel is named after Richard Cantillon, the French-Irish economist who first described in the 16th century how money flows impacts the distribution of wealth in a country through successive trades.

2 ASSET PURCHASE PROGRAMS

Asset purchase programs have been the principal unconventional monetary policy measure implemented by central banks after the 2008 financial crisis. They have been used to influence monetary and financial conditions beyond conventional monetary policy tools – i.e. beyond setting, or closely controlling, short-term interest rates. With these programs, central banks buy assets on financial markets through open market operations. They finance these purchases by issuing their own money (central bank money or central bank reserves), which ultimately translates into an increase in their balance sheet.

Central banks have bought several types of assets in their different programs. In the euro area, the ECB bought public and private bonds, covered bonds, as well as private asset-backed securities. At the end of 2017, the ECB held EUR 2'286 billion of assets stemming from its different asset purchase programs. In the United States, the Fed bought mortgage-backed securities and Treasury securities. Following its different quantitative easing programs its balance sheet had risen to more than USD 4.4 trillion by end-2017. In the United Kingdom, the BoE bought government bonds (GBP 435 billion) and, to a lesser extent, corporate bonds (GBP 10 billion). In Japan, the BoJ implemented two waves of quantitative easing: from 2001 to 2005 and from 2010 onward. In its different programs, the BoJ bought government bonds, asset-backed securities and equities. Between 2001 and end-2017, its balance sheet increased more than five-fold.

The next sections look first at the new transmission channels from central banks' asset purchases to aggregate output and inflation that were presented in the workshop and then focuses on three new channels, also highlighted during the workshop, through which asset purchase programs affect income and wealth distributions, as well as output composition. It then summarizes empirical estimations of the distributive effects of asset purchase programs for the United States and Japan.

2.1 AGGREGATE EFFECTS

With asset purchase programs, central banks aim at stimulating the economy on aggregate through three main channels: direct pass-through, portfolio rebalancing and a signaling effect (see ECB, 2015). The *direct pass-through* works as follows: when central banks buy assets that are linked to households' and firms' loans, it increases demand for such loans and drives up their prices. This encourages banks to make more such loans, to securitize them and to resell them. This increases the supply of loans and tends to lower lending rates for firms and households. *Portfolio rebalancing* occurs when investors reinvest the proceeds of the assets that they have sold to central banks into other assets. In doing so, they push down other long-term interest rates, such as those on corporate bonds, and push up asset valuations, including equity prices. This results in reduced costs for companies seeking to

obtain financing through debt and capital markets. Finally, asset purchase programs signal to market participants that central banks will keep key interest rates low for an extended period. This *signalling effect* reduces volatility and uncertainty in the market regarding future interest rate developments, which is an important signal to guide various investment decisions.

In addition to these three channels, the research presented at the workshop highlighted three new transmission channels from asset purchases to aggregate output: the *public transfers channel*, the *risk redistribution channel* and the *collateral value channel*.

Public Transfers Channel

Benigno and Nisticò (2017) study the conditions under which asset purchase programs have an aggregate impact on output and inflation in a textbook economy – i.e. with complete asset markets and unrestricted financial market access for fully rational agents. In these conditions, Wallace neutrality traditionally holds, and asset purchases are neutral for output and inflation⁴. Benigno and Nisticò underscore, however, that transfer schemes between the central bank and the treasury play a key role in this neutrality. They identify which transfer schemes preserve Wallace neutrality and highlight three schemes, which breach it – i.e. in which asset purchase programs have an impact on aggregate output and inflation through the public transfers channel.

Asset purchases are neutral when the treasury fully supports the central bank and follows a passive fiscal policy

Benigno and Nisticò distinguish between two public institutions: the central bank and the treasury⁵ and show that the transfer schemes between these institutions influence the impact of asset purchase programs on aggregate output and inflation. In their framework, the treasury raises lump-sum taxes from the private sector and receives remittances from (or makes transfers to) the central bank. It finances its deficit through riskless short-term and risky⁶ long-term debt. The central bank issues non-interest-bearing money and reserves bearing a (riskless)⁷ nominal interest. It uses money and reserves to finance a portfolio of short-term and long-term securities. Central bank profits depend on two components: the revenues obtained by issuing non-interest-bearing money and the excess gains of holding long-term securities with respect to a riskless portfolio. Note that the latter component may

⁴ Whether central banks can influence economic activity through balance sheet policies under these conditions (complete asset markets, full asset market participation and rational economic agents) has been debated ever since Neil Wallace presented his neutrality theorem (Wallace, 1981). Wallace neutrality states that alternative sizes and compositions of the central bank's balance sheet, and thus standard open-market operations, have no effect on output or on inflation. This debate revived after the Fed started using extensively asset purchase programs and peaked after Michael Woodford's speech at Jackson Hole in 2012, in which he gave credit to Wallace neutrality (Woodford, 2012, see Bruegel's blog on "[Wallace Neutrality and Balance Sheet Monetary Policy](#)" to get an outline of the debate generated by this speech).

⁵ In his influential paper, Wallace (1981) does not make this distinction and considers a consolidated public balance sheet.

⁶ In Benigno and Nisticò's model, long-term debt risk is modeled by an exogenous default probability.

⁷ Reserves are "nominally" riskless, but they bear the risk of inflation shocks.

induce losses for the central bank – the more so the larger the holdings of long-term securities are. Finally, households maximise their life-time consumption utility by investing in money, reserves, short-term and long-term securities.

Benigno and Nisticò show that asset purchases by central banks are neutral – i.e. do not impact either output or inflation – if the private sector ultimately bears the potential losses stemming from these assets. This is the case under two conditions: when there is *full support* from the treasury to the central bank – i.e. when the treasury immediately compensates central bank's losses – and when the treasury follows a *passive fiscal policy* – i.e. when it immediately adjusts its taxes to compensate for changes in transfers to the central bank. In other terms, if the losses from the assets bought by the central banks are immediately compensated by the treasury through taxes on the private sector, then the private sector ultimately bears the risk of these assets and unconventional monetary policy has no impact either on output or on inflation.⁸

Asset purchases impact aggregate output and inflation under three public transfers schemes

Benigno and Nisticò identify three transfer schemes that breach the neutrality of asset purchases programs: when the treasury does not fully support the central banks, when the central bank commits to financial independence and when the treasury does not immediately adjust its taxes to compensate for central bank losses. In each of these cases, asset purchases end up having an impact on aggregate output and on inflation, because they trigger some (temporary) wealth redistribution between the public and the private sector.

Treasury does not fully support the central bank

If the assets bought by the central bank generate large losses and if these losses are not backed up by transfers from the treasury, then the profitability and the solvency of the central bank can be impaired – i.e. the net worth of the central bank can become negative. In that case, the central bank can restore its profitability by increasing the supply of money – and thus its seigniorage revenues – above the level needed by conventional monetary policy. This breaks the neutrality of unconventional monetary policy and triggers inflationary pressures and a positive impact on output.

The Federal Reserve Deferred Asset regime is an illustration of such a scheme: if the Federal Reserve suffers losses, the treasury does not intervene, and the Fed must issue a deferred asset. In that case, the Federal Reserve must then retain its future profits until the deferred asset is written down. The case of pre-arranged transfers between the central bank and the

⁸ Note that when these two conditions are met, the central bank can implement interest rate policy – i.e. conventional monetary policy – and balance sheet policy – i.e. unconventional monetary policy – independently. The central bank can set the short-term interest rate regardless of the size of its balance sheet and, conversely, it can buy assets at any level of the short-term rate (*decoupling principle*). This is because “the same amount of bank reserves can coexist with very different levels of interest rates; conversely, the same interest rate can coexist with different amounts of reserves. What is critical is how reserves are remunerated relative to the policy rate” (Borio and Disyatat, 2009). The decoupling principle also implies that exiting from the current very low, or zero, interest rate policies can be done independently of balance sheet policies.

treasury (or exogeneous remittances) is another case in which the central bank is not fully supported by the treasury.

Central bank commits to financial independence

If the central bank commits to stay financially independent – i.e. commits not to rely on treasury support – then it wants to limit the size and duration of balance sheet losses, to avoid insolvency. In this situation, the neutrality property of asset purchases never holds because the central bank must adjust its conventional policy in response to its unconventional monetary policy to satisfy the constraints on its profits. Unconventional monetary policy therefore signals a change in the conventional monetary policy stance, which translates into higher inflation and a positive impact on output.

Treasury does not pass central bank losses to private sector

If the treasury does not follow a passive fiscal policy and thus does not immediately pass central bank losses to the private sector through higher taxes, then it induces a (temporary) reallocation of losses in the economy, from the private sector to the public sector. This generates a positive wealth effect for the private sector, which raises nominal spending and inflation.

Risk Redistribution Channel

Silva (2017) proposes another channel through which asset purchase programs can impact aggregate input and inflation: the risk redistribution channel.⁹ This channel works when the economy is subject to balance sheet recessions. Silva shows how a central bank can dampen such recessions by following a predetermined rule for asset purchases.

Heterogenous risk aversion can trigger balance sheet recessions

Silva's results rely on two sources of heterogeneity in the economy: first, some agents do not have access to financial markets – aka limited asset market participation hypothesis – and, second, financial markets participant have different risk tolerances – aka heterogeneous risk tolerance hypothesis. The latter hypothesis is at the roots of so-called balance sheet recessions.

In Silva's model, asset market participants are divided in two: risk-tolerant investors (financial intermediaries) and risk-averse investors (savers). Financial intermediaries issue riskless assets and sell them to savers. They then invest the proceeds of the sales in risky assets to fund the productive sector. They thus take a leveraged position and expose themselves to risk-mismatch as their assets are riskier than their liabilities. After a negative shock on the economy, a part of financial intermediaries' assets is lost and, consequently their share in

⁹ The term "risk redistribution channel" is our own; Silva uses the term "risk channel".

total wealth decreases compared to the share of risk-averse investors. This induces an increase in the (wealth-weighted) average risk aversion in the economy. Higher risk aversion in the economy implies a higher risk premium for risky assets, which depresses asset prices and, ultimately, reduces investment and growth – and thus causes a balance sheet recession.

Central banks can use asset purchases programs to dampen balance sheet recessions

Silva shows that central banks can use asset purchase programs to partially offset balance sheet recessions. The limited asset market participation hypothesis is key to generate this effect. In Silva's framework, some agents participate in asset markets and are thus directly exposed to market risk; others do not invest in asset markets and are thus not concerned by this risk. Asset purchase programs blur this frontier because the central bank rebates the proceeds (or the losses) of its holdings to all agents through the treasury. Thus, when the central bank buys assets, it takes some asset risk off asset market participants' balance sheets and transfers it to the balance sheet of agents that do not directly participate in asset markets. Agents that are not directly exposed to asset market risk become indirectly exposed to it through the central bank's balance sheet.

In this context, a central bank can use asset purchases to counterbalance balance sheet recessions by committing to a rule to buy assets when risk aversion is high and asset prices are depressed.¹⁰ By doing so, the central bank reduces the supply of risky assets available to investors when risk aversion is high – i.e. during a balance sheet recession. This implies a smaller return per unit of risk to clear asset markets – i.e. a smaller risk premium. By purchasing risky assets during downturns, the central bank can reduce the increase in risk premium at the roots of a balance sheet recession, and thus reduce its severity. A side effect of this policy is that it also decreases risky asset price volatility. This indirectly adds to the decrease in the risk premium directly generated by the purchases of risky assets.

Note that if investors know that the central bank follows such a policy, they will hold less precautionary savings in response to the lower asset price volatility that it induces. The expectation of intervention during crises thus reduces savings in normal times. This leads to higher interest rates in normal times and lower investments by the productive sector, which in turn reduces growth. To sum-up, a policy in which the central bank commits to buy risky assets in a balance sheet recession will have the benefit to dampen recessions but at the cost of reducing growth in normal times.

Collateral Value Channel

Schabert (2018) presents a special case in which asset purchase programs by central banks can increase aggregate welfare. He considers an economy in which contract enforcement is

¹⁰ Silva dubs this rule an *Unconventional Greenspan's Put*.

limited, which implies that borrowers must pledge collateral to access lending.¹¹ In addition, he assumes that some agents are financially constrained and thus cannot borrow as much as they would like to – e.g. poor households do not have enough assets to pledge to get the amount of loans that would be optimal for them. Dávila and Korinek (2018) show that this situation gives rise to pecuniary externalities¹² that lead to non-Pareto efficient allocations in the economy. They also show that a planner can modify the allocation in the economy with a Pigovian tax or subsidy to correct the distortions induced by these externalities.

Schabert shows that the purchases of secured loans by central banks induces an increase in the prices of assets that households can pledge as collateral. This increases the borrowing capacities of households that are financially constrained and allows them to borrow at a level that is closer to their optimum. In addition, by purchasing loans, the central bank increases lenders' willingness to supply loans and reduces the equilibrium loan rate, which stimulate the economy.

Schabert also shows that a central bank can mirror a Pigovian tax or subsidy by purchasing collateralized loans at preferable conditions in the secondary markets and thus correct the distortions resulting from pecuniary externalities. This outcome cannot be achieved with conventional monetary policy and is welfare enhancing. In addition, by implementing asset purchases in a countercyclical way – i.e. buying assets in recessions and selling assets in booms – a central bank can support prudential policies by dampening debt growth during booms.

2.2 DISTRIBUTIVE EFFECTS

Independently from their aggregate effects, asset purchase programs have redistributive impacts. The next sections present three channels newly highlighted in the workshop by which central banks' asset purchases introduce distributive effects: the first two channels affect households' income and wealth distributions, the last one the distribution of output between firms. It then provides empirical evidence on the impact of asset purchases programs on income distribution in the United States and in Japan.

Loss Transfer Channel

At the aggregate level, in the textbook case of an economy with complete asset markets and rational agents, Wallace neutrality implies that asset purchases have no impact on output nor on inflation if the private sector ultimately bears the potential losses stemming from

¹¹ As in Kiyotaki and Moore (1997).

¹² A pecuniary externality occurs when the actions of one single economic agent cause an increase or decrease in market prices. Pecuniary externalities operate through price effects rather than through real resource effects and thus contrast with technological or real externalities.

central bank's asset holdings (as shown by Benigno and Nisticò, see above). However, neutrality at the aggregate level does not preclude redistributive effects between households. When central banks purchase assets, the gains or losses stemming from their portfolios are passed to the treasury and ultimately redistributed to the private sector through fiscal policy. How these gains and losses are distributed among households defines the redistributive impact of asset purchase programs.

This can be problematic if the central bank purchases assets from a few private agents, endures losses from these assets and then indirectly passes on these losses to the entire population, including people from which the central bank did not buy any assets in the first place. Imagine, for example, an economy with two types of agents: a risk-averse agent *A*, who holds a safe asset portfolio, and a risk-seeking agent *B*, who holds a risky asset portfolio. Without central bank asset purchases, if a negative shock hits risky assets, then agent *B* will lose more than agent *A*, which reflects his/her higher risk exposure resulting from his/her preferences in terms of risk. However, if the central bank purchases risky assets before a negative shock, agent *A* will be indirectly exposed to losses in *B*'s portfolio through the holdings of the central bank. A part of *B*'s losses will thus be transferred to *A* through the losses of the central bank and ultimately through the treasury. In other terms, through central bank's purchases, *A* is bearing some parts of the consequence of *B*'s choices in terms of risky financial investments.

The loss transfer channel is a potential side-effect of the risk redistribution channel discussed above. With the risk redistribution channel, central banks can mitigate the severity of balance sheet recessions by buying risky assets from the part of the population that hold them. This takes some risk off their balance sheet and moderates the increase in risk premium at the roots of a balance sheet recession (see above). However, it also indirectly transfers some risk to the agents that were not engaged in asset markets – i.e. it exposes them to a risk that they did not have in the first place. If some losses occur on the assets that the central bank buys, then the agents that do not directly hold assets will indirectly bear some of the costs through the central bank's balance sheet.

Cantillon Effect Channel

When a central bank injects money into the economy through asset purchase programs, it does not spread it evenly: the first beneficiaries of the newly created money are the owners of the assets bought by the central bank. The money injection then trickles down to the rest of the economy through the transactions made by the first beneficiaries. Andrei, Herskovic and Ledoit (2017) study how money injection propagates through the economic network and show that agents that directly benefit from central bank purchases are better off than the

agents that do not, even if the latter indirectly benefit once the money injection trickles down to the entire economy.

Andrei, Herskovic and Ledoit develop a model of multiple agents, which are endowed with a unit of (distinct) consumption good – i.e. wealth is equally distributed in the economy. Agents are organized in a circular social network in which each agent trades goods only with his two immediate neighbors. The central bank increases the money supply by purchasing one particular good from one particular agent – e.g. the central bank buys good A from agent A. Andrei, Herskovic and Ledoit show that this pushes up the price of good A more than the prices of other goods. This benefits agent A and makes her better off as a result of dealing directly with the central bank. They also show that the agent who is the furthest from the central banks – i.e. the one whose good is bought last after the money injection – is worse off. They conclude that monetary expansions redistribute real consumption from the agent who is furthest from the central bank to the agent who is closest to the central bank.

Andrei, Herskovic and Ledoit's model can be applied to an economy in which agents are endowed with wealth in different forms of assets: financial wealth (stocks, bonds, deposits), real wealth (housing) and human wealth (future labor earnings). Each agent is endowed with a different portfolio of assets; some of them, for example, only have human wealth – i.e. their income stems from labor only. The central bank injects money by buying one single kind of asset. This pushes up the price of this asset more than the prices of other assets, which benefits the owners of this type of asset and makes them better off. The money injection then trickles down into the economic network through asset trades between agents. The group of agents which will be the worst off is the one owning the asset that will be bought last after a cascade of trades.

Central banks acknowledge that asset purchase programs increase financial asset prices and thus first benefit financial asset owners – see, e.g., Bank of England (2012) – but they argue that the effects of these programs will eventually trickle down to the entire economy and also benefit households without financial wealth by increasing labor income – i.e. by increasing returns on human capital. Andrei, Herskovic and Ledoit's results raise concerns about this claim: if households without financial wealth are the last beneficiary of central bank's money injection – i.e. if the labor market stimulus occurs only after a cascades of asset trades in financial markets – then they are likely to be relatively worse off than the households that directly received the money injection – even if asset purchase programs eventually trickle down and reach them.

Firms Funding Conditions Channel

Central banks have bought diverse types of assets in their asset purchase programs. The ECB and the BoE, for example, bought corporate bonds. Kurtzman and Zeke (2017) study the

impact of the purchase of non-financial corporate bonds on the funding conditions of the productive sector. They show that when central banks purchase bonds of some firms and not of others, they introduce biases that have a material impact in the allocation of capital in the productive sector. This can lead to misallocation cost that are higher than the aggregate positive impact of private sector bond purchase programs.

Corporate bond purchases introduce biases in firms' capital costs

Kurtzman and Zeke consider an economy in which two groups of firms produce different imperfect substitute goods. Both groups of firms must finance their capital through financial intermediaries (banks). The first group of firms is constituted of large firms, issuing highly rated bonds, and the second group of small firms that issue riskier bonds. Financial intermediaries are constrained by regulatory limits on leverage. The regulatory framework makes it costlier for banks to hold risky private sector debt than government bonds and it discourages them to hold too much of riskier classes of private securities.

Kurtzman and Zeke focus on two alternative policies: a first one in which the central bank buys government bonds in large quantities and a second one in which it buys private bonds from the group of large firms only. They study these two alternatives in a New Keynesian DSGE model calibrated on U.S. data and consider two situations: one in which the economy is at the zero-lower bound and one in which it is away from it.

In Kurtzman and Zeke's model, when the central bank buys government bonds, it reduces the cost of capital for all firms evenly, but when it focuses on one subset of corporate bonds, it lowers the cost of capital for that set of firms more than for the others.¹³ This creates distortions in the cost of capital among firms. Differences in the cost of capital induce differences in firms' investments decisions and thus in the allocation of capital, which has consequences for aggregate output. In other terms, Kurtzman and Zeke show that corporate bond purchases of one set of firms have two effects: one on aggregate capital stock and one on the allocation of capital, whereas government bond purchases only influence aggregate capital stock.

Output distortion costs of corporate bond purchases can offset their aggregate gains

Kurtzman and Zeke estimate the size of these effects in a model calibrated on U.S. data. They find non-negligible costs due to misallocation of resources caused by corporate bond purchases. When the economy is away from the zero-lower bound, Kurtzman and Zeke's calibration suggests that, abstracting from misallocation effects, a government bond purchase is less effective in increasing aggregate output than a large-scale corporate bond purchase of the same size. However, misallocation effects are large enough to make a government bond purchase more effective than a private bond purchase. At the zero-lower

¹³ Krishnamurthy and Vissing-Jorgensen (2011), among others, highlight that the price effect on bonds that the central bank buys is more pronounced than on bonds that they do not buy.

bound, the effects of bond purchases on output are amplified, while the misallocation effects are not. Therefore, the misallocation effects from corporate bond purchases will be relatively smaller at the zero-lower bound when compared to its impact on aggregate output. In that case, a purchase program focused on corporate bonds might be more effective than purchases of government bonds.

Impact on Income Distribution: Empirical Assessments

This section summarizes the empirical evidence of the distributive impact of asset purchase programs in the United States and Japan that were presented during the workshop.

United States

Montecino and Epstein (2017) provide a thorough assessment of the distributional impacts of asset purchase programs for the United States. To estimate the impact of the Fed's asset purchases on the distribution of net income (total income, including capital gains, minus debt payments), they first isolate the contributions of changes in employment, financial asset returns and other covariates to changes in net income distribution between 2010 and 2013. They find that: 1) changes in employment and in mortgage refinancing were highly equalizing, 2) changes in bond prices had little distributional impact, 3) lower returns for short-term assets were somewhat disequalizing and 4) increases in equity price were largely disequalizing. All in all, the disequalizing impact of equity price appreciation more than offset the equalizing impact of changes in employment and mortgage refinancing.

Of course, the contributions to changes in income inequality listed above cannot all be entirely attributed to the Fed's asset purchases; in fact, asset purchase programs might have dampened the increase of inequality that would have happened, had the Fed not intervened.¹⁴ Montecino and Epstein explore this possibility by assessing the hypothetical impacts on equity prices and on employment that the Fed's asset purchase program should have had to generate lower inequality. They conclude that, for the Fed's asset purchases to have decreased inequality, "it is necessary to either strongly downplay the potential impact of QE on stock returns or assume very large employment effects. In other words, it is necessary to either assume that the large disequalizing impact of stock returns was mostly not due to QE but a 'normal' feature of the economic recovery, or that the Federal Reserve prevented an implausibly large increase in the unemployment rate." (p. 20). They conclude that asset purchases programs in the United States led to a modest increase in inequality despite having some equalizing effects through employment and mortgage refinancing.

¹⁴ This line of argument has been used by Bivens (2015) in defense of the Fed's asset purchase programs.

Japan

Inui, Sudo and Yamada (2017) provide an assessment of the impact of monetary policy on income inequality in Japan. Their sample covers the period 1981 to 2008 and thus includes a period of conventional monetary policy (1981-1998) and of unconventional monetary policy (1999-2008).¹⁵ However, the authors always present their results for the whole period and for the 1981-1998 period (conventional monetary policy); their comparison gives a hint on the direction of the impact of unconventional monetary policy on inequality. The authors use definitions of income that do not include capital gains.

Their results can be interpreted as follows: 1) conventional and unconventional monetary policy have the same equalizing impact on labor earnings, 2) conventional monetary policy has a disequalizing impact on labor earnings for the households already employed, which is offset by a decrease in unemployment, and 3) unconventional monetary policy does not seem to have a disequalizing impact on labor earnings for the households already employed, but is likely to have a smaller impact on unemployment. Note that other authors do include capital gains in their definition of income and find a significant and disequalizing impact of unconventional monetary policy in Japan (see Saiki and Frost 2014, 2018), which emphasizes the disequalizing impact of asset purchases programs through the increase in stock prices that they generate.

3 OTHER UNCONVENTIONAL MONETARY POLICIES

This part describes new findings presented in the workshop about the aggregate effect of unconventional monetary policy other than asset purchase programs. The first section explains that, when agents do not share the same expectations about future economic conditions, the power of forward guidance is greatly attenuated. The second section shows that negative interest rates can be a solution for central banks to escape from a liquidity trap. The last section discusses the aggregate impact of helicopter drops, an alternative option that central banks have not used so far.

3.1 FORWARD GUIDANCE

Forward guidance has been extensively used by central banks facing the zero-lower bound. With forward guidance, central banks disclose their intention about future monetary policy and by doing so provide information that households and firms use in their decisions about

¹⁵ The BoJ started its asset purchase program in 2001, but reached the zero-lower bound in 1999, which Inui *et al.* consider as the beginning of unconventional monetary policy in Japan.

current and future spending and investments. Thus, by specifying what monetary policy will be in the future, central banks can influence financial and economic conditions today.

After the 2008 crisis, the Fed and the ECB have both used forward guidance to inform markets about future interest rates, by stipulating that interest rate will remain low for an extended period,¹⁶ and about the horizon of their asset purchase programs. Major central banks now consider forward guidance as “a fully-fledged monetary policy instrument”.¹⁷

The forward guidance puzzle

In theory, forward guidance is a very powerful tool. In a standard New Keynesian model with rational agents and common knowledge – i.e. when everyone shares the same expectations about future economic conditions – a commitment by the central bank to keep interest rates low for long has very large effects on current economic activity. Theoretically, these effects increase more than proportionally with the commitment horizon – i.e. doubling the commitment horizon from one to two years, for example, has a bigger impact than twice the impact of a commitment to one year. This, however, is at odds with available evidence (see, e.g., Del Negro, Giannoni and Patterson, 2012) – a discrepancy that several authors have tried to reconcile (see, e.g., McKay, Nakamura and Steinsson, 2016a and 2016b).

Heterogeneous expectations mute the power of forward guidance

Angeletos and Lian (2017) study the case of forward guidance when agents do not share common knowledge – i.e. when each agent has his/her own expectations about future economic conditions – and show that in such a case the power of forward guidance is greatly attenuated. The key mechanism at the roots of this result is that the lack of common knowledge induces a so-called higher-order expectation effect: agents are less concerned by how much news affect their own expectations than by how much it affects others’ expectations and thus the average market expectation, which is the main driver of current prices.¹⁸ Given the uncertainty about the impact of news on others’ expectations, agents give less weight to the news in their own expectations than in the case of common knowledge¹⁹ and thus, overall, the impact of news is muted compared to common knowledge. This “muting” effect is stronger the longer the expectation horizon. Higher-order expectation implies that news about central banks’ long-term policy has less impact on expectations than news about short-term policy. This is exactly the opposite of the result for common knowledge and thus can explain why central banks’ commitments for long horizon have less impact on agents’ decisions today than awaited by policy makers.

¹⁶ The Fed used this formulation for the first time in March 2009 and the ECB in July 2013.

¹⁷ This expression was used by Mario Draghi at the [Central Bank Communications Conference](#) organised by the ECB on November 2017.

¹⁸ See, e.g., Allen, Morris and Shin (2006) for a very clear and concise explanation of the impact of higher-order expectations on prices. Higher-order expectations are also referred to as “beauty contest games” after Keynes (1936) used the example of a beauty pageant to illustrate this phenomenon.

¹⁹ In the case of common knowledge, the impact of news on others’ expectation is known with certainty since everybody has the same expectations.

A corollary of Angeletos and Chian's results relates to fiscal policy. Standard New-Keynesian models predict that, at the zero-lower bound, a fiscal stimulus is more effective when it is back-loaded, i.e., when it is announced now but implemented later on. Higher-order expectations also reduce the power of announcement about future fiscal policy and thus imply that front-loading fiscal stimuli are more effective than long-term commitments.

3.2 NEGATIVE INTEREST RATES

In the aftermath of the 2008 financial crisis, most central banks have set their policy rates close to zero, a level which is traditionally seen as the lower bound for nominal interest rates. In an attempt to provide further monetary stimulus, five central banks have since moved their policy rates below zero: the ECB (in June 2014), Danmarks Nationalbank (in September 2014), the Swiss National Bank (in December 2014), the Sveriges Riksbank (in February 2015) and the Bank of Japan (in January 2016).

Altermatt (2017) provides a framework which explains why, in a liquidity trap, asset purchases are ineffective in triggering inflation – as it seems to be empirically the case when looking at the subdued inflation observed in the euro area years after the beginning of asset purchase programs – and how negative interest rates can provide a tool for central banks to escape the liquidity trap and regain control of inflation through asset purchases.

Asset purchase programs have no impact on inflation in a liquidity trap

Altermatt's model's main feature is to distinguish between two types of money: fiat money issued by the central bank and inside money issued by private banks. In his model, money is essential for agents to trade, but inside money is preferred because it yields some interest whereas fiat money does not. Banks issue inside money to attract deposits, which they then invest in real assets, in government bonds or in excess reserves – i.e. in fiat money – if the other assets are not attractive enough. This last situation arises when nominal interest rates on both bonds and deposits are at zero – i.e. when the economy is in a liquidity trap – a case which is more likely to happen if there is a high supply of deposits, if investment opportunities are bad, or if there is a shortage of savings instruments (government bonds) in the economy.

In a liquidity trap, fiat money and bonds are perfect substitutes for banks since they both have an interest rate of zero. Altermatt claims that, in this situation, asset purchase programs by central banks have no impact on the economy and on inflation. The reason is that, when the central bank purchases bonds, it shortens the supply of bonds by the same amount as it increases the supply of fiat money. Private banks absorb all the newly issued fiat money by selling bonds to the central bank but do not issue new inside money. The amount of money available to agents for economic transactions thus stays constant and the newly issued fiat money remains in banks and has no impact on the economy nor on inflation.

Negative interest rates are a tool to escape the liquidity trap

In Altermatt's model, negative interest rates are a way for the central bank to escape the liquidity trap because negative rates reintroduce a differential between the interest rates on bonds and on reserves – i.e. bonds still yield zero interest but reserves now yield a negative interest. This restores the conditions that are necessary for asset purchase programs to work: fiat money and bonds are not perfect substitutes anymore and central bank's asset purchases again influence the amount of inside money that private banks issue, which translates into impact on the economy and on inflation.

There are two main caveats to this result: first, in the model, nobody is willing to hold bonds at negative interest rates, which means that the interest rate on bonds cannot fall below zero. The experience so far suggests that modestly negative policy rates are transmitted through to money market rates in much the same way as positive rates are (see Linnemann Bech and Malkhozov 2016). Negative policy rates thus translate into negative interest rates for bonds, which cancels the interest rate differential between bonds and reserves needed for asset purchase programs to have an impact. Second, the model implies that, following negative interest rates, private bank can get rid of their excess reserves. This is difficult to do, especially when central banks are issuing such reserves in large amount to purchases assets.

3.3 HELICOPTER DROPS

What if central banks did not inject money in the economy by buying financial assets but by distributing newly printed money to all households – i.e. what if central banks use Milton Friedman's (1969) idea of helicopter money? Several authors have underlined that such a policy would be more effective in boosting the economy after a crisis than asset purchase programs (see, e.g., Blyth and Lonergan, 2014, Buiters, 2016, or Baeriswyl, 2017).

Two papers presented in the workshop studied this alternative policy. They conclude, first, that helicopter drops can constitute a better option than open-market operations for central banks when households use liquidity as insurance against economic shocks and thus when aggregate demand depends on the level of liquidity in the economy, and, second, that they can help to regain control of inflation when the economy is in a liquidity trap.

Helicopter drops are a better policy than asset purchases when liquidity matters

Bilbiie and Ragot (2017) revisit the standard New Keynesian model for optimal monetary policy by adding heterogeneous households that face an uninsurable risk resulting from incomplete markets and that participate infrequently in financial markets. In these conditions, households hold liquidity – i.e. money – as self-insurance against shocks. In equilibrium, aggregate demand depends on the level of liquidity in the economy and on its distribution – i.e. each household wants to keep some amount of liquidity for self-insurance motives and its consumption depends on its "excess" liquidity.

In this situation, optimal monetary policy includes an additional dimension to the traditional inflation control objective: the liquidity-insurance motive. With imperfect insurance, there is a rationale for the central bank to inject liquidity to insure households against negative shocks – i.e. more liquidity provides some of the insurance that households lack in incomplete markets. The inflationary costs of providing this liquidity are generally dominated by its insurance benefits. In other words, “the trade-off faced by central bank changes: providing insurance through liquidity is consistent with its standard objectives of stabilizing inflation and aggregate demand – but [the liquidity-insurance motive] implies that inflation stabilization takes a back seat” (Bilbiie and Ragot, p. 4). In this configuration, the optimal policy for the central bank consists in providing liquidity that insure the households that are closer to the liquidity constraints – i.e. the poor households – and inflating some of its value to give an incentive to the unconstrained households – i.e. the wealthy households – to hold the optimal amount of liquidity.

Bilbiie and Ragot compare the effectiveness of two alternative policies (helicopter drops vs. asset purchases) when liquidity matters for aggregate demand through the liquidity-insurance motive. They show that helicopter drops, which is a direct way of injecting money, is more effective than asset purchases, which is a more indirect way to inject money. The reason behind this result is that helicopter drops reach all households, and more importantly the more constrained ones – i.e. the poor households, which have the highest marginal propensity to consume – during the period in which the money is injected. Money injected by assets purchases – i.e. through financial markets – only reach households later, when the proceeds of asset purchases is transferred to all households through fiscal policy. Asset purchases thus deprive the central bank of a within-the-period transfer and hence stimulate aggregate demand only with a delay.

Helicopter drops help central banks regaining control over inflation in a liquidity trap

Altermatt (2017) explores the impact of helicopter drops when the economy is in a liquidity trap. He shows that in this situation, asset purchases do not have any impact on the economy because the money injected by central banks is a perfect substitute for bonds – i.e. they both yield zero interest. In that case, banks just substitute bonds with reserves but do not increase the level of money they provide to the households. This leaves monetary conditions unchanged and thus has no impact on the economy and on inflation.

With helicopter drops, the situation is different: as the central bank injects outside money directly by giving it to households, it changes the monetary conditions for them and generates inflation. Helicopter drops are thus a tool for central banks to regain control over inflation, but it does not help getting out of the liquidity trap.

4 CONCLUSION

The research presented at the workshop highlighted three new channels by which asset purchase programs impact on aggregate output and inflation: the public transfer channel, the risk redistribution channel and the collateral value channel. One important conclusion is that central banks' asset purchases are a powerful tool to dampen a balance sheet recession. However, for asset purchases to work in this case, they must generate a redistribution of risk between households by transferring some of it from households that took this risk in the first place to households that were not initially exposed to it (risk redistribution channel). This risk transfer occurs through the central bank's balance sheet. If these risks materialize, then some of the losses resulting from the initial exposure of the former group of households will be incurred by households that initially did not bear any market risk (loss transfer channel).

The losses resulting from asset purchases bought to dampen a balance sheet recession may also have additional effects on aggregate output and inflation depending on the transfer scheme in place between the central bank and the treasury (public transfer channel). If the treasury is fully supporting the central bank – i.e. if the treasury immediately compensates central bank losses – and if the treasury follows a passive fiscal policy – i.e. if it immediately adjusts its taxes to compensate for changes in transfers to the central bank – then central bank losses resulting from asset purchase programs do not have an additional effect on the economy. In any other case – i.e. when the treasury does not fully support the central bank, when the central bank commits to financial independence or when the treasury does not follow a passive fiscal policy – asset purchases programs impact on aggregate output and on inflation.

Some results presented at the workshop also raise questions about central bank claims that, even if asset purchase programs push financial asset prices up and thus benefit asset owners, their effect eventually trickles down to the entire economy and benefits all. The Cantillon effect channel described in this note shows that even if a money injection eventually reaches all households, the first beneficiaries of this injection are better off than the ones which indirectly get it after a cascade of trades. This channel suggests that, in the context of asset purchase programs, the households of which assets were bought directly by central banks ended up better off than the households that indirectly benefited from asset purchase programs through, e.g., their impact on employment. The empirical estimation of the impact of the Fed's asset purchase programs on income inequality in the United States seems to back the Cantillon effect channel: the disequalizing effect induced by equity price increases is not fully compensated by the equalizing effect following an increase in employment income.

Asset purchases programs also have an impact on the distribution of output between firms. By purchasing some assets and not others, central banks affect firms' capital costs differently

and introduce a bias in firms funding conditions (firms funding condition channel). The research presented in the workshop shows that the welfare costs associated with this bias can offset the welfare gains that asset purchase programs generate by stimulating aggregate output.

Other results presented in the workshop also raise concerns about the effectiveness of forward guidance, a tool that is currently extensively used by central bankers. Theoretical models show that, when households have different expectations about future economic conditions – which is very likely to reflect the reality on asset markets – high-order expectation situations arise. In this case, households react less to news because they are uncertain of the news impact on the average market expectation, which is the main driver of asset prices. This greatly dampens the impact of central bank communication on agents' expectations and thus reduces the effectiveness of forward guidance policies.

Finally, some authors looked at the impact of helicopter drops on aggregate output. They conclude that, when households use liquidity as insurance against economic shocks, helicopter drops are more effective in stimulating economic activities than open-market operations. This is the case because, in this situation, aggregate demand depends on the level of liquidity in the economy and helicopter drops impact it more directly than asset purchases. Some results also show that helicopter drops can help central banks regain control over inflation when the economy is in a liquidity trap. Helicopter drops have not been used by central banks so far but, given these results, they should be considered as a valuable unconventional policy option in case of another crisis.

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