Recent trends in international reserves: theory and evidence

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Editorial – Recent Trends in International Reserves: Theory and Evidence

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This editorial briefly introduces the Lille-Reading Workshop on International Finance, and then reviews the seminal early literature on international reserves, in its first section, and the seven articles published in the present special issue, in the second section. My hope is that our special issue constitutes a timely and representative update on the most recent developments in the theoretical and empirical analysis of international reserves. This topic has always been an issue with immediate and profound policymaking implications. Yet especially now, when our world has unfortunately moved away from economic cooperation and globalisation toward fragmentation into "friendly" and "unfriendly" blocs of countries and an outright "civilisational" war, the articles published herein could provide some research-supported views, possible clues and provisional answers to hard fundamental questions, given the huge uncertainty in the global financial order nowadays.

The idea for the joint workshop was agreed on 12 December 2019, with my colleagues Etienne Farvaque and Florence Huart at the Université de Lille. The inaugural event was planned for 5-6 November 2020 at Lille, but had to be postponed due to the COVID-19 pandemic and the related confinement measures. It was, then, held online (for the same reason) at the University of Reading on 4-5 November 2021, and the recordings are accessible via the Lille-Reading WInFi (the workshop name, for short) website. This new annual workshop will seek to collaborate with the main policymaking institutions and central banks in Europe and beyond. We are grateful to *Open Economies Review* for their initial trust in the quality of our workshop: even without any pre-existing reputation, their Editor-in-Chief George Tavlas kindly agreed to publish the 1st and 2nd special issues – and here we go with the 1st one.

Key Literature on International Reserves: A Brief Tour

To provide a perspective on the theme of focus of the workshop and this special issue, it will be useful to propose a dense overview of the seminal early literature on international reserves. That literature perceived reserves, essentially, as a buffer stock, concentrating on their relationship with liquidity (Balogh, 1960; Caves, 1964). Balogh (1960) seems to have been among the first to propose an economic theory of reserve holdings, where the level of international reserves depended on the objective of economic policy and provided liquidity to the economy. Caves (1964), consequently, defined the liquidity problem as financing the United States (US) trade deficit,[2] and analyzed the role of international reserves in the context

[2] It is worth noting that the US ran trade deficits in parallel with current account surpluses during most of the 1960s.

of fixed exchange rates. Heller (1966), then, discussed three motives for holding reserves, by analogy with the motives for holding money in the Keynesian tradition: (i) a transaction motive; (ii) a precautionary motive; and (iii) a speculative motive. He appears also to have been the first to propose an optimal reserve function, taking adjustment cost and opportunity cost into account. Mihailov and Nasir (this issue) revisit the modeling of optimal reserves and derive an encompassing formula.

It is widely accepted in the subsequent literature that the above three motives are the "traditional factors" of the optimal reserve function. Clark (1970), Kelly (1970), and Hamada and Ueda (1977) developed this "traditional view" in terms of modifying some assumptions, but their key result remained consistent with Heller (1966): the optimal reserve level increases with balance of payments (BoP) volatility and decreases with the propensity to import and the opportunity cost of reserve holdings. Frenkel and Jovanovic (1981) proposed a buffer stock model for the optimal reserve level based on the same two types of costs. The opportunity cost was defined as a comparison of alternative investment returns, and the cost of adjustment as the cost of reserve depletion. In order to determine the optimal level of reserves, both costs were minimized. However, a tradeoff emerged: the opportunity cost increases when reserves are at a high level, whereas a high level of reserves is associated with a lower adjustment cost. The costs of reserves are reconsidered in Levy Yeyati and Gómez (this issue) and Torriani et al. (this issue).

As trade and financial liberalization was progressing with a rapid pace in the course of the 1990s, precautionary demand for holding international reserves gained more prominence in the analysis. Ben-Bassat and Gottlieb (1992) introduced the effect of sovereign risk on it and discussed the cost of decreasing the reserve level, which might be taken as a signal of an external payment problem for a country with external debt. The authors also pointed out that past defaults mattered: therefore, a country that has experienced a default should hold more reserves to sustain its international credibility.

In the wake of the East Asian financial crisis of 1997-1998, researchers and policymakers also became concerned with the issue of "reserve adequacy", allowing a safeguard for a country from a "sudden stop" of capital inflows. Some simple policy rules were proposed in order to provide insurance for economies which had a risk of vulnerability from such episodes or crises – as in the contribution of Mihailov and Nasir (this issue). Feldstein (1999) argued that the accumulation of foreign reserves was an insurance against sudden stops of capital inflows and capital outflows in emerging market economies (EMEs). Greenspan (1999) similarly suggested a pragmatic measure of the "optimal" level of international reserves, equal to a country's short-term external debt (STED). Along such lines, Eichengreen and Mathieson (2000) analyzed the importance of the currency composition of international reserves, a topic that recurs in Dooley et al. (this issue), Iancu et al. (this issue), and Laser and Weidner (this issue).

The most recent literature has made considerable further progress. Bianchi et al. (2018) model international reserves as non-state-contingent assets that provide insurance against rollover risk. Differently from Alfaro and Kanzuk (2009), who quantify optimal reserves at the counterintuitive level of zero, Bianchi et al. (2018) assume that the debt may not be repaid in full in the next period, leading to the emergence of debt rollover risk, and quantify optimal reserves for EMEs in their endowment model at 6% of national income. Bianchi and Sosa-Padilla (2020) further examine a macroeconomic stabilization channel and its interaction with a precautionary motive. They depart from the existing work by incorporating nominal rigidities, which also gives rise to a macroeconomic stabilization hedging role for international

reserves. Their key contribution consists in proposing a theory that is quantitatively consistent with the observed levels of reserves in EMEs, also linking, both theoretically and empirically, the accumulation of international reserves to the exchange rate regime. In turn, Arce et al. (2019) study the joint dynamics of private and official capital flows, employing the idea that the motive for reserve accumulation derives instead from the correction of an externality, indeed typical for the literature on the mercantilist motive of reserve holdings. The mercantilist motive explains reserve accumulation as a by-product of industrial policies promoting exports when there are growth externalities (see, e.g., Rodrik, 2008; Benigno and Fornaro, 2012). Yet in contrast to that literature, they focus on an externality originating in financial markets and leading to excessive systemic risk. These very recent advances have also viewed reserve accumulation as a kind of macroprudential policy.

This Special Issue

The articles in this special issue are seven in number (plus the present editorial). Two of the articles, Laser and Weidner and Mihailov and Nasir, were presented at the workshop, the remaining five were submitted in response to the updated call for papers following the workshop. They were all single-blind peer-reviewed, following a usual, but somewhat faster, refereeing process. The accepted articles in this special issues are ordered to provide a logical sequence, starting from the most topical and general paper, Dooley et al., and then branching into a few popular and active strands of the recent literature. We first present an update on the theory of optimal international reserves in production small open economies (SOEs) facing sudden stops, in Mihailov and Nasir, and on the carry-trade costs of international reserves, in Levy Yeyati and Gómez; then, two papers follow on the empirical currency composition of reserves, Iancu et al. worldwide and Laser and Weidner with a focus on the EU; we conclude by a paper on how rare natural disasters such as earthquake shocks affect international reserves, in Jinjarak et al., and a related one on the more general and more pragmatic topic of the strategic allocation of central bank reserves to cushion shocks, in Torriani et al.

Dooley et al. (this issue) provide a very timely article that echoes the unprecedented by its scale seizure of international reserves held by the Bank of Russia in late February 2022, as part of the sanctions imposed on the aggressor country by the international community. In it, Dooley et al. furnish an answer to a topical and worrisome question, by stating, as the title to their article, that "US Sanctions Reinforce the Dollar's Dominance" – and not weaken it, as many observers and commentators have claimed. Arguing from the perspective of nearly two decades of research, cited in their article, the same three co-authors reiterate that a reserve currency does not just provide a safe asset but also needs to be able and willing to potentially serve as a tool in comprehensive financial asset seizures. The authors maintain that the US still remains the most trusted country to fulfil such a responsibility. That is, the US also produces assets that are not safe in case of a misbehavior in the global financial system. Such a central role in the latter system must ensure the right incentives by providing safety for good behavior but punishment – via asset seizures and/or economic sanctions – for bad behavior. Indeed, this is what really happened to Russia, as a retaliation to the Kremlin's invasion of Ukraine. As a counterexample of the Russian case, the article by Dooley et al. further provides an overview of the case of China since 2002. The country embarked on an ambitious growth strategy, empowered mostly by export of high-quality products produced with cheap labor in foreign direct investment locations in China. To convince foreign investors to pour capital, technology and know-how into China, the country accumulated huge international reserves in US dollars, which acted as a "collateral value" that guaranteed safety for these foreign investors. The authors also refer to empirical evidence that supports such a "collateral argument", indeed also

highlighted in the theoretical study by Mihailov and Nasir (this issue). Then, the authors warn that the analogy with private collateral should not be taken literally. Public collateral, as defined by Dooley et al., provides a less powerful incentive since private investors in the central country (the US, in the present context) may not be compensated even after a seizure of assets by this central country in the misbehaving country (Russia, in the present context). To justify the title of their article, i.e., also its main conclusion, the authors state that "the dollar is the dominant reserve currency because the US is the only country with sufficient power to impose exactly such sanctions when a country like Russia misbehaves. The US earns the "exorbitant privilege" of having the global reserve currency by daring to impose penalties when justified by the behavior of the owners of reserves." Some shift toward euros as a reserve currency is possible in the near future too, according to the authors, due to the fact that the EU backed the US seizure and sanctions. Yet such a shift will not challenge the dominance of the US dollar, even if Russia remains excluded from the dollar-based international financial system and even if China decides to do so too, the authors expect.

To continue with the theme of international reserves viewed as a collateral, Mihailov and Nasir (this issue) explore in a theoretical exercise calibrated to a sample of 34 medium-income countries the role of collateral to foreign investors that physical capital per capita plays in an insurance model of a SOE with conventional labor-augmenting neoclassical growth production function. The aim of the paper is to highlight how consideration of the typical neoclassical production factors, capital and labor, affects the optimal level of international reserve holdings by SOEs facing the risk of sudden stops. The authors extend the Jeanne and Rancière (2011) endowment SOE model by adding to it a Cobb-Douglas production function with constant returns to scale and exogenous population growth, which is consistent with a long-run balanced growth path and the sustained per capita income growth in the data. This extension incorporates investment, capital, labor and production and, first of all, implies a richer analytical version of the optimal reserves formula driven by productivity and the saving rate. Under a plausible calibration based on the 1975-2020 period for typical EMEs facing the risk of sudden stops in capital inflows, Mihailov and Nasir, then, quantify the optimal reserves-to-output ratio at 7.5%. This is the mid-point in the range between the reserve ratio in Jeanne and Rancière (2011), of 9.1%, calibrated to the same sample of 34 middle-income countries in the simpler endowment SOE model, and that in Bianchi et al. (2018), of 6.0%, obtained in a different, sovereign debt model without capital and production but allowing for repayment of foreign debt beyond a single period, perhaps the key limitation of the extended SOE model of Mihailov and Nasir. As the countries in the sample used for calibration appear quite heterogeneous, Mihailov and Nasir conclude their study by also computing the optimal reserves-to-output ratio by region. It turns out that the insurance SOE model of reserves these authors extended to production is validated empirically in terms of the average reserves-to-output ratio in the data for Latin America, at just above 10%. This world region has the highest weight in their sample, and represents nearly half of it, 16 countries. However, for Asia, Africa and Europe these regional model-based ratios understated considerably the respective data averages, unless this uncovers a corresponding degree of reserve hoarding. The authors, therefore, conclude that this type of modeling of reserves as insurance against sudden stops or, equivalently, precautionary saving, is empirically relevant for Latin American economies, but alternative approaches need to be explored for other world regions. The lower optimal reserves-to-output ratio relative to the endowment SOE of Jeanne and Rancière (2011) can indeed be explained by the role of capital accumulation as precautionary saving: the accumulated capital stock can potentially be used as a pledge to external creditors in obtaining borrowing.

To build upon, and extend, an influential strand in the seminal literature briefly surveyed earlier, Levy Yeyati and Gómez (this issue) reconsider the cost of foreign exchange reserve accumulation. Their empirical analysis covers 16 EMEs over the 2005-2021 period. The novelty of the article is to highlight that the proper way of measuring the cost of holding reserves depends on the instrument used to purchase those reserves. To make that point, the authors argue that the instrument used depends, in turn, on the motive for reserve accumulation: precautionary reserve accumulation, often linked to a neo-mercantilist motive or a stabilization motive, was typically done with foreign currency liabilities; whereas leaning-against-the-wind (LAW) interventions are typically done with domestic currency liabilities. The authors show that the commonly used metric for the cost of reserves, the sovereign spread, is too simplistic and may overstate the true cost. The reason is that, since most of the recent reserve buildup can arguably be attributed to LAW interventions, the "carry-trade" cost is a more appropriate metric, and it has been lower than the sovereign spread for most countries in their sample. Levy Yeyati and Gómez further demonstrate that if the reserves are purchased using local-currency debt, then the correct way of computing the cost is the interest rate differential minus the depreciation rate, i.e., what they refer to as the "inverse of a carry-trade". Then, for most countries in their sample the carry-trade cost is lower than the credit-risk cost.

Revisiting another influential strand of the surveyed literature in the second section of this editorial, Iancu et al. (this issue) investigate the drivers of reserve currencies at the global and country level, how these drivers have changed over time, and how they differ across advanced and emerging market economies. To do so, the authors compile a novel database of reserve holdings of individual countries by currency, based on official data published by the respective central banks. The article finds that inertia and financial links are important drivers of reserve currency shares, and their importance has increased since the global financial crisis. The empirical analysis leads into a discussion of factors that could shape future reserve currency configurations, namely trade links/gross value chains (GVCs), credibility/macroeconomic sustainability, exchange rate regimes, geopolitics, and technology (payment systems and central bank digital currencies – i.e., CBDCs). The key contribution of the paper consists in providing a succinct summary of trends in reserve currency developments using more informative country-level data, as well as a discussion of potential scenarios of evolutions of reserves currencies in the light of recent economic developments, including the COVID-19 pandemic.

In a similar vein, Laser and Weidner (this issue) also examine the determinants of the composition of international reserves, aiming in particular to disentangle the impact of the euro crisis on currency compositions. The authors compile a new dataset based on publicly available central bank data on international reserves in order to overcome the lack of comprehensive data. Relating these data to a selection of country-specific factors reveals that trade patterns and currency pegs are primary determinants of foreign currency holdings. The analysis suggests the importance of transaction motives in determining the composition of currency shares. Correlations between currency pegs and imports are revealed too. These findings confirm earlier ones from papers based on access to confidential IMF data. The authors further show that the euro crisis caused a break in the rising relative significance of EUR holdings. In pre-crisis years and since the euro introduction in 1999, the EUR was able to establish itself as the world's second reserve currency after the USD, and was even considered a rival to the USD as the world's main international reserve currency. Since 2010, however, EUR shares have ended to decline. The article also claims that a simple model can, on average, explain currency compositions reasonably well, and deviations from predicted shares suggest that additional factors, e.g., geopolitical ones, might play a role too. The model is, finally, used to predict

currency shares for China, Japan, and Saudi Arabia – the largest non-disclosing reserve holding countries – uncovering USD dominance in these countries' reserve holdings.

To better understand the dynamics of international reserves following shocks, Jinjarak et al. (this issue) focus on the case of earthquakes in a cross-country sample. Insofar as the disasters are empirically exogenous, the quasi-experiment performed by the study allows to examine the responses of international reserves to external shocks directly. The authors argue that this setup is better suited to track reserves than alternative setups using financial shocks (e.g., currency and banking crises). They find evidence suggestive of both precautionary and mercantilist motives for accumulating reserves in countries affected by disasters over the past four decades. Whereas the article provides new evidence on the patterns of reserves accumulation in the aftermath of disaster shocks, future research could delve into the interactions between the external positions (external net debt more broadly), financial risk transfer mechanisms (such as insurance), and domestic resource mobilization (fiscal and monetary). These interactions have potentially important implications for optimal disaster risk management policies that governments should adopt. Holding reserves is, indeed, a financial buffer – in line with the cited seminal literature insights – that can help mitigate the impact of disasters. But the authors conclude that it is only one of several tools to be used for such a purpose, and the other need more exploration as avenues of future research.

Finally, Torriani et al. (this issue) look on a more pragmatic, policymaking level at central bank hedging against shocks, by exploiting strategic asset allocation of the international reserves portfolio. As is well understood since the earliest literature reviewed here above, a key function of central bank reserves is to serve as a liquidity buffer to mitigate a country's exposure and vulnerability to external shocks. The authors point out that EMEs are the countries most exposed to the volatility of capital flows and have usually preferred to build up large "war-chests" of international reserves as a self-insurance mechanism, as it is under their full discretion. Nevertheless, the standard practice of immobilizing large amounts of "cash" to insure against jumps in volatility and risk-aversion could be improved upon, the authors maintain. They claim that the inclusion in the strategic asset allocation decision of external shock hedging strategies, which may increase the market value of the reserves portfolio when reserves are most needed, can help to enhance the risk management of the national balance sheet. Their article suggests a framework that seeks to boost the strategic asset allocation of a central bank, by including in the portfolio construction the analysis of correlations between the reserves' portfolio and the country's main vulnerabilities to external shocks. Torriani et al. propose a central bank portfolio where the objective is not limited to only the return, volatility, and diversification across financial assets, but also considers how each asset contributes to increase the market value of international reserves when reserves are most needed (e.g., under stress scenarios). An index emulating external shocks is constructed with the aim to synthetize the positive and negative shocks hitting EMEs. This index is included in the portfolio construction process to expand the risk dimension to one where the volatility of international reserves is driven not only by the volatility of financial assets but also by the volatility originating in external shocks. This new dimension of risk allows to introduce in the portfolio construction of central bank reserves the hedge properties provided by some financial assets under stress scenarios, which is generally overlooked in the traditional mean-variance analysis. Consequently, this approach pragmatically highlights what dimensions of risk are worth taking and which asset classes are worth diversifying into. The analysis is, then, extended into currencies, credit, and duration.

We hope that this special issue will update the knowledge in the field, and will be useful for academics, policymakers and PhD students around the globe – as a current overview of the topic and a source of references to the recent literature, as well as inspiration for further scientific enquiry.

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