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New Dimensions and Frontiers in Central Banking

Summary of the 2022 BOJ-IMES Conference

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I. Introduction

The Institute for Monetary and Economic Studies (IMES) of the Bank of Japan (BOJ) held the 2022 BOJ-IMES Conference, entitled "New Dimensions and Frontiers in Central Banking," on May 25–27, 2022.[1] This was the 27th conference since its start in 1983, and was held online as last year. It covered a wide range of issues on new dimensions faced by central banks and frontiers that they are developing.

The conference began with the opening remarks delivered by Haruhiko Kuroda, Governor of the BOJ. The Mayekawa Lecture, presented by Kenneth S. Rogoff (Harvard University) on central bank independence and the challenges, followed. The keynote speech on inflation surges and monetary policy was given by Carl E. Walsh (University of California, Santa Cruz), honorary adviser to the IMES. The paper presentation sessions discussed four papers on economic inequality, climate change, digital currencies, and the automation of the economy from central bank perspectives, presented by Jesús Fernández-Villaverde (University of Pennsylvania), Alexander Ludwig (Goethe University Frankfurt), Daisuke Ikeda (BOJ), and Luca Fornaro (Centre de Recerca en Economia Internacional and Universitat Pompeu Fabra), respectively. The policy panel discussion on challenges facing central banks, moderated by Masazumi Wakatabe, Deputy Governor of the BOJ, was comprised of panelists: Pierre-Olivier Gourinchas (International Monetary Fund: IMF), James Bullard (Federal

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The conference organizers wish to express their sincere gratitude to the two IMES honorary advisers, Athanasios Orphanides and Carl E. Walsh, the IMES chief councillor Kazuo Ueda, and all other conference participants for the thought-provoking presentations and discussions. The views expressed throughout this summary are those of the attendants and do not necessarily reflect those of their respective institutions. All remaining errors are the authors' responsibility.

[1] See Appendix 1 for the program. See Appendix 2 for a list of participants; their affiliations are as of May 25–27, 2022.

Reserve Bank of St. Louis), Philip R. Lane (European Central Bank: ECB), and Benjamin E. Diokno (Bangko Sentral ng Pilipinas: BSP). The concluding remarks were delivered by Athanasios Orphanides (Massachusetts Institute of Technology), honorary adviser to the IMES.

II. Opening Remarks

Kuroda pointed out that the environment surrounding central banks had changed dramatically since the conference last year and that the themes for discussion appeared to have expanded rapidly. He then provided an overview of the theme, focusing on the new dimensions faced by central banks and the frontiers they are developing.[2]

First, **Kuroda** pointed out a global surge in inflation as one of the two challenges currently facing central banks. He argued that the supply and demand factors behind this inflation differ between countries and that the appropriate monetary policy response will also differ. He noted a surge in geopolitical risk as another challenge and argued that central banks were required to pay close attention not only to the further increase in commodity prices and subsequent higher inflation but also to its long-term impact on the global economy, for instance, that on trade and capital flows.

Next, as for frontiers that central banks should develop, he first pointed out the acceleration of structural changes in the economy, such as the digitalization and automation of society and the economy. He also noted the increase in income inequality. He argued that central banks should pay close attention to the changing economic structure and its potential impact on prices and the real economy. He then raised climate change issues as the second frontier. He argued that in principle it is the governments' industrial and fiscal policies that play the primary role in addressing them, but the role of central banks may also be considered from the perspective of the use of market mechanisms and initiatives. Finally, he raised the transformation of the monetary system as the third frontier. He argued that central banks are required to engage in designing and building the new monetary system globally while examining the possible effects of future changes to money on monetary policy and financial stability.

Kuroda stressed that in a rapidly changing world filled with uncertainty central banks need to be nimble, agile, and smart to adapt to changing environment. He concluded his remarks by saying he was looking forward to the new insights gained in this conference will ensure that central banks are all fit and ready to face those challenges.

III. The Mayekawa Lecture: Institutional Innovation and Central

[2] For details, see Kuroda (2022).

Bank Independence 2.0

Rogoff began his lecture by pointing out that central bank independence is the bedrock of modern inflation targeting.[3] However, he argued that this independence has been challenged in recent years due to the zero-bound on nominal interest rates. He also pointed out that the effectiveness of monetary policy has been reduced and the political economy pressure on central banks has increased significantly. He stated that this new pressure emerged because fiscal policy has been responsible for much more of the burden of routine macroeconomic stabilization after the global financial crisis.

Rogoff then indicated that, in a global low interest rate environment, innovations in policy measures are required to restore the efficacy of monetary policy. He claimed that it would be the most effective to make legal and institutional changes which invoke deep negative interest rate policy. He argued that a central issue in this innovation is to prevent arbitrage by financial institutions (e.g., insurance firms, pension funds and banks) from all interest-bearing assets into paper currency under negative interest rates environment. He then suggested two possible approaches to this challenge: (i) phasing out paper currency, and (ii) setting an exchange rate between cash and electronic currency and controlling it so that the value of cash depreciates at a rate calibrated to match the path of negative interest rates.

As for other factors which challenge central bank independence, **Rogoff** first raised the recent retreat from globalization. He stated that globalization had increased price flexibility and reduced monopoly power, which had made it easier for central banks to control inflation. Meanwhile, he argued that contemporary trends in deglobalization would make it more difficult for central banks to achieve low inflation in the future. Next, he stressed that a greater challenge to central bank independence is the rise of digital and crypto currencies, which threatened the effectiveness of central bank policy instruments. He concluded his lecture by saying that the world has arrived at a new era of central bank independence, and central banks need to innovate to deal with the political and technical changes.

From the floor, **Kazuo Ueda** (Kyoritsu Women's University and University of Tokyo) asked whether the Federal Reserve (Fed) had acted a bit later than desirable in this cycle in raising rates. **Rogoff** replied that central banks, including the Fed, might have hesitated to raise interest rates because they did not have adequate tools for pushing the economy if raising interest rates caused a recession and the interest rates hit the zero-bound again. He noted that it was important for central banks to have some toolkits that made them not afraid to raise interest rates. **Orphanides** asked how the governance of central banks should be improved, commenting that longer non-renewable terms for board members could protect central bank independence. He also inquired about how the mandates of central banks should be specified to protect their independence, given pressures on them to deal with climate

[3] For details, see Rogoff (2022).

change. **Rogoff** agreed with the comment that having longer terms could protect central bank independence. He also argued that narrow and well-defined mandates would lead to greater central bank independence. He added that central banks would not have comparative advantage and instruments to deal with climate change, although they should fully support environmental policies. **Etsuro Shioji** (Hitotsubashi University) inquired about the welfare impact of adopting foreign digital currencies within a county. **Rogoff** answered that we should distinguish the welfare impact in advanced countries from that in developing countries. He then argued that, while the domestic circulation of foreign digital currencies may lead to a variety of problems, such as the retention of transaction data by certain countries, stable foreign digital currencies could provide monetary stability, and a consequent improvement in social welfare, in emerging markets. **R. Anton Braun** (Federal Reserve Bank of Atlanta) asked how central banks should be involved in digital currencies. **Rogoff** replied that, instead of having a CBDC, central banks and governments should regulate digital currencies in order to keep their stability. Finally, **Wakatabe** asked whether the environment surrounding central banks would be heading into an inflationary period rather than a deflationary one, due to geopolitical situations and the retreat from globalization, which led central banks to prepare for the higher inflation period from now, although central banks could ultimately control inflation rate. **Rogoff** agreed with the comment, pointing out that it might not be easy to rein in inflation due to the reversal of globalization.

IV. Keynote Speech: Inflation Surges and Monetary Policy

Walsh stated that major central banks have fallen behind the curve in response to the current inflation surges and seemed to be ignoring the lessons learned from the Great Inflation of the 1960s and 1970s.[4]

Walsh showed that the policy rate projections by the Federal Open Market Committee (FOMC) are too low compared with the policy rate calculated based on the Taylor rule using the FOMC's own economic projections, and he pointed out the Fed's slow policy response to recent high inflation. Next, using model simulations, he showed that the cost of a delayed policy response was not very large when people understood that policy would respond in the future and long-run inflation expectations are anchored to the Fed's target. However, he cautioned that when people form inflation expectations in a backward-looking manner, persistently high inflation could lead to long-run inflation expectations becoming unanchored, forcing the Fed to take a more aggressive policy response that might then lead to more volatile fluctuations of the economy.

Next, **Walsh** reviewed two of the main explanations of the Great Inflation in the 1960s and 1970s and discussed their implications for current inflation surges. He stated that

[4] For details, see Walsh (2022).

the first explanation was the underestimation of the persistence of exogenous shocks. He argued that central banks have once again dismissed the current inflation surge as a temporary shock, even though results from the economic literature on policy under uncertainty suggests that policymakers should act as if exogenous shocks are likely to be persistent. He mentioned political pressure as the second explanation. He argued that the Fed's recent change in policy framework with the goal of broad-based and inclusive maximum employment and flexible average inflation targeting (AIT) reduced transparency and accountability, creating room for political pressure on central bank independence.

Walsh argued that the delayed policy responses might matter little thanks to the power of forward guidance, as the Fed had been consistently signaling interest rate hikes since December 2021, and the 2% inflation target may still maintain some credibility. However, he concluded that, if inflation does not return to target quickly, re-establishing a low-inflation environment might require a costly recession.

From the floor, **Toshitaka Sekine** (Hitotsubashi University) asked whether it was correct to understand that the introduction of the AIT framework by the Fed was one reason why the Fed fell behind the curve. **Walsh** agreed with him that the AIT could have contributed to the delay in policy responses and pointed out that under the current circumstances, if the "2% average" is to be achieved over the next few years in accordance with the concept of AIT, then a very large deflation would need to be achieved after the end of the current high inflation. However, he argued that the Fed is unlikely to have that intention and pointed out that AIT was originally introduced with low inflation in mind, rather than the current situation where actual inflation is much higher than the target. He also referred to the implications for policy communication, pointing out that inflation targets should be clear and straightforward, but under AIT, especially if it is asymmetric, it becomes unclear what level of inflation the Fed would aim for in the future, and this lack of clarity risks confusion.

Orphanides argued, from a different perspective, that preemptive monetary policy rules that reacted to fluctuations in future inflation better described the monetary policy in the Great Moderation than a simple Taylor rule. He also argued that the Fed fell behind the curve because they abandoned such a preemptive element after the policy framework change in 2020. **Walsh** pointed out that a preemptive policy rule requires a forecast of future inflation and that, in the face of uncertainty, policy outcomes are improved if the inertia of exogenous shocks is systematically overestimated when forecasting future inflation. He then noted that the literature on robust control suggested a similar idea. **Kosuke Aoki** (University of Tokyo) pointed out that the current government debt level was extremely high, compared to that in the 1960s and 1970s, and so monetary tightening had a large impact on public finances. He then asked how this fiscal situation would affect the ability of central banks to fight against inflation surges. **Walsh** commented that fiscal policy had been playing an increasingly important role following the financial crisis and the recession associated with the COVID-19.

He then argued that central banks would face strong political pressures given the large impact on public finances that monetary tightening would cause.

V. Presentation Sessions

A. Inequality and the Zero Lower Bound

Fernández-Villaverde presented his study that showed that the level of real interest rates depended on central bank's inflation target which appears to be irrelevant to the rates. The study sheds light on new theoretical findings that low target tends to depress the real interest rates and lead to deflation, and that larger inequality of household wealth results in deeper decline in the real interest rates.[5] He constructed a heterogeneous-agent New Keynesian (HANK) model with aggregate uncertainty and an occasionally-binding zero lower bound (ZLB) on nominal interest rates and proposed a novel solution algorithm. He emphasized three channels in this model that reduce the level of the interest rates and make the room for maneuver of the central bank smaller: (i) *deflationary bias*[6], (ii) precautionary savings due to idiosyncratic income risk, and (iii) precautionary savings due to aggregate negative shocks. He then claimed the non-neutrality of the inflation target on the level of real rates. He argued that, with a lower inflation target, households anticipate that the ZLB will bind more often, which stimulates their precautionary savings to insure against larger recession risks due to the limits of monetary policy and thus leads to lower real interest rates. He also emphasized that the effect of changes in the inflation target on the level of real rates would be much larger in economies with greater wealth inequality. This is because wealth-poor households have a stronger motive for precautionary savings. To evaluate the quantitative effects, he calibrated the model to the U.S. economy and showed that changes in the trend inflation (namely the central bank's inflation target) and household inequality explain an important part of the drop in real rates over recent decades.

As the discussant, **Taisuke Nakata** (University of Tokyo) began by praising the paper for the methodological contribution, pointing out a novel solution algorithm to solve HANK models with the ZLB and aggregate uncertainty. He also praised for showing anticipation effects of the ZLB on inflation and real rates. He then commented that more quantitative investigation could be explored when compared to actual data, in particular regarding the frequency and the duration of the ZLB in the model. He also suggested that an inertia in the Taylor rule should be considered. He asked whether several suggested strategies to overcome the *deflationary bias* in typical representative-agent New Keynesian (RANK)

[5] For details, see Fernández-Villaverde et al. (2022).

[6] Anticipation of hitting the ZLB in the future by forward-looking households and firms puts downward pressures on the rate of inflation, even when the policy rate is above the ZLB. This downward pressure is referred to as deflationary bias.

models were applicable to HANK models as well. **Fernández-Villaverde** agreed with the importance of further quantitative efforts and answered to his question that he could explore the persistence of the monetary policies and monetary policy strategies in HANK models. He also stated that it was still an issue to study the existence of equilibrium in models where the ZLB binds with a very high probability.

From the floor, **Shioji** asked how the results would be changed when demographic changes and assets other than government bonds are incorporated into the model. **Fernández-Villaverde** replied that the main message of the model would not be changed when other types of assets were introduced. On the other hand, he pointed out that it was an interesting extension to incorporate the overlapping generations into this model. **Ludwig** commented that poor households would become poorer because firm profits were distributed to households according to their income in this model. He also inquired about the advantage of the solution method developed in this paper. **Fernández-Villaverde** agreed with the first comment and to the question he emphasized that the solution method developed in this paper was attractive because it required less domain knowledge to design a good algorithm. **Ippei Fujiwara** (Keio University and Australian National University) asked whether it was possible to discuss the deflationary steady state in this model. **Fernández-Villaverde** replied that, the model economy could be in a deflationary steady state in the long run. He also argued as one of the implications from the model that a mild increase in the inflation target from 2% to 3% would be enough to let the economy escape from the deflationary spiral.

B. Climate Change Mitigation: How Effective is Green Quantitative Easing?

Ludwig presented an analysis on the effectiveness of green quantitative easing (QE) using an Integrated Assessment Model, which consists of an economic module and a climate module.[7] In this model, the production of final goods requires two types of intermediate goods, *dirty* and *clean*. While clean intermediate goods production firms use clean energy which does not emit CO2, dirty intermediate goods production firms use dirty energy which emits CO2 and thus has a negative impact on the economy through increasing temperatures. Under this model settings, he analyzed the following three simulation scenarios: (1) the government levies a carbon tax, (2) the central bank applies green QE, that is, the central bank shifts its asset holdings away from dirty firms' capital to that of clean firms, and (3) a carbon tax and green QE are applied simultaneously. He noted that in case (1), temperature increase is suppressed by 0.17°C. On the other hand, in case (2), temperature increase is suppressed by only 0.04°C. In case (3), he showed that the two green policies are complements, yet the policy effectiveness is less than the sum of the effects of the two policies in isolation. He explained that this occurs because green QE increases capital costs facing dirty firms, inducing these

[7] For details, see Abiry et al. (2022).

firms to substitute dirty energy for dirty capital in their production process, and it partially offsets the effect of the carbon tax to reduce the dirty energy use. Based on these results, he argued that a carbon tax is a more effective tool than green QE. However, he also noted that green QE can be an effective complement to carbon taxes, as it has an additional climate change mitigation effect when the carbon tax is already in place.

As the discussant, **Toan V. Phan** (Federal Reserve Bank of Richmond) commended the paper for its careful analysis based on the combination of the dynamic stochastic general equilibrium (DSGE) and the dynamic integrated climate-economy (DICE) frameworks, and commented on two additional points that are relevant to the effectiveness of green QE. First, he pointed out that the lack of financial frictions in the model could lead to an underestimation of the effectiveness of green QE. Clean firms tend to face larger credit frictions than dirty firms, because they tend to be younger, smaller and have less tangible capital. Therefore, sufficient credit injections from the central bank to clean firms may have a greater effect. As a second point, he proposed the assumption of the initial convexity in the production function of the clean sector, or "clean poverty trap." Under this realistic assumption, capital injections from the central bank would have a greater effect by helping the clean sector escape the clean poverty trap. This also implies that green QE may only need to be in place temporarily, until the clean sector achieves sufficient scale to escape the initial clean poverty trap. Finally, he added that the elasticity of substitution between clean and dirty input would be a more important parameter if financial frictions and the clean poverty trap are accounted for. **Ludwig** agreed with him and replied that the paper aimed to be an important first step to incorporate a finance perspective and that the development of this field was just beginning. He added that credit frictions are certainly important at least in the short run.

From the floor, **Orphanides** argued that central banks have two very different approaches to asset purchases. One is green QE, which is effectively a subsidy to a specific sector of the economy over others, and the other is normal QE, which effectively empowers the government to decide the use of proceeds from the sale of government bonds. He then claimed that normal QE seems preferable from the perspective of maintaining central bank neutrality with respect to sectoral distribution effects and avoiding central bank politicization. **Ludwig** agreed with him and replied that it would be much more efficient if the government taxes carbon and subsidizes the clean sector with the revenue while the central bank implements normal QE. **Braun** asked about the relative efficacy of three types of strategies, changing portfolio allocation of exchange traded funds (ETFs) in the case of the Bank of Japan, subsidized credit to financial intermediaries, and improving energy efficiency of payment system, in terms of the promotion of green sectors by central banks. He also asked for views on the very limited opportunities for the Fed to intervene in financial markets. **Ludwig** responded that some suggestions for subsidized credit could be obtained by extending the current model. Related to the latter question, he replied that the degree of market intervention

by the authorities varies from country to country, and that one way to address this point would be to add the European Union (EU), which is relatively active in market intervention, and other countries to the model instead of the single global monetary authority in the current model.

C. Digital Money as a Medium of Exchange and Monetary Policy in Open Economies

Ikeda considered global digital money, i.e. digital money that is widely used for transaction across borders, and its possible impact on monetary policy in open economies.[8] He started by noting that global digital money had yet to emerge, but it was technologically feasible and might materialize in the future. He pointed out that against this background, global digital money, including global stablecoins, had gained increasing attention among policymakers. He used an open economy search model with multiple currencies and derived two results. First, he showed that monetary policy autonomy, i.e. central banks' capacity to set monetary policy, would be lost in the standard model with global digital money. Second, he showed that this was not an inevitable outcome, and that monetary policy autonomy could be restored by extending the model and introducing specific government policies. He argued that such government policies include limiting the amount of global digital money that serve for a transaction or banning the use of global digital money for some transactions. He also added that the possibility of the counterfeiting of global digital money could give rise to an incentive constraint that plays a similar role to government policy that can help restore monetary policy autonomy. In conclusion, he argued that the design, policy, and regulations of global digital money were crucial for preserving monetary policy autonomy.

As the discussant, **Linda S. Goldberg** (Federal Reserve Bank of New York) commented that the paper provided a thoughtful analysis on conditions for monetary policy autonomy in the economy with global digital money. She also commented that detailed modeling of the global digital money would enrich the analysis and emphasized the importance of its definition. She then asked how the characteristics of the global digital money considered in the paper are defined, and by whom and with what goals the supply of global digital money was determined in the model. As an example, she pointed out that in the case of stablecoins as global digital money, further considerations would deepen the analytical perspective, such as how the assets that support the value of the stablecoins could affect liquidity services for the coins and monetary policy autonomy. **Ikeda** replied that the supply of global digital money was exogenous in his model and agreed that modeling the supply side would enhance the analysis. He added that the simple modeling of the global digital money was an initial step toward a more practical analysis and more work would be required to

[8] For details, see Ikeda (2022).

deepen the understanding of the possible impact of global digital money on monetary policy.

From the floor, **Sekine** pointed out that although the paper focused on the medium-of-exchange role of money, the unit-of-account role was also important and, in practice, it might not be separated from the medium-of-exchange role. **Ikeda** agreed with the comment and replied that a joint consideration of the two roles of money would be a challenge for his future research. **Shioji** asked if the provider of the global digital currency might have an incentive to peg its value to that of the currency of a large country, when we change the underlying assumption of the model and introduce asymmetry in size between the two economies. He also asked if the requirement to pay taxes exclusively in national currency could play a similar role to government policy that helps restore monetary policy autonomy. **Ikeda** replied that the size of a country did not affect his results and that tax payments in national currency were similar in spirit to the government policy in the model. **Soejima** commented that in addition to Goldberg's points incorporating the market microstructure of the retail payment system into the model, including payment fees and payment cost bearers that vary by payment methods, would be a promising direction for future research on digital money.

D. Monetary Policy in the Age of Automation

Fornaro presented a new framework in which monetary policy affects the progress of automation in the production of goods and services.[9] He explained that this framework was based on a standard task model with nominal wage rigidities and a long-run IS curve, which described the impact of monetary policy on employment and the investment for automation. Specifically, there exists a threshold for the interest rate which makes the value of capital and labor equal for firms. When the interest rate is lower than the threshold, capital is cheaper than labor, and thus firms boost investment in automation, which results in a high-automation economy. Conversely, when the interest rate is higher than the threshold, capital is more expensive than labor. Thus, firms do not substitute labor with capital, and automation remains low. Then, he showed there could be multiple steady state equilibria with different automation levels depending on the level of the interest rate. Then, **Fornaro** argued that monetary expansions had the effect of increasing labor productivity by inducing firms to use more automation technology due to the lower price of capital. Therefore, in addition to the effect of increasing employment and inflation as described in the traditional New Keynesian model, monetary expansion could have the opposite long-run effect of decreasing them through higher labor productivity. Thus, he offered a new perspective that the central bank therefore could face a tradeoff between automation and employment in the long run. For example, he explained the case, such as the secular stagnation, in which demand is permanently low and

[9] For details, see Fornaro (2022).

the central bank cannot necessarily achieve full employment due to the zero-interest-rate constraint. He argued that in that case the central bank faces a choice: i) to ease monetary policy as much as possible and allow automation to progress, thereby increasing productivity while allowing some unemployment, or ii) to keep interest rates high and hinder automation aiming at maximum employment by constraining productivity growth and wage increases.

As the discussant, **Fujiwara** commended the paper by **Fornaro** for offering a simple but innovative model with many implications. He then explained the relevance of the results of the paper to the Japanese economy in the past. Specifically, he explained that the trend of robot stock in Japan reached its peak in the late 1990s and decreased thereafter and that real wages began to decrease right around that time, which implied that firms had less incentive to automate. He noted that these facts were consistent with the framework of **Fornaro**. He also gave the following six comments. First, he pointed out that labor and capital may not be highly substitutable, referring to some previous studies. Second, he asked if this automation channel has the first order importance in the effect of interest rates on total factor productivity, compared to the other channels discussed in the literature. Third, he asked if there were observable sufficient statistics to estimate the breakeven interest rate where the values of capital and labor were equal. Fourth, he pointed out the importance of some empirical testing to show the existence of the automation channel of monetary policy transmission. Fifth, he proposed to weaken the assumption in the impulse response functions that agents knew the terminate steady state since there could be multiple ones. Finally, he underscored the difficulty of monetary policy making and its communication under many counteracting channels of monetary policy. **Fornaro** agreed on the importance of empirical testing and commented that his model could serve as a framework to motivate empirical research on this topic.

From the floor, **Aoki** asked whether there were multiple equilibria in the case where the productivity of capital and labor varied by task. **Fornaro** replied that he also discussed such a case in the paper and there still existed multiple equilibria. **Masaaki Kaizuka** (BOJ), the chairperson, asked about the effect of fiscal policy as a measure to stimulate labor displaced by automation. **Fornaro** replied that he also discussed this point in the paper and that fiscal policy can support automation and a high level of employment. **Andrea Gerali** (Banca d' Italia) pointed out that automation in Japan had not been boosted despite massive monetary policy stimulus in the last 10 to 20 years, which was not consistent with the framework of the paper, and proposed the introduction of uncertainty to understand the situation in which investment in automation is not boosted with low interest rates. **Fornaro** replied that a liquidity trap with no automation is properly modeled by introducing the assumption of liquidity preference instead.

VI. Policy Panel Discussion

In the policy panel discussion, moderated by Wakatabe, four panelists, Gourinchas, Bullard, Lane, and Diokno, discussed the new dimensions and frontiers facing central banks.

A. Remarks by Panelists

Gourinchas discussed policy challenges for central banks in advanced economies and emerging markets. He first mentioned that the current world economy was marked by the rebound from the COVID-19 pandemic and the war in Ukraine, and that the conjunction of the two had led to a significant downward revision for growth and a sharp upward revision for inflation in the IMF forecast for the world in 2022 and 2023. Regarding advanced economies, he pointed to combating inflation as a major policy challenge. He explained that in most economies except for Japan, inflation had exceeded target levels and nominal wages had risen as labor markets had tightened. He added that some measures of long-run inflation expectations had exceeded target levels in several economies, which was certainly a source of concern. Regarding emerging markets, he pointed to managing financial spillovers as a major challenge facing central banks. He mentioned that a historical pattern of adverse financial conditions, such as a repricing of risk and capital outflows, that was associated with interest rate hikes in advanced economies had yet to be seen in emerging markets as a whole. But he argued that a source of concern was an increase in the number of countries with debt problems. Finally, he concluded that from a medium- to long-term perspective, central banks should address frontier challenges such as climate change and the new forms of digital money and crypto-assets.

Bullard discussed the recent surge in U.S. inflation, credibility, and forward guidance. He firstly noted that the current U.S. inflation was comparable to levels seen 1974 and 1983. He argued that there was a risk that inflation expectations could become unmoored, and this situation was straining the Fed's credibility with respect to its inflation target. However, he added that modern central banks had maintained higher credibility than in the past, much of it stemming from an explicit commitment to inflation targeting, and they also made more use of forward guidance. As an illustration that forward guidance had taken effect, he pointed to the fact that medium- to long-term market interest rates had moved above their pre-pandemic benchmarks, while the policy rate had not. He stressed that U.S. inflation was far above target, so market rates would have to move well above the benchmarks this year before converging back to lower levels in subsequent years. To provide an idea of the policy rate increases required to bring inflation under control, he mentioned a minimal Taylor-type rule calculation and its recommended policy rate of 3.63%. He closed his remarks by stressing again that forward guidance was helping the Fed move more quickly to keep inflation under control.

Lane discussed the current high rates of inflation, the formation of inflation

expectations, and the conduct of monetary policy. He focused on a central scenario discussed by many experts that inflation would return to around 2% after a prolonged period of inflation above the target. He added that supply shocks, such as an increase in energy prices and a shortage of productive capacity, would ultimately dissipate, but argued that developments in inflation expectations were an important issue, as these can to some extent be adaptive in nature. He explained that inflation expectations had been updated upon changes in the actual inflation data, as for example these had been revised downward in the years before the pandemic. He argued that a big question was how the current surge in inflation would affect inflation expectations and whether there was a risk of inflation expectations settling down above the target. He added that he therefore would keep a close eye on the formation of inflation expectations and would focus on the dynamics of prices and wages. He also mentioned a potential difference between the euro area and the U.S. regarding the impact of the energy shock. He explained that for the euro area, energy shocks increased prices initially but could have the opposite effect in the medium term as the energy shock constituted a large negative shock to the terms of trade and could reduce demand in the economy. Finally, regarding the conduct of monetary policy at the ECB, he emphasized that there was a straightforward and robust roadmap until the summer, as made clear by President Lagarde. Beyond the summer the ECB monetary policy would remain data-dependent to make sure that inflation stabilizes at 2%.

Diokno discussed the post-pandemic recovery in the Philippines, as well as how the BSP had adapted to the ever-changing environment. He stated that the Philippine economy had been recovering strongly from the pandemic-driven recession as mobility restrictions had eased and borders had opened to foreign tourists. He added that the recovery had been made possible by expanding healthcare capacity and accelerating the vaccination program. He also noted that the inflation rate was expected to rise to 4.6% in 2022, due to higher oil prices, but it was expected to return to within the target range at 3.9% in 2023. He added that under the economic circumstances, the BSP raised the key policy interest rate to 2.25%. Next, he pointed out that the pandemic was an effective catalyst for the financial sector to evolve and innovate, and he mentioned the BSP's efforts on the digitization of the payment system as an example. He explained that even before the pandemic, the BSP had already prepared a roadmap to transform the Philippine payments system into an efficient, inclusive, safe, and secure digital payment ecosystem that supports the diverse needs and capabilities of individuals and firms, and the pandemic boosted the progress. He stressed that with digitalization and financial technology, the BSP stood ready to reform, innovate, and transform by providing an enabling regulatory environment. He closed his remarks by stating that the wide-ranging reforms would ultimately create tangible economic benefits to the Philippine public, as the BSP remained committed to promoting price stability and a resilient, responsive, and inclusive financial system.

B. Discussion among the Moderator and Panelists

Wakatabe began the discussion with recent price developments and new challenges for central banks. He first pointed out that prices were rising at rates not experienced in recent years in the euro area and the U.S., and that the pace of price increases had accelerated in the Philippines while it remained moderate in Japan. Looking at the demand side, he stated that real GDP had recovered to pre-pandemic levels in those economies except for Japan. He explained that pent-up demand for consumer spending had been limited in Japan. Looking at the supply side, he noted that a slow recovery in the labor force participation rate, due in part to so-called "Great Resignation," contributed to high inflation in the U.S. He then argued that soaring energy prices were driven not only by the global economic recovery but also by the curbing of fossil fuel-related capital investment with a view toward de-carbonization, and by heightened geopolitical risks. He noted that recent price developments seemed to suggest that inflation had become more persistent. Next, he turned to new challenges for central banks, focusing on climate change and the digitalization of money. He pointed out that risks related to climate change were increasing and that public interest in climate change issues was growing. He then stated that demands on central banks to address climate change risks and the movement toward de-carbonization are increasing. He also mentioned that many central banks were engaged in some form of CBDC work and moving on to more advanced stages, such as developing a CBDC. Finally, he pointed out that the expansion of private digital currencies, including stablecoins, could pose a risk to financial stability and investor protection.

Wakatabe asked two sets of questions to the panelists. First, he asked whether the fear of low inflation or deflation was over, and we would see the return of high inflation. And relatedly, he asked whether the current inflation targeting monetary policy framework was still valid. **Gourinchas** replied that high inflation was already here, and we were now in a high inflation environment. He also replied that the flexible inflation targeting framework was still valid in addressing the current inflation. He added that inflation would come down as long as central banks do their job and keep inflation expectations well anchored. He mentioned that in the medium to long term, the forces that had led to a low neutral interest rate, such as lower productivity, ageing populations, and demand for safe assets, might reassert themselves. He added that if fragmentation of the global economy were to occur, it could lead to higher volatility in prices and higher unit labor costs. **Bullard** replied that low inflation in the U.S. seemed over, and the U.S. would have a new regime of higher nominal interest rates and higher inflation than those seen previously. Regarding the monetary policy framework, he explained that the Fed's review of monetary policy strategy ratified in 2020 had been designed for low inflation and low nominal interest rate situations. He added that the implicit

background argument was that the Fed would implement the ordinary inflation targeting in high inflation situations. **Lane** recalled that the ECB's strategy review analyzed the sources of low inflation before the pandemic. There had been a mixture of a series of negative shocks, the financial crisis, the European debt crisis, and fiscal austerity. He added that the analyses suggested that inflation pressure could materialize if the sources of low inflation either disappear or go into reverse. He argued that inflation had certainly upside risk and the temptation was to focus on the uncertainty factors that bring more inflation, but he added that the distribution of risk was not on the upside only and that downside risks to the 2% target also continued to exist. **Diokno** replied that the current inflation targeting framework remained valid and appropriate for the Philippines. He added that the introduction of the inflation targeting framework by the BSP had succeeded to lower headline inflation and controlled average inflation within its target.

Next, **Wakatabe** asked whether the mandates of central banks should be reconsidered given the recent development of new challenges and whether central bank independence needed to be redefined. **Gourinchas** argued that central banks could play a role in addressing climate change, but they could not be the core of any climate transition. He added that serious climate transition rested on carbon pricing, investment in renewable technologies, subsidies, and measures to address distributional issues that might arise during climate transition. He emphasized that central bank independence was really critical for anchoring inflation expectations and a loss of independence would be a tremendous blow to macroeconomic stability. **Lane** stressed that price stability was the ECB's primary mandate, and that the ECB essentially had a secondary mandate of supporting the general economic policies in the European Union as long as this did not conflict with the primary mandate. He added that the ECB had worked on reshaping the operational framework to support the green transition, in line with its mandate. He also reflected on digital money and noted that the anchor of the payment system was the central bank, and it made a lot of sense for central banks to consider the potential of CBDC as an anchor of a digital monetary system. **Diokno** stressed that central banks should remain focused on price stability. He pointed out that traditional monetary instruments were best suited to deal with demand-side management and might not be appropriate to directly address other important issues such as climate change and inequality. He noted that inflation expectations had remained relatively well anchored in the Philippines, so the credibility of the central bank's commitment to price stability would be maintained, even in the face of rising inflation. **Bullard** commented that climate change or any other very long transition in the economy would affect the long-run balanced growth path of the economy, so central bankers needed to be aware of this and understand how to react. He mentioned inequality and argued that monetary policies were designed to get the very best outcome for the whole of society, but making it more convincing would require economic models that take inequality into account. He added that getting greater granularity regarding data and models,

to understand who was affected and how by monetary policy, would be an interesting research theme.

C. General Discussion

Wakatabe opened the floor for questions. **Walsh** noted that monetary policy based its effectiveness on the credibility of central banks and the ability to use forward guidance and asked how central banks should communicate policy intentions with the public to preserve credibility when there was a gap between households' and financial markets' expectations about inflation and monetary policy. **Bullard** replied that he focused on financial markets' expectations, such as treasury inflation-protected securities (TIPS), because they were sensitive to day-to-day information. He noted that the people being asked in surveys might not be well informed. He pointed out the importance of firms' pricing and noted that firms appeared to set prices in a state-dependent manner and to speed up price reviews in the current high inflation environment. **Shioji** pointed out that central banks have developed various unconventional monetary policy tools in pursuit of macroeconomic stability, but, as a result, are now subject to potential political pressures to intervene in resource allocation at the microeconomic level. He asked if we could devise a new institutional arrangement under which they can focus on their traditional mandates without giving up those new policy tools. **Lane** replied that it was clear that all of the ECB monetary policy instruments, including balance sheet policies, were subordinated to the price stability mandate and that the ECB had demonstrated that such policies were set to stabilize inflation at the target. He added that all monetary policy instruments were looked at jointly and the underpinnings were always price stability.

VII. Concluding Remarks

Orphanides summarized the presentations and discussions at the conference. He noted that the conference covered a broad range of issues facing central banks today, as in the Opening Remarks, such as the surge in inflation and geopolitical risks, structural change in the economy, climate change, and the digitalization of money. First of all, he argued that the Mayekawa Lecture by Rogoff focused on challenges in central bank independence in recent years, saying that there appeared to be a rise in political economy influence on monetary policy, drawing on recent experience in the United States. He agreed with the point and cautioned that central bank independence should not be regarded as a given, and that central banks need to operate the policy properly to maintain it over time. Next, he noted that the keynote speech by Walsh focused on the recent surges in inflation and monetary policy response, and underscored the importance of maintaining central bank credibility to contain the cost of falling behind the curve. He also highlighted that given the uncertainty about the

persistence of inflationary shocks, robust monetary policy response should be much more forceful than otherwise. Regarding the four paper presentations, he stated that the challenges facing central banks were thoughtfully discussed. He commented that the recent increase in scrutiny about the effects of monetary policy on inequality might reflect the fact that more central banks have faced the ZLB, where the effects on inequality are actually more pronounced than otherwise, as Fernández-Villaverde presented. With respect to climate change, he pointed out that the most important contribution of the paper by Ludwig was that green QE was inferior to proper fiscal policy in dealing with climate change, and he cautioned that central banks should not over-promise on climate change problems. On the digitalization of the economy, he argued that it was necessary to restrict the use of global digital currency in some way, in order to preserve monetary policy autonomy, as presented by Ikeda. The study by Fornaro, which revealed the link between automation and monetary policy, was a new finding that suggests that the ZLB made it harder for monetary policy alone to ensure full employment. He then suggested that close cooperation between fiscal and monetary policy should be beneficial to an economy when faced with the ZLB. As for the policy panel discussion, he touched upon the issues on the validity of monetary policy frameworks against current inflation and pointed out that a plain and simple inflation targeting framework was quite effective in delivering price stability. On the reconsideration of the central banks' mandates, he warned that if central banks' priorities were not clear, their mandates might inevitably continue to be reconsidered and, as a result, their independence could be threatened. He concluded his remarks by highlighting the importance of central banks continuing to focus on maintaining price stability and being as clear and transparent as possible and symmetric about maintaining the inflation objective without any bias.

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APPENDIX 1: PROGRAM

Wednesday, May 25, 2022

Chairperson: **Kazuo Ueda**, Kyoritsu Women's University and University of Tokyo

Opening Remarks

Speaker: **Haruhiko Kuroda**, Bank of Japan

Mayekawa Lecture: Institutional Innovation and Central Bank Independence 2.0

Lecturer: **Kenneth S. Rogoff**, Harvard University

Keynote Speech: Inflation Surges and Monetary Policy

Speaker: **Carl E. Walsh**, University of California, Santa Cruz

Thursday, May 26, 2022

Chairperson: **Yutaka Soejima**, Bank of Japan

Session 1: Inequality and the Zero Lower Bound

Presenter: **Jesús Fernández-Villaverde**, University of Pennsylvania

Discussant: **Taisuke Nakata**, University of Tokyo

Session 2: Climate Change Mitigation: How Effective is Green Quantitative Easing?

Presenter: **Alexander Ludwig**, Goethe University Frankfurt

Discussant: **Toan V. Phan**, Federal Reserve Bank of Richmond

Session 3: Digital Money as a Medium of Exchange and Monetary Policy in Open Economies

Presenter: **Daisuke Ikeda**, Bank of Japan

Discussant: **Linda S. Goldberg**, Federal Reserve Bank of New York

Friday, May 27, 2022

Chairperson: **Masaaki Kaizuka**, Bank of Japan

Session 4: Monetary Policy in the Age of Automation

Presenter: **Luca Fornaro**, Centre de Recerca en Economia Internacional, Universitat Pompeu Fabra

Discussant: **Ippei Fujiwara**, Keio University and Australian National University

Policy Panel Discussion

Moderator: **Masazumi Wakatabe**, Bank of Japan

Panelists: **Pierre-Olivier Gourinchas**, International Monetary Fund

James Bullard, Federal Reserve Bank of St. Louis

Philip R. Lane, European Central Bank

Benjamin E. Diokno, Bangko Sentral ng Pilipinas

Concluding Remarks

Speaker: **Athanasios Orphanides**, Massachusetts Institute of Technology

APPENDIX 2: LIST OF PARTICIPANTS

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Kosuke Aoki	University of Tokyo
Ryo Aruga	Bank of Japan
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Jan Marc Berk	De Nederlandsche Bank
Martin Bodenstein	Board of Governors of the Federal Reserve System
R. Anton Braun	Federal Reserve Bank of Atlanta
James Bullard	Federal Reserve Bank of St. Louis
Carlos Canizares Martinez	Národná banka Slovenska
Lillian Cheung	Hong Kong Monetary Authority

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Nobuo Inaba	Ricoh CO., LTD.
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Kazumasa Iwata	Japan Center for Economic Research
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Tokiko Shimizu	Bank of Japan
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