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A MACRO-FINANCIAL MODEL OF THE EUROZONE ARCHITECTURE EMBEDDED IN THE GLOBAL OFFSHORE US-DOLLAR SYSTEM

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Abbreviations

ABCP	asset-backed commercial paper	FRF	French Franc
ABSs	asset-backed securities	F-RRP	Foreign Reverse Repo
AFD	Agence Française du Développement	FSB	Financial Stability Board
BdF	Banque de France	FX	foreign exchange
Bdl	Banca d'Italia	GBP	British pound
BIS	Bank for International Settlement	GSEs	Government-Sponsored Enterprises
BMF	Bundesministerium für Finanzen	IADB	Inter-American Development Bank
BMWi	Bundesministerium für Wirtschaft und Energie	IBRD	International Bank for Reconstruction and Development / World Bank
BoP	Balance of Payments	IMF	International Monetary Fund
Buba	Deutsche Bundesbank	IOU	Credit instrument (as in <i>I owe you</i>)
CD	credit default	IPE	International Political Economy
CDP	Cassa Depositi e Prestiti	IR	interest rate
CEPS	Center for European Policy Studies	IT	Italian
DE	deutsch/German	ITL	Italian Lira
DFG	Deutsche Forschungsgemeinschaft	KfW	Kreditanstalt für Wiederaufbau
DM	Deutsche Mark	MBS	mortgage-backed security
DSGE	Dynamic Stochastic General Equilibrium	MFA	Macro-Financial Assistance
EBdB	Einlagensicherungsfonds des Bundesverbandes deutscher Banken	MMF	money market fund
EBRD	European Bank for Reconstruction and Development	MMT	Modern Monetary Theory
ECB	European Central Bank	NBFIs	non-bank financial institutions
ECOFIN	Economic and Financial Affairs Council	NCB	national central bank
ECU	European Currency Unit	OBFAs	off-balance-sheet fiscal agencies
EdB	Entschädigungseinrichtung deutscher Banken GmbH	OCA	Optimum Currency Area
EIB	European Investment Bank	OLA	Orderly Liquidation Authority
EIF	European Investment Fund	OLF	Orderly Liquidation Fund
EMF	European Monetary Fund	PEPP	Pandemic Emergency Purchase Programme
EMU-19	European Monetary Union (incl. 19 EU member states)	QE	Quantitative Easing
ESCB	European System of Central Banks	RRP	Reverse Repos
ESF	Exchange Stabilization Fund	SDR	Special Drawing Right
ERM	Exchange Rate Mechanism	SGP	Stability and Growth Pact
ESRB	European Systemic Risk Board	SRF	Single Resolution Fund
ESM	European Stability Mechanism	SPV	Special Purpose Vehicle
Euratom	European Atomic Energy Community	STS	Simple, transparent, and standardized
EU-27	European Union (incl. all 27 member states)	TARGET	Trans-European Automated Real-time Gross Settlement Express Transfer System
FDIC	Federal Deposit Insurance Corporation	TARP	Troubled Asset Relief Program
FGD	Fondo di garanzia dei depositanti	TFEU	Treaty on the Functioning of the European Union
FGDR	Fonds de Garantie des Dépôts et de Résolution	US	United States
FoF	Flow of Funds	USD	US-Dollar
FR	French	\$	US-Dollar
		€	Euro
		¤	other units of account

Executive Summary

Monetary union has been a centerpiece of the European integration project. The design of the Eurozone 1.0 (1999-2009) subordinated national central banks to the supranational ECB but it neither introduced a supranational fiscal institution nor did it harmonize Eurozone banking systems. The historically unprecedented monetary reform was met with widespread skepticism from the start. The Eurocrisis (2009-12) seemed to prove critics right. Despite profound changes in the Eurozone 2.0 (since 2012), it is a commonplace to describe the Eurozone architecture as ill-constructed and unfinished.

Monetary architecture, however, is not a well-defined term, and there is no consensus what the Eurozone architecture is beyond being a metaphor. Credit money systems are often analyzed with inapt categories based on simplified fiat or commodity money theories. Criteria for what makes a monetary architecture functional and complete resort to 1950s-style national monetary systems as normative benchmarks that are at odds with the realities of financial globalization and miss out on shadow banking and offshore money as facts of our age.

Against this backdrop, this study comprehensively defines monetary architecture and presents a macro-financial model of the Eurozone architecture.

The study makes four conceptual choices. First, it thinks of the Eurozone architecture as a web of interlocking balance sheets in which every asset is another institution's liability. Some of these liabilities function as money for other balance sheets that hold them as assets. Second, it treats the Eurozone as a peripheral monetary jurisdiction in the US-dominated international monetary system, termed "Offshore US-Dollar System". This is a systemic view on globalized finance which stands in contrast to traditional bottom-up views on the Eurozone as formerly independent national monetary systems. Third, it perceives the Eurozone as having a 'fiscal ecosystem' of national and supranational treasuries and 'off-balance-sheet fiscal agencies'. Fourth, it defines the fiscal ecosystem's role in a monetary architecture as issuing bonds to close treasuries' budget deficits, create public goods, supply safe assets, and provide capital insurance of last resort.

The model portrays two *monetary jurisdictions*—the US and the Eurozone—which have a hierarchical relationship. Each monetary jurisdiction is subdivided into four *segments* of central banks, commercial banks, non-bank financial institutions and a fiscal ecosystem. Different *institutions* are located within these segments, represented as balance sheets. These have a hierarchical relationship with each other as well, and interlock through the *instruments* they hold as assets and liabilities. This adds up to a fully self-referential credit system. Each institution has its own respective *elasticity space* for balance sheet expansion that depends on available counterparties, stipulations for allowed on-balance-sheet activities and available contingent assets and liabilities which are provided by higher-ranking institutions and only become real once a crisis hits. A *monetary architecture* is thus a historically specific hierarchical setup of segments, institutions, instruments and elasticity space within a monetary jurisdiction.

The study advances three main arguments. First, it stresses the centrality of the TARGET2 system for the Eurozone architecture to overcome challenges of European monetary integration. Second, it shows that despite the national fragmentation of Eurozone banking systems, the integration in the global Offshore US-Dollar System offers alternative cross-border lending channels such as the Eurodollar market or the shadow banking system. These should be understood as part of the Eurozone architecture. Third, it suggests that notions of a 'finished' monetary architecture are misleading as institutions, instruments and elasticity space are in constant flux.

The model serves as starting point for follow-up research. For instance, it can be used for descriptive and theoretical analyses of institutional change, the creation and maintenance of hierarchy, or crisis dynamics and systemic risk. In terms of prescriptive work, it offers a framework for developing and comparing policy proposals or building scenarios for the systemic implications of policy interventions or endogenous transformations. This is particularly relevant as the year 2020, given the Covid-19 crisis and the political responses to it, likely marks the transition to a Eurozone 3.0.

Acknowledgments

This study is part of the research project “Hierarchical and Hybrid Money on a Fractured Continent: Europe’s Monetary Architecture after the Eurocrisis” (2019-21), funded by Deutsche Forschungsgemeinschaft (DFG). It is the first in a series of successive studies that adopt an institutionalist view on the Eurozone and use the conceptual framework of interlocking balance sheets on the global Offshore US-Dollar System. The analytical interest of the project is to understand the Eurozone architecture as a genuine credit money system. This study develops a methodology that provides the necessary “grammar” to carry out future research which will address at the creation of international hierarchy and transformation dynamics.

I have presented versions of this study at different stages of development at the workshop “Critical Macro Finance” organized by the Warwick Critical Finance Group at Goldsmith University London (September 2019), the 31st annual conference of the European Association for Evolutionary Political Economy (EAEPE) in Warsaw (September 2019), the workshop “Critical Macro-Finance and the European Monetary Union”, jointly organized by the Global Development Policy (GDP) Center and the Center for the Study of Europe at Boston University (March 2020), and at the online workshop “Crisis Capitalism. Shadow Banking, Central Banks, and New Configurations of State-Financial Market Entanglements” (July 2020). I am grateful to all participants for their valuable feedback.

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All errors remain mine, and mine only.

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Introduction

The statement that the architecture of the Eurozone (or European Monetary Union, EMU) is ill-constructed and unfinished has become almost a convention. Many scholars and practitioners argued so before the start of EMU in 1999, typically with reference to Optimum Currency Area (OCA) theory (Mundell 1961). Even more scholars have come to share this assessment after the Eurocrisis, which began in 2009, continued until 2012, and has been overshadowing the European political economy ever since (e.g. Matthijs and Blyth 2015; Copelovitch, Frieden, and Walter 2016; Wyplosz 2016; Bénassy-Quéré et al. 2018; Bibow 2018). This criticism remains prevalent even despite the transformation of the “Eurozone 1.0” into the post-Eurocrisis “Eurozone 2.0” (Sapir and Schoenmaker 2017). This Eurozone 2.0 is a substantially reformed monetary regime that turned out much different than originally planned (Rostagno et al. 2019) and is even more difficult to grasp conceptually than the Eurozone 1.0.

There is no consensus, however, what exactly the “Eurozone architecture” is, beyond being a mere metaphor. With regard to the Eurozone’s actual institutions, monetary architecture is often referred to in the context of having a supranational central bank without a supranational fiscal institution. This design has followed up on the traditional debate over the best way of achieving monetary union (Van Riet 2017), with its two conflicting positions of coronation theory (first political and fiscal, then monetary union) and locomotive theory (first monetary, then political and fiscal union). Others consider either the price stability mandate of the European Central Bank (ECB) (McNamara 1998), the Stability and Growth Pact (Trichet 2019), or the power structure in the ECOFIN council (Varoufakis 2017) as defining features of the Eurozone architecture.

Yet the issue goes deeper. ‘Monetary architecture’ is not a concept that has been properly defined in monetary theory—a problem closely connected to

the age-old difficulty to comprehensively define ‘money’ in a credit money system in the first place. Solving this problem implies overcoming biases towards overly simplifying fiat money or commodity money theories (Murau 2017b). In fact, there is a wide-spread tendency of using misleading models of the monetary dynamics within the Eurozone, for example by applying a gold standard logic as in the price-specie flow mechanism (see e.g. Baldwin and Wyplosz 2020, 326). Such approaches fail to grasp that the Eurozone is a genuine credit money system.

In light of these empirical and conceptual intricacies, this study asks how the Eurozone architecture can be comprehensively conceptualized as a genuine credit money system.

Monetary architecture is not a well-defined concept. Often credit money systems are analyzed with inapt categories. This is also true for the Eurozone architecture.

To develop an answer to this question, this study makes four conceptual choices, which advance the literature on the Eurozone in International Political Economy (IPE) and neighbouring disciplines.

First, the study combines insights from the emerging strand of (critical) macro-finance (Borio and Disyatat 2011; Dutta et al. 2020; Gabor and Vestergaard 2016; 2018; Gabor 2020; Tooze 2018), taking into account key features of the monetary system known from the Money View framework such as endogenous money creation, hierarchy and public-private hybridity (Mehrling 2011; Pozsar 2014; Murau 2017b), in order to develop a macro-financial model of the Eurozone architecture.

(Critical) macro-finance perceives the monetary and financial system as a web of interlocking balance sheets.¹ In IPE, however, institutionalist analysis via

¹ Gabor (2020) provides a compelling definition of critical macro-finance. Accordingly, ‘macro-finance’ refers to the conceptualization of institutional reality as a web of interlocking balance sheets, just as does the Money View (Mehrling 2011). ‘Critical’ applies to various questions of IPE that can be asked within this framework.

interlocking balance sheets remains a rather abstract idea that has not yet been translated into a concrete institutionalist methodology (Bezemer 2016). To advance this idea, the study crafts a conceptual framework that allows to inductively construct a model of the Eurozone architecture as a web of balance sheets that interlock with each other through credit instruments which some institutions hold as assets and others as liabilities. By depicting how each asset is issued as another institution's liability, the model shows a genuine credit money system.

To become a well-defined concept, the Eurozone architecture should be seen as a web of interlocking balance sheets that issue different credit instruments.

Second, the study follows the idea of Avdjiev, McCauley and Shin (2015) of the Bank for International Settlements (BIS) to think of today's monetary system beyond nation state categories which assume a "triple coincidence" of decision-making area, economic area, and monetary area. Hence, the model applies a global systemic approach to the international monetary system, which it labels as global "Offshore US-Dollar System" (Murau, Rini, and Haas 2020).

This framework does not look at states or territories but "monetary jurisdictions" (Awrey 2017). The US monetary jurisdiction is located at the "apex" of the system, organized around the creation of US-Dollar (USD) denominated credit money. The Eurozone is a monetary jurisdiction situated on the "first-layer periphery" of the system but its institutions are closely interconnected with the apex via the instruments held on-balance-sheet (Murau, Rini, and Haas 2020). Hence, we cannot think of the Eurozone architecture as being independent of the general shape of the international monetary system.

The framework attributes a key role to offshore USD creation, a process that happens when financial institutions located outside of the US create loans and deposits denominated in USD as unit of account. As offshore USD creation is the defining feature of the contemporary international monetary system (Aldasoro and Ehlers 2018), it systematically plays a role in the Eurozone architecture. By contrast, offshore EUR creation in the US is only an abstract possibility that hardly exists in practice (Borio et al. 2016). The Eurozone is thus part of the US-Dollar's "monetary area" but not vice versa (see conceptualization in Murau, Rini, and Haas 2020). Such structure induces an international hierarchy.

The Eurozone does not exist in isolation. It is a monetary jurisdiction in the global Offshore US-Dollar System. Offshore US-Dollars are part of the Eurozone architecture.

Perceiving the international monetary system as a hierarchical global credit money system follows a 'key currency' approach (Williams 1934; Kindleberger 1970; Ito and McCauley 2018). It stands in sharp contrast to the OCA approach that has been dominating most research on the Eurozone architecture and is based on what today is an inaccurate premise of triple coincidence.

Third, the study pays particular attention to the idiosyncrasies of the European Union's political structure and practices, especially the dualism of national and supranational multi-level governance. The EU is a 'compromise-making machine' with seemingly clear rules but also exceptions and grey areas. There is the layer of Primary Law, the European Treaties, which have to serve as a reference and legitimation point, and Secondary Law, Regulations and Directives of the European Commission, the European Parliament and the Council.

While this framework of "ruling by numbers" (Schmidt 2020) often seems rigid and technocratic, the Eurozone is a real-world credit money system that has developed some endogenous institutional solutions beyond what an overly legalistic or economicist discourse may suggest. This applies in particular to the EU's national and supranational 'off-balance-sheet fiscal agencies', which are conceptually important (Quinn 2017) but typically neglected when discussing questions of monetary architecture.

Just as shadow banking entities, off-balance-sheet fiscal agencies have emerged outside the established framework of fiscal institutions and are able to carry out some activities that national treasuries cannot as they are subject to political imperatives, rigid treaty rules and tight fiscal coordination. For instance, such entities are state development banks (Mertens and Thiemann 2018, 2019) or rescue funds such as the European Stability Mechanism and its predecessors.

Together with national and supranational treasury balance sheets, off-balance-sheet fiscal agencies form a 'fiscal ecosystem'. In particular, the recurring debates over joint debt issuance by the Eurozone member states often insufficiently take note of the extent to which various forms of 'Eurobonds' *de facto* exist in the Eurozone's fiscal ecosystem.

Fourth, the study theorizes on the relationship of monetary and fiscal balance sheets.

The economic doctrine that has informed the Eurozone 1.0 aimed at keeping fiscal institutions and central banks as detached as possible from each other (Goodhart 1998). Central banks were thought to be in charge of providing price stability, fiscal authorities were supposed to keep the budget balanced over the business cycle (Arestis and Sawyer 2007). This legitimized an institutional blueprint in which the Eurozone's central banking segment is Europeanized while the fiscal segment is not (McNamara 1998). This "neoliberal consensus" position has been frequently criticized from different heterodox perspectives such as Post Keynesianism (Arestis and Sawyer 2007; Bibow 2014) and Modern Monetary Theory (MMT) (Wray 2015; Ehnts 2015).

While this long-standing debate is continuously reproduced, the institutional reality of the Eurozone 2.0 has advanced further and in practice has created a high degree of monetary and fiscal interconnectedness—especially via the frequently reformed ECB collateral framework (van 't Klooster 2020). This relationship is an important feature of the Eurozone monetary architecture that has not yet received sufficient academic scrutiny.

To conceptualize the fiscal segment's integration in the monetary architecture, the study proposes a 'four functions approach'. Accordingly, fiscal balance sheets have the role of issuing public debt instruments in order to fulfill different functions: closing treasuries' budget deficits, creating public goods, supplying safe assets, and providing capital insurance of last resort. These functions are jointly carried out by treasuries and off-balance-sheet fiscal agencies in the Eurozone fiscal ecosystem.

The 'fiscal ecosystem' issues public bonds that are needed to close budget deficits, create public goods, supply safe assets and provide capital insurance of last resort.

Following from these four considerations, the study presents the macro-financial model of the Eurozone architecture in [Figure 1](#). The model depicts the Eurozone and the US as two different monetary jurisdictions in the global Offshore US-Dollar System. The monetary architectures in both jurisdictions are portrayed as webs of interlocking balance sheets, organized around three conceptual elements (institutions, instruments and elasticity space), which are located in four different segments (central banks, commercial banks, non-bank financial

institutions and the fiscal ecosystem). These terms represent the 'grammar' of the macro-financial model. For the Eurozone, the model adds the crucial antagonism of a national and a supranational public layer. For simplicity, it looks only at Germany, France and Italy—representing surplus, balanced and deficit countries—but could readily be expanded to all of the nineteen Eurozone member state (EMU-19).

The model is a mapping exercise that synthesizes conceptual and empirical information derived from various political-economic literatures in one coherent framework. It portrays the global credit money system as a "self-referential network of expanding but unstable debt claims" (Mura 2017), in which every asset is another institution's liability, and vice versa. Along the way, the study fleshes out a comprehensive definition of monetary architecture in general and of the Eurozone architecture in particular.

By framing the Eurozone as genuine credit money system, the study advances three main arguments. First, it stresses the centrality of the TARGET2 system for the Eurozone architecture to overcome long-standing challenges of European monetary integration. This becomes obvious only if we adopt a disaggregated view on the Eurosystem. Second, despite the national fragmentation of the Eurozone banking systems, the integration in the global US-Dollar System offers alternative cross-border lending channels such as the Eurodollar market or the shadow banking system. These should be understood as part of the Eurozone architecture as well. Third, the study challenges the notion that the Eurozone architecture is 'unfinished' by rejecting the normative idea of a 'finished' monetary architecture that relies on an idealized nation-state monetary system, which not only is at odds with the realities of financial globalization but also abstracts from the real-world institutional variations in the fiscal ecosystem.

The model serves as starting point for follow-up research. It can be used for descriptive and theoretical analyses of institutional change, the creation and maintenance of hierarchy, or crisis dynamics and systemic risk in a monetary architecture. In terms of prescriptive work, it offers a framework for developing and comparing policy proposals or building scenarios for the systemic implications of policy interventions or endogenous transformations.

The remainder of the study systematically explains the model of the Eurozone architecture depicted in [Figure 1](#). To this end, section 2 develops the conceptual framework. Sections 3-6 showcase the institutional details of the Eurozone architecture with regard to the four segments of central banks, commercial banks, non-bank financial institutions, as well as the fiscal ecosystem. Section 7 concludes.

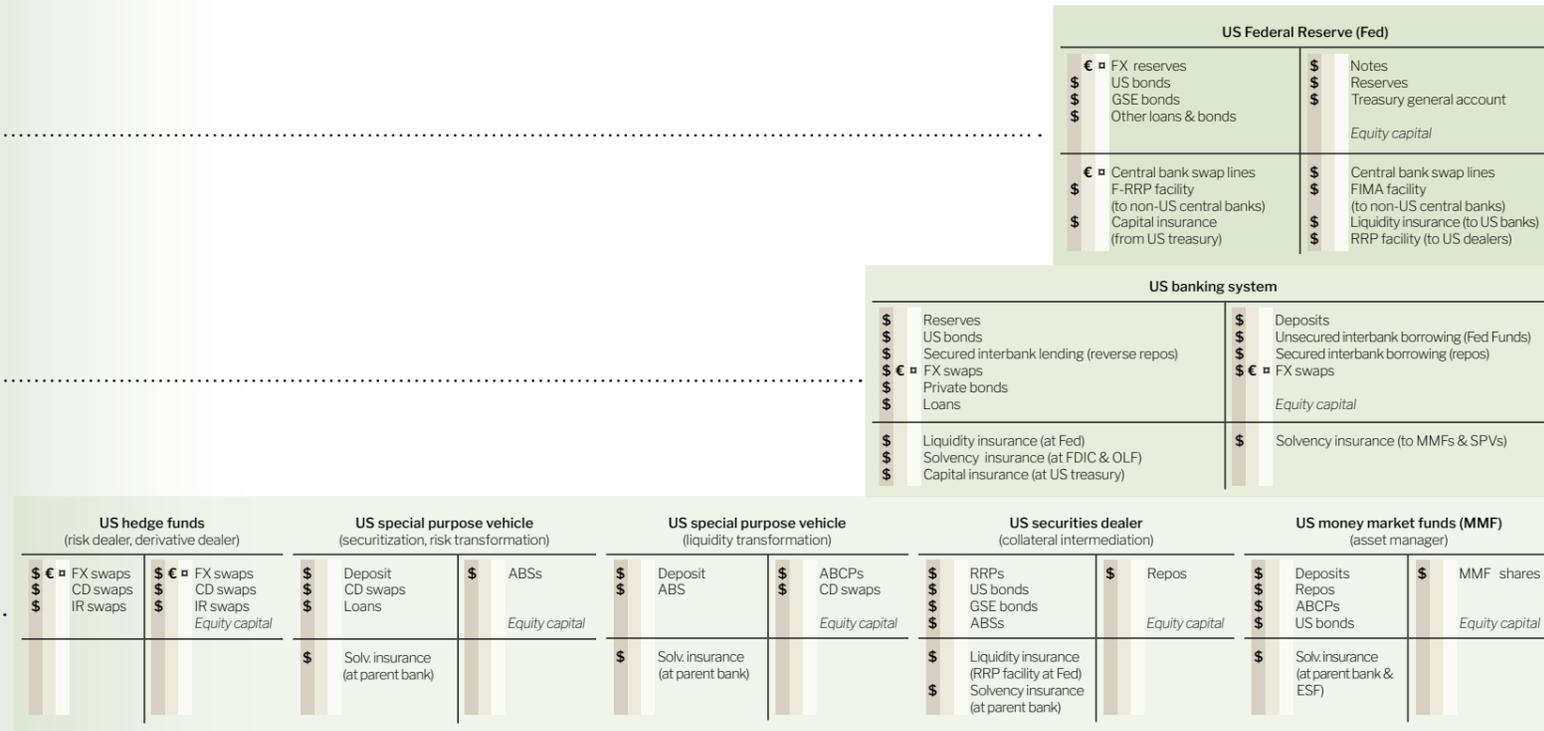
Figure 1 – The Eurozone architecture embedded in the global Offshore US-Dollar System

US MONETARY JURISDICTION

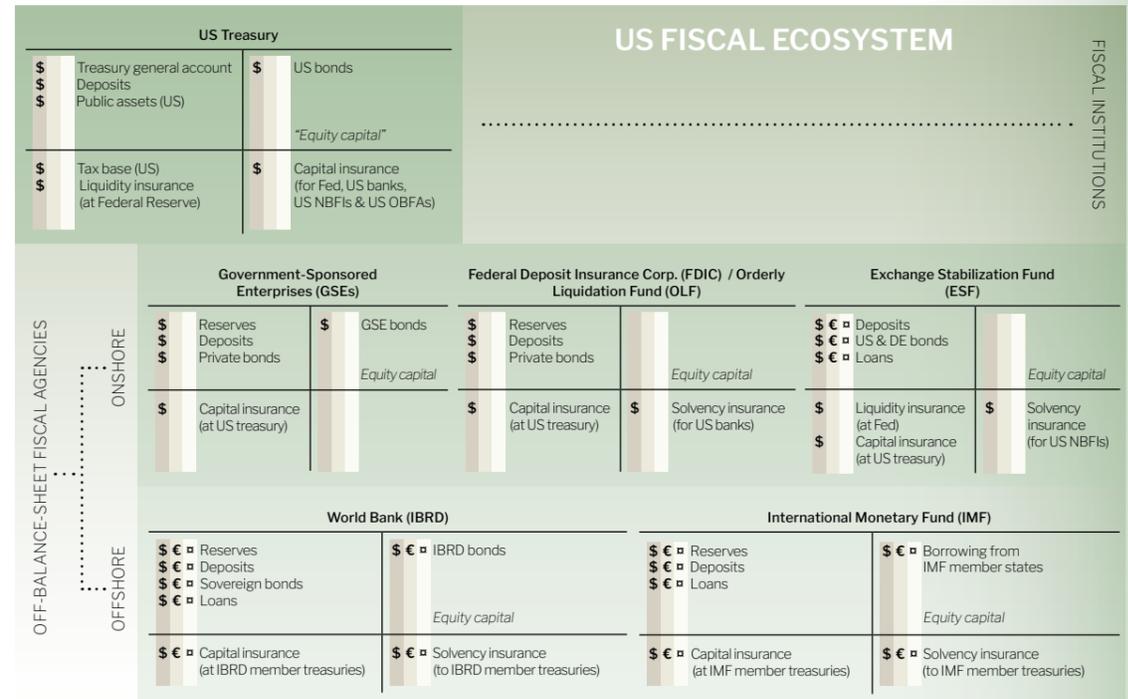
CENTRAL BANKS

COMMERCIAL BANKS

NON-BANK FINANCIAL INSTITUTIONS



FISCAL INSTITUTIONS

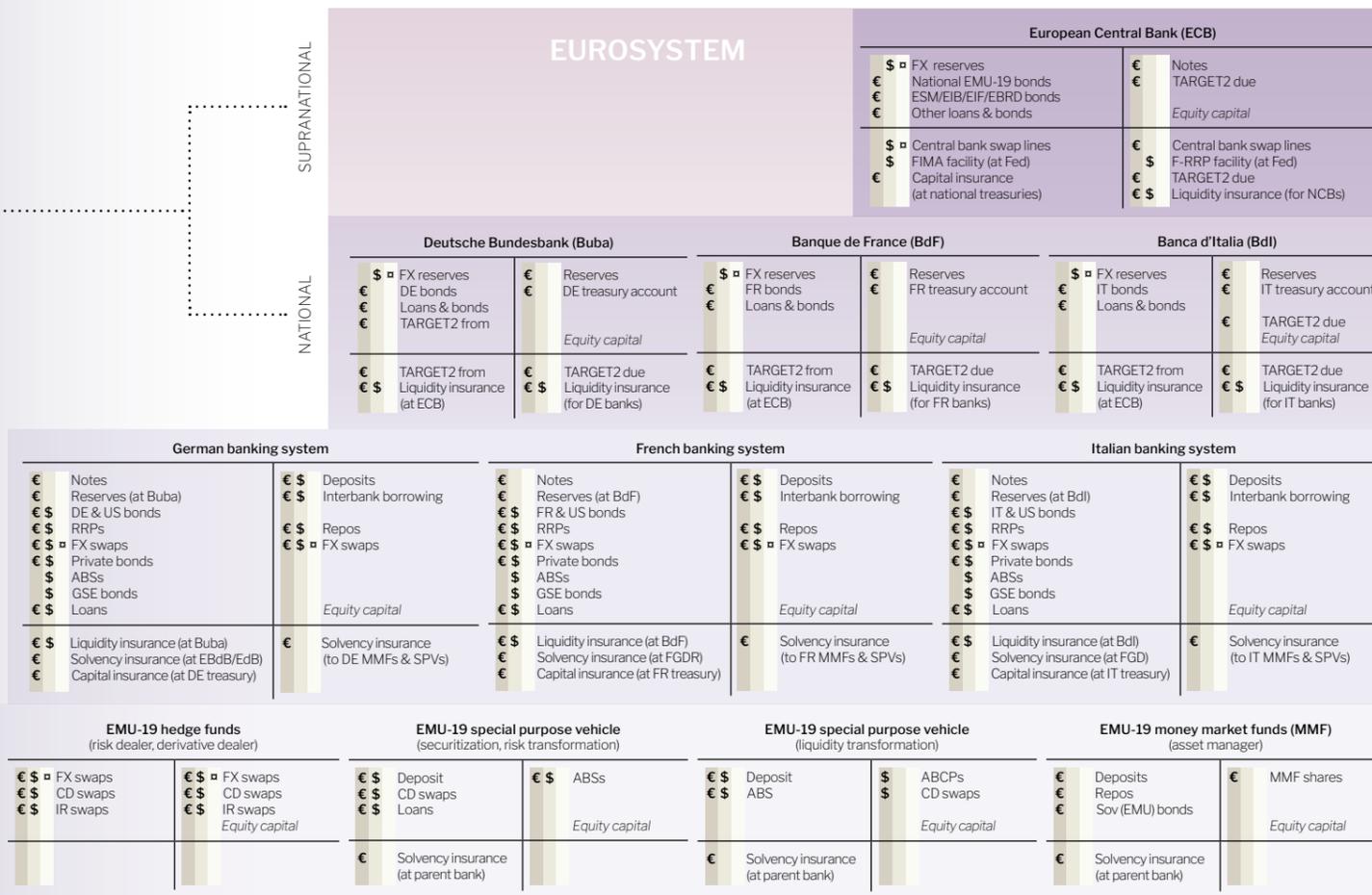


EUROZONE MONETARY JURISDICTION

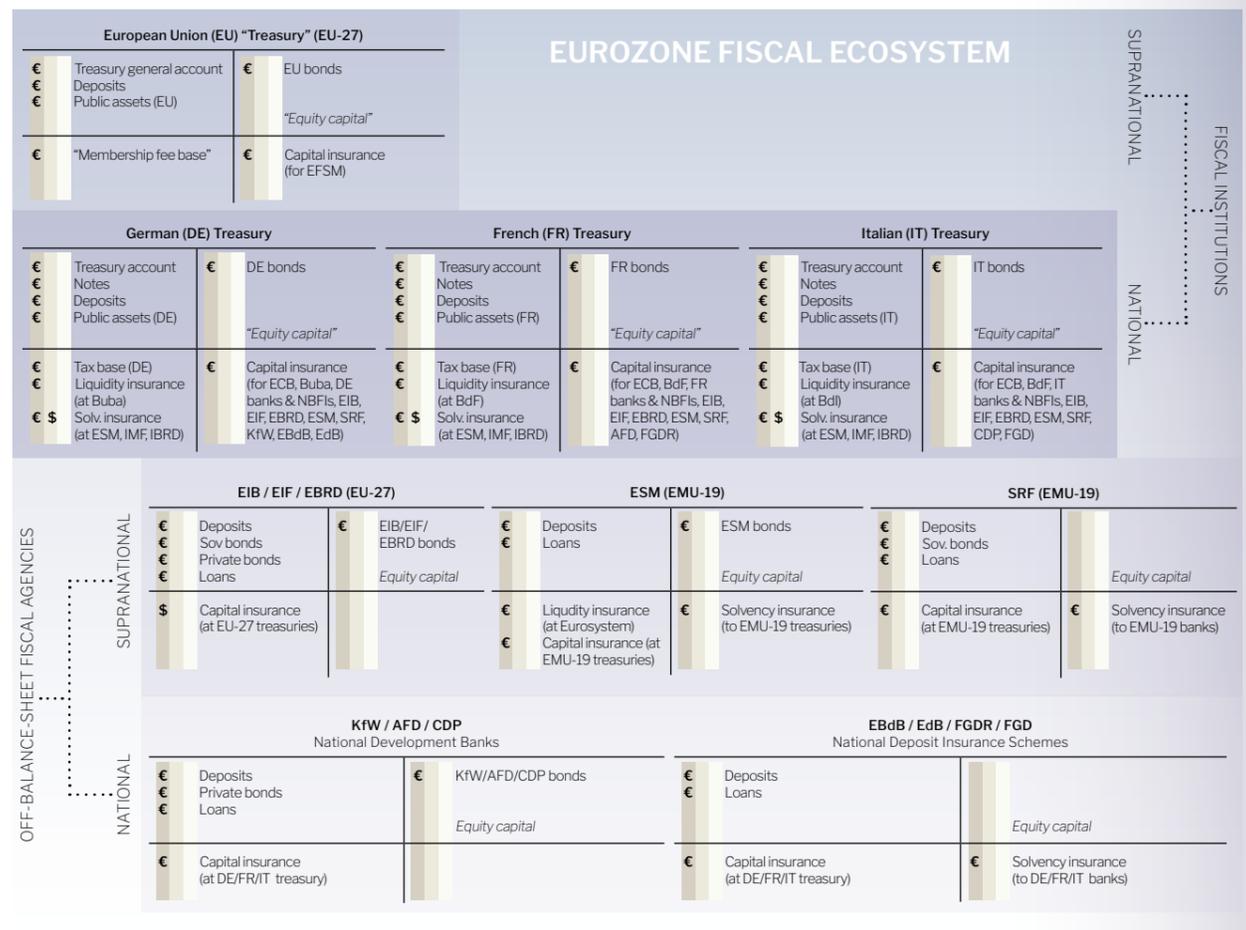
CENTRAL BANKS

COMMERCIAL BANKS

NON-BANK FINANCIAL INSTITUTIONS



FISCAL INSTITUTIONS



Institutions: AFD: Agence Française du Développement; BdF: Banque de France; Bdl: Banca d'Italia; Buba: Deutsche Bundesbank; CDP: Cassa Depositi e Prestiti; DE: deutsch/German; EBdB: Einlagensicherungsfonds des Bundesverbandes deutscher Banken; EBRD: European Bank for Reconstruction and Development; ECB: European Central Bank; EdB: Entschädigungseinrichtung deutscher Banken GmbH; EIB: European Investment Bank; EIF: European Investment Fund; EMU-19: European Monetary Union (19 EU member states); ESF: Exchange Stabilization Fund; ESM: European Stability Mechanism; EU-27: European Union (incl. all 27 member states); FDIC: Federal Deposit Insurance Corporation; FGD: Fondo di Garanzia dei Depositi; FGDR: Fonds de Garantie des Dépôts et de Résolution; FR: French; GSEs: Government-Sponsored Enterprises; IMF: International Monetary Fund; IBRD: International Bank for Reconstruction and Development / World Bank; IT: Italian; KfW: Kreditanstalt für Wiederaufbau; MMF: money market fund; NBFIs: non-bank financial institutions; NCB: national central bank; OBFAs: off-balance-sheet fiscal agencies; OLF: Orderly Liquidation Fund; SRF: Single Resolution Fund; SPV: Special Purpose Vehicle; US: United States. **Instruments:** ABCP: asset-backed commercial paper; ABSs: asset-backed securities; CD: credit default; F-RRP: Foreign Reverse Repo; FX: foreign exchange; IR: interest rate; MBS: mortgage-backed security; RRP: Reverse Repos; TARGET2: Trans-European Automated Real-time Gross Settlement Express Transfer System. **Units of account:** \$: US-Dollar; €: Euro; □: other units of account. © 2020 Steffen Murau (CC-BY).

Conceptualizing a Monetary Architecture

OUTLINE

This study conceptualizes the global monetary and financial system as a web of interlocking balance sheets in line with the (critical) macro-finance literature. The model in [Figure 1](#) portrays two *monetary jurisdictions*—the US and the Eurozone—which have a hierarchical relationship. Each monetary jurisdiction is subdivided into four *segments* of central banks, commercial banks, non-bank financial institutions and a fiscal ecosystem. Different *institutions* are located within these segments, represented as balance sheets. These have a hierarchical relationship with each other as well, and interlock through the *instruments* they hold as assets and liabilities. This adds up to a fully self-referential credit system in which each asset is another institution's liability. Each institution has its own respective *elasticity space*, which depends on available counterparties, stipulations for allowed on-balance-sheet activities as well as available contingent assets and liabilities. In this model, therefore, a *monetary architecture* is a historically specific hierarchical setup of segments, institutions, instruments and elasticity space within a monetary jurisdiction.

This study is not the first attempt to model the Eurozone architecture. For example, there are New Keynesian Dynamic Stochastic General Equilibrium (DSGE) models of the Eurozone (Smets and Wouters 2002), Stock Flow Consistent (SFC) models in the Post Keynesian strand of thought (Miess et al. 2019) or a flow of funds (FoF) perspective on the Eurozone (Bê Duc and Le Breton 2009; Winkler, Van Riet, and Bull 2014). These models typically provide a simplified representation of real-world institutional configurations and then feed them with statistical data to analyze and predict variables such as prices, quantities, or interest rates. The macro-financial model, by contrast, does not take as its primary purpose to be calibrated with quantitative data to compute endogenous developments of such data—even though this might be possible in future research. Instead, it follows an institutionalist logic that inductively synthesizes and maps political-economic configurations.

While established models simplify institutional variety and abstract from real-world complications to allow for better computation, the macro-financial model zooms into these historical changes in the institutional setup, which we may call 'financial plumbing'. It shifts the focus away from changing numerical values of data within static institutional structures assumed in a DSGE, SFC, or FoF world, which cannot appropriately address changes in the institutional setting. Such changes can emerge at any point in time, e.g. through political decisions, technocratic puzzling, or inherent dynamics of the constantly transforming credit money system. Taking into account these forces makes the development of this model inherently an exercise of political economy.

To give a systematic introduction into the 'grammar' of the macro-financial model, this section specifies its building blocks in five successive steps.

MONETARY JURISDICTIONS

The macro-financial model explicitly depicts the Eurozone as part of one globally integrated monetary and financial system. Analyses of the Eurozone or the international monetary system traditionally use a bottom-up approach. They start from national closed economies as smallest building blocks and model the international system as the connection between them. The macro-financial model, in contrast, follows a global systemic approach. Instead of thinking about different autonomous national monetary and financial systems, the global system is a coherent whole which can be sub-divided into different monetary jurisdictions (Avdjiev, McCauley, and Shin 2015; Awrey 2017). The Eurozone is just one of such monetary jurisdictions, and so are the United States.

Given that the international monetary system is a credit system and as such is inherently hierarchical (Mehrling 2012a), these monetary jurisdictions do not have an equal structural position in the international system as they would have had if it were a commodity money system where only assets (e.g. gold) function as money. Since the US-Dollar is the international *key currency*, the US monetary jurisdiction is at the apex of the global system, while the Eurozone—as well as

other monetary jurisdictions, which are not depicted in the model—form a periphery to it.

Thinking about the international monetary system as hierarchical has a long tradition in IPE (Strange 1971; Cohen 1998). In economics, the key currency approach has been coined by Williams (1934) and picked up by Kindleberger (1970, Ch. 13-14) who contrasts the existing “hierarchical system” with an idealized “universal system”. The hierarchical character of the system can be traced at every level depicted in the model.²

SEGMENTS

Within each monetary jurisdiction, the respective monetary architecture is made up of four segments: *central banks, commercial banks, non-bank financial institutions* as well as the *fiscal ecosystem*.

In its most basic form, a monetary system may be defined through central banks and commercial banks. While this is the traditional approach that can still be found in most textbooks (e.g. Mishkin 2009; Ryan-Collins et al. 2011), the model adds two additional features to define a monetary architecture.

First, to combine the literature on the Eurozone architecture with the burgeoning research on shadow banking or market-based finance (Helgadóttir 2016), the model brings non-bank financial institutions into the picture. These represent an important field of institutional evolution and are connected to the creation of ‘shadow money’ (Pozsar 2014; Gabor and Vestergaard 2016; Ricks 2016; Murau and Pforr 2020a, 2020b).

Second, the model adds the fiscal ecosystem as fourth segment to allow theorizing on the monetary-fiscal relationship in a monetary architecture. In this regard, the framework expands the Money View literature (Mehrling 2011) that usually leaves fiscal institutions out of the picture and establishes a connection with the traditional European Eurozone discourse that focuses on both monetary and fiscal entities. As a consequence, the model is able to paint a more accurate picture of institutional reality than approaches that by definition consolidate the monetary and fiscal segments as is a common practice in IPE (see e.g. Braun and Hübner 2018) or MMT (see e.g. Wray 2015; Kelton 2020).

INSTITUTIONS

Within each segment, institutions are represented as balance sheets that all participate in the modern credit money system as a global payments system.

The model comprises balance sheets both of individual entities (such as central banks, treasuries, or off-balance-sheet fiscal agencies) and aggregated balance sheets of sectors of a sub-system (such as banking systems or non-bank financial institutions). These institutions are either public (such as states or, more accurately, treasuries), private (such as banks and shadow banks), or a hybrid of both (such as central banks and off-balance-sheet fiscal agencies). Complementary institutions that do not belong to one of the four segments and are not explicitly reflected in **Figure 1** are households and firms.

Due to the nature of payments systems which need central nodes through which payment flows are organized, the various balance sheets within a monetary jurisdiction form a hierarchical structure (Mehrling 2012a). This is true for banking systems, which typically have a central bank at the apex, and commercial banks and non-bank financial institutions that occupy layers below. We can expand this idea of hierarchy also to other balance sheets, integrating treasuries and off-balance-sheet fiscal agencies.

Importantly, the balance sheets presented in the model should not be seen as the *actual* officially reported balance sheets of the institutions but are representations on a higher level of abstraction. Depicting an actual empirical web of interlocking balance sheets is an almost impossible task. Real balance sheets are not only data intense and permanently fluctuating, but also subject to changing accounting conventions and often based on *ad hoc* decisions that do not account for all promises to pay on-balance-sheet.³

Although treating institutions of all four segments as identical balance sheets may seem to be a simplification, it allows us to uncover their structural similarities within the system. For example, the German treasury relies on a cameralistic accounting technique and only registers inflows and outflow. It does not *actually* put together a balance sheet that would require specifically attaching a value to the physical assets they own (e.g. roads, land and

2 For recent scholarship on international monetary hierarchy, see e.g. Alami (2018), Bonizzi, Kaltenbrunner and Powell (2019), Kaltenbrunner (2015), Koddenbrock (2020), Koddenbrock and Sylla (2019), Mehrling (2016), Murau, Rini and Haas (2020), Palludeto and Abouchedid (2016) or Pistor (2013).

3 For example, FX swaps have become an essential instrument to manage offshore US-Dollar creation but are not recorded on-balance-sheet due to current accounting conventions. They represent “missing debt” (Borio, McCauley, and McGuire 2017).

buildings) and marking them to market. Still, in the context of the model, we can ignore these valuation problems and instead look at the functional role of the treasury in the credit system as a whole.

The agency of individual actors within institutions, and how they are limited by structures, is reflected in the model in so far as they are able to influence what is happening on the balance sheets of the institutions under their purview. Some balance sheets may be exclusively operated by an individual (such as a one-person household or firm), others are subject to competition of different interest groups, with varying degrees of institutionalization. This is true for the political struggle over the state's treasury balance sheet between parties or political institutions, just as it may be true for competing fractions and departments in the management of a bank. However, no actor can have full control over its balance sheet since the on-balance-sheet dynamics of a single institution depend on the dynamics of the whole system. Generalizations such as the notion that there could be a 'state' as coherent actor that controls all of its public balance sheet (notably that of the treasury and the central bank) are not possible within this framework.

INSTRUMENTS

Each institution holds different credit instruments as assets or liabilities on-balance-sheet. By definition, assets are promises to get paid at some point in the future. Liabilities are promises to pay at some point in the future (Minsky 1986).

Each asset of an institution has to be another institution's liability. It is through these instruments that the different balance sheets 'interlock'. Due to this feature, the global monetary and financial system can be defined as a *self-referential network of expanding but unstable debt claims* (Murau 2017b). When actors influence the respective balance sheet(s) under their purview by creating or shifting instruments, they trigger repercussions throughout the web of interlocking balance sheets. These have intended and unintended effects on other balance sheets. Outcomes cannot be planned with certainty and can be accidental or even counter-intentional.

In the global credit money system, there cannot be an absolute definition of money. What counts and what doesn't count as money differs for each balance sheet. It depends on a balance sheet's relative position in the hierarchy and can change over time. The system is organized around the transfer of public, private and hybrid credit instruments ('IOUs', as in *I owe you*) that are issued as liabilities of higher-ranking institutions to function as assets for lower-

ranking institutions. By definition, these instruments are promises to pay a higher-ranking instrument. If they have a stable price vis-à-vis the higher-ranking instrument—i.e. if they trade at 'par', a one-to-one exchange rate—they may be referred to as 'money'. The creation of such credit money follows the logic of a 'swap of IOUs' between a hierarchically higher and a hierarchically lower institution. Since the model describes a fully self-referential system in which no 'outside' money such as gold exists (Gurley and Shaw 1960), money creation is fully endogenous to this system (Murau 2017b; Murau and Pforr 2020b).

The approach raises the question of how to conceptualize the instrument that is highest up in the hierarchy. A wide-spread position is that these instruments are 'fiat money', a mere token which is 'outside money', whereas hierarchically lower instruments are 'inside money' or 'credit money', promises to pay the outside money. By contrast, the model assumes that central bank money is 'public inside money' which has also a credit character and which is created in a structurally parallel way as private bank money (Mehrling 2020). The only difference is that the hierarchically highest institution, usually the central bank, is relaxed of the immediate survival constraint (Minsky 1957)—i.e. the danger of becoming illiquid in case it cannot meet its payment commitments—because its money forms are promises to pay nothing else but themselves.

Instruments are denominated in a unit of account such as the USD, the GBP or the EUR. These units of account are, for historical evolutionary reasons, tied to state structures within their respective monetary jurisdiction. But the institutions that create money denominated in these units of account do not have to be state institutions. Private banks and non-bank financial institutions can autonomously create credit money as well.

Moreover, credit money can be issued both 'onshore' and 'offshore'. Onshore money creation implies that the institution issuing money in a specific unit of account (say the US-Dollar) is also located in a state's monetary jurisdiction—e.g. when USD denominated deposits are issued in the US monetary jurisdiction. While this is often seen as the norm, it is by no means a logical or legal necessity. USD-denominated deposits can very well be created outside of the US monetary jurisdiction, e.g. in that of the UK or the Eurozone. In that case, money creation occurs offshore. Recent BIS research indicates that indeed more USD denominated liabilities are created offshore than onshore (Aldasoro and Ehlers 2018; Borio, McCauley, and McGuire 2017). In the model, offshore money creation is a crucial feature of the global system.

ELASTICITY SPACE

Each institution in the model has a specific elasticity space. Any balance sheet can be to some degree extended by creating new credit instruments, which requires the simultaneous expansion of both assets and liabilities while interacting with another balance sheet as counterparty. The concept of elasticity space describes the extent to which such an expansion on an individual balance sheet is possible. In the macro-financial model, a balance sheet's elasticity space is determined by three factors.

The first factor is the willingness and the ability of the other institutions in the system to act as counterparty for balance sheet expansion and maintaining that level of expansion.

Given that all credit instruments taken together form a closed global system, every asset and liability of one balance sheet requires a corresponding liability and asset on another balance sheet. For the *initial expansion* of a balance sheet, e.g. to simultaneously create a loan and a deposit, the elasticity space of an institution depends on the willingness and ability of another *specific* balance sheet to take the counterposition. Once the institution has created such instruments, its elasticity space depends on the willingness and the ability of the *entire system of balance sheets* to—*ceteris paribus*—maintain the given level of expansion and 'fund' the systemic expansion over time by holding the credit instrument and not repaying or defaulting on it (Mehrling 2020).

This factor varies with the financial cycle. The elasticity space is wider in expansionary phases as it is easier for any balance sheet to find a counterparty. In contractionary phases, the elasticity space is lower.

The second factor for a balance sheet's elasticity space is what 'stipulations' exist for the allowed on-balance-sheet activities and how these stipulations are enforced. *Prima facie*, each balance sheet that finds a suitable counterparty can expand without definite limits by creating new debt instruments, unless external restrictions are in place.

'Stipulations' is a broad term deliberately chosen in this study to describe such restrictions because they manifest themselves differently in each of the four segments. *Commercial banks* are subject to banking regulations that are often coordinated internationally to then be implemented and enforced nationally by bank supervisors. These stipulations comprise rules such as reserve ratios and capital buffers. *Non-bank financial institutions*, by contrast, are subject to a much milder form of regulation and supervision than what applies to institutions regulated as banks.

Central banks' on-balance-sheet activities are, if at all, 'regulated' through stipulations connected

to their mandate, their level of institutional independence and the collateral framework which determines the assets they are allowed to purchase. It is, however, very difficult to enforce compliance with the existing mandate or to sanction deviance. Still, the German constitutional court has been repeatedly asked to scrutinize if the ECB's actions stay within the bounds of its mandate and has set some limits via a widely debated ruling in May 2020 (Bundesverfassungsgericht 2020).

In the *fiscal segment*, treasury balance sheets are constrained by the checks and balances of national political systems (e.g. by parliament's budget authority) and stipulations that policymakers have imposed upon themselves (e.g. Germany's debt break codified in the German Basic Law). In the Eurozone, different techniques have been developed which are supposed to restrict the elasticity space on national treasuries' balance sheets. On one hand, the Stability and Growth Pact and the Fiscal Compact define clear *ex ante* criteria for allowed budget deficits and general debt levels; the European Commission has even been endowed with the power to sanction states that disrespect the criteria. On the other hand, the prohibition for central banks to buy sovereign bonds on the primary market attributes a 'disciplining' power to private market forces, which restricts elasticity qua European Treaties. Still, such rules can be circumvented by using off-balance-sheet fiscal agencies—a very widespread practice.

The third factor that determines a balance sheet's elasticity space is the level of access that it has to 'contingent' assets and liabilities.

Contingent assets and liabilities are 'counterfactual' instruments which higher-ranking institutions grant to lower-ranking institutions. They emerge only in a crisis—defined as the endogenous contraction of the credit money system—to compensate for the contraction on a particular balance sheet. This implies that, in a moment of crisis, the contingent assets and liabilities become actual assets and liabilities.

One form of contingent assets and liabilities are liquidity, solvency and capital 'insurance' (they may also be called 'guarantees' or 'backstops') from higher-ranking to lower-ranking balance sheets (Haldane and Alessandri 2009). The model depicts them as contingent liabilities of the insuring institution and contingent assets of the insured institutions. *Liquidity insurance* is defined as the guarantee of the central bank to replenish another institution's holding of central bank money in a moment of scarcity. The straightforward example is the discount window. *Solvency insurance* are mechanisms to guarantee the nominal value of an institution's liabilities in case it defaults. The main example of it is deposit insurance.

It can be organized via funds or parent institutions. *Capital insurance* describes the guarantee to ‘recapitalize’ or ‘bail out’ another balance sheet in case of negative ‘equity capital’. The capital insurer of last resort for a monetary jurisdiction is the treasury.

Another type of contingent assets and liabilities emerges spontaneously, without discretion, by virtue of the higher-ranking balance sheet being the central node of a payment system. If the payment system doesn’t clear (i.e. if surpluses and deficits remain), the higher-ranking balance sheet automatically stands ready to expand. Such contingent assets and liabilities comprise the discount window for central bank reserves or TARGET2 balances for the payments system between national central banks and the ECB.

Moreover, there are contingent assets and liabilities which emerge through swap agreements such as the swap lines between central banks.

The mechanisms to provide all of these contingent assets and liabilities may be explicit or implicit. Explicit backstops, for example, are different types of ‘facilities’ offered at central banks which specify clear ex ante conditions. Implicit backstops exist e.g. for money market funds in the US. During the 2007-9 Financial Crisis, a guarantee scheme had been set up which expired afterwards but was expected to be re-activated any time it should be necessary—which then indeed happened during the Covid-19 crisis.

However, neither explicit nor implicit backstops can provide full certainty that the contingent assets will become actual assets. The higher-ranking balance sheet could simply change the requirements attached to making use of any such scheme. Therefore, the ‘ontological status’ of this category of contingent assets and liabilities is intricate.

The model’s balance sheets are idealized abstractions. They also denote *contingent* instruments that only become *real* in a crisis but are always key to the architecture.

Figure 2 depicts a template balance sheet used in the macro-financial model to visualize institutions, instruments and elasticity space. The top row lists the actual assets and liabilities that the exemplary institution holds on its balance sheet. The residual between both is the institution’s equity capital. The bottom row depicts contingent assets and liabilities which are not normally visible on a balance sheet. Only in moments of crisis do the contingent assets and liabilities become actual assets and liabilities, and the measurable balance sheet expands. Each class of actual and contingent instruments is denominated in one or more units of account. The model depicts US-Dollars (\$), Euros (€), as well as other units of account (¤) in the columns to the left of each instrument.

Figure 2 – Template balance sheet with contingent and actual instruments

Assets	Name of the institution (single or consolidated sectoral balance sheet)	Liabilities
<p>\$ € ¤ Actual assets</p> <p>Held on the balance sheet over time, commitments for future cash inflow, subject to changes in valuation; typically are financial claims but also physical assets can be treated as a bond</p>		<p>\$ € ¤ Actual liabilities</p> <p>Held on the balance sheet over time, commitments for future cash outflow, subject to changes in valuation, are merely financial claims</p> <p>Equity capital</p> <p>Residual category, difference of actual assets and actual liabilities</p>
<p>\$ € ¤ Contingent assets</p> <p>Represent the potentiality of balance sheet expansion and cash inflow once the credit system contracts; then they become actual assets; can be explicit or implicit; as counterfactual instruments it is often not clear if they exist or not</p>		<p>\$ € ¤ Contingent liabilities</p> <p>Represent the potentiality of balance sheet expansion and cash outflow once the credit system contracts; then they become actual liabilities; can be explicit or implicit; it is in the issuer’s power to decide on whether or not to grant the cash outflow</p>

Traditionally, a fair share of ideology is connected to the question of whether a specific institution in a monetary architecture should have a larger or smaller elasticity space. For example, the conflict between central banking 'hawks' and 'doves' is about the appropriate level of elasticity space on central banks' balance sheets. Discourses about bank regulation are arguments on the elasticity space on commercial bank balance sheets. Calls for full-reserve banking are one extreme case where this elasticity space would be fully restricted, whereas proponents of free banking call for a total absence of such restrictions. The 2007-9 Financial Crisis has yielded debates over elasticity space on the balance sheets of non-bank financial institutions, which have also informed today's Basel III regulations (Turner 2015). The debates about the Stability and Growth Pact, the Fiscal Compact and the austerity discourse (Blyth 2013) concern the elasticity space on treasury balance sheets.

Preferences for more or less elasticity space on a particular balance sheet are often driven by idiosyncratic historical experiences of individual institutions within the global credit money system. For instance, it is often suggested that the German Bundesbank's hawkish orientation was due to the experience of hyperinflation during the Weimar Republic, whilst the Fed's tendency to grant ample elasticity in crises is due to the deflationary experience during the Great Depression.

In view of those discourses, the model is agnostic on the right degree of elasticity space on a particular balance sheet. Elasticity is neither good or bad as such. Instead, it is a feature of any balance sheet that is not set in stone and may change over time.

SUMMARY

With these building blocks combined, the model conceptualizes a monetary architecture specific to a monetary jurisdiction as a web of interlocking

hierarchical public, private or hybrid balance sheets. These belong to one of four segments—central banks, commercial banks, non-bank financial institutions or the fiscal ecosystem—and issue different credit instruments, some of which function as credit money for a selection of hierarchically lower institutions. Each balance sheet has a particular elasticity space which depends on the availability of counterparties to issue and fund new assets and liabilities, on stipulations for allowed on-balance-sheet activities, and on the availability of contingent assets and liabilities.

The monetary architecture forms a superstructure to households and firms, which are not themselves part of the monetary architecture but form the complement to it. Figure 3 depicts their stylized balance sheets, without specifying a particular monetary jurisdiction they belong to. They hold various credit instruments provided by the monetary architecture as their assets, some of which function as money. At the same time, they issue loans and corporate bonds as actual liabilities and provide the tax base as contingent liability.

A monetary architecture is a historically specific setup of segments, institutions, instruments and elasticity space in a monetary jurisdiction. These categories are the 'grammar' of the macro-financial model.

Drawing on these conceptual reflections, the following sections analyze the four segments of the contemporary Eurozone architecture, in juxtaposition with the US monetary jurisdiction where appropriate. Section 3 discusses central banking, section 4 commercial banking, section 5 non-bank financial institutions and shadow banking, and section 6 the fiscal ecosystem. Each of those sections looks at institutions, instruments, and elasticity space in successive order.

Figure 3 – Households and firms as complementary balance sheets

Households		Firms	
€ \$ ▣ Notes	€ \$ ▣ Loans	€ \$ ▣ Notes	€ \$ ▣ Corporate bonds
€ \$ ▣ Deposits		€ \$ ▣ Deposits	
€ \$ ▣ MMF shares		€ \$ ▣ Bonds	
€ \$ ▣ Sovereign bonds			
€ \$ ▣ Private bonds	Equity capital		Equity capital
€ \$ ▣ Solvency surance (at treasury)	€ \$ ▣ Tax base	€ \$ ▣ Solvency surance (at treasury)	€ \$ ▣ Tax base

Central Banking

OUTLINE

Central banking is the key segment of the Eurozone architecture in the macro-financial model (see Figure 4). This is where European monetary unification in a *narrow* sense took place via the introduction of the TARGET system. This study suggests in contrast to many established positions in the literature that the crucial innovation when the Eurozone 1.0 became effective was not simply the introduction of the EUR as unit of account and the fixation of exchange rates between the former national units of account (Hall 2014; Höpner and Lutter 2014), or the setting up of the ECB as supranational central banking institution and the design of a centralized interest rate (McNamara 1998; Flassbeck and Spiecker 2011). While all these aspects are true and are indeed part of monetary unification in a *broader* sense, the main innovation was that the TARGET system allowed funding imbalances between national central banks (NCBs) by turning the liabilities of a deficit NCB into liabilities of the ECB.

In the early years of the Eurozone 1.0, the TARGET system remained below the radar outside of central banking circles. Only the Eurocrisis sparked considerable debate on what by then had become the TARGET2 system (Sinn and Wollmershäuser 2012; Whelan 2011; Whittaker 2011; Cour-Thimann 2013; Schelkle 2017). Ever since, the TARGET2 system frequently becomes the subject of public interest and scrutiny but remains conceptually ambiguous among policy-makers and scholars alike (Baldwin and Wyplosz 2020; Cecchetti, McCauley, and McGuire 2012; Ehnts 2015; Sahr 2019).

The macro-financial model provides an analytical framework to assess the role of the TARGET system in the Eurozone architecture. Drawing on Garber (1998), Bindseil and König (2011), Cour-Thimann (2013) and Kregel (2019), this study argues that the instruments and elasticity space provided by the TARGET system made it possible to overcome the pre-Eurozone dilemma of having to choose between exchange rate alteration and foreign exchange drainage in case of imbalances between central banks.

Figure 4 – The central banking segment in the Eurozone architecture

EUROSYSTEM		European Central Bank (ECB)			
		\$ □ FX reserves € National EMU-19 bonds € ESM/EIB/EIF/EBRD bonds € Other loans & bonds	€ Notes € TARGET2 due Equity capital		
		\$ □ Central bank swap lines \$ FIMA facility (at Fed) € Capital insurance € (at national treasuries)	€ Central bank swap lines \$ F-RRP facility (at Fed) € TARGET2 due € \$ Liquidity insurance (for NCBs)		
Deutsche Bundesbank (Buba)		Banque de France (BdF)		Banca d'Italia (Bdl)	
\$ □ FX reserves € DE bonds € Loans & bonds € TARGET2 from	€ Reserves € DE treasury account Equity capital	\$ □ FX reserves € FR bonds € Loans & bonds	€ Reserves € FR treasury account Equity capital	\$ □ FX reserves € IT bonds € Loans & bonds	€ Reserves € IT treasury account € TARGET2 due Equity capital
€ TARGET2 from € \$ Liquidity insurance (at ECB)	€ TARGET2 due € \$ Liquidity insurance (for DE banks)	€ TARGET2 from € \$ Liquidity insurance (at ECB)	€ TARGET2 due € \$ Liquidity insurance (for FR banks)	€ TARGET2 from € \$ Liquidity insurance (at ECB)	€ TARGET2 due € \$ Liquidity insurance (for IT banks)

INSTITUTIONS

The macro-financial model portrays central banks as the hierarchically highest banking institution in a monetary jurisdiction. This is true for both the US and the Eurozone. In the contemporary Offshore US-Dollar System, the Federal Reserve is the balance sheet at the apex of the international hierarchy, the ultimate backstop for both the US and the global system. In the Eurozone, the ECB is the hierarchically highest balance sheet (supranational layer), which is located on top of the NCBs (national layer).

The model's central banking segment focuses specifically on the *Eurosystem* which comprises the NCBs of the EU states that have introduced the EUR (EMU-19). It excludes the NCBs of the eight EU states which have not introduced the EUR. These are part of the EU-27's *European System of Central Banks* (ESCB), which the model doesn't depict.

Conceptually, the model deviates from the convention of portraying the Eurosystem as a single *consolidated* balance sheet (European Central Bank 2019). Instead, it sees the ECB and the EMU-19 NCBs as a federation of tightly coupled but separate balance sheets. In this *disaggregated view*, the ECB and the NCBs have a particular division of labor. The ECB is the Eurosystem's headquarter that manages the Eurozone's integration in the Offshore US-Dollar System and decides on monetary policy. The NCBs implement these monetary policy decisions. Hence, the model portrays the Deutsche Bundesbank, Banque de France and Banca d'Italia as the institutions interacting with the national banking systems.⁴

INSTRUMENTS

The model emphasizes that the Eurosystem and the Federal Reserve issue three different types of *actual liabilities* on their balance sheets which they supply as money for various other institutions (see e.g. Bindseil 2004, 46ff). *Notes* (or 'currency') function as money for all other financial and non-financial institutions; for the Eurozone, the model depicts EUR notes as liabilities of the ECB balance sheet. *Reserves* (or 'central bank deposits') are issued to be held by the

banking system; in the Eurozone, they are liabilities of the NCBs. Finally, central banks—in the Eurozone the NCBs—offer *treasury accounts* for their respective national treasuries.

As complements to those liabilities, central banks hold different types of *actual assets*. Among them are instruments denominated in the domestic unit of account such as sovereign bonds issued by national treasuries, private bonds issued by firms or bonds issued by off-balance-sheet fiscal agencies. What assets central banks are allowed to hold is regulated by the collateral framework (Nyborg 2016). Other instruments are denominated in a different unit of account, for example foreign central bank and commercial bank money or foreign sovereign bonds. Formally, these are parts of the foreign exchange (FX) reserves.⁵

Moreover, central banks have three categories of *contingent assets and liabilities* on their balance sheets.

First, within the Eurosystem, the balance sheets of the NCBs are connected with each other via the *TARGET2 system* ('Trans-European Automated Real-time Gross Settlement Express Transfer System'). As long as the national banking systems are willing to fund imbalances between different Eurozone states, TARGET2 balances are *contingent* instruments on the ECB's and the NCBs' balance sheets. Only if banks are no longer willing to fund imbalances between each other do TARGET2 balances emerge as *actual assets* of the surplus central bank (here: Bundesbank) and *actual liabilities* of the deficit central bank (here: Banca d'Italia). Imbalances between NCBs are first recorded as claims of one NCB against another NCB, just as in a simple fixed exchange rate system. At the end of each workday, the *actual TARGET2 liabilities* are shifted upwards in the hierarchy and become a claim against the ECB (Bindseil and König 2011). Then the Bundesbank no longer holds its TARGET2 claim against the Banca d'Italia but rather uses the ECB as its counterparty. From the perspective of this disaggregated view, the actual TARGET2 balances are a monetary asset which is issued by the ECB for its surplus NCBs and is valid merely within the Eurosystem.

4 It would be possible to also portray the Federal Reserve System via a disaggregated view and look at the twelve Federal Reserve district banks in isolation. The key balance sheet would then be the New York Fed, and the Washington Fed would merely be the headquarters without their own balance sheet. However, as it is less relevant for the purpose of conceptualizing the Eurozone architecture, the model abstracts from that level of detail and sticks to a consolidated view on the Federal Reserve System.

5 An additional type of instrument that could feature here are Special Drawing Rights (SDRs). However, as they are not an integral part of the Eurozone architecture and are based on a highly idiosyncratic mechanism, this study abstracts from them. A follow-up study will use the same framework to analyze offshore USD liquidity provision in the wider Offshore USD System and conceptually integrate SDRs in the model.

Figure 5 shows why the TARGET system means monetary unification in a narrow sense. At the time of the European Exchange Rate Mechanism (1979-99), there had already been a common unit of account in use in between NCBs—the European Currency Unit (ECU), which was defined as a currency basket of the European Community member states. In 1999, the EUR replaced the ECU at par value. As the ECU and the EUR are essentially the same ‘denomination item’, the common European unit of account was not an innovation in itself. It was rather the introduction of *actual and contingent instruments* denominated in that unit of account which can be used for payment transactions in between NCBs that has reformed the system. In the ERM, the NCBs used their balance sheets to issue credit money denominated in their national units of account. With their exchange rates pegged within a band, they had to intervene in the FX market to maintain the politically agreed exchange rates. Structural current account imbalances led to a continuous drainage of FX reserves of the deficit

central bank and often necessitated exchange rate adjustments. This not only offered an open flank to speculative attacks but was also an obstacle to completing the common market project (Jabko 2006). The ECB became the balance sheet in charge of funding the payments imbalances, with TARGET balances as *contingent* assets and liabilities that would become *actual* instruments if necessary (cf. European Monetary Institute 1995). The same logic has remained since the ECB upgraded the system to TARGET2 in 2007 (European Central Bank 2007).

Second, central banks provide *liquidity insurance* to lower-ranking balance sheets. This is true for banking systems via what has been traditionally called the discount window. The Fed provides it to the US banking system, the NCBs to the different European banking systems. Since its emergency interventions in the 2007-9 Financial Crisis, the Fed also has *de facto* extended this liquidity insurance to some non-bank financial institutions (Murau 2017a). After the crisis, most of these liquidity insurances

Figure 5 – Central bank money before and after the Euro introduction

European Monetary System (1979-1999)

EUROPEAN EXCHANGE RATE MECHANISM														
Deutsche Bundesbank (Buba)				Banque de France (BdF)				Banca d'Italia (BdI)						
ECU (unit of account)														
DM	\$ □	FX reserves	DM	Notes	FRF	\$ □	FX reserves	FRF	Notes	ITL	\$ □	FX reserves	ITL	Notes
DM		DE bonds	DM	Reserves	FRF		FR bonds	FRF	Reserves	ITL		IT bonds	ITL	Reserves
DM		Private bonds	DM	DE treasury account	FRF		Private bonds	FRF	FR treasury account	ITL		Private bonds	ITL	IT treasury account
DM		Capital insurance (at DE treasury)	DM	Liquidity insurance (for DE banks)	FRF		Capital insurance (at FR treasury)	FRF	Liquidity insurance (for FR banks)	ITL		Capital insurance (at IT treasury)	ITL	Liquidity insurance (for IT banks)

European Monetary Union (since 1999)

EUROSYSTEM						European Central Bank (ECB)											
						\$ □	FX reserves	€	Notes								
						€	National EMU-19 bonds	€	TARGET2 due								
						€	ESM/EIB/EIF/EBRD bonds	€	Equity capital								
						€	Other loans & bonds										
						\$ □	Swap line (with Fed)	€	Swap line (with Fed)								
						\$	FIMA facility (at Fed)	€	F-RRP facility (at Fed)								
						€	Capital insurance (at national treasuries)	€	TARGET2 due								
						€	Liquidity insurance (for national treasuries)	€	Liquidity insurance (for NCBs)								
Deutsche Bundesbank (Buba)		Banque de France (BdF)		Banca d'Italia (BdI)		Deutsche Bundesbank (Buba)		Banque de France (BdF)		Banca d'Italia (BdI)		Deutsche Bundesbank (Buba)		Banque de France (BdF)		Banca d'Italia (BdI)	
€	\$ □	FX reserves	€	Reserves	\$ □	FX reserves	€	Reserves	\$ □	FX reserves	€	Reserves	€	Reserves	€	Reserves	
€		DE bonds	€	DE treasury account	€	FR bonds	€	FR treasury account	€	IT bonds	€	IT treasury account	€	IT bonds	€	IT treasury account	
€		Loans & bonds	€	Equity capital	€	Loans & bonds	€	Equity capital	€	Loans & bonds	€	Equity capital	€	Loans & bonds	€	Equity capital	
€		TARGET2 from	€	TARGET2 due	€	TARGET2 from	€	TARGET2 due	€	TARGET2 from	€	TARGET2 due	€	TARGET2 from	€	TARGET2 due	
€		Liquidity insurance (at ECB)	€	Liquidity insurance (for DE banks)	€	Liquidity insurance (at ECB)	€	Liquidity insurance (for FR banks)	€	Liquidity insurance (at ECB)	€	Liquidity insurance (for IT banks)	€	Liquidity insurance (at ECB)	€	Liquidity insurance (for IT banks)	

had expired and remained in place only implicitly as a contingent central bank liability (Mehrling 2015; McDowell 2016). An exception was the reverse repo facility (RRP), which is an explicit liquidity backstop for US securities dealers (Pozsar 2019a). In the 2020 crisis, however, some of them were re-introduced. In Europe, the ECB provides a *de facto* liquidity backstop to the NCBs. While this had not been the case in the original Eurozone design, ECB President Mario Draghi effectively announced it via his ‘Whatever it takes’ speech in 2012, which has been termed ‘Draghi put’, and the ensuing Open Market Transactions Program (Miller and Zhang 2014).

Third, to provide a backstop to offshore money, central banks have increasingly institutionalized *swap lines* between each other through which they stand ready to reciprocally create liabilities denominated in their own unit of account and lend them to another central bank to mutually replenish the central banks’ FX reserves. Such swap lines are agreements with varying degree of explicitness and codification. During the 2007-9 Financial Crisis, the Fed set up *ad hoc* emergency swap lines with 14 partnering central banks (McDowell 2016). Since 2013, the Fed has explicit reciprocal, permanent and unlimited swap lines with the ECB and four other major central banks (Mehrling 2015). In March 2020, the C-15 swap lines were reactivated again. In the model, these appear as contingent assets and liabilities both on the Fed’s and the ECB’s balance sheet. Drawing on a swap line increases the central banks’ reserves on the liability side in their own unit of account as well as their FX reserves on the asset side in another unit of account. The central bank which initiates the trade will have to pay interest to the other central bank and hence becomes the borrower from the other central bank. So far only the ECB has requested US-Dollars from the Fed and pledged Euros as collateral to replenish its USD-denominated FX reserves.⁶ In addition, the Fed offers a symmetric repo facility to foreign central banks through its traditional foreign reverse repo facility (F-RRP) (Pozsar 2016; 2019b) and the Foreign and International Monetary Authorities (FIMA) repo facility set up during the Covid-19 pandemic (Federal Reserve Board 2020). Through these facilities, non-US central banks including the ECB are able to exchange US treasury bonds against USD reserves with the Fed, and vice versa.

ELASTICITY SPACE

The blueprint for the Eurozone 1.0 sought to strongly limit the elasticity space for the Eurosystem. The discourse of the time was to make the EUR as strong and stable as the Deutsche Mark (DM), which meant keeping the inflation rate low. The fear on the German side was that the ‘stability culture’ of the Bundesbank could get lost when ‘mixing’ it with other currencies prone to higher inflation such as the Italian Lira (ITL). In consequence, the stipulations for the Eurosystem—via its strict price stability mandate—sought to craft a rules-based and highly inelastic balance sheet which would exercise ‘discipline’ on commercial banks in the Bundesbank tradition and create the EUR as a ‘hard currency’ (Brunnermeier, James, and Landau 2016). Translated into the categories of the macro-financial model, this approach hoped to provide ‘stability’ (as in ‘price stability’) by creating a monetary architecture in which the hierarchically highest balance sheet has as little elasticity space as possible.⁷

The design idea of the Eurozone 1.0 was to reduce the Eurosystem’s elasticity space as far as possible, but the TARGET system was an inbuilt source of elasticity.

Despite the official discourse, however, the Eurozone 1.0 had already been endowed with a considerable and often neglected elasticity space due to the TARGET system as the heart of EMU and the contingent assets and liabilities it provides. The TARGET system was developed in closed central banking circles at the time of the European Monetary Institute and largely separated from the political discourse. Still, this elasticity space only becomes evident if we think about the Eurosystem as separate balance sheets, stressing the logic of an internal federation in which each central bank continues to run its own national payments system (Garber 1998).

The Eurocrisis triggered a profound expansion of the Eurosystem’s elasticity space—one of the main transformations from the Eurozone 1.0 to the Eurozone 2.0. Analytically, we can trace it along the three defining factors of elasticity space.

6 Due to its Eurozone-US focus, the model abstracts from the ECB’s other swap lines, e.g. with the Eurozone periphery (Gabor 2015) and the Bank of England established in 2019 (Richtmann 2019).

7 Such reasoning (see e.g. Trichet 2019) essentially thinks of the Euro and the US-Dollar as two competing commodities, one of which is ‘better’ if it is artificially scarcer. This is very much at odds with the conceptualization of the Eurozone in this macro-financial

As to the first factor, there was an increase in the number of counterparties for the Eurosystem that were willing and able to expand the credit system further. This applies in particular to other central bank balance sheets, first and foremost the Federal Reserve, via the introduction of central bank swap lines in 2008 and their substantial use from then on. Moreover, the introduction of quantitative easing in the form of the ECB's various asset purchase programmes had a similar effect as it allowed the Eurosystem to fund higher volumes of both sovereign and private bonds (Haldane et al. 2016).

The second factor are the allowed on-balance-sheet activities for the Eurosystem and how these stipulations are enforced. During the Eurocrisis, the collateral requirements for Eurozone banks were constantly relaxed (Orphanides 2017). This made it easier for them to receive emergency liquidity from their NCBs and thus enhanced the Eurosystem's elasticity space.

The main transformation of central banking from the Eurozone 1.0 to the Eurozone 2.0 was the widening of the elasticity space in the Eurosystem through multiple processes.

Third, the volume of contingent liabilities changed. The available elasticity space became visible through the emergence of TARGET2 balances as *actual* assets and liabilities. Though often framed as a bug and not a feature (Sinn 2018), TARGET2 worked as a stabilizer that provided emergency funding for the rising imbalance between different banking systems and therefore served to maintain par between EUR-denominated credit money on German and Italian bank balance sheets.

Most importantly, the 2012 Draghi put has *de facto* given the ECB balance sheet the same unlimited elasticity space as that of the Fed by announcing an unlimited liquidity guarantee for the NCBs. This feature had been missing in the Eurozone 1.0 setting and had induced massive uncertainties about the stability of the banking systems in deficit countries. By expressing a liquidity guarantee and ensuring that elasticity space is available, the Draghi put eradicated the precondition for runs on banking systems as a self-fulfilling prophecy and kickstarted the Eurozone 2.0.

SUMMARY

Even though the TARGET2 system is often declared to be a minor technical or statistical feature that is conceptually largely irrelevant,⁸ this study sees it as the heart of the Eurozone architecture as it provides potentially unlimited elasticity space to the Eurosystem. The connection of the NCBs via TARGET2 to the higher-ranking ECB balance sheet represents European monetary unification narrowly defined. Academic and policy-oriented work on the Eurozone should pay close attention to it and appreciate its distinct logic of credit money creation, and avoid resorting to misleading analogies such as those of a gold standard.

A macro-financial perspective, in line with a disaggregated view on the Eurosystem and an emphasis on gross flows, brings in more conceptual clarity and advances the discourse in IPE and neighboring disciplines on EMU. In mitigating endogenous crises that may arise in the global credit money system, the Eurosystem is the ultimate backstop to provide EUR-denominated emergency elasticity. The TARGET2 system is the inbuilt stabilizer of that institutional arrangement.

model where EUR and USD are nominal units of account to denominate instruments which both are used offshore in each other's monetary jurisdictions.

8 A good example of this conceptual ambiguity is the hearing on TARGET2 in the German Bundestag in September 2018 when the invited experts were unable to agree on a joint conceptual framework to interpret TARGET2. See Sahr (2019) for a detailed review of the positions.

Commercial Banking

OUTLINE

With regard to the commercial banking segment, the model highlights two key aspects of the Eurozone.

On one hand, when designing the Eurozone 1.0, policymakers largely left out the harmonization of national banking systems (Mourlon-Druol 2012; Murau 2016). If the Eurozone architecture is 'incomplete', this assessment should primarily refer to the national fragmentation of the Eurozone's banking systems (Jones 2016), which continuously forces the Eurosystem to maintain ever higher TARGET2 balances to defend the integrity of the system (Whittaker 2011). Despite the effort to introduce a Banking Union, announced in 2012 via the Four Presidents' Report (Van Rompuy et al. 2012), creating a fully integrated Eurozone banking system remains a major construction site (Howarth and Quaglia 2013; 2016; European Parliament 2020).

On the other hand, the model highlights the extent to which offshore USD creation is enmeshed in the Eurozone architecture (see Figure 6). Although this feature remains largely neglected in the literature, it has played a role in European efforts of monetary integration at least since the 1970s (Werner 1970; Braun, Krampf, and Murau 2020). Offshore USD markets in the Eurozone partially alleviate the national fragmentation of the Eurozone's banking systems by integrating them in the global USD system.

INSTITUTIONS

To understand the systemic features of the Eurozone architecture, it is not necessary to look at individual banks' balance sheets but most useful to remain at a higher level of aggregation. Therefore, the model consolidates banks' balance sheets in a single sectoral balance sheet of national banking systems.

This logic is applied both to the US and the Eurozone. With the introduction of the Euro in 1999, most efforts of institutional change focused on the central banking segment, while commercial banking systems remained largely untouched (Valiante 2016, 31–34). Cross-border activities between the national banking systems increased in the first years of EMU but dried out in the Eurocrisis. As a consequence, banking systems became nationally fragmented, yet again. Policymakers reacted by introducing the Banking Union agenda, comprising a Europeanization of supervision, resolution and deposit insurance. However, this project has not been completed and it is uncertain when, if ever, it will be (CEPS 2019).

Instead, the national fragmentation of banking systems continues. This manifests itself in such phenomena as persistently high TARGET2 balances and a continuation of the bank-sovereign doom loop (Covi and Eydam 2020). This is the reason why the model chooses to frame the banking systems along national borders within the Eurozone.

Figure 6 – The commercial banking segment in the Eurozone architecture

German banking system		French banking system		Italian banking system							
€	Notes	€ \$	Deposits	€	Notes	€ \$	Deposits	€	Notes	€ \$	Deposits
€	Reserves (at Buba)	€ \$	Interbank borrowing	€	Reserves (at BdF)	€ \$	Interbank borrowing	€	Reserves (at Bdl)	€ \$	Interbank borrowing
€ \$	DE & US bonds	€ \$		€ \$	FR & US bonds	€ \$		€ \$	IT & US bonds	€ \$	
€ \$	RRPs	€ \$	Repos	€ \$	RRPs	€ \$	Repos	€ \$	RRPs	€ \$	Repos
€ \$	FX swaps	€ \$	FX swaps	€ \$	FX swaps	€ \$	FX swaps	€ \$	FX swaps	€ \$	FX swaps
€ \$	Private bonds	€ \$		€ \$	Private bonds	€ \$		€ \$	Private bonds	€ \$	
€ \$	ABSS	\$		\$	ABSS	\$		\$	ABSS	\$	
\$	GSE bonds	\$		\$	GSE bonds	\$		\$	GSE bonds	\$	
€ \$	Loans	€ \$	Equity capital	€ \$	Loans	€ \$	Equity capital	€ \$	Loans	€ \$	Equity capital
€ \$	Liquidity insurance (at Buba)	€	Solvency insurance (to DE MMFs & SPVs)	€ \$	Liquidity insurance (at BdF)	€	Solvency insurance (to FR MMFs & SPVs)	€ \$	Liquidity insurance (at Bdl)	€	Solvency insurance (to IT MMFs & SPVs)
€	Solvency insurance (at EBdB/EdB)			€	Solvency insurance (at FGDR)			€	Solvency insurance (at FGD)		
€	Capital insurance (at DE treasury)			€	Capital insurance (at FR treasury)			€	Capital insurance (at IT treasury)		

INSTRUMENTS

The sectoral bank balance sheets are constructed in analogy to an individual bank's balance sheet which engages in traditional banking. Its primary activity is to create deposits (which appear as actual liabilities) by swapping them with loans and bonds (which appear as actual assets) using households, firms and fiscal authorities as counterparties. Here, the European banking systems have a considerable 'home bias' as they predominantly hold public and private loans and bonds of their national treasuries, households and firms. Deposits are promises to pay central bank reserves or notes. Some of these reserves and notes have to be held as liquid assets by the banking system. Banks operate the payments system and transfer deposits among each other. In the course of this, surpluses and deficits with regard to their promises to pay reserves emerge. These are balanced via the unsecured interbank market and the secured interbank market, the repo market.

The Eurozone and the US banking systems differ from each other with regard to one important feature. The US system used to have a sharp division between commercial banking and investment banking through the Glass-Steagall-Act, which was introduced after the Great Depression in the 1930s. This implied that commercial banks were very strongly regulated with regard to the permitted on-balance-sheet activities. Even though this act got repealed in the 1990s, it still affects the contemporary institutional reality in the US. The Eurozone's banking systems, by contrast, were modeled as universal banking systems by the European Commission in the 1980s, allowing European banks to conduct more operations on-balance-sheet than their US counterparts (Bayoumi 2017). This explains why some instruments such as asset-backed securities are held by the European banking systems, while in the US these can be held only by non-bank financial institutions.

On the level of instruments, the model pays particular attention to the units of account used by banking systems in Europe and the US to portray how offshore money creation is enmeshed in the Eurozone's monetary jurisdiction. We may assume that the US banking system will primarily hold and create instruments denominated in USD, while the Eurozone banking systems primarily hold and create instruments denominated in EUR. However, as a monetary jurisdiction in the periphery of the Offshore US-Dollar System, the Eurozone's banking systems are permeated by instruments denominated in USD.

First, the Eurozone banking systems are integrated into the Offshore US-Dollar System through the *Eurodollar market*. European banks can

create deposits against loans or bonds denominated in USD, making them—by definition—offshore USD (or Eurodollar) deposits, bonds and loans (note that 'Euro' here is an old-fashioned synonym for offshore) (Braun, Krampf, and Murau 2020). Although the City of London is typically portrayed as the heart of the Eurodollar market, a considerable amount of Eurodollar creation takes place within the Eurozone (Aldasoro and Ehlers 2018)—apparently so considerable that during the global run on Eurodollars in the 2007-9 Financial Crisis, the EMU's Eurodollar market had to be backstopped with emergency swap lines by the Federal Reserve that amounted to 314 billion USD (Denbee, Jung, and Paternò 2016).

Second, European banking systems rely on *foreign exchange (FX) swaps* to manage their USD exposure. As FX swaps have characteristics of both money market instruments and derivatives (Stenfors 2017; Toporowski 2017), they are notoriously ambiguous (Murau and Pforr 2020a), in particular as accounting conventions do not list them as on-balance-sheet instruments which makes them "missing global debt" (Borio, McCauley, and McGuire 2017). The model conceptualizes FX swaps as on-balance-sheet instruments that help institutions navigate their exposures to units of account of different monetary jurisdictions. Their role as money market instruments is reflected in their usage in the banking system; their role as derivatives makes them appear on the balance sheets of hedge funds, understood as global risk dealers. They are always denominated in two units of account as at the point in time of making the FX swap contract, it is not clear which unit of account is borrowed and which is lent. However, the empirics of the FX swap market make clear that institutions in hierarchically lower monetary jurisdictions use them to get instruments denominated in the unit of account of hierarchically higher jurisdictions. Hence, FX swaps are mainly used to attain US-Dollars (DeRosa 2014).

While the creation of offshore USD instruments in the Eurozone is very common, the creation of offshore EUR instruments in the US is more of a theoretical possibility than an actual reality.

With regard to contingent assets and liabilities, the US and European banking systems enjoy an encompassing support via liquidity, solvency and capital insurance by higher-ranking balance sheets. Liquidity insurance is provided to US banks by the Fed, while European banks receive it from their respective NCBs. Solvency insurance is provided by the Federal Deposits Insurance Corporation (FDIC) and the Orderly Liquidation Fund (OLF) in case of systemically important financial institutions (OLA) in the US and by the national treasuries in the Eurozone.

Capital insurance refers to the last resort bail-out support which, for example, had become necessary during the 2007-9 crisis and had also been provided by the respective treasuries, e.g. the Troubled Asset Relief Program (TARP) in the US or the bail-outs in Eurozone states such as Ireland, Spain and Portugal.

ELASTICITY SPACE

In the Eurozone's banking segment to-date, the elasticity space is unevenly distributed between national banking systems as the planning for the Eurozone 1.0 was primarily focused on designing the central banking segment while not paying too much attention on creating a harmonized European commercial banking system. This problem flared up during the Eurocrisis and has remained an issue ever since. As a consequence, the elasticity space differs profoundly between surplus and deficit banking systems.

The elasticity space of different national banking systems in the Eurozone is unequal. This birth defect has been haunting the Eurozone architecture ever since.

Let us discuss the three factors of the Eurozone banking systems' elasticity space, comparing the Eurozone 1.0 and 2.0.

First, the banking systems of deficit (or crisis) countries are less attractive counterparties for other balance sheets in the global system than those of surplus (or non-crisis) countries. In crisis countries, the (distressed) banking system tends to hold the loans and bonds of the (distressed) national treasuries, firms and households. This makes them a less attractive counterparty than the members of a surplus country's banking system, which tends to hold the loans and bonds of non-distressed national treasuries, firms and households. This is an ever proliferating discrepancy—often called the 'sovereign-bank doom loop'—which maintains the differences between Eurozone countries.

Second, although the stipulations for national banking systems were rather unequal within the Eurozone in the early years, they have by now become increasingly harmonized. In the Eurozone 1.0, the competences for banking regulation were spread across the national, European and international levels. International financial governance processes influenced banking regulation before the Eurocrisis via the Basel Accords (Basel I of 1988 and Basel II of 2004), which provided international guidelines

for bank capital requirements. Basel II was picked up in the EU Directives 2006/48/EG and 2006/49/EG (Goldbach 2015) and implemented in each EU Member State through national laws. Still, national levels continued to be the most important and influential frameworks for bank regulation and reflected various national particularities and historical experiences (Busch 2009). The supervision of commercial banks remained a national issue, which led to a non-uniform application of EU Regulations and Directives throughout the Eurozone (De Larosière 2009, 13). In the Eurozone 2.0, the Capital Requirements Regulation and the Capital Requirements Directive implemented the Basel III Accord in 2013 with the goal to counteract the doom loop by increasing minimum capital and liquidity standards. Moreover, the Single Supervisory Mechanism introduced in 2014 harmonized the supervision for banks by transferring the responsibility to the ECB.

Third, the elasticity space of European banking systems depends on their contingent liabilities to access balance sheets in the central banking and fiscal segment—liquidity, solvency and capital backstops. Before 1999, national banking systems had *liquidity guarantees* without evident constraints on their NCBs' balance sheets. With the introduction of the Eurozone 1.0, the conditions for using the liquidity backstop were sought to be harmonized via the Eurosystem's collateral framework. Its initial version was a two-tiered system which defined strict general rules for acceptable collateral (tier 1) but in addition to that allowed national exceptions (tier 2) which essentially enabled the same heterogeneity as before the monetary unification. In 2005, this collateral framework was changed profoundly by introducing private sector standards based on rating agencies to determine collateral acceptability. This decision proved fatal in the Eurocrisis when the banking systems of crisis countries were no longer allowed to use their national treasuries' sovereign debt as collateral for emergency liquidity at their respective NCBs (van 't Klooster 2020).

The explicit *solvency guarantees* for Eurozone banking systems in the form of deposit insurance remained nationally organized in the Eurozone 1.0. Even though the deposit insurance limits were unequal, this was quickly harmonized during the Eurocrisis. In the Eurozone 2.0, deposit insurance remains organized nationally—the German treasury insures the deposits of the German banking system, the Italian treasury those of the Italian banking system. Harmonization of deposit insurance could either imply that a European balance sheet guarantees the German and the Italian deposits or, more realistically, that the German and the Italian treasury jointly

guarantee German and Italian deposits to a similar extent. Those proposals, however, are nowhere near reaching an agreement. Hence, the heterogeneity of elasticity space in the commercial banking sector remains.

Similarly, national treasuries have implicit *capital guarantees* for their national banking systems. The banking systems of Ireland, Portugal and Spain had to draw upon them in the Eurocrisis when their national treasuries were bailing them out. As the elasticity space of treasuries differed, the capital guarantees led to a divergent elasticity space of the national banking systems. Still, major steps have been taken to alleviate this, starting with the ad hoc bailout funds set up during the Eurocrisis and the European Stability Mechanism (ESM) after the crisis. In addition, an implication of the European Bank Recovery and Resolution Directive is that it attempts to make the capital guarantees for European banks more independent from their national treasuries' balance sheets.

SUMMARY

The macro-financial model points out that the commercial banking segment until today remains a construction site in the Eurozone architecture. Due to its national fragmentation, it is not (yet) appropriate to refer to a single unified Eurozone banking system. This fragmentation is partly caused by differences in national banking systems' elasticity space. It is reflected in continuously high TARGET2 balances through which the ECB and NCB balance sheets compensate the lack of banks' cross-border lending. Although it is indeed the purpose of the TARGET2 system to provide elasticity space in crisis times, it may not be the best tool used in normal times.

While EUR-denominated cross-border lending is suppressed, the USD-denominated interbank market provides an institutional alternative to cross-border lending, also *within* the Eurozone architecture. This feature potentially alleviates the pressure on the TARGET2 system to fund intra-European imbalances.

Non-Bank Financial Institutions and Shadow Banking

OUTLINE

The macro-financial model positions non-bank financial institutions, which are tightly connected to shadow banking activities, on the layer hierarchically below the commercial banking system. The term “shadow banking” was coined by McCulley (2009) in order to describe the financial structures that imploded in the 2007-9 Financial Crisis. After the crisis, the Federal Reserve adopted this term when Pozsar et al. (2012) published the seminal US-centered shadow banking map, which has shaped the discourse decisively. The Financial Stability Board (FSB) (2011, 1) focused on shadow banking as a key source of systemic risk, defining it as “credit intermediation involving entities and activities outside the regular banking system”.

The term “shadow banking system” has been used synonymously with “market-based credit system” (Mehrling 2012b). Recently, the FSB (2019) has decided to streamline terminology and use shadow banking synonymously with “non-bank financial intermediation”. This, however, conflicts with the view that shadow banking activities are inextricably intertwined with commercial banking institutions, which is particularly true for the Eurozone (Bayoumi 2017; Gabor 2016). To account for this complication, the conceptualization of shadow banking here follows the definition of Mehrling et al. (2013) who describe it as “money market funding of capital market lending”. This is a functional definition that looks at financial activities beyond traditional banking practices, rather than a purely institutions-based approach.

The model stresses that non-bank financial institutions and shadow banking activities are a key part of the Eurozone architecture, even though they typically remain a blind spot in the discourse (see e.g. Wyplosz 2016). This is a major shortcoming of existing accounts of the Eurozone architecture, given that the 2007-9 Financial Crisis, which later triggered the Eurocrisis, was essentially a global run on the shadow banking system (Murau 2017a). The model shows how, in a similar way as the Eurodollar market, shadow banking connects Eurozone-based institutions to the global US-Dollar system and to

some extent provides an alternative to the nationally fragmented Eurozone banking systems.

While there are lively conceptual and empirical debates about shadow banking in the United States, research on shadow banking in the Eurozone has long remained rather exploratory (European Central Bank 2012; European Commission 2012). Even today, it has a lot of unknowns, conceptually and empirically (Gabor and Ban 2016; Nabilou and Prüm 2019; Bayoumi 2017; European Central Bank 2020a; Hardie and Thompson 2020). The following discussion of institutions, instruments and elasticity space therefore largely aims at conceptualizing Eurozone shadow banking vis-à-vis the global system.

INSTITUTIONS

While the traditional commercial banking systems evolved historically in a nationally circumscribed setting and can thus be depicted along national lines (US, Germany, France, Italy), shadow banking is a different case. The origins of shadow banking lie in the 1970s (Murau 2017a). It developed in co-evolution with financial globalization and thus transcends national boundaries, with offshore USD creation being a key feature of it (Mehrling et al. 2013). Hence, the model does not depict national non-bank financial institutions that form national shadow banking systems but one *global* shadow banking system that mimics the hierarchy of the Offshore US-Dollar System. Different monetary jurisdictions contribute their unique ‘specializations’ to that system.

The institutions that participate in shadow banking are distinguished functionally. Instead of looking at one balance sheet that carries out different activities as in the commercial banking system, non-bank financial institutions are represented as various balance sheets that specialize in a daisy-chain of different shadow banking activities (Pozsar et al. 2012). Therefore, the model does not make a difference between Germany, France and Italy but only depicts one shadow banking system specific to the Eurozone, which is peripheral to shadow banking in the US (Hardie and Thompson 2020). To the extent that regulatory differences exist between

Eurozone member states, the model subsumes it under the functional, not regional, differentiation of the institutions (Thiemann 2018, 17). This allows maintaining a sufficiently high level of abstraction for the model as an analytical tool (see Figure 7).

US shadow banking traditionally takes place via non-bank financial institutions. Eurozone shadow banking activities are more enmeshed with commercial bank balance sheets.

Different regulatory environments have yielded fundamentally different shapes of shadow banking in the US and the Eurozone (Bayoumi 2017; Nabilou and Prüm 2019; Thiemann 2018). In the US, there is a stronger institutional separation between commercial banking and shadow banking entities. Shadow banking activities have been almost entirely outsourced to non-bank financial institutions which are not regulated by the Fed. The non-bank financial institutions this model identifies as part of shadow banking activities are money market funds (MMFs), securities dealers, special purpose vehicles (SPVs) for liquidity and risk transformation, as well as hedge funds. Hence, for the US a definition of shadow banking that focuses on *non-bank financial institutions* is largely appropriate (FSB 2011; Ricks 2016) and consistent with Mehrling et al. (2012).

In Europe, the transformation of the financial system has been less driven by private financial innovation rather than steps of financial integration through Primary Law (i.e. the European Treaties) and Secondary Law (i.e. Regulations and Directives) (Valiante 2016; Ralli 2019). After the 1986 Single European Act, the European Commission stipulated via the 1989 Banking Directive that the future Eurozone should have a universal banking system. This implied that many shadow banking activities did not require different institutions with their own balance sheets but could be carried out on banks' balance sheets (Bayoumi 2017). By contrast, some US non-bank shadow banking entities can also be found in Europe, even though at a much lower scale and volume than in the US. Key institutions are money market funds and alternative investment funds (AIFs) which are typically sponsored by banks or asset managers (Nabilou and Prüm 2019). Many of the SPVs used for securitization and liquidity transformation as well as risk dealers are offshore constructs, located outside the US while issuing USD-denominated instruments. Typically, these are based in tax havens some of which are located in the Eurozone, e.g. in Ireland, Luxembourg or the Netherlands (Haberly and Wójcik 2017).

Recent ECB research shows that European shadow banking is moving towards non-banks, making the European model more akin to that of the US (European Central Bank 2020a). Still, as European banks remain key balance sheets in shadow banking,

Figure 7 – Shadow banking in the Eurozone architecture

US hedge funds (risk dealer, derivative dealer)		US special purpose vehicle (securitization, risk transformation)		US special purpose vehicle (liquidity transformation)		US securities dealer (collateral intermediation)		US money market funds (MMF) (asset manager)	
\$ □ FX swaps	\$ □ FX swaps	\$ Deposit	\$ ABSs	\$ Deposit	\$ ABCPs	\$ RRPs	\$ Deposits	\$ Deposits	\$ MMF shares
\$ CD swaps	\$ CD swaps	\$ CD swaps		\$ ABS	\$ CD swaps	\$ US bonds	\$ Repos	\$ Repos	
\$ IR swaps	\$ IR swaps	\$ Loans	Equity capital		Equity capital	\$ GSE bonds	Equity capital	\$ ABCPs	
	Equity capital					\$ ABSs		\$ US bonds	Equity capital
		\$ Solv. insurance (at parent bank)		\$ Solv. insurance (at parent bank)		\$ Liquidity insurance (RRP facility at Fed)		\$ Solv. insurance (at parent bank & ESF)	
						\$ Solvency insurance (at parent bank)			

German banking system		French banking system		Italian banking system	
€ Notes	€ Deposits	€ Notes	€ Deposits	€ Notes	€ Deposits
€ Reserves (at Buba)	€ Interbank borrowing	€ Reserves (at BdF)	€ Interbank borrowing	€ Reserves (at BdI)	€ Interbank borrowing
€ DE & US bonds		€ FR & US bonds		€ IT & US bonds	
€ RRPs	€ Repos	€ RRPs	€ Repos	€ RRPs	€ Repos
€ □ FX swaps	€ □ FX swaps	€ □ FX swaps	€ □ FX swaps	€ □ FX swaps	€ □ FX swaps
€ Private bonds		€ Private bonds		€ Private bonds	
\$ ABSs		\$ ABSs		\$ ABSs	
\$ GSE bonds		\$ GSE bonds		\$ GSE bonds	
€ Loans	Equity capital	€ Loans	Equity capital	€ Loans	Equity capital
\$ Liquidity insurance (at Buba)	€ Solvency insurance (to DE MMFs & SPVs)	€ Liquidity insurance (at BdF)	€ Solvency insurance (to FR MMFs & SPVs)	€ Liquidity insurance (at BdI)	€ Solvency insurance (to IT MMFs & SPVs)
€ Solvency insurance (at EBdI/EdB)		€ Solvency insurance (at FGDR)		€ Solvency insurance (at FGD)	
€ Capital insurance (at DE treasury)		€ Capital insurance (at FR treasury)		€ Capital insurance (at IT treasury)	

EMU-19 hedge funds (risk dealer, derivative dealer)		EMU-19 special purpose vehicle (securitization, risk transformation)		EMU-19 special purpose vehicle (liquidity transformation)		EMU-19 money market funds (MMF) (asset manager)	
€ □ FX swaps	€ □ FX swaps	€ Deposit	€ ABSs	€ Deposit	€ ABCPs	€ Deposits	€ MMF shares
€ CD swaps	€ CD swaps	€ CD swaps		€ ABS	€ CD swaps	€ Repos	
€ IR swaps	€ IR swaps	€ Loans	Equity capital		Equity capital	€ Sov (EMU) bonds	Equity capital
	Equity capital						
		€ Solvency insurance (at parent bank)		€ Solvency insurance (at parent bank)		€ Solvency insurance (at parent bank)	

the choice of the Financial Stability Board (2019) and the European Systemic Risk Board (2019) to reduce the scope of shadow banking to “non-bank financial intermediation” may push us further away from developing an integrated understanding of the globalized system. The macro-financial model is an attempt to have a more comprehensive outlook on the phenomenon.

INSTRUMENTS

The instruments that the model depicts on the balance sheets of US shadow banking institutions comprise deposit-like MMF shares issued by MMFs, which pool the liquid funds of private and institutional investors to invest them into money market instruments such as repurchase agreements (repos) issued by securities dealers. These fund some instruments on the capital market that are the result of securitization (by slicing up loans and turning them into asset-backed securities, ABSs) and liquidity transformation (by transforming ABSs into short-term debt such as asset-backed commercial papers, ABCPs). Hedge funds which deal in derivatives allow hedging against credit risk (via credit default swaps), interest rate risk (via interest rate swaps) and FX risk (via FX swaps). The eminent shadow banking *markets*—note that markets in this model are defined as the trading of instruments in between institutions—occur primarily on the balance sheets of non-banks, first and foremost the repo market.

Many shadow banking instruments, which in the US require their own balance sheet, can be created and held on banks’ balance sheets in the Eurozone. Therefore, European shadow banking activities are more enmeshed with the traditional banking system.

In line with the literature on money creation in the shadow banking system, some of the short-term IOUs may count as “shadow money” provided that they trade at “par” with bank deposits (Pozsar 2014; Gabor and Vestergaard 2016; Ricks 2016). Depending on how strict we are in defining par (mathematically exact or with a greater range of tolerance), there are different classifications of what instruments can count as shadow money (Murau and Pforr 2020a).

As many of those shadow banking instruments are USD-denominated, the activities form part of the global Offshore US-Dollar System. To showcase this point, let us look at the three most important cases.

First, a core venue of shadow banking is the *repo market*. While in the US the repo market is concentrated on the balance sheets of securities dealers, in Europe it takes place predominantly on the balance sheets of commercial banks, given that commercial and investment banking have not

traditionally been separated. European repo markets rely to a larger extent than its US counterpart on bilateral repo (as opposed to triparty repo) and on sovereign bonds as collateral (as opposed to securitized private bonds (Nabilou and Prüm 2019).

Prior to 2007, the European Commission had tried to harmonize national Eurozone repo markets by treating all Eurozone sovereign bonds as equal collateral (Giovannini Group 1999; European Central Bank 2002). As this attempt fell apart in the Eurocrisis (Gabor 2016), it was a contributing factor to banking systems’ national fragmentation and the bank-sovereign doom loop in the Eurozone. Due to the lack of a European safe asset, Eurozone institutions resort to US treasuries as repo collateral, thus increasing the role of the USD in European shadow banking.

Repos are one of the key shadow money instruments. The EU Commission’s attempt to create a harmonized Eurozone repo market failed in the 2007-9 Financial Crisis.

Second, European banks were able to hold *asset-backed securities* created by US and non-US SPVs and *mortgage-based securities* created by US off-balance-sheet fiscal agencies due to different regulatory treatment of European banks within the Basel II regime in the 1990s (Bayoumi 2017). This led to a further dollarization of European banks and entailed the need for more US-Dollar funding for European banks.

As part of its Capital Market Union initiative, the European Commission promotes the expansion of loan securitization in the Eurozone (European Commission 2015), which in this model is reflected in strengthening Eurozone-based securitization SPVs.

Third, in the Basel III environment, *FX swaps* have adopted an increasingly important role for shadow banking as they have remained largely untouched by regulators. Due to the low interest rate environment, Eurozone-based non-bank balance sheets use FX swaps as money market instruments to fund capital market lending in the US, predominantly in US treasuries but also other longer-term credit instruments (Pozsar 2020).

Although within current accounting conventions FX swaps are not recorded on-balance-sheet (Borio, McCauley, and McGuire 2017), their conceptualization in the macro-financial model deviates from these conventions and puts them in the center of attention as credit instruments that can be denominated in various units of account, not only EUR or USD.

ELASTICITY SPACE

The first factor that determines the elasticity space of non-bank financial institutions refers to available counterparties. Unlike in any other segment, this varies throughout the financial cycle. These balance sheets are attractive to counterparties in phases of financial expansion but become very unattractive in phases of financial contraction. Many of the balance sheets attributed to the shadow banking system have been created to provide elasticity space which the traditional banking system did not have under Basel I and II. This is the core motive of regulatory arbitrage. The Basel III regime reacted to this and attempted to restrict the elasticity space on balance sheets involved in shadow banking activities.

Stipulations for allowed on-balance-sheet activities are the second factor. Non-bank financial institutions are by default less strictly regulated than banks. As shadow banking entities are constantly transforming, it stands to reason to believe that new ways of shadow banking are constantly developing in order to surpass existing regulations and enhance the balance sheet space. Moreover, with shadow banking less pronounced on the balance sheets of non-bank financial institutions in the Eurozone, the European Commission has even been pushing for more such activities on non-bank balance sheets. In particular via the Capital Market Union initiative, EU policymakers have been trying to develop a Eurozone-wide market for loan securitization (European Commission 2015; Braun and Hübner 2018; Gabor and Vestergaard 2018). The call of the ECB and the Bank of England for simple, transparent, and standardized securitization (STS) (Bank of England and European Central Bank 2014), translated into the EU's Securitization Regulation (Regulation (EU) 2017/2402), attempts to incentivize the use of shadow banking activities and thus to enhance elasticity space in the segment in order to support Eurozone-wide financial integration, i.e. shifting emphasis towards the securitization SPVs in the Eurozone architecture. Such policy seeks to make the Eurozone more similar to the US financial model.

The Capital Market Union initiative promotes shadow banking activities as an attempt to overcome the fragmentation of the banking systems in the Eurozone architecture.

Contingent assets and liabilities are the third factor for elasticity space. Before the 2007-9 Financial Crisis, shadow banking institutions did not

have any public guarantees for their instruments. Some institutions such as SPVs, dealers and MMFs had private capital insurance from their sponsoring banks. During the crisis, some institutions received public backstops—in particular securities dealers at the Fed and MMFs at the Exchange Stabilization Fund (ESF), one of the US treasury's off-balance-sheet fiscal agencies. After the crisis, these explicit guarantees initially disappeared and were only implicitly in place until some of them were re-introduced in the 2020 crisis. Moreover, the Fed operates the Reverse Repo Facility for securities dealers (Murau 2017a). The evaluation of shadow banking institutions' elasticity space is particularly complicated by the fact that the contingent guarantees granted by higher-ranking balance sheets for non-bank financial institutions are not always clear. They are often implicit and get tested only when a crisis hits.

SUMMARY

The analysis in this section leads to four arguments about the role of shadow banking in the Eurozone.

First, the shadow banking system is a structure specific to the global Offshore US-Dollar System. In the Eurozone, it has a more dominant manifestation on banks' balance sheets than in the US. This is a major complication for conceptualizing it regarding institutions, instruments and elasticity space.

Second, the usage of shadow banking-specific non-bank balance sheets in the Eurozone was not only driven by Eurozone-based institutions themselves but also by US shadow banking institutions that wanted to use them as offshore vehicles and by European policymakers that seek to push their agendas, e.g. via Capital Market Union.

Third, there are repeated ideas to shift more financial activity from the commercial bank segment to non-bank financial institutions as a way to overcome the commercial banking system's national fragmentation in the Eurozone. This should be seen as an attempt, for better or worse, to advance the Eurozone architecture. This initiative, however, bears the danger that instead of remedying shortcomings of the existing Eurozone architecture, it brings in new vulnerabilities. While European policymakers take the US institutional setup as a role model, they may overlook that the US structures had only developed as second-best solutions in the Glass-Steagall environment and lay at the core of the 2007-9 Financial Crisis.

Finally, FX swaps are a core feature of today's shadow banking. How they mitigate between the Eurozone and the global US-Dollar system should be subject to future conceptual and empirical research.

Fiscal Ecosystem

OUTLINE

Conceptualizing the fiscal segment in the macro-financial model of the Eurozone architecture requires a theoretical position on two questions: the relationship of the monetary and fiscal segment and, in consequence, on the role of public debt in a monetary architecture, first and foremost in the form of sovereign bonds. Opinions on those questions have been continuously transforming throughout the 20th century (Marshall 1890; Keynes 1936; Musgrave 1959; Woodford 2003; McCulley and Pozsar 2013; Ryan-Collins and van Lerven 2018), and the debates are far from being settled. There is lack of consensus on both questions, different trends come and go.

The doctrine of the Eurozone 1.0 advocated a conceptual separation of central banking and the fiscal segment and sought to translate that into institutional reality. The ECB was supposed to be in charge of achieving price stability, and the fiscal balance sheets were meant to be in charge of keeping the budget balanced (Arestis and Sawyer 2007). Due to the logical separation of both segments, it seemed feasible to give the Eurozone an institutional design with a supranational central bank and but maintain national treasuries which are coordinated through *ex ante* rules that allow neither implementing fiscal transfers nor mutualizing sovereign bond issuance (McNamara 1998). However, this position has been fiercely criticized from the start. It is a wide-spread expectation, in line with *locomotive theory*, that the Eurozone architecture can only be 'complete' once there is a supranational treasury balance sheet with fiscal transfers in between member states and joint sovereign bond issuance to complement the ECB in the central banking segment (see e.g. Bibow 2018). This narrative dates back as far as the Werner Report (1970) and was affirmed by the Delors Report (1989).

These different viewpoints broadly reproduce antagonisms of monetarism and Keynesianism on the monetary-fiscal relationship or the 'sound finance' vs 'functional finance' approach on public debt issuance (Lerner 1943). However, they tend to operate with a distorted picture on the institutional reality of the Eurozone 2.0. On one hand, the monetarist doctrine

of a strict simplistic separation between the fiscal and monetary segment has been repeatedly disproven, for instance by the events of the Eurocrisis 2009-12 when treasuries had to bail out banks and the ECB had to guarantee sovereign bonds. The ECB's PEPP may count as the latest example for this shift. On the other hand, the expectation that the Eurozone can only be 'complete' once a full-fledged European treasury is able to conduct Keynesian demand management policies with the supranational ECB takes the ideal type of a mid-20th century style nation state as a role model and assumes that the Eurozone can only be functional and complete once it corresponds to this ideal type. This is an unrealistic expectation under conditions of financial globalization (Murau and van 't Klooster 2019).

Against this backdrop, the macro-financial model uses a different conceptual angle on the relationship between the fiscal and the monetary segment. The model assumes that fiscal balance sheets have the role of issuing public debt instruments in order to fulfill four different functions: closing treasuries' budget deficits, creating public goods, issuing safe assets, and providing capital insurance of last resort. The section fleshes out this 'four functions approach' to demonstrate that whether or not the fiscal segment of the Eurozone architecture is complete or functional does not depend on a particular ideal-typical institutional design or if there are specific instruments jointly and severally guaranteed by all Eurozone member states, maybe called Eurobonds. Instead, the benchmark is whether all the balance sheets of the fiscal segment taken together are able to appropriately perform on all four functions simultaneously.

INSTITUTIONS

The fiscal segment of the Eurozone comprises treasuries, which represent the balance sheets of states and are typically subject to the checks and balances of the executive and legislative branches of government, as well as the broadly defined group of off-balance-sheet fiscal agencies (cf. Quinn 2017). These are balance sheets that also perform parts

of states' fiscal functions but are often designed as public-private hybrids and not controlled and regulated in the same way as treasury balance sheets. In the Eurozone, this fiscal segment is further subdivided into a national and a supranational layer. This applies both to treasuries and off-balance-sheet fiscal agencies. In analogy to the banking system, the model depicts the balance sheets of the German, the French and the Italian treasuries as well as the balance sheet of the European Union, which is a 'treasury' in name only as it has substantially reduced competences. In contrast to the central banking segment, the European fiscal level follows an intergovernmental logic. The main decision-making competences remain on the national level and the autonomy of European institutions is very narrowly circumscribed by the European Treaties. Taken together, the Eurozone's different national and supranational fiscal balance sheets form an 'ecosystem' of national and supranational treasuries and off-balance-sheet fiscal agencies (see Figure 8).

The same intuition of a 'fiscal ecosystem' applies to the US. The hierarchically highest balance sheet is the US treasury on the federal level; hierarchically lower institutions (not depicted in the model) would imply state and municipal treasuries (Feygin and Reddy forthcoming). In addition, the US fiscal segment comprises a plethora of off-balance-sheet fiscal agencies. On one hand, this involves Government Sponsored Enterprises (GSEs) such as the Federal National Mortgage Association ('Fannie Mae', founded 1938) and the Federal Home Loan Mortgage Corporation ('Freddie Mac', established 1970), the Federal Deposit Insurance Corporation (FDIC, founded 1933) and the Orderly Liquidation Authority (OLA, established 2010), or the Exchange Stabilization Fund (ESF, set up 1934). On the other hand, the Bretton Woods Institutions, founded in 1944, have become *de facto* US off-balance-sheet fiscal agencies. The IMF had initially been established to provide short-term loans to non-US central banks so that they could intervene in the FX market and

Figure 8 – The Eurozone fiscal ecosystem

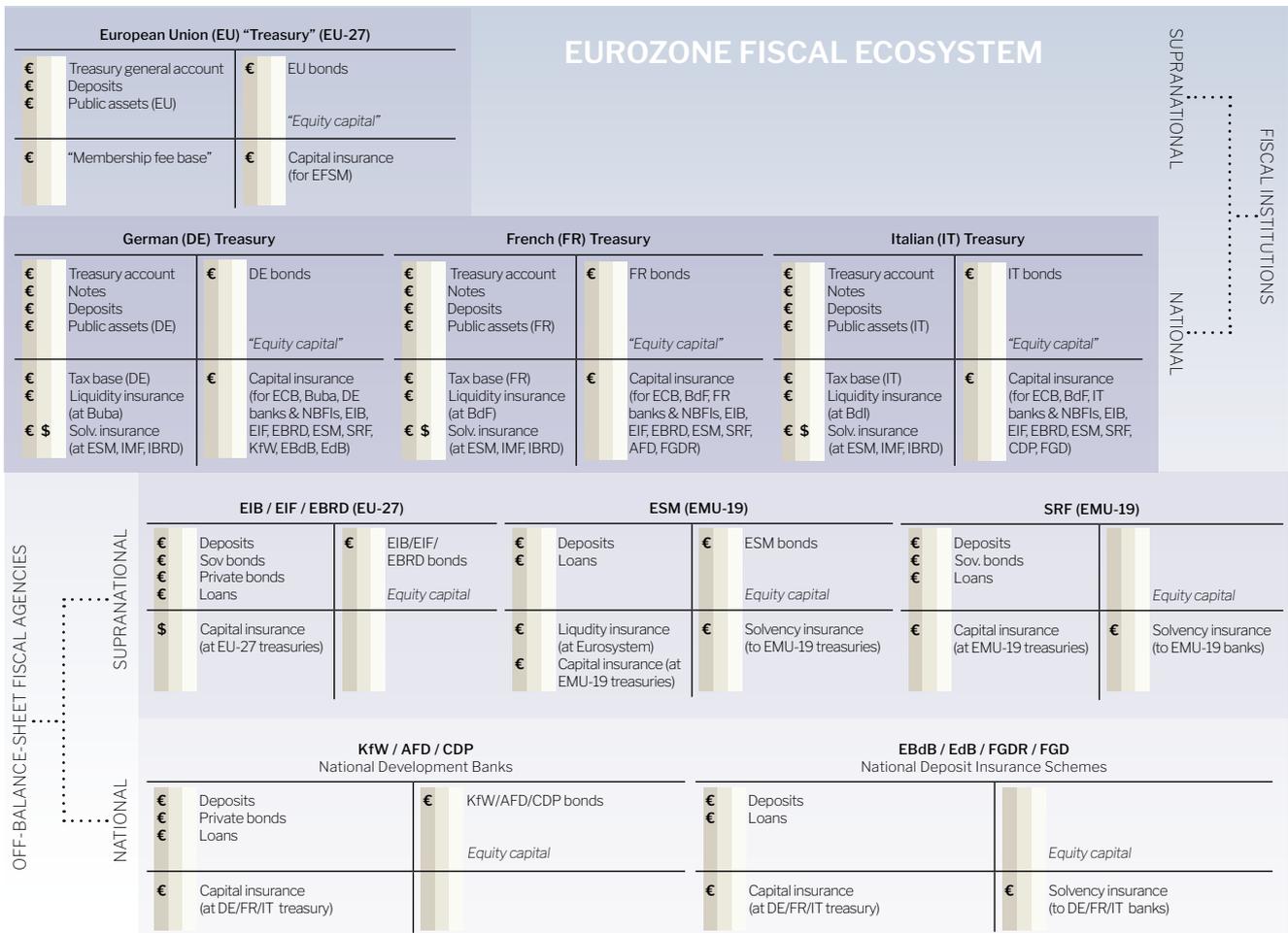
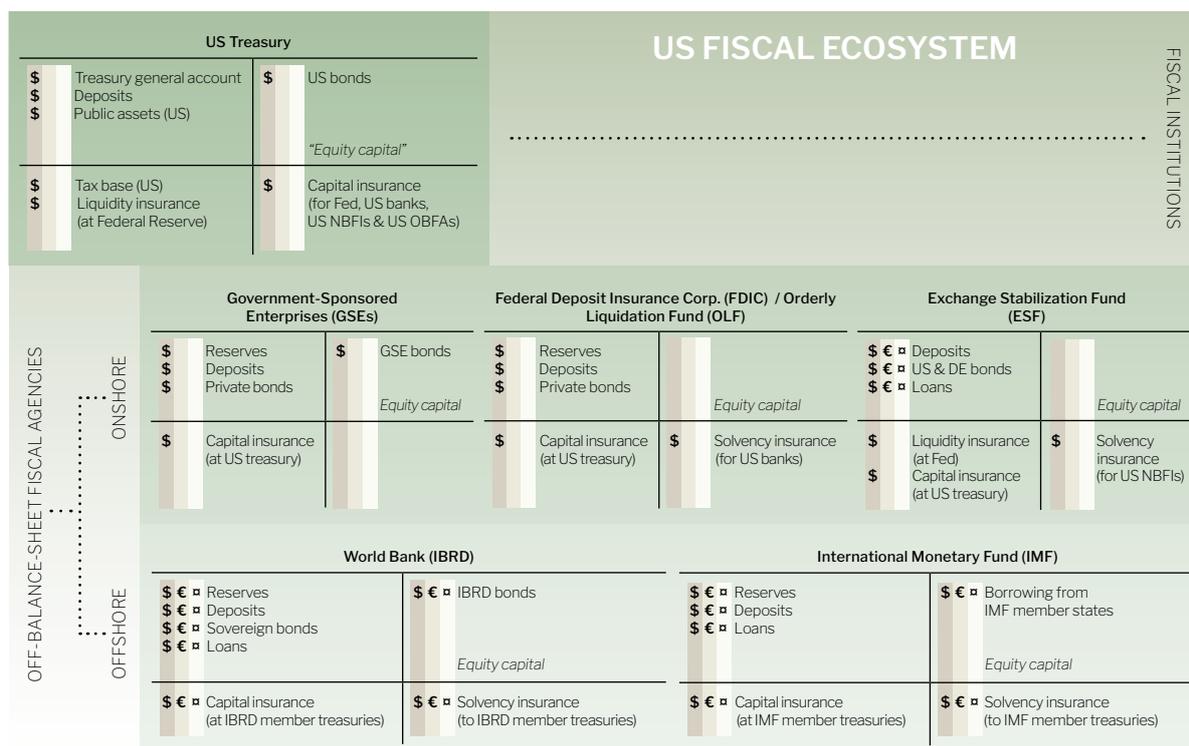


Figure 9 – The US fiscal ecosystem



stabilize the politically agreed exchange rates in the Bretton Woods System. After that system’s demise, however, the IMF received a complete make-over in the 1970s and started lending to non-US fiscal agencies, very much in line with the World Bank’s activities. Though formally international organizations, both are integrated into the institutional framework of Washington DC, also due to the revolving door of employee turnover, and contribute to the activities of the fiscal segment in the apex of the Offshore US-Dollar System (see Figure 9).

The World Bank and the IMF are explicitly conceptualized as off-balance-sheet fiscal agencies of the US, not as autonomous and impartial international financial institutions.

The first function of the balance sheets in these fiscal ecosystems is to issue sovereign

bonds to finance a state’s budget deficit, i.e. when its expenditure exceeds its tax revenue (Musgrave 1959, 36). This *public budget function* is carried out by national treasuries solely, without the support of off-balance-sheet fiscal agencies. The EU balance sheet is not allowed to issue debt for these purposes.

From a (neo)classical or ordoliberal perspective, closing the public budget deficit is the primary function of public debt (Dyson 2014, 5). The ideal level of sovereign debt as to this function is thus zero—if a treasury consistently issues new public debt, it ‘lives above its means’. This view is the underlying idea of the ordoliberal German ‘Schwarze Null’ doctrine. It has informed the Stability and Growth Pact (SGP) and the Fiscal Compact, and thus has been dominating the fiscal policy doctrine in the Eurozone.⁹

In Musgrave’s classical theory of public finances, public debt issuance should not be connected to activities of the allocation and the distribution branch but could possibly contribute to the stabilization

9 The idea of fiscal prudence is that in normal times tax revenues and government expenditure should match each other. It depends on individual countries’ decision-making structure whether or not this can be achieved. The SGP approach is guided by the fear that the interest groups in control of some Eurozone member states could treat their country’s treasury balance sheet as a source to fund their interest groups, without generating sufficient tax revenues and therefore creating a tragedy of the commons-style problem.

branch insofar as it implies transfer payments or tax reduction—aspects traditionally emphasized by Keynesians who see public debt as the source of fiscal policy to push macroeconomy towards full employment (Hansen 1949, 167).¹⁰

The second function of balance sheets in the fiscal ecosystem is to finance the creation of public goods, also potentially by issuing debt. This *public goods function* refers to elements such as war finance (Keynes 1940; Zielinski 2016), development finance (Xu, Ren, and Wu 2019) or stabilization policy insofar as it implies debt-financed public investments (Musgrave 1959, Ch. 22).

The (neo)classical approach, applying a general equilibrium view on the economy and assuming that Say's Law is valid, denies this role for the fiscal segment as it would crowd out private investment. The counter-position suggests that the creation of public goods is a way of crowding in private investment. The traditional macroeconomic debate over fiscal policy and public debt is shaped by the antagonism of both these positions. Hence, it is mainly due to this second function that a debt level greater than zero was seen as acceptable in the ordoliberal design of the Eurozone 1.0.

The public goods function is not carried out by treasuries alone. Instead, state banks or state development banks are off-balance-sheet fiscal agencies which take-over various types of investment financing such as the German Kreditanstalt für Wiederaufbau (KfW), the French Agence Française de Développement (AFD), the Italian Cassa di Risparmio di Roma (CR) or, on a European level, the European Investment Bank (EIB), the European Investment Fund (EIF) and the European Bank for Reconstruction and Development (EBRD).¹¹ While formally international organizations, the World Bank or the Inter-American Development Bank (IADB) play that role in the US monetary jurisdiction.

A third function not reflected in both these positions is the *safe asset function*. Accordingly, the balance sheets of the fiscal ecosystem have to provide safe assets for all other balance sheets in the

system to be able to 'store wealth', i.e. maintain their level of balance sheet expansion over time. The idea of a safe asset is that it keeps its value even in case of acute systemic contraction (Caballero, Farhi, and Gourinchas 2017). Safe assets play an important role in all three segments of the banking system, but in particular the repo market which is built around the use of safe assets as collateral. From this point of view, public debt is itself a public good that is in high demand and constant undersupply—in fact, the more the credit system expands, the greater the shortage of safe assets becomes.

There is general agreement that in the Eurozone 2.0, the main safe asset is provided by the German treasury (Brunnermeier et al. 2012), a suboptimal situation for various reasons which also necessitates that the US treasury has to provide safe assets for the Eurozone. In the burgeoning literature on the Eurozone's safe asset problem (Leandro and Zettelmeyer 2019), there are conflicting suggestions about the type of balance sheet that should issue safe assets. As treasuries are the traditional issuers of safe assets, there are proposals to either create a full-fledged European treasury as supranational balance sheet endowed with the full faith and credit of all Eurozone member states (Bibow 2014) or that different national treasuries could partly guarantee each other's bonds (Delpla and Von Weizsäcker 2010). Others propose safe asset issuance to be carried out by off-balance-sheet fiscal agencies, either existing ones such as the EIB or the EIF (Varoufakis, Holland, and Galbraith 2013) or newly created ones as in the Sovereign Bond-Backed Securities (SBBS) proposal (Brunnermeier et al. 2012; Van Riet 2017).

In the US, the GSEs support the US treasury in supplying safe assets by securitizing mortgage loans (Quinn 2019).

The fourth function of fiscal balance sheets is to issue sovereign bonds in order to act as capital insurer of last resort for virtually all other balance sheets in the system (*capital insurance function*). It implies that in case of a crisis—the sudden contraction of non-fiscal balance sheets—treasuries stand ready to bail

10 It is hard to overestimate the relevance of Musgrave (1959) for the dominant understanding of fiscal policy and public debt issuance. Implicit and explicit references to this work permeate analyses on the Eurozone's fiscal segment (Hübner 2019). For the purpose of this macro-financial model, however, his conceptualization reduces too much complexity as he consolidates the treasury and the central bank balance sheets, treats the issuance of sovereign bonds and central bank liabilities as largely equivalent, and bases his analyses on full-reserve banking without autonomous private credit money creation (Musgrave 1959, Ch. 22).

11 The terminology of state (development) banks is misleading because they do not actually perform banking in the form of issuing deposits as liabilities. Instead they issue bonds on behalf of the state, which makes them rather akin to investment funds. The EIB, established in 1958, is the EU's non-profit long-term lending institution. Its shareholders are the EU member states (Liebe and Howarth 2020). The EIF, established in 1994 and majority owned by the EIB, is the EU's venture capital arm that provides financing and guarantees to small and medium-sized enterprises. The EBRD, founded in 1991, is a multilateral developmental investment bank that has historically used its investments as a tool to build market economies.

out other institutions by passing on assets to them, either in the form of a loan or a permanent transfer.

This function is reflected in the debate about risk sharing and often connected to an insurance logic against symmetric or asymmetric shocks, which arguably makes this function a matter of “monetary solidarity” (Schelkle 2017; critical: Hübner 2019). Treasuries have performed on that function when they ‘bailed out’ banks in the Eurocrisis 2009-12 or when they provided emergency loans to European firms and households during the Covid-19 crisis in 2020.¹²

Some off-balance-sheet fiscal agencies support the treasury in exercising that function by pooling resources of a broader member base in order to then lend them back to some of its members in need. US institutions that perform on that function are the FDIC, the OLF, the ESF and also the IMF. Examples of European institutions are the Single Resolution Fund (SRF) and the European Stability Mechanism (ESM) as well as its non-permanent predecessors, the European Financial Stability Facility (EFSF) and the European Financial Stability Mechanism (EFSM). As counter-factual institution, there are also proposals for a European Monetary Fund (EMF) (Sapir and Schoenmaker 2017).

INSTRUMENTS

The balance sheets in the fiscal ecosystem issue different types of national and supranational bonds. Against a widely held misconception, there are also forms of public debt issued on supranational balance sheets which can be considered to be forms of ‘Eurobonds’. Let us look at the instruments in the ecosystem in more detail.

The national treasuries issue *sovereign bonds* as actual liabilities which are held by various other balance sheets in the system. As their actual assets, they hold cash in the form of deposits at the central bank and commercial banks as well as a variety of *public assets*, which we don’t have to specify further in the model. To the extent that the value of their assets exceeds those of their liabilities, treasuries have equity which arguably belongs to their citizens.

To generate possible future revenue, treasuries have access to households and firms as ‘tax base’, which the model sees as a contingent asset. At the same time, the treasury balance sheet is the ultimate capital insurance backstop for virtually all other balance sheets in the system—be it central banks, banks, potentially non-bank financial institutions, or off-balance-sheet fiscal agencies. The model represents this as a contingent liability.

Among the national off-balance-sheet fiscal agencies, the state (development) banks such as the KfW, the AFD and the CDP issue *off-balance-sheet fiscal agency bonds* which add on top of their paid-in capital in order to hand out loans and bonds to fund various investment projects. In the US, Fannie Mae and Freddie Mac issue GSE bonds such as mortgage-backed securities. Backstopping funds such as the FDIC are off-balance-sheet fiscal agencies that pool resources from banks while having deposit insurance as contingent liability. Off-balance-sheet fiscal agencies typically enjoy capital guarantees from their national treasuries.¹³

The European Union’s ‘treasury’ balance sheet differs from national treasury’s balance sheets in two ways. On one hand, the EU ‘treasury’ cannot tax EU citizens. It therefore depends on the membership contributions of the EU member states and all its assets are capital that belongs to the EU member states. On the other hand, the EU is not able to issue its own public debt to finance its budget deficit.

That being said, the inability of the EU’s ‘treasury’ balance sheet to issue debt needs to be qualified in two respects.

On one hand, there has been a proliferation of EU off-balance-sheet fiscal agencies which are able to issue public bonds. The European development agencies, namely the EIB, EIF and EBRD, issue bonds and provide public sector financing for the public investment function. The EFSF, the EFSM and the ESM deliver on the capital insurance function. They have been set up and are guaranteed by the Eurozone states and partly the European Commission. Their task is to pool deposits for supporting Eurozone treasuries and banking segments in financial need (see [Figure 10](#)).¹⁴

12 The Eurozone literature often calls this function “lender of last resort” (see e.g. Schmidt 2020). This terminology creates some ambiguity with the traditional usage of the term (cf. Bagehot 1873) as a function of the central bank in relation to the banking system.

13 An interesting instrument that is not easy to conceptualize is the IMF’s Special Drawing Rights (SDRs). As they have no direct relevance for the Eurozone architecture, this study and its version of the architecture abstract from them. They can, however, very well be integrated in a future version that places more emphasis on how the Offshore US-Dollar System is managed from the apex.

14 The ESM, established in 2012 to support Eurozone treasuries in crisis, has an authorized capital of €700 billion. The EFSF is a SPV financed by the national treasuries of the Eurozone. It can issue bonds to raise the funds needed to provide loans to Eurozone countries

Figure 10 – The transition towards the European Stability Mechanism

Ad hoc EU-level fiscal rescue funds

European Financial Stability Facility (EFSF)		European Financial Stability Mechanism (EFSM)	
€ Deposits € EMU-19 bonds € Loans to EMU-19 treasuries & banks	€ EFSF bonds	€ Deposits € Loans to EMU-19 treasuries	€ EFSM bonds
€ Capital insurance (from EMU-19 treasuries)	€ Solvency insurance (for EU treasuries)	€ Capital insurance (from EU treasuries)	€ Solvency insurance (for EU treasuries)

Permanent EU-level fiscal rescue fund

European Stability Mechanism (ESM)	
€ Deposits € Loans	€ ESM bonds Equity capital
€ Liquidity insurance (at Eurosystem) € Capital insurance (at EMU-19 treasuries)	€ Solvency insurance (to EMU-19 treasuries)

On the other hand, three exceptions permit bond issuance on the EU 'treasury' balance sheet. First, bonds may be issued on behalf of the European Atomic Energy Community (Euratom), an international organization that has identical membership as the EU but is legally distinct (European Commission 2020a). Second, the EU Commission may borrow funds to provide capital insurance to EU members which are not part of the Eurozone via the Balance of Payments (BoP) program and to non-EU members via the Macro-Financial Assistance (MFA) program (European Commission 2020b).¹⁵ Third, the Commission may exceptionally issue up to € 750 billion in bonds from from 2020 to 2026 to respond to the Covid-19 crisis (European Council 2020).

In the ongoing discourses on reforming the Eurozone's fiscal segment (Pekanov 2019), it is frequently argued that the Eurozone architecture lacks a proper supranational debt issuance. This overview, by contrast, demonstrates that the fiscal ecosystem produces three types of supranational credit instruments which we could think of as 'Eurobonds': those of the state development banks (EIB, EIF, EBRD), those of the ESM, EFSF or EFSM, and those that the EU 'treasury' issues on behalf of other national treasuries, Euratom or to fight the Covid-19 crisis. This indicates that the lack of a European safe asset (Gabor and Vestergaard 2018) is not so much a question of quality, but rather of *quantity*—an issue inherently connected to fiscal elasticity space.

in financial troubles, recapitalize banks or buy sovereign debt. It was first authorized to borrow up to €440 billion (2010) and then €780 billion (2011). Each Eurozone country made financial commitments to the EFSF based on its ECB capital. In 2010-11, the EFSF issued 5 and 10-year bonds in several rounds to pay out €18 billion to Ireland (2011-12) and €26 billion to Portugal (2011-14). In 2014, €164 billion of Greek public bonds were shifted to the EFSF. The EFSM issues bonds to raise funds on private financial markets. These are guaranteed by the European Commission using the EU budget as collateral. It has the authority to raise up to €60 billion. In 2010-11, the EFSM issued bonds in seven rounds with maturities between 5 and 30 years. Ireland received €22.4 billion (2010-13), Portugal €26 billion (2011-14) and Greece €7 billion (2015) from the EFSM. The SRF is supposed to be filled up over an eight-year period until 31 December 2023 and will have an estimated size of € 55 billion (Brandt and Wohlfahrt 2019).

¹⁵ The Balance of Payments Programme has a volume up of up to € 50 billion of which 13.4 billion have been used for Hungary, Latvia and Romania. The Macro-Financial Assistance Programme, with a volume of € 4.73 billion, has borrowed for Ukraine and Jordan.

ELASTICITY SPACE

The elasticity space on a fiscal balance sheet by definition denotes how much public debt such a balance sheet is able or permitted to issue. Appropriately evaluating the available elasticity space of the fiscal segment in a given monetary jurisdiction requires a combined analysis of the treasury balance sheets and off-balance-sheet fiscal agencies.

A comparison of the Eurozone and the US along the three dimension of elasticity space shows that the fiscal elasticity space—i.e. the ability to issue public debt—is unevenly distributed among different balance sheets in the Eurozone’s fiscal ecosystem, in particular in between different national treasuries, and in general is considerably lower on Eurozone balance sheets than those of the US.

First, the elasticity space on fiscal balance sheets depends on the ability to find counterparties.

Bonds issued in the Eurozone fiscal ecosystem tend to be in high demand, in particular by the own national banking system. As a rule of thumb, the demand for sovereign bonds will be higher if the treasury is of a surplus country and has a good track record of repaying its debts. This is primarily a matter of reputation, a social construct. For this reason, German sovereign bonds are more sought after than those of Italy and hence the German treasury has more elasticity space than the Italian one. The same is true for all forms of supranational debt, which are highly rated and qualify as safe assets.

Still, bonds of the Eurozone fiscal ecosystem are less attractive than US sovereign debt—both short-term bills and longer-term bonds—which are in high demand as safe assets, in particular because they are issued denominated in the international key currency. Given the prevalence of a multitude of balance sheets willing and able to act as counterparties for balance sheet expansion, the US treasury can maintain extremely high levels of government debt. In US politics, this has led to a structural compromise position where domestic tax revenue decreases and the budget deficit is funded more via sovereign bond issuance (Streeck 2014; Hager 2016).

The second factor that determines the fiscal elasticity space are stipulations for allowed on-balance-sheet activities.

On one hand, stipulations that directly address the Eurozone fiscal segment are the SGP and the Fiscal Compact. Not only do they attempt to coordinate different autonomously operating national treasury balance sheets, they also strongly limit national treasuries’ elasticity space, even though the enforcement mechanisms have not proven to be equally strong for everyone. These pacts are one of

the most significant features of the Eurozone 1.0 and 2.0 architecture, but they are not a necessary element of monetary unification narrowly defined; rather they have been thought of as an alternative to shifting fiscal authority from the national to the supranational level. The EU ‘treasury’ balance was initially fully inelastic but the exceptions for EU bond issuance have to some extent relaxed the constraints.

The discipline focus both on the national and the supranational level is partly alleviated by off-balance-sheet fiscal agencies. In particular, the ESM and the EIB provide more elasticity space for the supranational level in the Eurozone 2.0 than is often suggested. In fact, it has been a recurring pattern in the evolution of the Eurozone architecture to maintain the logic of fiscal discipline for treasury balance sheets while granting elasticity to off-balance-sheet fiscal agencies. Arguably, this is one of the default compromise positions in the political struggles between Eurozone members that advocate fiscal discipline and those in favor of more elasticity.

The elasticity space of national treasuries in the Eurozone is very unequal. Off-balance-sheet fiscal agencies partly alleviate this imbalance, despite disciplining treaties.

On the other hand, national treasuries’ elasticity space is *indirectly* restricted by the prohibition of monetary financing of member state budgets by central banks (Art. 123(1) TFEU). The Eurosystem cannot buy treasury bonds on the primary market, i.e. directly swap IOUs with the national treasuries. Still, purchases on the secondary market are possible and via QE occur at a high volume. As a consequence of this arrangement, the Eurosystem and the Eurozone treasuries cannot act as direct counterparties for mutually expanding their balance sheets by issuing new IOUs but have to insert third-party balance sheets in between them, typically those of the commercial banking segment. Still, as the Eurosystem holds Eurozone sovereign bonds at an increasing volume, it is nevertheless able to *fund* the sovereign bonds.

The US fiscal balance sheet does not have such constraints. Even though Congress has placed a debt ceiling on the US household, it has not proven to be an effective stipulation to restrict the elasticity space of the US treasury balance sheet but is rather used as a bargaining chip in case of a divided government. Moreover, off-balance-sheet fiscal agencies such as the ESF are used for emergency interventions during the 2007-9 and 2020 crises to grant additional elasticity space to the US treasury.

Third, the elasticity space on fiscal balance sheets depends on the availability of contingent instruments.

Generally speaking, we may infer that treasury balance sheets have access to the *tax base*, a contingent asset matched by contingent liabilities of households and firms that is as an ultimate source of recapitalization and elasticity space for treasuries.

In addition to that, two other factors play a crucial role for treasuries' elasticity space.

On one hand, national treasuries provide *capital backstops* as contingent liabilities to most other balance sheets in the system which enhance its elasticity space. For example, these guarantees were necessary in the Eurocrisis when defaulting banks in the Eurozone, infected by the run on the shadow banking system, had nowhere else to turn to than to their national treasuries. In the US, the treasury provided a capital backstop for banks via the Troubled Asset Relief Program (TARP). A similar case are the massive fiscal interventions during the Covid-19 pandemic when the main beneficiaries were national households and firms. Such contingent treasury liabilities remain in place and can be called upon, independently of any stipulations seeking to prevent it.

On the other hand, a treasury's elasticity space is crucially determined by whether or not it has a *liquidity guarantee* on the central bank's balance sheet—that is, whether or not the instruments they issue as bonds can be purchased by central banks on the primary or secondary market.

In the Eurozone, this depends on the ECB's *collateral framework* (Nyborg 2016; van 't Klooster 2020). The initial collateral framework of the Eurosystem allowed that NCB's accepted 'their' respective national treasuries' sovereign bonds independently of their credit ratings as Tier 2 collateral, just as in the US system. In 2005, the ECB adopted a collateral framework in which this option was ruled out. The Eurosystem was only allowed to buy up the sovereign bonds of Eurozone treasuries as long as they had investment-grade ratings. In 2010, this stipulation amplified the rising spreads on the collateral for the Greek, Italian, Irish, Spanish and Portuguese sovereign bonds, which lost their investment-grade rating and hence also their central bank backstop (Orphanides 2017).

It was this lack of a contingent *liability* for national treasuries in the Eurosystem that translated into diverging contingent assets on national treasuries' balance sheets and thus created the fundamental difference in elasticity space on the various Eurozone treasury balance sheets that escalated the banking crisis and turned it into a sovereign debt crisis.

SUMMARY

The model stresses that the Eurozone's fiscal segment is an 'ecosystem' of national and supranational balance sheets of treasuries and off-balance-sheet fiscal agencies. In discourses on the Eurozone's fiscal segment—e.g. those with emphases on Eurobonds, risk-sharing or safe assets—it is not helpful to look at the EU 'treasury' balance sheet exclusively. Instead, the model casts doubt on the widespread view that the Eurozone is only complete once 'fiscal union' is achieved. *De facto*, this idea implies the highly unrealistic expectation that the triple coincidence of political, economic and monetary area assumed for national economies is created on the European level. By contrast, the model sees no strict reason why monetary unification—narrowly defined through the TARGET2 system—can only function with strictly coordinated or unified fiscal balance sheets.

The *four functions approach* shows that the challenge for the fiscal segment is to find the right distribution of elasticity space to be able to simultaneously perform on all functions at the same time. There are good reasons to believe that this distribution is currently sub-optimal in the Eurozone architecture, even though we must acknowledge that it is constantly transforming. *Prima facie*, each of the four functions would require a different elasticity space for the balance sheets in the fiscal ecosystem. While the *public budget* function would require the level of public debt to be zero over the business cycle, the *public investment* function would require a higher volume of public debt, which is substantially smaller than the required volume for the *safe collateral function*. All such considerations are in vain, however, once an exogenous shock hits and requires treasuries to perform on their *capital insurance function*.

Solving this structural *simultaneity problem* lies in a better fine-tuning of the fiscal ecosystem of national and supranational treasuries and off-balance-sheet fiscal agencies. Having different types of balance sheets issuing a variety of debt instruments with divergent elasticity spaces may also be a source of strength if appropriately used. At the same time, it would be myopic to believe that a single measure such as introducing sovereign bond issuance on the European Union's 'treasury' balance sheet or any of the safe asset proposals alone could be the full remedy to the simultaneity problem.

Rather than discussing whether the Eurozone's fiscal segment is (in)complete, it is more productive to analyze how well the existing balance sheets in the idiosyncratic fiscal ecosystem are able to make use of their elasticity space to issue the amount of bonds necessary to perform well on all four functions.

Conclusion

This study has set out to comprehensively conceptualize the Eurozone architecture as a web of interlocking balance sheets. Drawing on the (critical) macro-finance literature, it has defined a monetary architecture as a combination of three elements (institutions, instruments and elasticity space) distributed across four segments (central banks, commercial banks, non-bank financial institutions, and the fiscal ecosystem) within a monetary jurisdiction. These elements and segments are the 'grammar' of the macro-financial model.

A defining conceptual choice for the model has been to not only look at institutions' *actual* assets and liabilities but also *contingent* ones and trace them throughout the entire web of interlocking balance sheets. This not only unveils the extent to which various institutions provide insurance to each other but also contributes to portraying the Eurozone architecture as a self-referential credit system.

Contingent assets and liabilities are key to a monetary architecture, even though they are counterfactuals. As an analytical tool, they may help us better understand monetary reality.

The study's mapping exercise comes along with three main take-aways.

First, the model emphasizes that the main feature of European monetary unification narrowly defined is the TARGET2 system. It provides the mechanism to defend the monetary integrity of the Eurozone by making it possible for deficit NCBs to turn their liabilities into a liability of the higher-ranking ECB balance sheet. From this perspective, the TARGET2 system allows the creation of monetary instruments that are merely valid within the Eurosystem. This enables the financing of imbalances in between NCBs and defends the integrity of the monetary union without having to incur exchange rate fluctuations as in a prototypical flexible exchange rate system or FX reserve drainage as in a fixed exchange rate system.

Second, by portraying the Eurozone as a monetary jurisdiction on the first-layer periphery of

the Offshore US-Dollar System, the macro-financial model is able to systemically integrate offshore US-Dollar creation and the shadow banking system into the Eurozone architecture. USD-denominated instruments for wholesale activities in the Eurozone are not typically recognized as a defining feature of the Eurozone architecture. Against this backdrop, this study argues that USD-denominated markets provide institutional alternatives to the EUR-denominated cross-border bank lending channels that have remained notoriously fragmented since the Eurocrisis and that European policymakers have been trying to fix with mixed results, among others via the Banking Union project.

Third, with its concept of a fiscal ecosystem, the model argues against the common preconception that the Eurozone is 'unfinished' as long as it does not have a supranational fiscal pillar. This argument is guided by ideas of a traditional Westphalian monetary system (Cohen 1998) as the norm, in which the triple coincidence of decision-making area, economic area and monetary area is met (Avdjiev, McCauley, and Shin 2015). Under conditions of financial globalization with systematic offshore money creation and shadow banking, this norm is a mere chimera (Murau and van 't Klooster 2019). Moreover, the model offers a direct comparison of the Eurozone architecture with the US monetary architecture which indicates that both are incomplete in the sense that they have a scattered fiscal segment. In particular, framing the IMF and the World Bank as US off-balance-sheet fiscal agencies stresses the similarities between the US and the Eurozone in this respect.

The TARGET2 system is central to the Eurozone architecture. Offshore US-Dollars compensate for architectural deficits. A fiscal ecosystem is in constant flux and cannot be 'complete'.

Based on these insights, the macro-financial model provides the starting point for various areas of future research. What follows is a non-exhaustive list of possible applications for the model.

One avenue for future research is to use the currently static model to analyze the dynamic transformation of the Eurozone architecture. This would involve tracking the changes of institutions, instruments and elasticity space within the web of interlocking balance sheets in the Eurozone monetary jurisdiction. This can refer to the transition from the European Monetary System to the Eurozone 1.0 and the emergence of a Eurozone 2.0 during and after the 2009-12 Eurocrisis. Moreover, it may address recent institutional innovations set up in connection with the 2020 Global Financial Crisis, induced by the Covid-19 lockdown measures, such as the ECB's PEPP facility (European Central Bank 2020b), the massive expansion of national treasury balance sheets (e.g. BMF and BMWi 2020) and the extension of elasticity space on the EU 'treasury' balance sheet (European Council 2020). These changes are likely to mark a transition from the Eurozone 2.0 to a Eurozone 3.0.

In this context, the model raises questions of individual and collective agency in relation to the self-referential credit money system, and the limits of such agency. To what extent can the dynamics within the monetary architecture be attributed to political decisions of governments and parliaments, technocratic bricolage, corporate influence, or citizens' initiative? And to which extent are interlocking balance sheets subject to endogenous dynamics of the self-referential credit system outside of agents' conscious control? For example, using insights of systems theory, we may hypothesize that endogenous contractions of credit instruments can cause a change of the system's institutions and their elasticity space without clearly attributable agency. Agents struggle to get control over such dynamics and even more often are busy pretending that they are in control rather than actually influencing them.

In future research, the model may be used to theorize on transformation dynamics, agency, the creation of hierarchy or systemic risk.

A different avenue of future research will be to use the model for crafting a more comprehensive picture of the Offshore US-Dollar System. This would involve using the 'grammar' of the model to integrate more monetary jurisdictions, conceptually fit in the SDR system, and establish a connection to the literature on the 'Global Financial Safety Net' (Gallagher et al. 2020). Such a broader empirical picture will allow tackling numerous questions: How is international hierarchy created and maintained? What governance mechanisms are emerging? How should we conceptualize monetary power?

Another way to advance the model will be to quantify institutions and elasticity space. In its current form, the model has merged insights of various political-economic literatures into a single conceptual framework and is well empiricized with regard to *institutions*. However, it remains merely conceptual with regard to *instruments*. The model abstractly maps instruments' interconnectedness and how they form a self-referential system but hasn't been calibrated with empirical data yet, partly due to the difficulties surrounding data collection in varying national accounting datasets. Moreover, making *elasticity space* measurable would require developing a methodology to estimate its three defining factors, first and foremost *contingent* assets and liabilities. If and how this is possible remains an open question.

Going down the road of quantification, the model may be used for research on systemic risk (Haas et al. 2019). The model portrays the global credit money system as a self-referential network of expanding but unstable debt claims, in which every asset is another institution's liability, and vice versa. In this context, systemic risk can be defined as the possibility that credit instruments implode and cause a chain of defaults that alter the institutional structure. With its unique way of depicting how the global shadow banking system and offshore US-Dollar creation are enmeshed in the Eurozone architecture, the model may allow, for instance, to anticipate contagion channels in future systemic crises.

Policy proposals on the basis of the model may address the simultaneity problem in the fiscal ecosystem, creative usage of TARGET2 or the governance of the Offshore US-Dollar System

Lastly, the model provides a tool kit for future-oriented descriptive or prescriptive analyses. This can involve scenario-building exercises about possible trajectories of systemic transformation, or mapping, comparing, evaluating, and refining policy proposals for deliberate systemic alterations. For Eurozone governance, such proposals could tackle the simultaneity problem in the Eurozone's fiscal ecosystem or for creatively using the TARGET2 system to work against the Eurozone's national fragmentation (see Cour-Thimann 2013 for a discussion of some options). On a global scale, the model may be applied to ask how a more effective and equitable governance of the wider Offshore US-Dollar System can be realistically achieved.

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