Fiscal Dominance, Monetary Policy and Exchange Rates: Lessons from Early-Modern Venice[1]

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Abstract:

This paper focuses on an early unique experiment of freely floating State-issued money, implemented in Venice between 1619 and 1666. Building on a new hand-collected database from a previously unexplored archival source, we show that, despite the Venetian ducat's status as an international currency and the government's reputation for fiscal prudence, its external value was significantly, and increasingly, affected by episodes of automatic government deficit monetization through the Banco del Giro during the crises of 1630 (outbreak of the bubonic plague) and 1648-50 (escalation of the Cretan War). This suggests that the institutional context plays an important role in the transmission mechanism between government deficit monetization and exchange rates.

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1. Introduction

Following the extensive fiscal expansions implemented by governments around the world in the aftermath of the COVID-19 pandemic, fiscal dominance has (re)gained centre stage in economic debates (Alberola et al. 2021, Benigno et al. 2024, Orphanides 2021).[2] Most studies on fiscal dominance have been devoted to investigating its impact on the *internal* value of money (i.e., on inflation), while the question of its effect on the *external* value of money (i.e., on exchange rates) has mainly centred around the case of developing countries, i.e., those at the periphery of the international monetary system. However, a shift to fiscal dominance may also have a significant impact on the value of an international currency – as the case of the sterling crisis of September 2022 appears to suggest (Leeper 2023; Pinter 2023). Moreover, the wording "fiscal dominance" has been used with different meanings in the literature – referring alternatively to the institutional equilibrium between monetary and fiscal authorities (central bank dependence) or the funding strategy implemented by the fiscal authority alone (non-Ricardian stance). These two definitions do not coincide: central bank dependence is not automatically associated with the fact that the government will necessarily take a non-Ricardian stance, and vice-versa, central bank independence does not mean that the government will necessarily assume a Ricardian stance. Still, the institutional equilibrium may play a role in determining the extent to which shifts in the fiscal stance impact exchange rates. Today, all core currencies are issued by formally independent central banks. Would central bank regime influence exchange rate sensitivity to government deficit monetization also in the case of a key international currency?

In this paper, we study a historical episode which is unique in many respects. Our focus is on Venice, a financial centre whose currency played a pivotal role in the international monetary system from the Middle Ages until well into the 18th century (Fratianni and Spinelli 2006; Flandreau et al. 2009a). Between 1619 and 1666, the Republic of Venice put in place what is arguably the first-ever experiment of purely managed State-issued money. During this period, the Banco del Giro (a public bank with no formal separation from the government) issued fiat money to systematically accommodate the Republic's fiscal deficits. Banco money, at that time, was formally inconvertible into specie upon demand. As a result, its price freely floated with respect to both circulating coins and foreign currencies. However – and contrary

[2] "Fiscal dominance" generally describes an institutional setting where monetary policy systematically accommodates fiscal expansions. For a discussion of this issue, see Section 2.1.

to other early monetary experiments, such as John Law's system in 1720s France (Velde 2007) – the mechanism was not intended to have an inflationary bias. Banco money supply was kept under control through regular redemptions into specie, made on the government's (and not on its counterparties') initiative. The government's fiscal stance preserved the sustainability of redemptions, which remained overall conservative in the long run. This experiment allowed the Venetian Republic to withstand the severe consequences of two major real shocks, i.e. those of 1630 (major outbreak of the bubonic plague) and 1648-50 (escalation of the Cretan War with the Ottoman Empire), respectively. Despite its overall success, the experiment ended in 1666, when, following petitions from merchants, the Senate eventually introduced the full convertibility of Banco money into specie on demand.

To date, the evolution of the external value of Banco del Giro money has only received passing attention in the work of Roberds and Velde (2016, p. 337), relying on very-low-frequency exchange rate data provided by Denzel (2010). In this paper, we rely on a previously unexplored archival source, i.e. the Saminiati-Pazzi records preserved at Bocconi University in Milan, and build a new database of high-frequency exchange rate data between Venice and 32 other cities or exchange fairs between 1627 and 1684. One major contribution of our research lies in the reconstruction of these exchange rate series itself.

Based on these new series as well as on other available quantitative and qualitative historical evidence, we implement event study analysis to test the impact of government deficit monetization on exchange rates throughout this period. Our results document a high sensitivity of the external value of the Venetian Banco ducat to fiscal deficit monetization, despite the Venetian government's strong reputation for fiscal prudence in the long run. This appears to suggest that even in the case of established international currencies with a reputation for fiscal soundness, exchange rates may be very sensible to the government's fiscal stance in a context of central bank dependence. Moreover, our findings appear to suggest that the choice of the monetary regime (inconvertibility vs. convertibility of bank-issued money into metallic coins on demand at a fixed rate) had a limited impact on the external credibility of the Venetian currency.

The remainder of the paper is organized as follows. Section 2 surveys the economic literature on fiscal dominance and currency depreciation, as well as the historical literature on 17th-century Venice. Section 3 discusses the workings of the Banco del Giro, as well as the events surrounding the two major shocks of 1630 and 1648-50. Section 4 outlines the data sources and series, followed by Section 5, which presents the findings of our empirical analysis. Section 6 provides some concluding remarks.

2. Literature review

2.1. Fiscal dominance and exchange rates

The recession triggered by the COVID-19 pandemic in early 2020 has once again emphasized the link between the government's funding needs, temptations for monetary accommodation, and risks of currency depreciation. The Turkish experience represents a well-known specific case study (Gürkaynak et al. 2023). Taking a relatively longer-time perspective, the last decade witnessed the largest, fastest and most broad-based increase in debt levels around the world (Kose et al. 2021), as most countries significantly increased their public-sector borrowing to GDP. Overall, this growing public debt might influence monetary policy action, inducing central banks to accommodate the costs of servicing public debt, eventually leading to higher risks of both inflation and currency depreciation. These considerations outline the relevance of studying the transmission channel between fiscal deficits, monetary policy, and exchange rates.

This line of research has a long history. As economic policy thought evolved over the last four decades, a consensual view has progressively emerged concerning how the institutional design of central bank rules can shape policymakers' incentives. Its key intuition can be summarized as follows: in general, governments would use monetary policy tools with a short-sighted perspective, aiming to smooth fiscal imbalances (Sargent and Wallace 1981; Barro 1983). The term fiscal dominance has become commonplace to describe an institutional framework in which monetary policy is driven by fiscal policy. However, as noted by Jeanne (2012, p. 143), this term – which Sargent and Wallace (1981) did not originally use in their foundational contribution – has been used with a variety of different meanings in the literature. On the one hand, the term has been employed to describe an institutional setting in which, as explained by the political economy literature (Rogoff 1985; Tabellini 1987; Grilli et al. 1991), the central bank is not independent enough to oppose government deficit monetization. On the other hand, the term has been employed to describe a macroeconomic setting – also defined as a non-Ricardian regime (Sargent 1982; Aiyagari and Gertler 1985) – in which instead of providing full backing for its debt by using a stream of future taxes, the fiscal authority finances its fiscal deficits with money creation. These two dimensions are not strictly coincident: at least in theory, a fiscal dominance institutional setting does not necessarily mean that a non-Ricardian regime will occur; and vice-versa, a non-Ricardian regime might well occur in an

institutional setting in which the monetary authority is independent if other considerations, such as e.g. financial or macroeconomic stability, will drive the latter's policy response (Woodford 1998, 2001). The original theoretical intuition *à la* Sargent and Wallace has been strengthened by the fiscal theory of price level (Canzoneri et al. 2021; Cochrane 2023), which highlights the link between the institutional design – monetary versus fiscal dominance – and the fiscal policy stance – Ricardian versus non-Ricardian choices. In what follows, we shall pay attention to keeping these two latter dimensions distinguished.

In a non-Ricardian regime, the government can use either inflation or exchange rate depreciation to solve its intertemporal budget constraint. It is worth noting that inflation and depreciations rely on different mechanisms: inflation generates seigniorage revenues, while depreciations erode the real value of domestic currency obligations (Ize 1987).

The literature on fiscal dominance has extensively explored the inflation channel (for a recent survey, see Cevik and Miryugin 2023). Inflation episodes tied to fiscal dominance have been investigated also from a historical perspective (Sargent and Velde 1995; Fratianni and Spinelli 2001; Gadea 2012; Bajo-Rubio et al. 2014; Sabaté et al. 2019). By contrast, the depreciation channel has been relatively overlooked, with some exceptions (Burnside 2001; Daniel 2001; Corsetti and Mackowiak 2006; Annichiarico et al. 2011). This is partly due to the fact that the relationship between fiscal dominance and depreciation is theoretically based on the assumption that exchange rates are fully flexible, thus adjusting automatically to changes in the domestic price level. In the last three decades, this assumption has been increasingly considered unrealistic: an influential strand of the literature has claimed that fully flexible exchange rates are unlikely to exist, as policymakers have an endemic incentive to manipulate them (Obstfeld and Rogoff 1995; Calvo and Reinhart 2002; Reinhart and Rogoff 2004; Ilzetki et al. 2019). Nonetheless, several contributions have indeed analysed empirically how fiscal dominance, debt, and exchange rate movements can be associated (Tanner and Ramos 2003; Blanchard 2004; Fratzsher et al. 2011; Ahmed et al. 2021; Kose 2021; Alberola et al. 2021; Jin and Xiong 2021). One of the messages of this literature is that while in Ricardian regimes fiscal expansions are associated with an appreciation of the domestic currency, in non-Ricardian regimes they are rather associated with its depreciation (Ize 1987; Alberola et al. 2021).

In the economic history literature, a number of papers have investigated the link between fiscal dominance and the stability of exchange rates under the gold standard (Bordo and Schwartz 1996; Sabaté et al. 2015). However, the very nature of the gold standard (i.e., a fixed-exchange-rate regime with strict boundaries to exchange rate fluctuations) makes the assessment of the impact of government debt monetization on the exchange rate more difficult

to measure. Closer to our study, a handful of papers have looked at the effect of fiscal dominance on the agio (Sargent and Velde 1995; Antipa 2016; Quinn and Roberds 2019). However, the very nature of the agio (i.e., an *internal* rather than an external exchange rate) does not allow to properly assess the impact of government debt monetization on the *external* value of the currency.

2.2. Monetary experiments in early-modern Venice

It is well known that since the late Middle Ages, Italian city-states achieved a remarkably high level of financial sophistication (Fratianni and Spinelli 2006). A top international financial centre in late medieval and early modern times, Venice was run for centuries by a stable constitutional regime controlled by its mercantile oligarchy. The historical literature has largely documented the modernity of the Venetian fiscal and monetary systems.

On the one hand, Venice developed remarkable fiscal capacity: the Republic's ability to farm taxes from the population (through a strongly regressive tax system) was high by international standards, as it could borrow large amounts on financial markets at comparatively low interest rates. Historical research on the Venetian fiscal policy has documented that while in troubled times the Republic was able to borrow largely from financial markets, in tranquil times it was equally able to generate substantial fiscal surpluses to decrease the outstanding amount of its public debt – so that in the long run, its public finances were kept on a sustainable path (Pezzolo 2003a, 2003b, 2018; Alfani and Di Tullio 2019).

On the other hand, Venice was also a pioneer in the development of modern banking, being among the very first places to create public banks which can be legitimately considered proto-central banks (Dunbar 1892; Luzzatto 1934; Roberds and Velde 2016; Ugolini 2017; Bindseil 2019). Recent studies have rediscovered the unique modernity of the "monetary experiment" implemented by the Republic between 1619 and 1666. During this period, the Banco del Giro (a public bank with no formal separation from the government) issued fiat money which was inconvertible on demand into specie: the value of this State money was therefore purely managed by the government itself. Such an experiment, however, was not meant to put the domestic economy on an inflationary path. The "moneyed interests" who stably ran the Republic had a strong anti-inflationary bias, and the Banco's mission was rather to preserve the stability of the money it issued. This notwithstanding, in this very period Venice endured a couple of short-lived but large real shocks, which obliged the government to resort

to active monetization of fiscal deficits through this public bank (Ugolini 2017, 2020; Goodhart et al. 2021).

To sum up, the historical literature suggests that the vicissitudes of the Banco del Giro between 1619 and 1666 provide an ideal case study to investigate the relationship between government deficit monetization and currency depreciation under a flexible exchange rate regime. On the one hand, the institutional setting in Venice resembled the prototypical "fiscal dominance" setting: the monetary authority was a mere division of the fiscal authority, and no formal obstacle prevented the government from automatically monetizing its deficits. On the other hand, though, the government had a strong reputation for fiscal soundness and consistently displayed a Ricardian behaviour in the long run. This invites an investigation into the impact on exchange rates of the punctual episodes of non-Ricardian behaviour by the Venetian government.

3. Historical background

3.1. The Venetian monetary system in the 17th century

The structure of the Venetian monetary and fiscal systems at the beginning of the 17th century is described in detail by Goodhart et al. (2021, pp. 303-7). In 1587, the first public bank called Banco della Piazza di Rialto was founded (Roberds and Velde 2016, pp. 333-5; Bindseil 2019, pp. 207-10). This bank was designed to collect deposits from the private sector, in order to shelter money users from the problems tied to the bad state of circulating coins. In theory, deposits were convertible into specie on demand; however, as the very species into which deposits were convertible were quickly demonetized, Banco della Piazza money became *de facto* inconvertible into circulating coins. Such inconvertibility was however intended not to destabilize, but rather to stabilize the value of Banco money by insulating it from the instability of coin circulation: in fact, bank money was constantly priced at a premium (called *agio*) with respect to specie. Unlimited convertibility on demand into the demonetized species remained however possible, and this put a floor on the price of the Banco della Piazza money. During the first three decades of its existence, the Banco della Piazza proved to be a considerable success – and provided the model for the creation of public banks in Amsterdam in 1609 and in Hamburg in 1619 (Roberds and Velde 2016, pp. 343 and 350; Bindseil 2019, pp. 211-222).

The fortunes of the Banco della Piazza started to be compromised at the end of the 1610s. Following the difficulties in funding the Uskok War of 1615-17, many government payments had fallen into long arrears (Cecchini 2021, pp. 114-5 and 122-123). In September 1619, Giovanni Vendramin, a merchant who was owed substantial sums for having sold large amounts of silver to the Mint, petitioned the Senate to obtain the ability to mobilize his frozen credits, by making them transferable to third parties as long as the government would not repay its debts in specie. As Vendramin himself recalled, such a practice had often been adopted in the past by many divisions of the public administration (Ugolini 2017, p. 43). The Senate accepted the petitioner's request in what was initially supposed to be a temporary device. It decided that purveyors to the State would be paid by being credited on transferable current accounts in a special government ledger called "*banco del giro*". These sums could be transferred without limit to other account holders – and thus used as a means of payment – until the government would eventually repay the original debt in specie. To grant its acceptability, Banco del Giro money was made legal tender for all payments exceeding 100 ducats (Soresina 1889, pp. 9-13). In the beginning, Banco del Giro money was therefore intended to be the provisory mean to monetize the government's floating debt as long as the Treasury could not find the "hard cash" to repay them. However, the Republic quickly saw the advantages of the mechanism, and the Banco del Giro soon became the permanent institution at the very core of the Venetian monetary system. The working of the Banco del Giro would essentially remain the same as in the original Vendramin operations: on the one hand, Banco money would be created without restrictions as the government paid its purveyors by crediting their current accounts; while, on the other hand, Banco money would be destroyed via their redemptions into specie (realized through regular transfers of coins from the Mint to the Banco), which would occur on the government's initiative. The decree of May 3, 1619, creating the Banco del Giro established that an amount of 10,000 silver ducats should be transferred monthly from the Mint to the Banco del Giro to redeem Banco money. This sum would be rapidly increased to 50,000 by October 1620, and to 80,000 by August 1625 (Soresina 1889, p. 17).

To sum up, the Banco del Giro created in 1619 was a completely different bank than the Banco della Piazza, whose model had been adopted in Amsterdam and Hamburg. While the Banco della Piazza issued money against the deposit of specie by privates, the Banco del Giro issued State money which was only backed by a promise of future redemption into specie. While holders of Banco della Piazza money could always convert their assets into specie (albeit demonetized ones), holders of Banco del Giro money could never be sure that their demand for conversion would be accepted. It was the government itself which held the initiative to create

and destroy Banco del Giro money. It should also be noted that the Banco del Giro was just a division of the Treasury and had no separate governance as all important decisions on monetary policymaking were indeed taken by the Republic's governing body, i.e. the Senate, which was an expression of the mercantile oligarchy in power (Ugolini 2020, pp. 838-42). By creating the Banco del Giro, therefore, the Republic of Venice had instituted the first example ever of a purely managed, State-issued money. Given the substantial share of government operations within the domestic money market, the success of the new device was immediate. As early as November 1625, the popularity of Banco del Giro money had started to compromise the business of the Banco della Piazza, so the demise of the latter had started to be considered (Cecchini 2021, p. 123). The Banco della Piazza would be completely outcompeted during the crisis of 1630, leading to its eventual closure in 1638 (Ugolini 2017, p. 44).

3.2. First shock: 1630

In 1628, Venice allied with France and declared war on the Habsburgs, in what is known by historians as the War of the Mantuan Succession, which was the Italian chapter of the Europe-wide Thirty Years' War. Military operations in Northern Italy escalated in March 1629, in a context of famine which had been enduring since the previous year and which obliged the Venetian government to intervene in the grain market (Goodhart et al. 2021, pp. 309-10). To pay for the troops that were defending Mantua from the Habsburgs' attacks as well as for its purchases of cereals, the government relied on the Banco del Giro, whose money supply increased; accordingly, the silver value of Banco money started to decline, but the depreciation remained limited until February 1630 (Mandich 1957, p. 1141).

It was only in March 1630 that the situation started to precipitate. Imperial soldiers who were crossing the Alps took the bubonic plague with them and, following the Carnival festivities, major outbreaks of the disease took place throughout Northern Italy – including, among others, Milan and several mainland cities under Venetian rule. While the pandemic ravaged in the mainland, the city of Venice was flooded with masses of refugees fleeing war, famine, and disease – whom the government found itself obliged to feed (Cecchini 2021, pp. 120-1). Moreover, on May 29, 1630, the Republic's army was disbanded by Imperial troops in the Battle of Villabona, which opened the path to the eventual surrender of Mantua on July 18. By June, Banco del Giro money supply had reached the record level of 2.7 million ducats (Tucci 1973). In a petition to the government, a group of merchants overtly complained that such an amount exceeded "the sum that the place can absorb, and therefore [its] true capacity",

and generated "very serious disorders" on the foreign exchange market (Cecchini 2021, pp. 124-6; our translation). On July 29, the Senate appointed by decree a new magistrature (*Inquisitori del Banco Giro*) to improve the financial situation and the governance of the Banco. With the same decree, the Senate took the first steps to reduce the outstanding amount of Banco money, by encouraging account holders to convert their sight claims on the bank into long-term government debt (Soresina 1889, pp. 23-6).

In September 1630, the bubonic plague eventually burst into the Lagoon. Peaking in October and lasting until December, this major epidemic wave would cost the city around 21,000 casualties and an enormous financial burden to support the locked-down population (Goodhart et al. 2021, pp. 308-10). It was in this moment of most intense financial need that the *Inquisitori* presented their proposal to largely reduce the Banco's money supply. In their September 18 audition with the Senate, the magistrates underlined that the depreciation of Banco money had inflicted on the government no less than 100,000 ducats of unanticipated losses in the realization of payments in foreign currency needed to pay mercenaries' wages and bullion imports. To stop the depreciation, the committee proposed three measures: 1) to devote to the Banco del Giro the receipts of a new tax; 2) to implement a big, one-off redemption of Banco del Giro money in specie by resorting to the so-called "Grand Deposit", i.e. an emergency reserve of bullion which had been accumulated by the Mint since the decree of July 25, 1584; and 3) to temporarily suspend the publication of exchange rates to restore calm on the foreign exchange market (Cecchini 2021, pp. 116 and 127-8). As the *Inquisitori*'s proposals were made effective on September 24, the government turned to a restrictive monetary policy at the very height of the sanitary crisis. Thanks to these measures as well as to the resorption of military expenditures (a truce was agreed on October 29), the financial situation of the Banco del Giro was significantly strengthened, leading to a strong appreciation of its money, although not to the pre-crisis levels (Goodhart et al. 2021, pp. 311-2). By December 1630, the Banco's money supply had been reduced to 1.4 million ducats (from 2.7 million ducats in June 1630). After this initial "shock therapy", however, the restrictive turn was paused, as the economy slowly coalesced from the impact of the war and pandemic: the target pre-crisis level of 0.8 million ducats would only be met again in 1638 (Tucci 1973).

3.3. Second shock: 1648-50

From 1638 to 1643, Banco del Giro's money remained strong, prompting complaints and petitions from merchants who asked for an increase in its supply (Luzzatto 1934, pp. 244-6).

In 1644, however, Venice's diplomatic relations with the Ottoman Empire rapidly deteriorated and after some months of incertitude, in June 1645 an Ottoman army landed in Crete. Following the loss of Cyprus in 1573, Crete remained the last substantial remnant of the Venetian colonial empire in the Eastern Mediterranean. Ottoman leaders expected the island to fall quickly into their hands – as did the Venetians (Vaccher 2016, p. 575) – but the military operations remained relatively sluggish for several months due to a variety of reasons (including an outburst of plague). In May 1648, however, the conflict rapidly escalated simultaneously on two fronts. On the one hand, the Ottoman army started to besiege the city of Candia (modern-day Heraklion), the island's capital and Venetian stronghold. On the other hand, the Venetian fleet started a large-scale blockade of the Dardanelles Strait, to cut off naval supplies to the city of Constantinople. Supporting logistically both the besieged population of Candia and the fleet in the Dardanelles implied an abrupt scale-up of the government's financial effort (Vaccher 2016). As the Republic's official chronicler, Giovan Battista Nani, wrote in his *History of the Venetian Republic*:

> The Senate was constantly deploying every effort. So many warships, cannons, weapons, and all kinds of equipment were coming out of the Arsenal, that everybody was stunned that such huge stocks could have been gathered there. And besides the immense expenditures due to all such armaments, ship rentals, and countless other initiatives, more than 8,200,000 ducats in cash had been sent to Dalmatia and Crete (Nani 1679, p. 270; authors' translation).

The already strained situation was further aggravated by the spectre of the famine. An extraordinarily wet spring announced bad harvests, and the price of cereals jumped. Riots developed in several mainland cities (Pezzolo 2021, pp. 71-2 and 106), prompting the government to intervene in the grain market. As Nani recalls:

> If the tough war with the Turks did not demoralize Senators, it was a major source of concern to them: as in the previous fiscal years the budget had been weakened by heavy expenditures […], it was not easy to find a solution for strengthening it and facing new challenges. […] Besides all this, a shortage of grain developed, as fields and crops were compromised by rainfalls and floods; and it became necessary to import it from abroad, even from the North, by promising to pay exporters one ducat per bushel above market price (Nani 1679, p. 189; authors' translation).

This rapid ramping up of government spending could no longer be met through traditional increases in taxation as in the first phase of the conflict (Pezzolo 2021).

Consequently (and similarly to what had been done in 1630), the government had to resort to the monetization of its deficits through the Banco del Giro. As in the previous crisis, the creation of Banco money skyrocketed, while the regular redemption of Banco money in specie was discontinued. Once more, the result was a strong depreciation of the value of Banco del Giro money (Luzzatto 1934, pp. 246-7; Roberds and Velde 2016, pp. 337-8).

The escalation of the military efforts by the Venetians was effective in derailing the Ottoman strategy. The blockade of the Dardanelles, which made the victualling of Constantinople (already strained by the bad harvests) even more difficult, increased the popular discontent in the capital city of the Ottoman Empire. In August 1648, the Grand Vizier was murdered by a mob, and Sultan Ibrahim I was imprisoned and then beheaded in a palace *coup* (Isom-Verhaaren 2016). Unrest at the very heart of the Empire cut off all supply lines to the Ottoman army in Crete. As a result, the military pressure on Candia weakened substantially, and the Venetians were thus allowed to de-escalate accordingly (Vaccher 2016, pp. 584-6). The siege of Candia continued, but the outcome of the war became much less obvious than it had appeared beforehand. It would not be until as late as 1669 that a regain in Ottoman effort would lead to the eventual capitulation of the city.

The success of Venice's military and logistical operations in 1648-50 gave room for some respite, allowing the government to rein in the floating debt. At the same time, other sources of long-term funding, such as forced loans and lotteries, were found (Pezzolo 2021). The outstanding amount of Banco del Giro money peaked in 1650 (Luzzatto 1934, p. 246), but in December of that year, the government increased the monthly amount of redemptions of Banco money into specie, so that during the year 1651 the Banco del Giro's liabilities decreased by more than one third (Tucci 1973; Pezzolo 2021, p. 97). Moreover, to increase its demand, in 1651 the Banco's money was made the sole legal tender for all payments above 50 ducats (instead of 100) – although the extent to which the rule was enforced remains unclear (Roberds and Velde 2016, p. 338). The sharp change in the Republic's policy since December 1650 is clearly stated in Nani's official chronicle:

> Because of war expenditures, the Banco del Giro found itself excessively overburdened, and this entailed an increase in the price of currencies of more than one quarter, which jeopardized trade with foreign countries […]. Therefore, despite the expenditures induced by the war, the Senate decided to redeem in specie more than one million of the Banco's debt – thanks to which its balance sheet was shored up, and consequently, the prices of currencies and commodities went back to their usual levels (Nani 1679, p. 341; authors' translation).

Although the Cretan War would last until 1669, after 1650 the Republic managed to finance its military efforts without resorting to monetary expansions. On the contrary, on May 5, 1666, while the siege of Candia was still underway, the Senate decided to go one step further and make Banco del Giro money fully convertible into specie on demand. The reform, which also allowed privates to open deposit accounts at will (Soresina 1889, p. 36), substantially modified the nature of the Banco del Giro model, making it closer to the one of the Banco della Piazza. With the 1666 reform, the early Venetian experiment with purely managed State-issued money was therefore terminated. From this moment on, and until the eventual dissolution of the Republic of Venice in 1797, Banco del Giro money became stably pegged to silver specie – except between 1714 and 1739, when its convertibility was suspended in connection with the Second Morean War (Roberds and Velde 2016, pp. 337-9).

4. Data

4.1. Exchange rates

The Historical Archive of Bocconi University in Milan contains the entire Saminiati-Pazzi family records, which comprise correspondences, ledgers, and economic documents relating to the international business conducted since the mid-15th century by two of the most important banking families of Florence, i.e. the Saminiati and the Pazzi (Ziani 2007).[3] The Saminiati-Pazzi company (a private partnership whose list of partners changed very often throughout the early modern era) was one of the most important merchant banks in Florence, at a time when Florentine bankers played a very important role in international trade and finance and dominated the business of bills of exchange (Accominotti and Ugolini 2020). Through their network of correspondents in the most important European financial centres (including Venice), these merchant banks were well positioned to collect and disseminate information, including exchange rate quotations, to exploit profit opportunities, when and where they occurred. This

[3] "[The Archive] is made up of 1,000 books and registers concerning both the administration of the real estate of the great Tuscan families – the Saminiati and the Pazzi – and the economic activities exercised by the members of two families associated with other merchants […]. To this series must be added the abundant correspondence […], devoted almost solely to commercial and banking operations, of the 'companies' established by the Saminiati between 1624 and 1719" (Romani 1966, p. 115).

is the reason why, in their correspondence, merchants reported current political and economic information, including the current exchange rate.

Among all the documents preserved in the Saminiati-Pazzi Archive, we focus on the exchange rate bulletins (*listini de' cambi*) which were remitted to Florence by the Saminiati's correspondents in Venice, and which provide the prices of foreign bills of exchange on the Rialto Square.

Figure 1 provides an example of the information reported in the exchange rate bulletins. This includes the date (*A dì 12 Marzo 1660*), followed by a list of European cities including the most important financial centres of Western Europe as well as exchange fairs (such as Bisenzone, Bolzano, Lyon or Nuremberg), the currency of reference associated to each exchange pair, and the exchange rate itself.[4] Toward the end of the list, it is also possible to find information on the price of different types of cooking oils, starting from *Ogli chiari di Lecce*, which are all expressed in Banco del Giro ducats. The last row of the document indicates "*Domen. Coffani deput. e figli"*, i.e. the name of the merchant which was licensed to print such financial information. In 17th-century Venice, the Coffani family was formally licenced to print the official exchange rate bulletins of the Rialto market (McCusker and Gravesteijn 1991).[5]

Figure 1 about here

As these data have never been digitized or transcribed before, we hand-collected the information reported in 883 *listini de'cambi* for Venice between January 2, 1627, and March 24, 1684. With a total of 21,035 exchange rate quotes between Venice and 32 other cities or exchange fairs, our dataset one of the richest available for early modern European history.[6] In addition to the exchange rate data, we have also hand-collected around 3,345 prices of the different types of oils quoted on the Piazza di Rialto.

[4] For what concerns the exchange rates, the digits after the decimal point, here expressed as fractions, have been transformed into decimals.

[5] However, this last information is not reported in all documents, as it will be possible to see in the examples provided in Figure 2.

[6] Appendix Table 1 provides the full list of exchange fairs available in our dataset, together with the name of the foreign bill of reference and the number of observations available for each city. The information reported in this table also highlights the fact that for 23 out of the 32 exchange fairs present in our dataset, we have exchange rate values available in more than 80% of the cases.

Figure 2 about here

Unfortunately, the exchange rate quotes we have collected are not always available at a weekly frequency, as in the documents reported in Figure 2. With a total of 883 documents collected over a period of around 57 years, on average we can observe exchange rates every 24 days, i.e. roughly once per month. This is the reason why our empirical analysis will be based on a sample of monthly observations. Note that this is a dramatic improvement with respect to the current state of the art: for instance, the exchange rate series for Venice provided by Denzel (2010) only features one observation per year. The number of *listini de'cambi* analysed in each month between 1627 and 1684 is shown in Figure 3, while Figure 4 presents the number of exchange rates quoted in each month.

Figures 3 and 4 about here

By analyzing the exchange rate quotations reported in the *listini de'cambi*, it is possible to note that not all of them were expressed using the "uncertain for certain" method. To allow for a comparison between the different exchange rate values, we standardized all quotes to have all the exchange rates quoted using the "uncertain for certain" method (Spufford et al. 1986; Mueller 2019), i.e. expressing the number of units of foreign currency per 100 Banco ducats. With such a quotation, the rise from 97.75 to 98, as shown for Cologne in Figure 2 during the period between June 16, 1628, and June 30, 1628, would indicate an appreciation of the Banco ducat as more groschens were needed to buy 100 ducats.

One of the problems inherent to using early-modern exchange rate series is the fact that, at the time, the prices quoted were not for *spot* exchange rates but for longer maturities, and therefore included an implicit interest rate which cannot be separated from the "pure" exchange rate (De Roover 1953). As pointed out by the literature, the interest rate which was incorporated in the quoted price of long-maturity bills of exchange was the interest rate applying in the place on which the bills were payable (Flandreau et al. 2009b). As a result, in case interest rates were very high in the place in which the bill was payable, the price of the bill would be substantially lower than the one reflecting the "pure" (spot) exchange rate. To check whether changes in the interest rate component might potentially bias our exchange rate series, in Figure 5 we compare

the exchange rate between Venice and the Bisenzone fairs using both our data (Saminiati-Pazzi archive) and the ones reported in Da Silva (1969).[7] If the interest rate differential had been significant between Venice and Bisenzone (which might arguably have been the case during the two episodes of fiscal deficit monetization in Venice), the gap between the Venice-on-Bisenzone and the Bisenzone-on-Venice long-maturity exchange rate would have been large. However, the data presented Figure 5 show the high correlation (0.99) between the Venice-on-Bisenzone exchange rate series from our source with the Bisenzone-on-Venice exchange rate series from Da Silva (1969). The figure suggests that the weight of the interest rate component was relatively small even during major shocks: this encourages us to think that the price of long-maturity bills of exchange can be relatively conveniently taken as a proxy for the "pure" (spot) exchange rate.

Figure 5 about here

4.2. Prices

As information on inflation is totally unavailable for 17th-century Venice, we looked for proxies. A very popular indicator for the price level which is often used for early-modern economies is the price of cereals. Although some fragmentary data on wheat prices are available for this period (Goodhart et al. 2021, p. 308), they are unfit for our purpose for at least two reasons. First, at the time wheat prices were highly sensitive from a social point of view and they were therefore heavily manipulated by the government. Second, the prices of wheat available for the period are not quoted in Banco del Giro ducats and should therefore be converted by using data on the exchange between Banco money and local currency – data which are, in turn, unavailable on a systematic basis. Given these limitations, we were obliged to resort to the only price series quoted in Banco ducats that are available together with our exchange rate data, i.e. the prices of the commodities (cooking oils) listed on the *listini de' cambi* (see Section 4.1).

Another important price series we consider is the agio, i.e. the internal exchange rate between the money issued by the Banco del Giro and legal domestic metallic (silver) currency, or,

[7] As discussed above, the exchange rate is expressed in terms of foreign currency needed to buy 100 ducats. On Bisenzone fairs, see Pezzolo and Tattara (2008).

alternatively, the price of bullion (silver) in Banco ducats. Whenever the money issued by banks is inconvertible into metallic coins or bars at a fixed price (which was typically the case in the early modern period), the agio can be taken as an important indicator of the strength of the inconvertible money (Sargent and Velde 1995; Antipa 2016; Quinn and Roberds 2019). In the case of Venice, the agio used to be positive most of the time – meaning that in normal times, the Banco ducat used to be overvalued with respect to the legal metallic ducat (Roberts and Velde 2016). However, data on the agio are unfortunately very fragmentary for 17th-century Venice. The only available information comes from Mandich (1957, p. 1173), who was able to retrieve archival data on the price of silver in Banco ducats for a handful of dates during the period 1625-1635. We use these fragmentary data (15 observations) to reconstruct the agio.

4.3. Fiscal deficit monetization

We also gather all the available information on the size of Banco del Giro's liabilities. As for the agio, data on Banco del Giro's liabilities is also unfortunately very fragmentary. The entire available archival information was collected by Tucci (1973, pp. 370 and 441-7), and consists of 31 monthly observations between March 1627 and March 1666. Such liabilities exclusively consisted of the current account credits held by accountholders, which were used as money as they were freely transferable (Goodhart et al. 2021). As a result, the Banco's liabilities indicate the total supply of Banco ducats. Given that until 1666 Banco ducats were only issued to pay for government expenditures which could not be honoured in "hard cash", these values can be considered a good proxy of the amount of fiscal deficit monetization conducted by the Venetian government (see Section 3). Importantly, as bills of exchange were compulsorily made payable in Banco money, exchange rates were expressed in this currency (see Section 4.1).

Given that the Banco del Giro's liabilities are only available for 31 months, we also create an alternative measure of fiscal deficit monetization by replacing the missing monthly data of the Banco del Giro's liabilities using the following linear interpolation:

$$x_{t,i} \equiv \frac{i}{s}\left(y_{t,s} - y_{t-1,s}\right) + y_{t-1,s} = \frac{i}{s}\, y_{t,s} + s - \frac{s-i}{s} y_{t-1,s} \qquad (2)$$

where $y_{t,s}$ are the original series and $x_{t,i}$ is the interpolated series. With $x_{t,i} = y_{t,i}$ for $i = s$, as the interpolation does not change the available observations.

As an alternative indicator of fiscal deficit monetization shocks, we also construct a dummy variable based on qualitative historical evidence. We define "fiscal deficit monetization shocks" as periods of rampant monetization of government deficits through the Banco del Giro. It must be noted that this definition is tailored to account for the chronology of monetisation shocks in a strict sense, which does *not* exactly coincide with the timing of other types of shocks (e.g. real). Based on the extensive secondary sources summarized in Section 3, we create a dummy variable taking the value of 1 during two periods. The first going from March 1, 1630 (major outbreak of bubonic plague in the Venetian mainland following the Carnival festivities) until September 24, 1630 (approval of the *Inquisitori*'s proposals allowing for an immediate decrease of Banco money supply: see Section 3.2). The second from May 1, 1648 (beginning of the Ottoman siege of Candia and the Venetian blockade of the Dardanelles Strait) until December 3, 1650 (approval of the reform increasing the redemptions of Banco money into specie: see Section 3.3).

5. Empirical analysis

5.1. Methodology

The data collected from the Saminiati-Pazzi Archive provide a reliable and high-frequency source of data on the foreign exchange rate for Venice in the 17th century. Therefore, our empirical analysis focuses on understanding how the fiscal deficit monetization shocks mentioned in the previous sections affected the external value of the Venetian Banco ducat. To do so, we adopt an event study analysis approach, an approach which has been recently used extensively to study how exchange rates react to monetary policy news (see e.g. Conrad and Lamla 2010; Ferrari et al. 2021; Gürkaynak et al. 2021).

Event study analyses have also been used in a few studies aimed at investigating the role of idiosyncratic factors, such as monetary policy changes adopted in Milan in 1400 (Bell et al. 2013) or the debasements of the British pound of 1544-51 (Li 2015), on exchange rate movements in the 15th and 16th centuries. This literature shares the common aim to shed light on how monetary policy events impact exchange rates, having in common a double challenge: the first challenge is to identify the event that can be considered an exogenous shock, while the second one is to test its relevance by mapping the corresponding response of exchange rates.

Our empirical analysis aims to investigate the effect of the two periods of fiscal deficit monetization shocks in Venice in 1630 and 1648-50 (see discussion in Section 3) on the exchange rate between the Banco ducat and the currency of the other cities in our database. It is important to note that if today analyses of the impact of monetary policy events on the exchange rate are implemented using high-frequency (minute-level) data around monetary policy events (see e.g. Ferrari et al. 2021, who focus their analysis on the 15-minute window around monetary policy announcements), having access to weekly or monthly data in early modern times was already challenging. In addition to the lack of available data, we know that in early modern times, the association between exchange rate movements and news took much more time to materialize. As a matter of fact, at the time, changes in exchange rates were determined by the usance and speed of communication, that in turn changed from time to time and from venue to venue. Looking, for example, at the evolution of the exchange rate between Venice, Bruges, and Barcelona in the 15th century, Li (2015) documents that information from Venice took on average between 30 and 60 days to reach Bruges and 22 to 45 days to reach Barcelona.

In addition, in each venue local and foreign traders can have information advantages, gathering personally soft and hard news, to exploit the flow of insider information for speculation in the money markets. For example, in the case of the Great Debasement of 1544-51, the information was known among merchants from an early date as compared to the moment in which the scheme was publicly announced (Li 2015). In this respect, it is worth noting that especially in early modern Venice oral networks, including informal talk of gossip and rumours, and public policies were deeply intertwined (Horodowich 2005). Given the lag response of exchange rate movement to news, we believe that the use of monthly data is a prudent assumption. Therefore, we aggregate our exchange rate quotes to have, for each city/fair, observations at a monthly frequency: that is, whenever more than one exchange rate quote is reported for a given city/fair in a month, we compute the average value of the exchange rate during that period.

From 1619 to 1666 the Banco del Giro ducat was inconvertible at a fixed price into metallic coins or bars. At the same time, the international monetary system of the time was multipolar, meaning that no single dominant currency (such as the British pound under the classical gold standard, or the US dollar today) existed at the time. As a result, we have no self-evident good indicator of the external value of the Venetian Banco ducat. To overcome this difficulty, we construct a basic index (a simple average) of the value of the Venetian Banco ducat against an unweighted basket of 16 currencies, composed of the 16 cities/fairs whose

data are more frequent in our database.[8] Figure 6 shows the interquartile distribution of the bilateral exchange rate between the Venetian Banco ducat and each one of the 16 cities/fairs in our sample. This figure provides a clear idea of the low dispersion of bilateral exchange rates, whose fluctuations were therefore more predominantly dictated by common factors than by specific bilateral factors. On this basis, we consider our currency index as a good indicator of the evolution of the external value of the Venetian Banco ducat.

Figure 6 about here

5.2. Stylized facts

Figure 6 shows the evolution of the average exchange rate between a sample of 16 currencies and the Venetian ducat together with the evolution of the Banco del Giro's liabilities. This figure provides a preliminary overview of the association between exchange rate depreciations and government deficit monetization (implemented via the expansion of Banco del Giro's liabilities) in the Venetian Republic. Indeed, despite the limited data on the size of Banco del Giro's liabilities, it is possible to notice how their increase by around 30% between April and June 1630 was associated with a sharp depreciation of the Venetian Banco ducat. This sharp decline had almost reverted by the end of 1630, following a drop in the Banco's liabilities of around 45% between June 1630 and December 1630. Similarly, the increase in the Banco del Giro liabilities between March 1648 and December 1650 is associated with a large depreciation of the ducat value, followed by an appreciation subsequent to the contraction of these liabilities.

Figure 7 about here

It is interesting to ask whether the impact of fiscal deficit monetization, which Figure 7 suggests being rapid and significant on exchange rates, was also equally strong on other indicators of the real value of the Venetian Banco ducat – i.e., commodity prices and bullion prices. As explained in Section 4.2, data for commodity prices and the agio are very fragmentary for 17th-century Venice. In Figure 8, we compare the evolution of the Venetian Banco ducat's

[8] The median exchange rate has been computed as the median value of the exchange rate for the first 16 cities reported in Appendix Table 1, i.e., those for which exchange rates are available in more than 98% of the codified documents.

purchasing power in terms of foreign currencies (viz., our currency index based on a basket of 16 currencies), in terms of commodities (viz., the price index of oils quoted in the original bulletins), and in terms of bullion (viz., the agio), for the period 1627-1635 (i.e., the only one for which information on the agio is available). Despite the fragmentary nature of available data, a few interesting features emerge from the picture. On the one hand, unsurprisingly, commodity prices appear to have behaved relatively erratically, following the state of supply and demand in their specific markets rather than evolutions in the monetary stance: for instance, at the peak of the 1630 shock, the purchasing power of the ducat in terms of oils briefly increased despite the Banco's rampant expansionary policy, probably because of a drop in the demand for these commodities during the plague. On the other hand, while the patterns followed by the external and internal exchange rates appear to be more mutually consistent, some differences between the two series also emerge: the purchasing power of the ducat in terms of bullion decreased well before the explosion of fiscal deficit monetization in 1630 and subsequently recovered quite slowly after the Banco del Giro implemented a strongly contractionary policy, while this was not the case of the purchasing power of the ducat in terms of foreign currencies. Thus, among available indicators of the real value of the Banco ducat, the exchange rate appears to have been the one which was more sensitive to fiscal deficit monetization.

Figure 8 about here

5.3. Econometric analysis

Based on the stylized facts presented in Figure 7, it is possible to observe a depreciation of the Venetian ducat around the expansion of the Banco del Giro's liabilities and the associated fiscal deficit monetization shock windows that we have discussed in Section 4.3. Therefore, our empirical estimation aims at assessing the response of the exchange rate to these the associated expansion of the Banco del Giro's liabilities implemented in the Venetian Republic.

In our baseline, we regress the (log) exchange rate change on the measure of fiscal deficit monetization represented by the Banco del Giro's liabilities:

$$\Delta ER_{i,t} = \beta_1 Fiscal\ deficit\ monetization_t + \beta_2\, \Delta Oli_t + \alpha_i + \epsilon_{i,t} \qquad (1)$$

where ΔER is the change in the exchange rate between the Venetian ducat and the currency of city/fair *i* at month *t*. Fiscal deficit monetization$_t$ is our main independent variable, which is either the value of the Banco del Giro's liabilities or its interpolated series. $\Delta\ Oli_t$ is the change in the price of cooking oils, i.e. *oli chiari*, *oli mosti* or an average of the two measures, and is used as a proxy of the change in prices in the Republic of Venice, given the absence of historical series on inflation. We also control for city fixed effects, α_i, to account for city-specific patterns in the exchange rate, which might have been motivated by the proximity of a city/fair to Venice and associated with a faster diffusion of information between the two cities. Given the inconvertibility of the Venetian ducat between 1619 and May 1666, our baseline estimations are obtained focusing on the period that goes from January 1627 (the first month of availability of our exchange rate values) and May 1666.

The results of this baseline specification are presented in Table 1. Columns (1)-(4) show the estimations using the original series of Banco del Giro's liabilities, while Columns (5)-(8) its interpolated values.[9] The negative and statistically significant coefficient of the fiscal deficit monetization variable presented in Column (1) suggests that monetization of fiscal deficits is associated with a depreciation of the Banco ducat. This means that the expansionary fiscal policies conducted by the Venetian Republic during these periods led to a depreciation of the Banco ducat. Columns (2)-(4) add the change in *oli chiari*, *oli mosti* and an *oli index* obtained as the average price of the two cooking oils employed in columns (2) and columns (3) respectively. The positive and statistically significant coefficients of the oli variables presented in columns (2)-(4) suggest that increases in the price of these commodities are associated with episodes of appreciation of the Banco ducat. Importantly, the magnitude and the statistical significance of the coefficient associated with the fiscal deficit monetization variable are unaffected by the inclusion of these additional control variables. In Columns (5)-(8) we perform the same estimations presented in columns (1)-(4), but using the interpolated series of the Banco del Giro's liabilities instead of only using the data points provided by Tucci (1973). The negative and statistically significant coefficient obtained using the interpolated series confirms the results obtained using the original series, i.e. that expansions of the Banco's liabilities are linked to depreciations of the ducat. The low dispersion of bilateral exchange

[9] As already mentioned in Section 4.3., the data on the Banco del Giro's liabilities have been collected from Tucci (1973). Its database comprises 31 monthly observations between March 1627 and March 1666. This explains the limited number of observations reported for the estimations run using the original (non-interpolated) series on the Banco del Giro's liabilities.

rates around the median values (see Figure 6) confirms that the Venetian ducat depreciated simultaneously against all other currencies. This is not a trivial result, which confirms that the depreciation was predominantly tied to fiscal deficit monetization: the Republic of Venice was not the only country to endure the real and fiscal shock, yet it was the only one to resort to fiscal deficit monetization.

Table 1 about here

As multiple factors might have affected the exchange rate dynamics of the Venetian ducat over the entire period of our analysis, we test the robustness of our results by focusing on a narrow window around the fiscal policy shocks of our interest. This ensures that we capture the effect of the fiscal policy expansions (and following contractions) on the Venetian Banco ducat with as little noise as possible.

Figure 9 summarizes the results obtained narrowing down the horizon of our empirical analysis to the 12, 24, 26, and 48 months around the fiscal deficit monetization episodes conducted in Venice during the period of our analysis. Similar to the results shown in Table 1, Figure 9 documents that periods of fiscal policy expansion are associated with the depreciation of the Venetian Banco ducat. In addition, the magnitude and statistical significance of the estimated coefficients remain almost unchanged across the various estimations, confirming that the effect we estimate is not affected by the spell of the analysed horizon.

Figure 9 about here

So far, we have analysed the two episodes of fiscal policy expansions together. Tables 2 and 3 replicate the results presented in Table 1 but focus on the two events individually. To do so, we split our sample into two periods: 1627-1639 and 1640-1666.[10] Despite the difference in the number of observations, which is mainly due to the fewer months of data available before the 1630 shock, the results presented in Tables 2 and 3 are overall consistent with the ones in Table 1. However, it is interesting to observe some minor discrepancies between the two episodes. In fact, we observe a relatively lower impact of the fiscal deficit monetisation on the exchange rate in 1630 (Table 2) compared to 1648-50 (Table 3). Figure 10 shows the difference

[10] This split allows us to assign the 9 years following the bubonic plague to the plague sample, and the following 8 years to the Cretan War period.

in the estimated magnitude of the effect between the two episodes for different time horizons. Given the limitations of available historical data (esp. concerning the liabilities series), these results should be taken with prudence. Still, these results seem to suggest that while the absolute depreciation of the Venetian Banco ducat was stronger in 1630 than in 1648-50, the exchange rate's sensitivity to fiscal deficit monetization was weaker in 1630 than in 1648-50 – something which was already observable in Figure 7. Given this, we might tentatively infer that over time, market participants became increasingly concerned about the potential negative effects of episodes of non-Ricardian behaviour by the Venetian government.

Figure 10 about here

5.4. Robustness checks

To assess the sensitivity of our results, we perform a series of robustness checks. First, given that the frequency of the exchange rate data coverage varies from city to city, the first category of robustness checks focuses on the subset of 16 cities/fairs for which the data are available in at least 98% of the cases. The results presented in Table 4 show that the use of a restricted sample of cities does not affect our conclusion that periods of expansionary fiscal policy are associated with the depreciation of the Venetian Banco ducat.

Table 4 about here

Next, we verify that our results are not driven by the frequency and volatility of the data on the Banco del Giro's liabilities. To do so, in Table 5, we replicate the results presented in Tables 1, 2 and 3, by replacing the fiscal deficit monetization variable with the fiscal deficit monetisation dummy discussed in Section 4.3. This dummy variable takes the value of 1 during periods of fiscal deficit monetisation shocks, i.e. from May to September 1630 and from May 1648 until December 1650, respectively. The results presented in Table 5 confirm the robustness of our results. This means that our data capture the strong link between fiscal policy expansions and exchange rate depreciations in Venice in the 17th century.

Table 5 about here

Next, we also control the robustness of our results by including the agio, i.e. the price of silver in Venetian Banco ducats, using the data gathered by Mandich (1957) for the period 1625-1635. Given the handful of monthly observations available (14 data points between September 1627 and May 1635), we estimate our results using the interpolated series for both the agio and the Banco del Giro's liabilities. The results presented in Table 6 confirm the robustness of our results. Adding the agio does not hamper the significance of the fiscal deficit monetization variable: while the agio reacted to the expansion of Banco del Giro's liabilities in a consistent way with respect to exchange rates (see Section 5.2), it was *not* the internal depreciation of the Banco ducat which primarily caused its external depreciation.

Table 6 about here

Finally, we verify that our results are robust to the extension of our analysis to the period of convertibility of the Venetian Banco ducat, i.e., from May 1666 until 1684. Once again, the results presented in this robustness table (Table 7) provide evidence in support of the idea that it was not the formal monetary regime, but specific fiscal expansions which brought to a depreciation of the ducat. To corroborate this conclusion, Figure 11 shows the evolution of the realised variance of exchange rate variations during the 1627-1684 period. This figure shows how the volatility of the Venetian Banco ducat was relatively similar during the inconvertibility (1627-1666) and convertibility periods (1666-1684), and that only the two episodes of fiscal deficit monetization were characterized by high volatility. This confirms that it was the government's actual fiscal stance (Ricardian vs. non-Ricardian), and not the formal monetary regime (convertibility vs. inconvertibility), which played a predominant role in determining the external credibility of the Venetian currency.

Table 7 and Figure 11 about here

6. Conclusions

Using the original bulletins of the Rialto market preserved in the Saminiati-Pazzi Archive at Bocconi University, we reconstructed new high-frequency exchange rate series between Venice and 32 other cities for the years 1627-1684. Using this new database and other

quantitative and qualitative historical sources, we implemented an event analysis aimed at investigating the impact of automatic government deficit monetization on the external value of the Venetian Banco ducat. Between 1619 and 1666, the Banco del Giro (a division of the Venetian government) created inconvertible fiat money to pay for public expenditures, and destroyed it through voluntary redemptions in specie – making it a quasi-prototypical example of a fiscal dominance institutional setting with a freely-floating State-issued money. This allowed us to analyse the consequences of fiscal deficit monetization on exchange rates during the major shocks of 1630 (bubonic plague) and 1648-50 (Cretan War).

Our findings suggest that under an institutional fiscal dominance setting, episodes of non-Ricardian fiscal policy had a strong and quick negative impact on the external value of the domestic currency – and this, even in a context in which deficits were the exception and fiscal policy consistently remained Ricardian in the long run. The reverse was also true: under the very same institutional setting, contractionary fiscal policies (i.e., a return to Ricardian behaviour) had a strong and positive impact on the external value of the domestic currency. Despite entering a potentially explosive spiral during the huge real shocks of 1630 and 1648-50, the external value of Banco money rapidly returned under control as soon as the government was able to restore its ability to raise tax revenues and issue long-term funded debt, henceforth reducing its short-term floating debt. Interestingly, our results suggest that the sensitivity of exchange rates to non-Ricardian policy even increased over time, being relatively higher in 1648-50 than in 1630 despite the smaller size of government deficit monetization. Interestingly, even the existence of non-negligible foreign exchange reserves (the Republic's "Grand Deposit" accumulated at the Mint) did not seem to sustain the credibility of the ducat, at least until such reserves were actually used to reduce the outstanding amount of money in circulation. But again, the reverse was also true: once the government went back to a Ricardian stance, the external credibility of the Banco ducat was quickly and fully restored – to the point that the eventual redesign of the monetary regime (i.e. the establishment of formal convertibility in 1666) did not generate any measurable impact on the behaviour of exchange rates.

Overall, the Venetian experiment of 1619-66 appears to suggest that, in an institutional fiscal dominance setting with freely-floating exchange rates, the external value of the domestic currency may be particularly sensitive to changes in the fiscal stance – and this, even if the government has a solid reputation for maintaining a Ricardian behaviour in the long run. This finding underlines the importance of the institutional design in determining the international credibility of a currency.

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Figures

Figure 1: Example of an exchange rate current

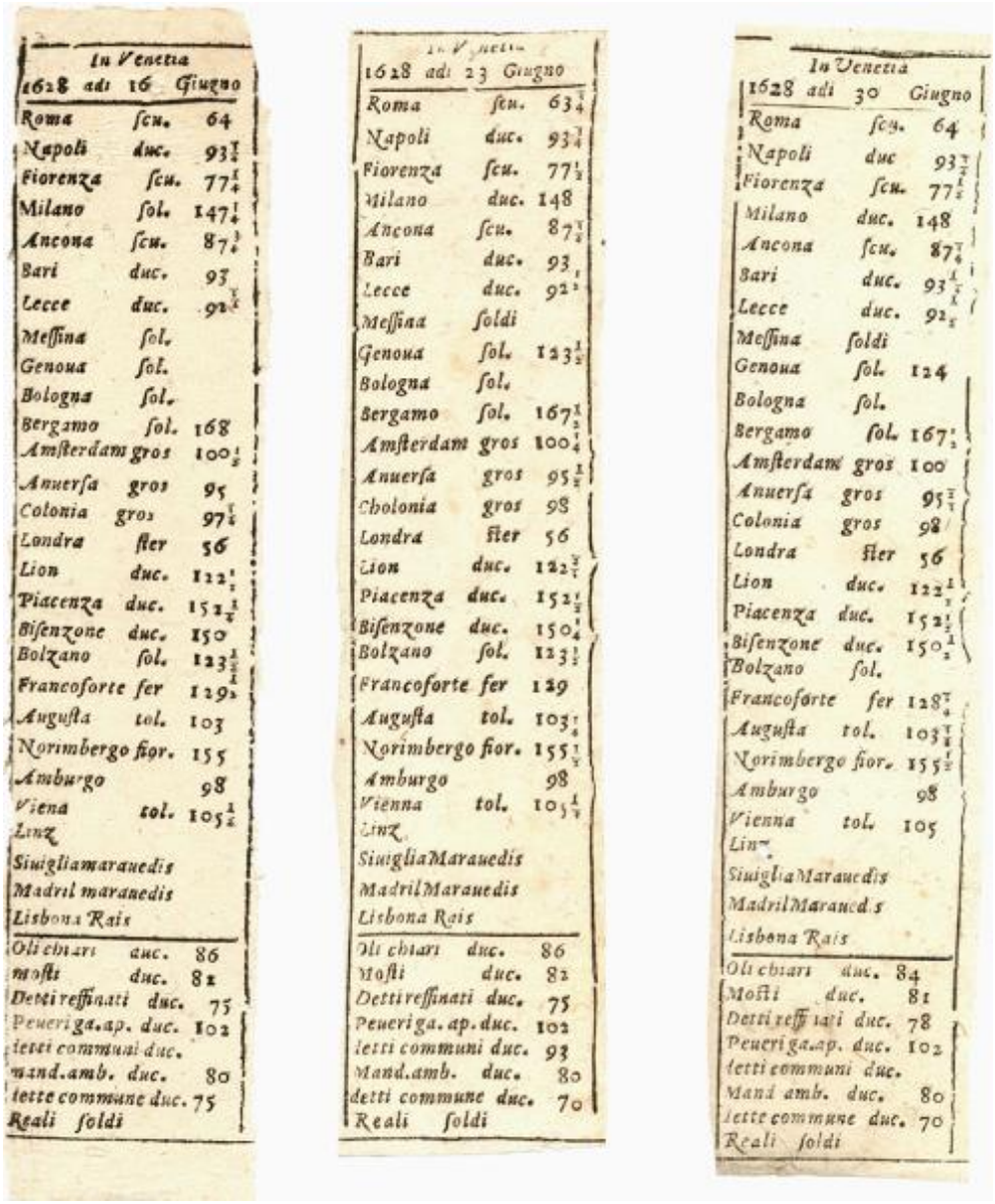
IN VENETIA
Alli 12. Marzo 1660.
FIERE DI

Murano	duc.
Bifenzone	duc. 187½
Lion	duc. 101½
Francoforte	fior. 120½
E Bolzano	fol.
Roma	ſcu. 53⅞
Napoli	duc. 90-
Fiorenza	ſcu. 72½
Liuorno p.se da 8. r.li	96-
Milano	ſol. 156-
Lucca	ſcu. 81½
Bologna	ſol. 128½
Ancona	ſcu. 82½
Bergamo	ſol. 173-
Genoua	ſol. 107½
Bari	duc. 91½
Lecce	duc. 91½
Anuerſa	groſ. 93-
Amſterdam	groſ. 95½
Amburgo	groſ. 92½
Colonia	groſ. 93½
Londra	ſter. 51½
Norimbergo	fior. 145-
Auguſta	tol. 96½
San Gallo	fior. 163½
Viena	tol. 97½
Ogli chiari di Lece	D. 88-
Detti di terra di Bari	D. 86-
Moſti	D. 82-
Raffinati	D. 80-

Domen. Caſſani deput. e ſogli.

Note: The figure provides an example of the information reported in the exchange rate currents (*listini de'cambi*) obtained from the Saminiati-Pazzi Archive.

Figure 2: Exchange rate currents – June 16, 23 and 30, 1628



In Venetia
1628 adi 16 Giugno

Roma	scu.	64
Napoli	duc.	93 1/4
Fiorenza	scu.	77 1/4
Milano	sol.	147 1/4
Ancona	scu.	87 1/4
Bari	duc.	93
Lecce	duc.	92 1/2
Messina	sol.	
Genoua	sol.	
Bologna	sol.	
Bergamo	sol.	168
Amsterdam	gros	100 1/2
Anuersa	gros	95
Colonia	gros	97 1/4
Londra	ster	56
Lion	duc.	122 1/2
Piacenza	duc.	152 1/2
Bisenzone	duc.	150
Bolzano	sol.	123 1/2
Francoforte	fer	129 1/2
Augusta	tol.	103
Norimbergo	fior.	155
Amburgo		98
Viena	tol.	105 1/2
Linz		
Siuigliamarauedis		
Madril marauedis		
Lisbona Rais		
Oli chiari	duc.	86
mosti	duc.	82
Detti reffinati	duc.	75
Peueriga.ap.	duc.	102
detti communi	duc.	
mand.amb.	duc.	80
Iette commune	duc.	75
Reali	soldi	

In Venetia
1628 adi 23 Giugno

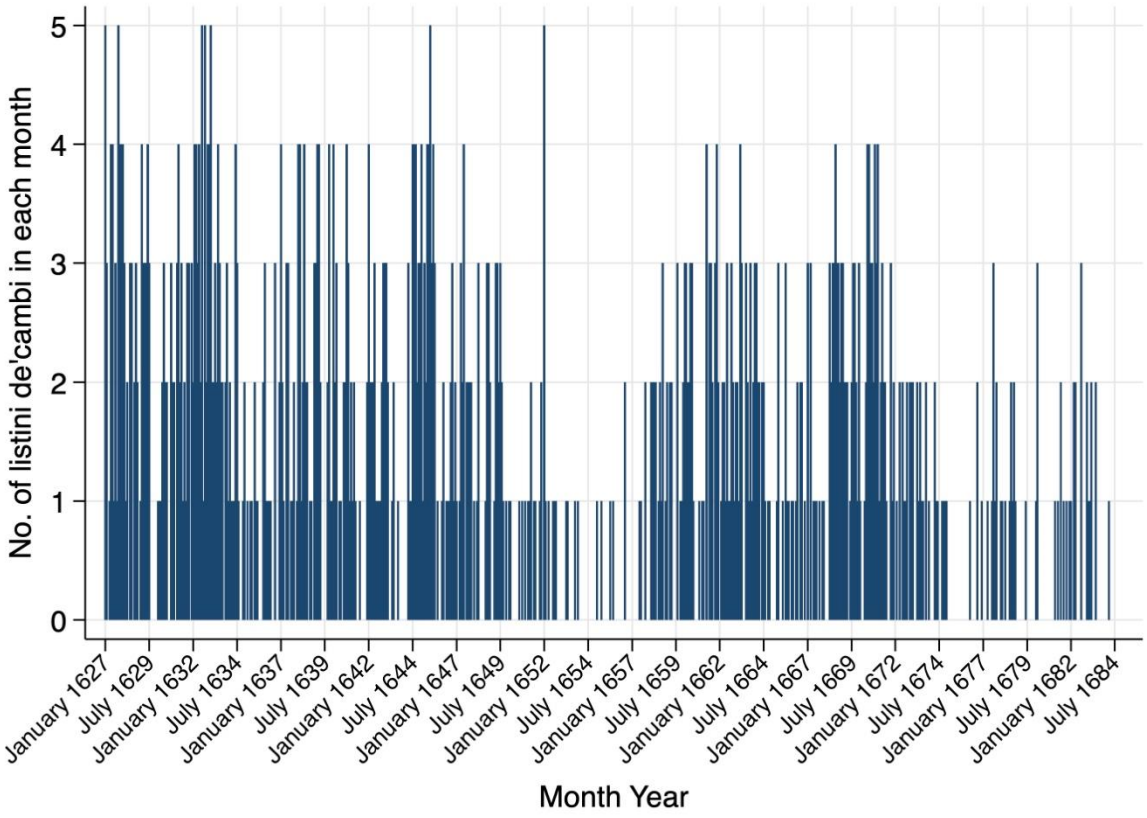
Roma	scu.	63 1/4
Napoli	duc.	93 3/4
Fiorenza	scu.	77 1/2
Milano	duc.	148
Ancona	scu.	87 1/2
Bari	duc.	93
Lecce	duc.	92 1/2
Messina	soldi	
Genoua	sol.	123 1/2
Bologna	sol.	
Bergamo	sol.	167 1/2
Amsterdam	gros	100 1/4
Anuersa	gros	95 1/2
Cholonia	gros	98
Londra	ster	56
Lion	duc.	122 1/2
Piacenza	duc.	152 1/2
Bisenzone	duc.	150 1/4
Bolzano	sol.	123 1/2
Francoforte	fer	129
Augusta	tol.	103 1/4
Norimbergo	fior.	155 1/2
Amburgo		98
Vienna	tol.	105 1/2
Linz		
SiuigliaMarauedis		
MadrilMarauedis		
Lisbona Rais		
Oli chiari	duc.	86
Mosti	duc.	82
Dettireffinati	duc.	75
Peueriga.ap.	duc.	102
detti communi	duc.	93
Mand.amb.	duc.	80
detti commune	duc.	70
Reali	soldi	

In Venetia
1628 adi 30 Giugno

Roma	scu.	64
Napoli	duc	93 1/2
Fiorenza	scu.	77 1/2
Milano	duc.	148
Ancona	scu.	87 1/4
Bari	duc.	93 1/2
Lecce	duc.	92 1/2
Messina	soldi	
Genoua	sol.	124
Bologna	sol.	
Bergamo	sol.	167 1/2
Amsterdam	gros	100
Anuersa	gros	95 1/2
Colonia	gros	98
Londra	ster	56
Lion	duc.	122 1/2
Piacenza	duc.	152 1/2
Bisenzone	duc.	150 1/2
Bolzano	sol.	
Francoforte	fer	128 1/4
Augusta	tol.	103 1/4
Norimbergo	fior.	155 1/2
Amburgo		98
Vienna	tol.	105
Linz		
SiuigliaMarauedis		
MadrilMarauedis		
Lisbona Rais		
Oli chiari	duc.	84
Mosti	duc.	81
Detti reffinati	duc.	78
Peueriga.ap.	duc.	102
detti communi	duc.	
Mand amb.	duc.	80
Iette commune	duc.	70
Reali	soldi	

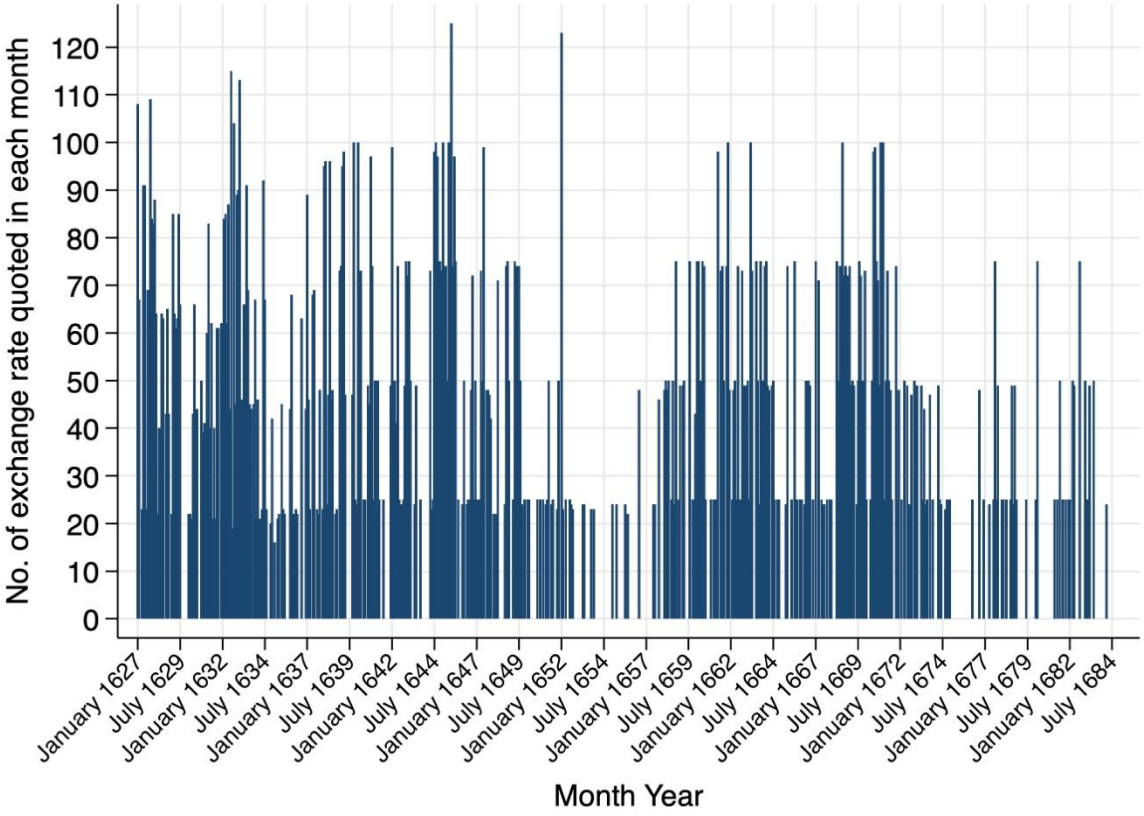
Note: The figure provides an example of the information reported in the exchange rate currents (*listini de'cambi*) obtained on June 16, 23 and 30 of 1628 from the Saminiati-Pazzi Archive.

Figure 3: Frequency of *listini de'cambi*, 1627-1684



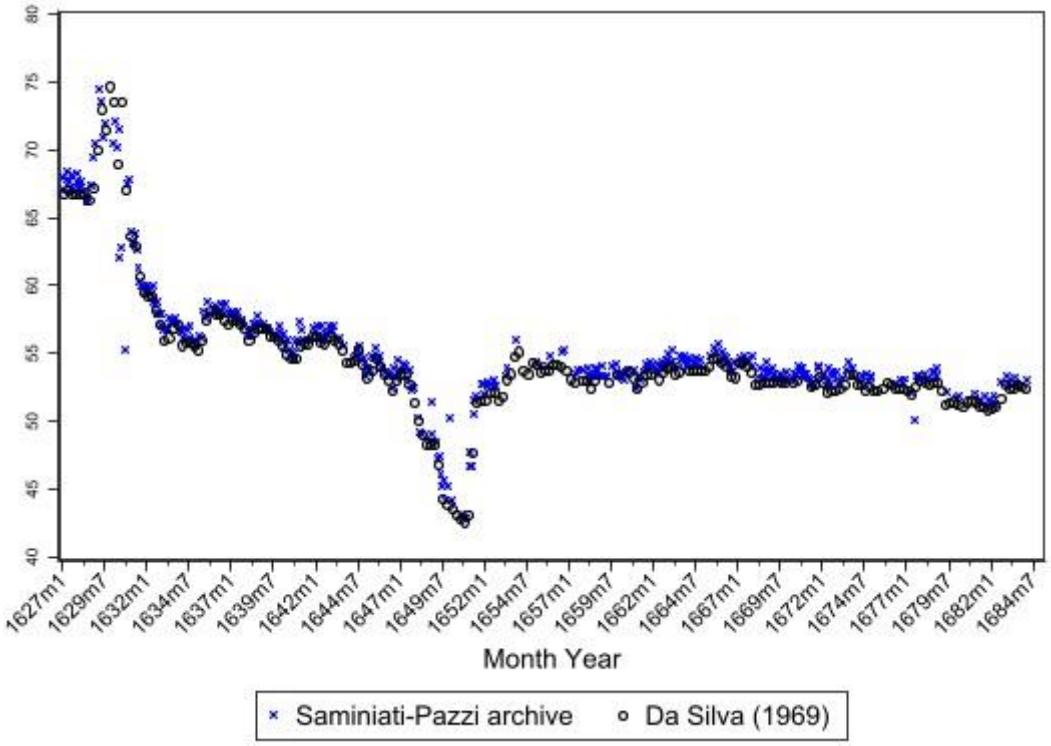
Note: The figure provides information on the number of *listini de'cambi* available in each month between 1627 and 1684.

Figure 4: Frequency of exchange rate quotations, 1627-1684



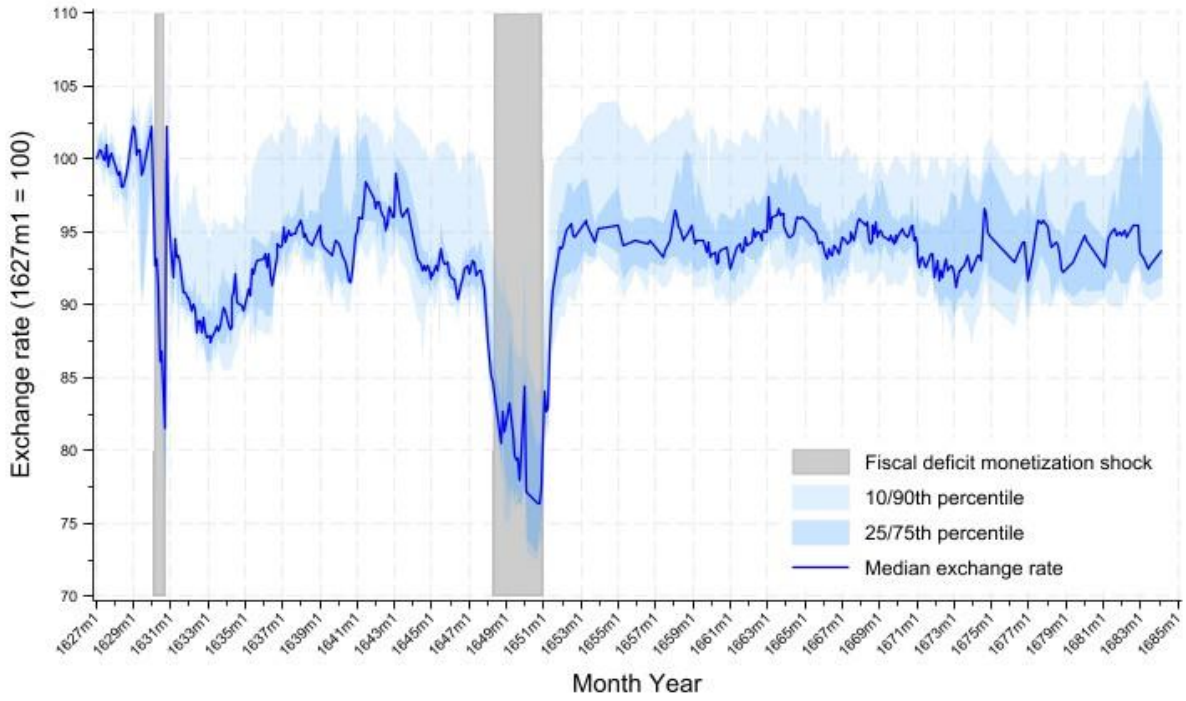
Note: The figure provides information on the number of exchange rate quotes available in each month between 1627 and 1684.

Figure 5: Venice-on-Bisenzone exchange rate vs. Bisenzone-on-Venice exchange rate



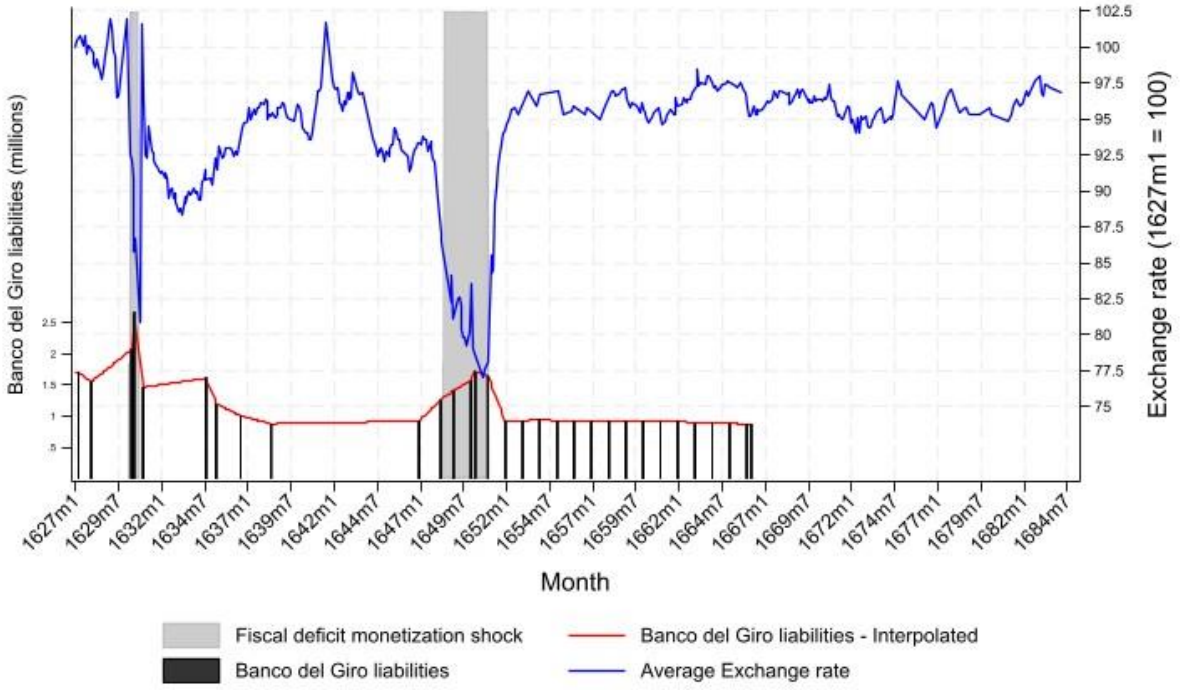
Note: the figure shows a comparison of the exchange rate between Venice and the Bisenzone fairs as quoted in Venice (Saminiati-Pazzi archive) and as quoted at Bisenzone (Da Silva 1969).

Figure 6: Dispersion of the 16 bilateral exchange rates around the median value



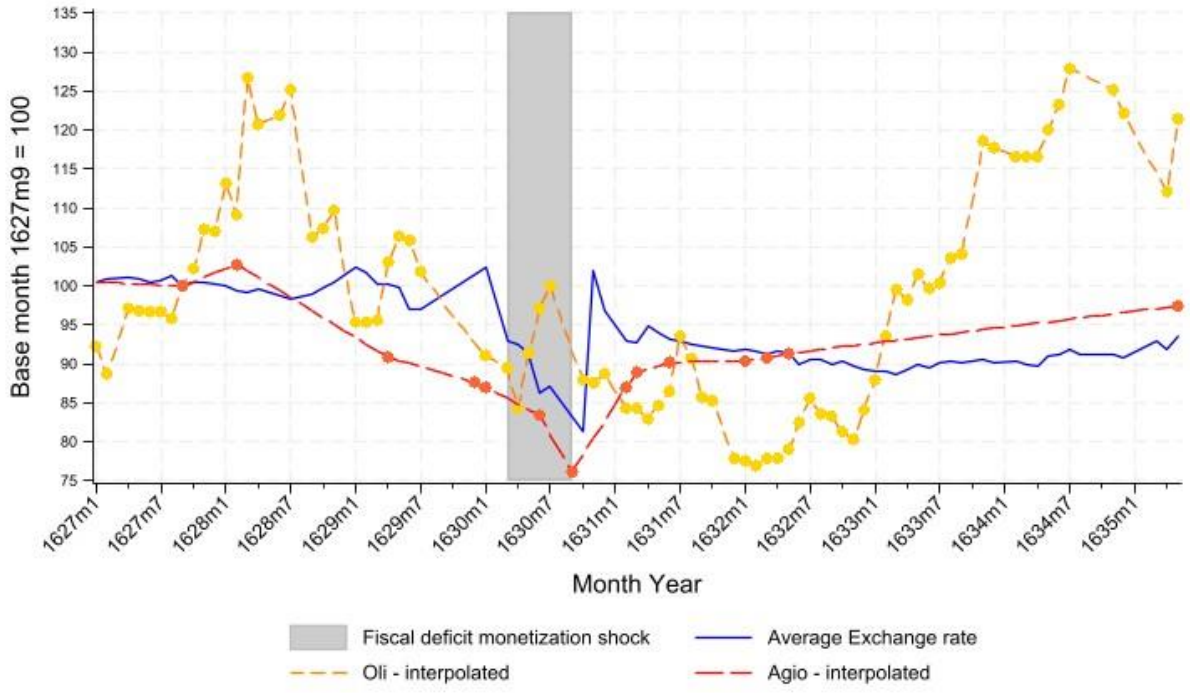
Note: The figure shows the interquartile distribution of the bilateral exchange rates between the Venetian Banco ducat and each one of the 16 currencies whose data are available in more than 98% of the archival documents between 1627 and 1684. To improve the graphical representation, for all cities/fairs, we set the exchange rate equal to 100 in January 1627.

Figure 7: Exchange rate evolution and fiscal deficit monetisation shocks



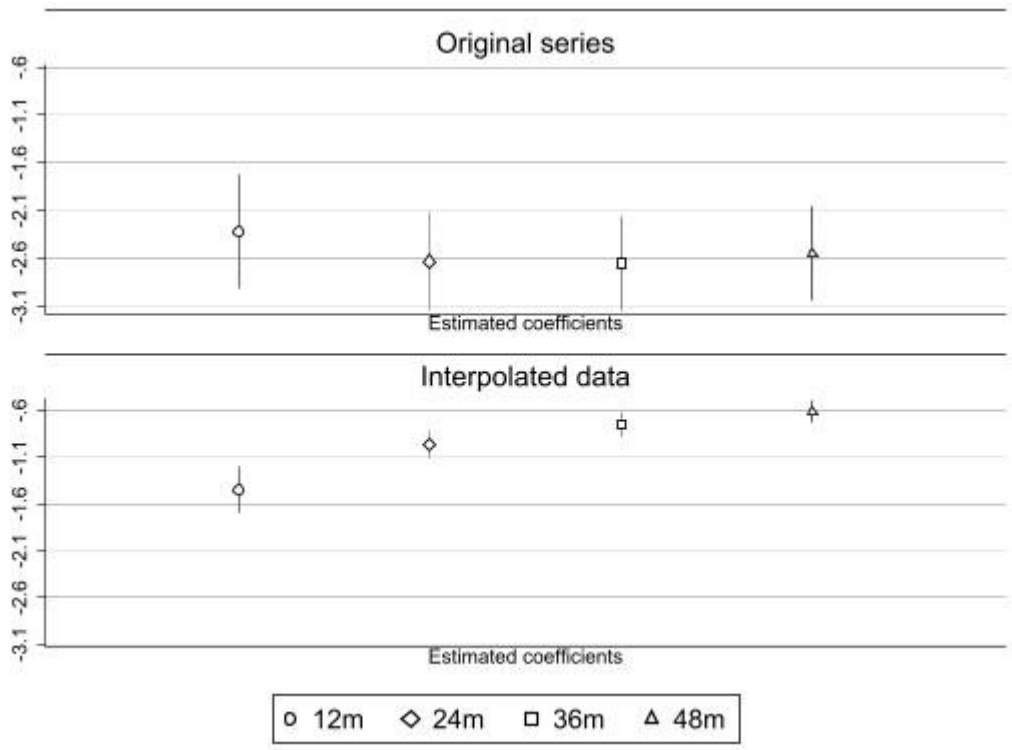
Note: The figure shows the evolution of the average exchange rate for the 16 cities/fairs for which data are available in at least 98% of the months analysed, together with the liabilities of the Banco del Giro (original and interpolated values) and the horizon of the fiscal deficit monetization shocks. To improve the graphical representation, we set the average exchange rate equal to 100 in January 1627.

Figure 8: Evolution of the real value of the Banco del Giro ducat as measured by three different indicators: commodity price index, foreign currency index, and agio (interpolated series at 100-basis)



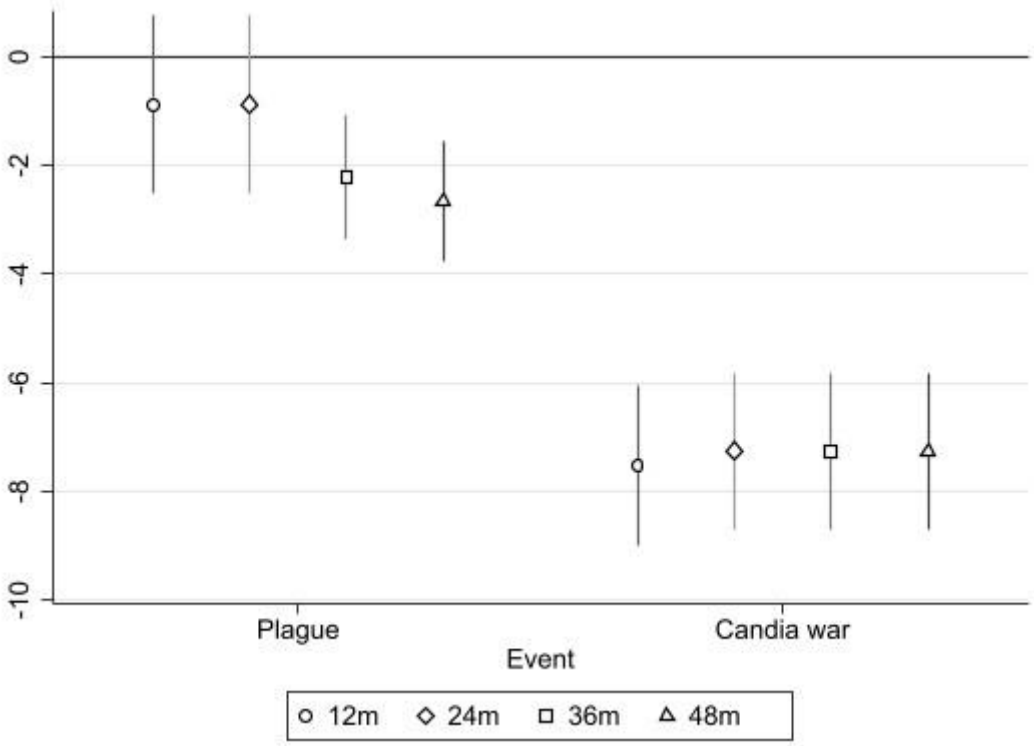
Note: The figure shows the evolution of the purchasing power of the Venetian Banco ducat in terms of a basket of 16 foreign currencies (average exchange rate for the 16 cities/fairs), in terms of commodities (index of oil prices), and in terms of bullion (agio). To improve the graphical representation, we set base values equal to 100 for all series in September 1627.

Figure 9: Exchange rate variation and fiscal deficit monetisation shocks around fiscal policy expansions: original vs. interpolated data



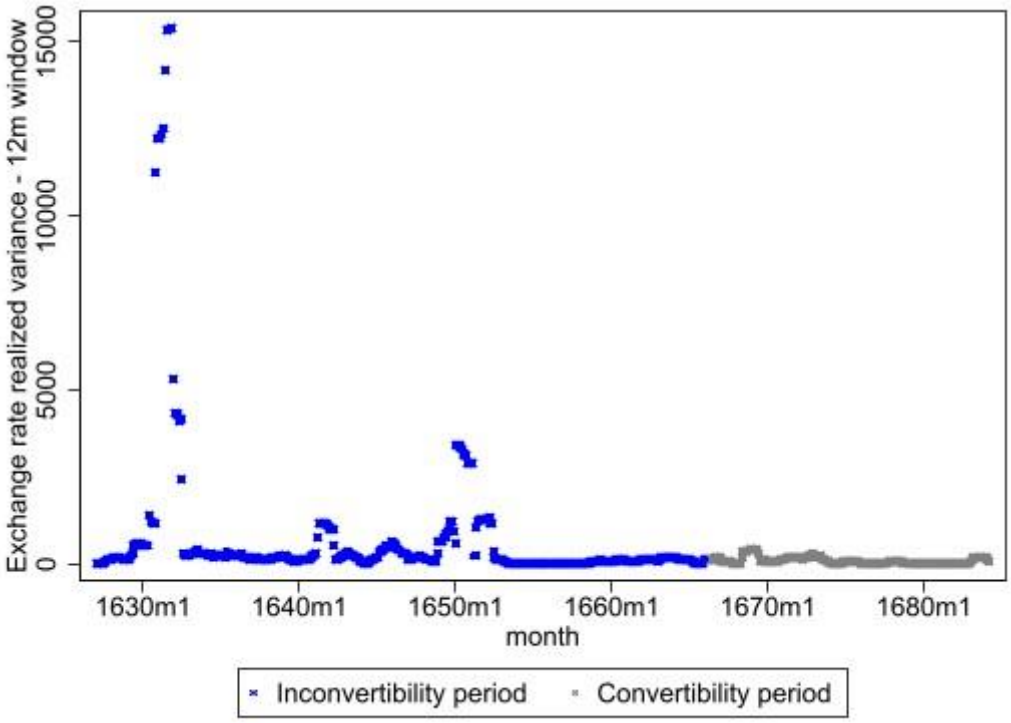
Note: The figures show the estimated coefficient of the fiscal deficit monetization variable in Eq. (1). The dependent variable is the change in the exchange rate between the Venetian ducat and the currency of city/fair i at month t, in the 12, 24, 36 and 48 months around the fiscal policy monetization events discussed in sections 3 and 4.3., respectively. The upper figure shows the estimates using the original series of the Banco del Giro's liabilities, while the lower one those obtained using its interpolated values. City fixed effects are included. 90% confidence intervals are presented.

Figure 10: Exchange rate variation and fiscal deficit monetisation shocks around fiscal policy expansions: 1630 plague vs. 1648-50 Cretan War



Note: The figure shows the estimated coefficient of the fiscal deficit monetization variable in Eq. (1). The dependent variable is the change in the exchange rate between the Venetian ducat and the currency of city/fair *i* at month *t*, in the 12, 24, 36 and 48 months around each of the two fiscal policy monetization events discussed in sections 3 and 4.3., respectively. The left figure shows the estimates around the 1630 plague event, while the right one those around the 1648-50 Cretan War event. City fixed effects are included. 90% confidence intervals are presented.

Figure 11: Exchange rate 12 months volatility



Note: The figure shows the evolution of the realised variance for a 12-month window of our exchange rate index during the 1627-1684 period.

Tables

Table 1: Exchange rate and expansionary fiscal policies (1627-1666)

	Original series				Interpolated data			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Control variables:		Δ Oli chiari	Δ Oli mosti	Δ Oli index		Δ Oli chiari	Δ Oli mosti	Δ Oli index
Fiscal deficit monetization	-2.496***	-2.558***	-2.633***	-2.580***	-0.398***	-0.309***	-0.377***	-0.335***
	(0.255)	(0.266)	(0.273)	(0.270)	(0.054)	(0.050)	(0.053)	(0.051)
Δ Oli		0.079***	0.044*	0.072**		0.037***	0.011	0.029***
		(0.027)	(0.024)	(0.029)		(0.006)	(0.007)	(0.007)
Observations	356	333	333	333	5,628	5,628	5,628	5,628
R-squared	0.257	0.318	0.307	0.313	0.004	0.008	0.004	0.006
Number of Cities	31	31	31	31	32	32	32	32
City FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: The dependent variable is the change in the exchange rate between the Venetian ducat and the currency of city/fair *i* at month *t*. The fiscal deficit monetization variable is the original series of the Banco del Giro's liabilities in Columns (1)-(4) and its interpolated data in Columns (5)-(8). Robust standard errors are clustered at the city level. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 2: Exchange rate and expansionary fiscal policies around the 1630 plague (1627-1639)

	Original series				Interpolated data			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Control variables:		Δ Oli chiari	Δ Oli mosti	Δ Oli index		Δ Oli chiari	Δ Oli mosti	Δ Oli index
Fiscal deficit monetization	-2.414***	-1.690***	-2.259***	-1.901***	-0.457***	-0.368***	-0.399***	-0.366***
	(0.390)	(0.388)	(0.394)	(0.393)	(0.071)	(0.074)	(0.074)	(0.074)
Δ Oli		0.291***	0.414***	0.359***		0.061***	0.036*	0.059***
		(0.026)	(0.042)	(0.033)		(0.010)	(0.018)	(0.014)
Observations	137	114	114	114	2,189	2,189	2,189	2,189
R-squared	0.167	0.392	0.390	0.402	0.003	0.010	0.005	0.008
Number of Cities	29	29	29	29	30	30	30	30
City FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: The dependent variable is the change in the exchange rate between the Venetian ducat and the currency of city/fair *i* at month *t*. The fiscal deficit monetization variable is the original series of the Banco del Giro's liabilities in Columns (1)-(4) and its interpolated data in Columns (5)-(8). Robust standard errors are clustered at the city level. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3: Exchange rate and expansionary fiscal policies around the 1648-50 Cretan War (1640-1666)

	Original series				Interpolated data			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Control variables:		Δ Oli chiari	Δ Oli mosti	Δ Oli index		Δ Oli chiari	Δ Oli mosti	Δ Oli index
Fiscal deficit monetization	-6.139***	-4.224***	-5.727***	-4.920***	-1.245***	-1.165***	-1.257***	-1.218***
	(0.715)	(0.835)	(0.767)	(0.806)	(0.341)	(0.311)	(0.340)	(0.327)
Δ Oli		-0.147***	-0.036**	-0.100***		0.015*	-0.004	0.006
		(0.034)	(0.013)	(0.023)		(0.007)	(0.006)	(0.006)
Observations	219	219	219	219	3,439	3,439	3,439	3,439
R-squared	0.495	0.537	0.502	0.519	0.018	0.019	0.018	0.018
Number of Cities	27	27	27	27	27	27	27	27
City FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: The dependent variable is the change in the exchange rate between the Venetian ducat and the currency of city/fair *i* at month *t*. The fiscal deficit monetization variable is the original series of the Banco del Giro's liabilities in Columns (1)-(4) and its interpolated data in Columns (5)-(8). Robust standard errors are clustered at the city level. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 4: Exchange rate and expansionary fiscal policies (1627-1666) – subset of 16 cities/fairs

	Original series				Interpolated data			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Control variables:		Δ Oli chiari	Δ Oli mosti	Δ Oli index		Δ Oli chiari	Δ Oli mosti	Δ Oli index
Fiscal deficit monetization	-2.394***	-2.349***	-2.415***	-2.362***	-0.329***	-0.236***	-0.305***	-0.262***
	(0.304)	(0.293)	(0.298)	(0.294)	(0.062)	(0.059)	(0.061)	(0.060)
Δ Oli		0.084**	0.056*	0.082**		0.041***	0.013**	0.032***
		(0.030)	(0.030)	(0.034)		(0.006)	(0.005)	(0.006)
Observations	236	220	220	220	3,771	3,771	3,771	3,771
R-squared	0.254	0.300	0.289	0.296	0.003	0.008	0.003	0.005
Number of Cities	16	16	16	16	16	16	16	16
City FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: The dependent variable is the change in the exchange rate between the Venetian ducat and the currency of the 16 cities/fairs, *i*, for which data are available in at least 98% of the months analysed. The fiscal deficit monetization variable is the original series of the Banco del Giro's liabilities in Columns (1)-(4) and its interpolated data in Columns (5)-(8). Robust standard errors are clustered at the city level. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5: Exchange rate and fiscal deficit monetization dummy

	Panel A: 1627-1666			
	(1)	(2)	(3)	(4)
Control variables:		Δ Oli chiari	Δ Oli mosti	Δ Oli index
Fiscal deficit monetization dummy	-1.393***	-1.325***	-1.383***	-1.354***
	(0.166)	(0.163)	(0.167)	(0.166)
Δ Oli		0.032***	0.013*	0.026***
		(0.006)	(0.007)	(0.007)
Observations	5,628	5,569	5,590	5,569
R-squared	0.021	0.025	0.022	0.023
Number of Cities	32	32	32	32
City FE	YES	YES	YES	YES
	Panel B: 1627-1639			
	(1)	(2)	(3)	(4)
Control variables:		Δ Oli chiari	Δ Oli mosti	Δ Oli index
Fiscal deficit monetization dummy	-1.783***	-1.683***	-1.720***	-1.677***
	(0.189)	(0.190)	(0.204)	(0.195)
Δ Oli		0.058***	0.029	0.054***
		(0.010)	(0.019)	(0.014)
Observations	2,189	2,151	2,151	2,151
R-squared	0.014	0.020	0.015	0.018
Number of Cities	30	30	30	30
City FE	YES	YES	YES	YES
	Panel C: 1640-1666			
	(1)	(2)	(3)	(4)
Control variables:		Δ Oli chiari	Δ Oli mosti	Δ Oli index
Fiscal deficit monetization dummy	-1.255***	-1.218***	-1.254***	-1.239***
	(0.246)	(0.232)	(0.246)	(0.240)
Δ Oli		0.015	0.003	0.010
		(0.009)	(0.006)	(0.008)
Observations	3,439	3,418	3,439	3,418
R-squared	0.039	0.040	0.039	0.039
Number of Cities	27	27	27	27
City FE	YES	YES	YES	YES

Note: The dependent variable is the change in the exchange rate between the Venetian ducat and the currency of city/fair *i* at month *t*. The fiscal deficit monetization dummy is a dummy variable that takes the value of 1 during periods of fiscal deficit monetisation shocks, i.e. from May to September 1630 and from May 1648 until December 1650, respectively. Robust standard errors are clustered at the city level. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 6: Exchange rate, expansionary fiscal policies and agio (1627-1635)

		Interpolated data		
	(1)	(2)	(3)	(4)
Control variables:		Δ Oli chiari	Δ Oli mosti	Δ Oli index
Fiscal deficit monetization	-1.988***	-2.895***	-2.945***	-2.886***
	(0.150)	(0.220)	(0.249)	(0.230)
Agio	-0.007***	-0.024***	-0.025***	-0.025***
	(0.001)	(0.003)	(0.004)	(0.003)
Δ Oli		0.058***	0.027	0.053***
		(0.011)	(0.024)	(0.017)
Observations	2,368	1,472	1,472	1,472
R-squared	0.019	0.045	0.041	0.043
Number of Cities	29	29	29	29
City FE	YES	YES	YES	YES

Note: The dependent variable is the change in the exchange rate between the Venetian ducat and the currency of city/fair *i* at month *t*. The fiscal deficit monetization variable is the interpolated series of the Banco del Giro's liabilities. Robust standard errors are clustered at the city level. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 7: Exchange rate and expansionary fiscal policies (1627-1684)

		Original series				Interpolated data		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Control variables:		Δ Oli chiari	Δ Oli mosti	Δ Oli index		Δ Oli chiari	Δ Oli mosti	Δ Oli index
Fiscal deficit monetization	-2.496***	-2.558***	-2.633***	-2.580***	-0.398***	-0.309***	-0.377***	-0.335***
	(0.255)	(0.266)	(0.273)	(0.270)	(0.054)	(0.050)	(0.053)	(0.051)
Δ Oli		0.079***	0.044*	0.072**		0.037***	0.011	0.029***
		(0.027)	(0.024)	(0.029)		(0.006)	(0.007)	(0.007)
Observations	356	333	333	333	5,628	5,628	5,628	5,628
R-squared	0.257	0.318	0.307	0.313	0.004	0.008	0.004	0.006
Number of Cities	31	31	31	31	32	32	32	32
City FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: The dependent variable is the change in the exchange rate between the Venetian ducat and the currency of city/fair *i* at month *t*. The fiscal deficit monetization variable is the original series of the Banco del Giro's liabilities in Columns (1)-(4) and its interpolated data in Columns (5)-(8). Robust standard errors are clustered at the city level. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Appendix

Appendix Table 1: List of exchange fairs, number of observations and coverage

City	Currency of denomination	Nr of obs	Coverage	City	Currency of denomination	Nr of obs	Coverage
Florence	Scudo	882	99.9%	Bisenzone	Ducat	822	93.1%
London	Pound	882	99.9%	Frankfurt	Guilder	804	91.1%
Milan	Soldo	881	99.8%	Lyon	Ducat	796	90.1%
Antwerp	Groschen	881	99.8%	Bolzano	Soldo	795	90.0%
Cologne	Groschen	881	99.8%	Bologna	Soldo	761	86.2%
Ancona	Scudo	880	99.7%	Lucca	Scudo	742	84.0%
Amsterdam	Groschen	879	99.5%	Rome	Scudo	711	80.5%
Hamburg	Guilder	878	99.4%	St. Gallen	Guilder	629	71.2%
Naples	Ducat	875	99.1%	Livorno	Real	352	39.9%
Bari	Ducat	875	99.1%	Verona	Ducat	348	39.4%
Bergamo	Soldo	874	99.0%	Piacenza	Ducat	93	10.5%
Wien	Thaler	874	99.0%	Murano	Ducat	52	5.9%
Lecce	Ducat	872	98.8%	Madrid	Maravedi	38	4.3%
Augusta	Soldo	868	98.3%	Seville	Maravedi	36	4.1%
Genoa	Soldo	867	98.2%	Lisbon	Real	27	3.1%
Nuremberg	Guilder	865	98.0%	Messina	Soldo	15	1.7%

Note: The table provides information on the full list of exchange fairs available in our dataset, together with the name of the foreign bill of reference, the number of observations available for each city and their coverage, i.e. the percentage of quotes available over the total number of documents analysed.