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

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Abstract:

The impact of fiscal dominance on exchange rates has been relatively overlooked by the literature. We focus on an early unique experiment of freely floating State-issued money, implemented in Venice from 1619 to 1666. Building on a new hand-collected database from a previously unused archival source, we show that despite the Venetian government's reputation for fiscal prudence, the external value of the ducat was highly sensitive, and increasingly so, to episodes of automatic government deficit monetization through the Banco del Giro during the shocks of 1630 (outbreak of the bubonic plague) and 1648-50 (escalation of the Cretan War).

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1. Introduction

Following the huge fiscal expansions implemented by governments around the world in the aftermath of the COVID-19 crisis, fiscal dominance has gained centre stage in economic debates.[2] While many studies have been devoted to the impact of fiscal dominance on the *internal* value of money, i.e. on inflation, much less attention has been dedicated to its impact on the *external* value of money, i.e. on exchange rates. This distinction is of fundamental importance as these two channels do not perfectly coincide and have quite different distributional implications.

In this paper, we study the relationship between fiscal dominance and exchange rate depreciation by focusing on a historical episode which is unique in many aspects. Between 1619 and 1666, the Republic of Venice put what is arguably the first-ever experiment of purely managed State-issued money in place. 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 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 exchange rate

[2] "Fiscal dominance" generally describes an institutional setting in which monetary policy systematically accommodates fiscal expansions. For a discussion of the uses of this wording, see Section 2.1.

data provided by Denzel (2010). In this paper, we rely on a previously unused 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 confirm that the institutional setting plays an important role in determining the international credibility of a currency.

The remainder 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 details the working of the Banco del Giro, as well as the events surrounding the two large monetary shocks of 1630 and 1648-50. Section 4 presents our data sources and series. Section 5 presents the results of our empirical investigation. 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. 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 Ricardian regime might well occur in an institutional setting in which the monetary authority is independent if other considerations, e.g. financial or macroeconomic stability, will drive the latter's policy response. In what follows, we shall pay attention to keeping the two 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: fiscal monetization generates seigniorage revenues, while depreciations erode the real value of domestic currency obligations (Ize 1987). Therefore, at least in principle, in a non-Ricardian regime inflation and depreciation can emerge independently, simultaneously, or sequentially.

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. Such neglect can be associated with two different but intertwined methodological issues. First, the theoretical literature on fiscal dominance has largely remained within the realm of closed-economy modelling (Ize 1987).

Second, 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 in the real world, 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 (Blanchard 2004; Ahmed et al. 2020; Kose 2021; Alberola et al. 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 (Alberola et al. 2021). Finally, a handful of historical 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).

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 as 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 through the implementation of open market operations. 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 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 being 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 showed 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 had been founded (Roberds and Velde 2016, pp. 333-5; Bindseil 2019, pp. 207-10). This bank was designed to collect deposits from the private sector, 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 specie remained however possible, and this put a floor on the price of Banco 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. 211-22).

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 1615-7, many government payments had fallen into long arrears (Cecchini 2021, pp. 114-5 and 122-3). 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 be able to pay 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 through the implementation of what we may legitimately call, in today's central banking jargon, "open market operations". 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's 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 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 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 various months for several 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; our 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 in 1629-30. 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; our 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 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 the Ottoman army in Crete from all supplies. 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 to 15,000 ducats, so that during the whole year of 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 after 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; our 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 commerce conducted by two of the most important banking families of Florence, i.e. the Saminiati and the Pazzi, with other Italian and European cities since the mid-15th century (Ziani

2007).[3] The Saminiati was a family of merchants which was also a powerful broker in the Florentine credit market, a market which, from the emergence of the bill of exchange in the Medieval Age, was systematically intertwined with other productive and commercial activities (Accominotti and Ugolini 2020). Being present in many productive sectors, as well as in many geographical markets, these merchants, through their branches and partnerships, were well positioned in collecting and disseminating information, including exchange rate quotations, to exploit profit opportunities, when and where they occurred. This 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 our attention on the exchange rate currents (*listini de' cambi*) which show the rates at which foreign bills of exchange were bought and sold on the Rialto Square in Venice, i.e. one of the most important European financial markets at the time.[4]

Figure 1 provides an example of the information reported in the exchange rate currents. This includes the date (*A dì 12 Marzo 1660*) of the quotation, followed by a list of European cities ranging from the capitals of Western Europe to the sites of medieval fairs, such as Bolzano, Lyon or Nuremberg, the currency of reference associated to each exchange fair and the exchange rate itself.[5] Toward the end of the list, it is also possible to find information on the price of different kinds 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

[3] "(The Archive) is made up of 1000 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).

[4] Needless to say, for this early modern dataset the usual question concerning its representativeness arises, i.e. can these prices be evaluated as a true market outcome? Here we can just quote the fact that, after the diffusion of the bills of exchange, it was customary to cite current exchange rates in the commercial letters issued by merchants Li 2015), assuming that the merchants quoted in their letters exchange rates in line with the current exchange rate set by the market. In the remainder of the paper, we assume that the exchange rates extracted from the Saminiati-Pazzi reflect the market exchange rate.

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

information: in 17th-century Venice, the Coffani family was responsible to print the exchange rate currents (McCusker and Gravesteijn 1991).[6]

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. This makes this dataset one of the richest available for early modern European history.[7] In addition to the exchange rate data, we have also hand-collected around 3,345 prices of the different kinds of oils quoted on the Piazza di Rialto.

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 econometric analysis will be based on a sample of monthly observations. 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

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

[7] 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.

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 fluctuations, we standardized all quotes to have all the exchange rate values quoted using the "uncertain for certain" method (Spufford, Wilkinson and Tolley 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.

4.2. Prices

As information on the price level is unavailable for 17th-century Venice, we looked for proxies for prices. 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 purposes 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 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 price of the commodities (cooking oils) listed on the *listini de' cambi* (see Section 4.1).

4.3. Fiscal deficit monetization

In addition, we also gather all the available information on the size of Banco del Giro's liabilities as collected by Tucci (1973, pp. 370 and 441-7). Such liabilities exclusively consisted of the current account credits held by accountholders, which were used as money as they were freely transferable. 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).

4.4. Monetary policy shocks

Available information on the actual size of Banco del Giro's liabilities is, unfortunately, extremely fragmentary. To overcome this difficulty, we use qualitative evidence to construct an indicator of monetary shocks during the whole period in which Banco del Giro money remained a managed inconvertible currency (1619-66). Given the functioning of the bank, we call "monetary shocks" the periods of rampant monetization of government deficits through the Banco. Based on the extensive historical evidence summarized in Section 3, we create a dummy variable taking the value of 1 during the following periods:

- From March 1, 1630 (first 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).
- 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, while the same is not true for consumer prices. Therefore, our empirical analysis will focus on understanding how the monetary policy shocks mentioned in the previous sections affected the external value of the Venetian Banco ducat. To do so, we adopt an event study analysis, an approach which has been recently used extensively to study how exchange rate reacts to monetary policy news (see Conrad and Lamla 2010; Ferrari et al. 2021; and Gurkaynak et al. 2021, among others).

Event study analyses have been also 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 monetary policy 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 notice that if today the analyses on the impact of monetary policy events on the exchange rate are implemented using high-frequency (minute-level) data around monetary policy events (Ferrari et al. 2021, for example, focus their analysis on the 15 minutes around monetary policy announcements), having assess 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 one observation at a monthly frequency. Whenever more than one exchange rate quote is reported in each month, we compute the average value of the exchange rate during that period.

5.2. Stylized facts

Figure 4 shows the evolution of the average exchange rate between a sample of 16 currencies and the Venetian Banco ducat together with the evolution of the Banco del Giro's liabilities.[8] This figure provides a preliminary overview of the association between exchange rate depreciations and the implementation of government deficit monetization in the Venetian Republic, implemented via the expansion of the Banco del Giro's liabilities. Indeed, despite the limited data on the 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 ducat. This sharp decline in 1630 had almost reverted by 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 following the contraction of these liabilities.

Figure 5 about here

One of the problems inherent to using early-modern exchange rate series is the fact that, at the time, exchange rate quotes included an implicit interest rate which cannot be separated from the "pure" exchange rate (De Roover 1953). In order 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).[9] The data presented in this figure 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). This strong correlation suggests that the evolution of quoted exchange rates in Venice was not driven by changes in the implicit interest rate component.

Figure 6 about here

[8] The average exchange rate has been computed using an arithmetic average of the interpolated 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.

[9] As already discussed in Section 4.1, the exchange rate is expressed in terms of foreign currency needed to buy 100 ducats. On Bisenzone fairs, see Pezzolo and Tattara (2008).

5.3. Effects of monetary policy shocks on exchange rates

Based on the stylized facts presented in Figure 5, it is possible to observe a depreciation of the Venetian Banco ducat around the monetary policy shock windows that we have discussed in Section 4.4 and the associated expansion of the Banco del Giro's liabilities. Therefore, our empirical estimation aims at assessing the response of the exchange rate to these expansionary monetary policies (monetary policy shocks) implemented in the Venetian Republic.

In our baseline, we regress the (log) exchange rate change on our measures of monetary policy shock (MPS):

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

where ΔER is the change in the exchange rate between the Venetian Banco ducat and the currency of city/fair i at month t. MPS_t is our main independent variable, which is either a dummy taking the value of 1 during periods of monetary policy shocks (from March 1630 to September 1630, and from May 1648 to December 1650) or the level of the Banco del Giro's liabilities. $\Delta\, Oli_t$ 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 Banco 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. The negative and statistically significant coefficient of the MPS variable presented in Column (1) suggests that monetary policy shocks are associated with a depreciation of the Banco ducat. This means that the expansionary monetary policy conducted by the Venetian Republic during these periods led to a depreciation of the Venetian 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 statistical 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 Venetian ducat. Importantly, the magnitude and the statistical significance of the coefficient associated with the monetary policy shocks

dummy is unaffected by the inclusion of these additional control variables. In Columns (5)-(8) we perform the same estimations presented in columns (1)-(4), but focus on the level of Banco del Giro's liabilities instead of the dummy indicating episodes of monetary policy shocks. The negative and statistically significant coefficient obtained for the level of the Banco del Giro's liabilities confirms the results obtained using the monetary policy shocks dummy, i.e. that expansions of the Banco's liabilities are linked to depreciations of the Venetian ducat.

Table 1 about here

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

Figure 7 summarizes the results obtained narrowing down the horizon of our empirical analysis to the 12, 24, 26, and 48 months around a monetary policy expansion episode for both the monetary policy shock dummy (Panel A) and the Banco del Giro's liabilities (Panel B). Similar to the results shown in Table 1, Figure 7 documents that periods of monetary policy expansion are associated with the depreciation of the Venetian 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 7 about here

So far, we have analysed the two episodes of monetary 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 prior to 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

[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 sample related to the Cretan War.

discrepancies between the two episodes. In fact, when considering the monetary shock dummy, we observe a relatively greater impact of the shock on the exchange rate in 1630 (Table 2, Panel A) compared to 1648-50 (Table 3, Panel A). Conversely, when examining the monetary expansion variable, we find a relatively smaller impact of the increase in Banco del Giro's liabilities on the exchange rate in 1630 (Table 2, Panel B) compared to 1648-50 (Table 3, Panel B). Given the limitations of available historical data (esp. concerning the liabilities series, for which we have very few observations in the 1630s), these results should be taken with prudence. Still, these numbers appear to suggest that while the absolute depreciation of the Banco ducat was stronger in 1630 than in 1648-50, the exchange rate's sensitivity to monetary expansion was weaker in 1630 than in 1648-50 – something which was already observable in Figure 5. In view of 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.

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 monetary policy are associated with the depreciation of the Venetian ducat.

Table 4 about here

Next, we verify that our results are not driven by the frequency of the collected data. Given that the exchange rate currents are not available for all the months, we replace missing monthly observation 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. The results presented in Table 5 are robust to the use of interpolated data. This means that, despite the potential smoothing of some of the data (those of the Banco del Giro's liabilities, in particular), our data capture the

strong link between monetary policy expansions and exchange rate depreciations in Venice in the 17th century.

Table 5 about here

Finally, we verify that our results are robust to the extension of our analysis to the period of convertibility of the Venetian ducat, i.e., from May 1666 until 1684.[11] Once again, the results presented in this robustness table (Table 6) provide evidence in support of the idea that monetary policy expansions implemented during the 1630 plague and the Cretan War brought to a depreciation of the Venetian ducat.

Table 6 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 as well as on other quantitative and qualitative historical sources, we implement an event analysis aimed at investigating the impact of automatic government deficit monetization on the external value of the Venetian 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 open-market 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 the monetization of expansionary fiscal policies on exchange rates during the major shocks of 1630 (bubonic plague) and 1648-50 (Cretan War).

As predicted by the economics literature, our results show that under an institutional fiscal dominance setting, episodes of non-Ricardian fiscal policy have a strong and quick negative impact on the external value of domestic currency – and this, even in contexts in which

[11] Appendix Figure 1 shows the evolution of the realised variance of exchange rate variations during 1627-1684. This figure shows how the volatility of the Venetian ducat was relatively similar during the inconvertibility (1627-1666) and convertibility periods (1666-1684) and how the two episodes of monetary policy shocks are those characterized by the highest volatility.

fiscal policy consistently remains Ricardian in the long run. The reverse is also true: under the very same institutional setting, contractionary fiscal policy (i.e., a return to Ricardian behaviour) has a strong and quick 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 value of Banco money rapidly returned under control as soon as the government was able to restore its ability to raise tax revenues and long-term funded debt, henceforth reducing its short-term floating debt. Interestingly, our results appear to suggest that the foreign exchange's sensitivity to monetary expansions even increased over time, being relatively higher in 1648-50 than in 1630 despite the smaller size of government deficit monetization.

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 is particularly sensitive to changes in the fiscal stance – and this is the case even if the government has a solid reputation for maintaining a Ricardian behaviour in the long run. This finding vindicates the importance of the institutional design in determining the international credibility of a currency.

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Figures

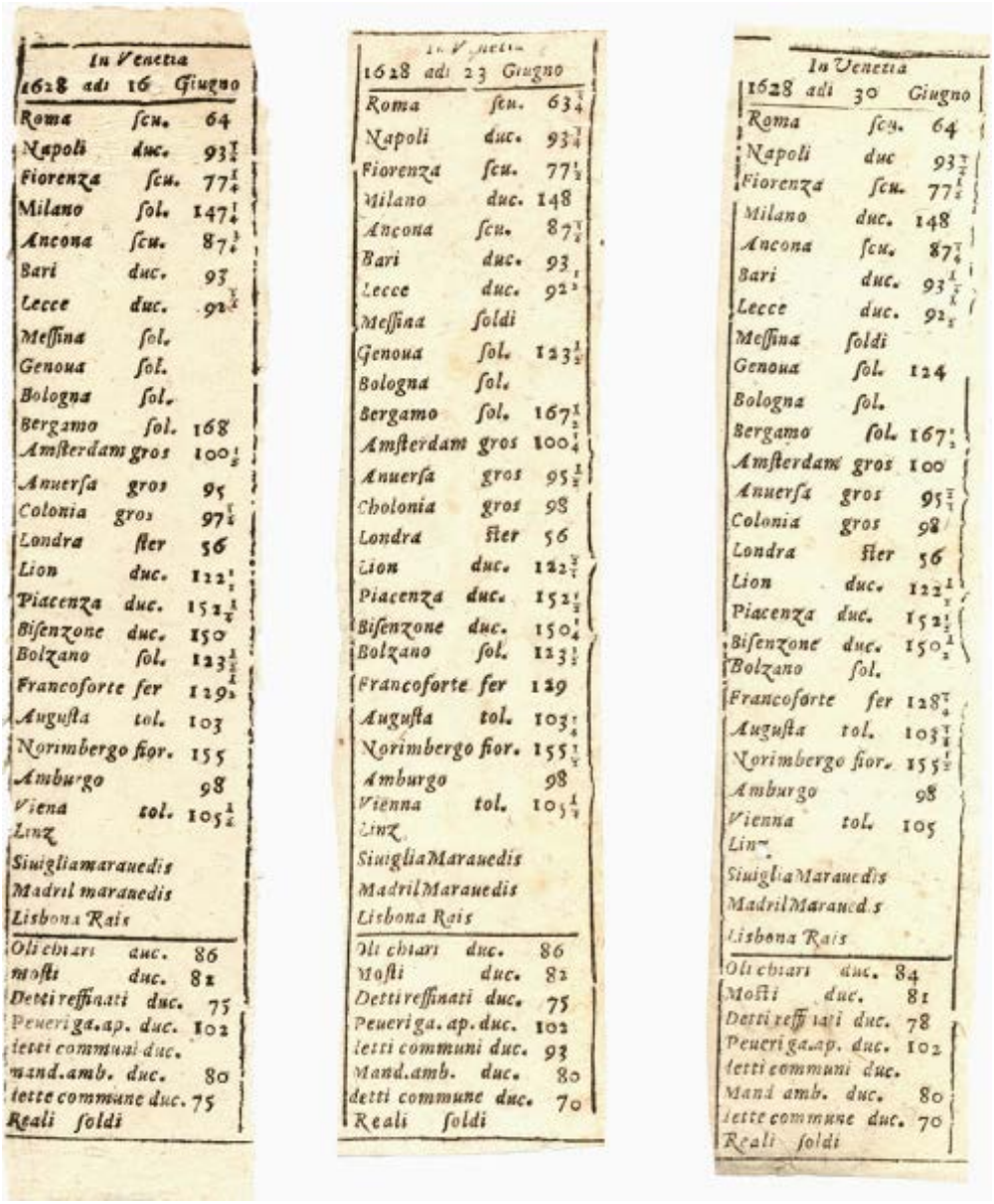
Figure 1: Example of an exchange rate current

IN VENETIA
Alli 12. Marzo 1660.
FIERE DI

Murano	duc.
Biſenzone	duc. 187½
Lion	duc. 101½
Francoforte	fior. 120½
E Bolzano	ſol.
Roma	ſcu. 53⅜
Napoli	duc. 90-
Fiorenza	ſcu. 72½
Liuorno p.ze 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 ſtamp. e ſogli.

Figure 2: Exchange rate currents – June 16-30, 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
detto 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
detto commune	duc.	70
Reali	soldi	

Figure 3: The frequency of listini de’cambi, 1627-1684

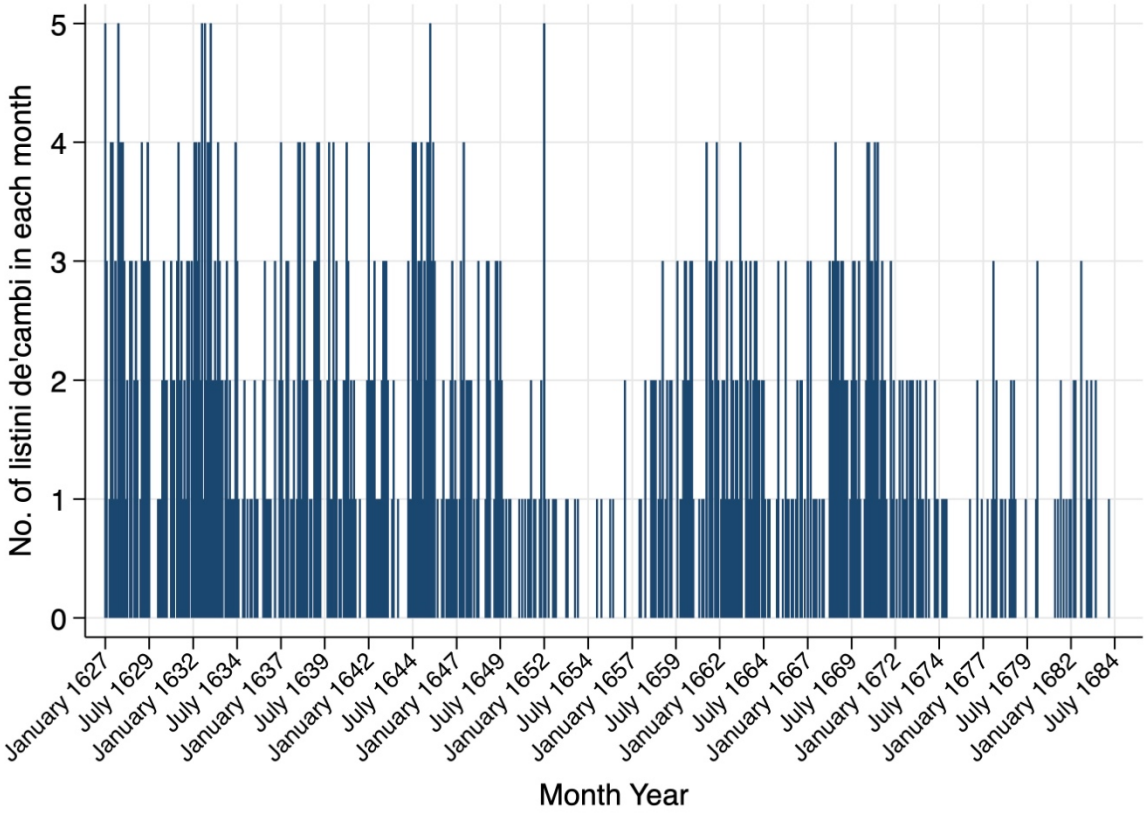


Figure 4: The frequency of exchange rate quotations, 1627-1684

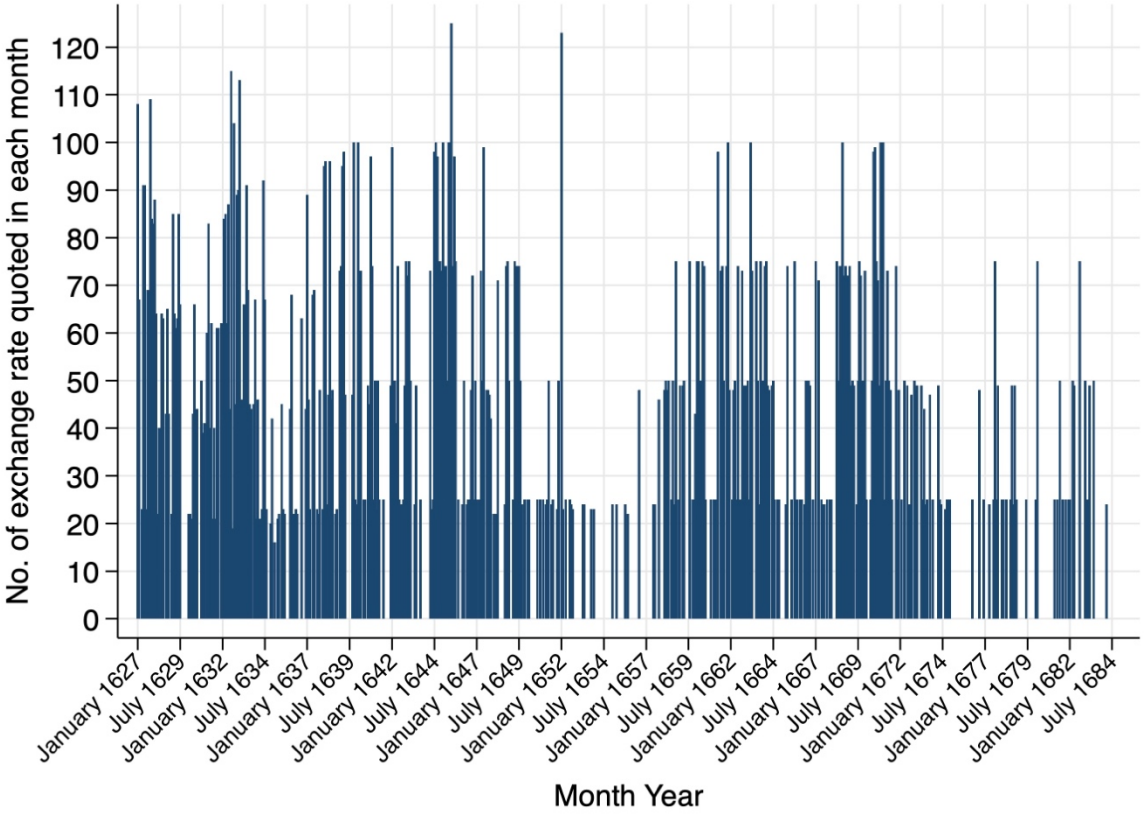


Figure 5: Exchange rate evolution and monetary policy shocks

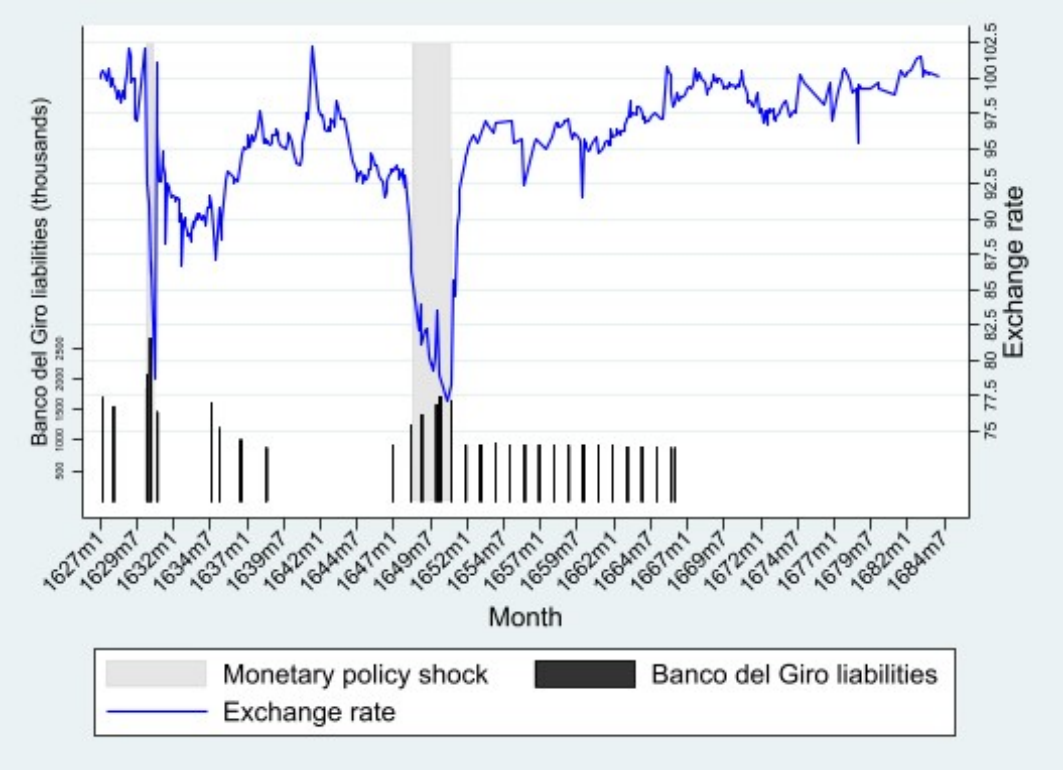


Figure 6: Venice-on-Bisenzone exchange rate vs. Bisenzone-on-Venice exchange rate

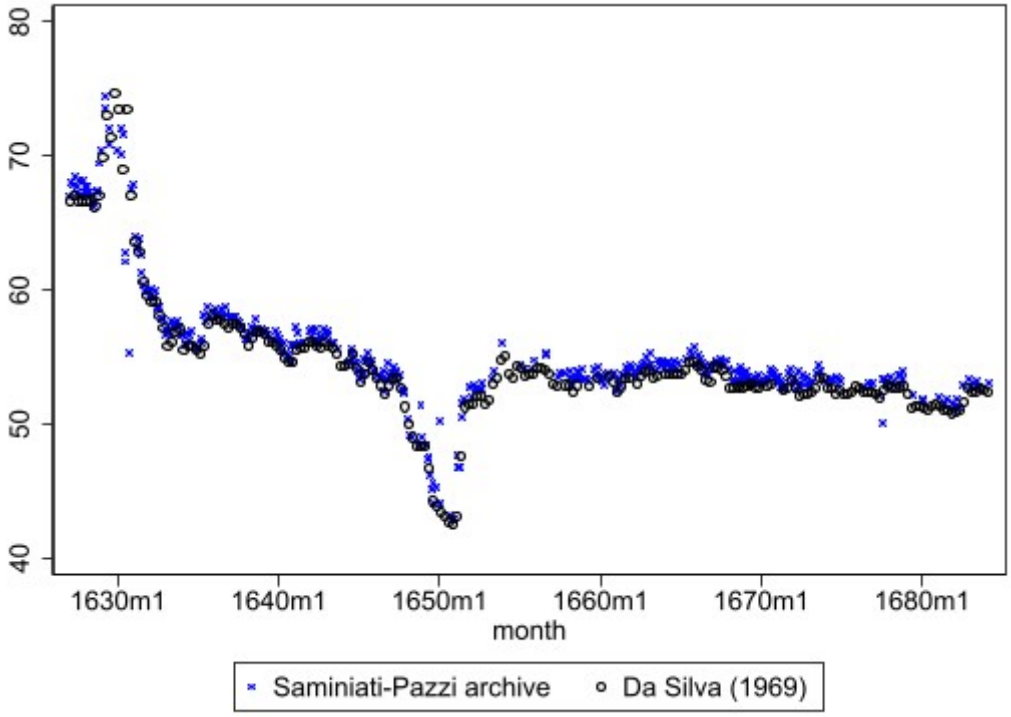
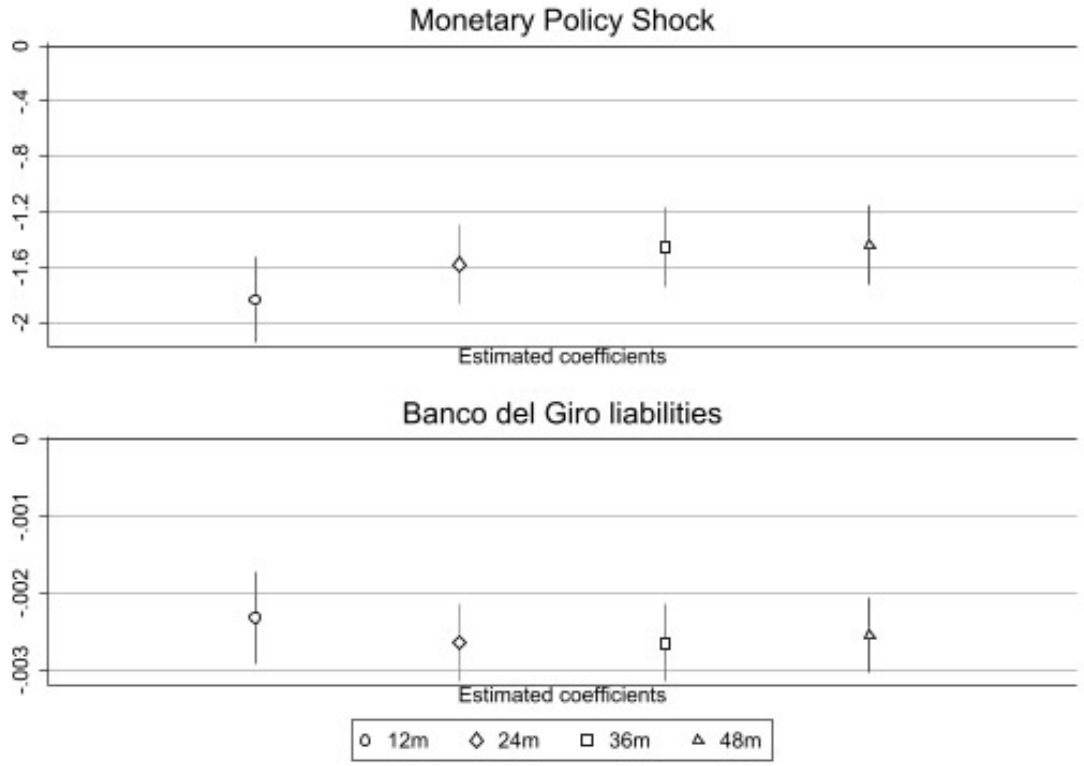


Figure 7: Exchange rate variation and monetary policy shocks around monetary policy expansions



Note: The figures show the estimated coefficient of MPS in Eq. (1). The dependent variable is the change in the exchange rate in the 12, 24, 36 and 48 months around the monetary policy shocks discussed in section 3 and 4.4., respectively. The upper figure (Panel A) shows the estimates using the dummy for monetary policy shocks, while the lower one (Panel B) those obtained using the level of the Banco del Giro liabilities. City fixed effects are included. 90% confidence intervals are presented.

Tables

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

	Monetary Policy Shock				Banco del Giro liabilities			
	(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
MPS	-1.392***	-1.324***	-1.383***	-1.354***	-0.002***	-0.003***	-0.003***	-0.003***
	(0.167)	(0.163)	(0.167)	(0.166)	(0.000)	(0.000)	(0.000)	(0.000)
Δ Oli		0.032***	0.013*	0.026***		0.077***	0.042*	0.070**
		(0.006)	(0.007)	(0.007)		(0.027)	(0.023)	(0.029)
Observations	5,631	5,572	5,593	5,572	358	335	335	335
R-squared	0.021	0.025	0.022	0.023	0.257	0.319	0.308	0.314
Number of cities	32	32	32	32	31	31	31	31
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*. Robust standard errors clustered on cities in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

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

	Monetary Policy Shock				Banco del Giro liabilities			
	(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
MPS	-1.783***	-1.683***	-1.720***	-1.677***	-0.002***	-0.002***	-0.002***	-0.002***
	(0.189)	(0.190)	(0.204)	(0.195)	(0.000)	(0.000)	(0.000)	(0.000)
Δ Oli		0.058***	0.029	0.054***		0.291***	0.414***	0.359***
		(0.010)	(0.019)	(0.014)		(0.026)	(0.042)	(0.033)
Observations	2,189	2,151	2,151	2,151	137	114	114	114
R-squared	0.014	0.020	0.015	0.018	0.167	0.392	0.390	0.402
Number of cities	30	30	30	30	29	29	29	29
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*. Robust standard errors clustered on cities in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

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

	Monetary Policy Shock				Banco del Giro liabilities			
	(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
MPS	-1.254***	-1.217***	-1.253***	-1.238***	-0.006***	-0.029***	-0.026***	-0.026***
	(0.247)	(0.232)	(0.246)	(0.240)	(0.001)	(0.005)	(0.003)	(0.004)
Δ Oli		0.015	0.003	0.010		0.066	-0.158***	-0.148
		(0.009)	(0.006)	(0.008)		(0.153)	(0.039)	(0.094)
Observations	3,442	3,421	3,442	3,421	221	226	226	226
R-squared	0.039	0.040	0.039	0.039	0.491	0.426	0.431	0.427
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*. Robust standard errors clustered on cities in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

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

	Monetary Policy Shock				Banco del Giro liabilities			
	(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
MPS	-1.290***	-1.219***	-1.283***	-1.251***	-0.002***	-0.002***	-0.002***	-0.002***
	(0.191)	(0.184)	(0.190)	(0.187)	(0.000)	(0.000)	(0.000)	(0.000)
Δ Oli		0.035***	0.014***	0.028***		0.083**	0.054*	0.080**
		(0.006)	(0.005)	(0.005)		(0.030)	(0.030)	(0.034)
Observations	3,774	3,734	3,748	3,734	238	222	222	222
R-squared	0.020	0.024	0.021	0.022	0.255	0.300	0.290	0.297
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 city/fair *i* at month *t*. Robust standard errors clustered on cities in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5: Exchange rate and expansionary monetary policies (1627-1666) – interpolated data

	Monetary Policy Shock				Banco del Giro liabilities			
	(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
MPS	-0.660***	-0.684***	-0.666***	-0.677***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.041)	(0.040)	(0.038)	(0.039)	(0.000)	(0.000)	(0.000)	(0.000)
Δ Oli		0.026***	0.008	0.020***		0.021***	0.002	0.014**
		(0.006)	(0.007)	(0.007)		(0.006)	(0.007)	(0.007)
Observations	11,582	11,582	11,582	11,582	11,532	11,532	11,532	11,532
R-squared	0.010	0.012	0.010	0.011	0.002	0.003	0.002	0.002
Number of cities	32	32	32	32	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*. Robust standard errors clustered on cities in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 6: Exchange rate and expansionary monetary policies (1627-1684)

	Monetary Policy Shock				Banco del Giro liabilities			
	(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
MPS	-1.356***	-1.296***	-1.350***	-1.325***	-0.002***	-0.003***	-0.003***	-0.003***
	(0.166)	(0.163)	(0.166)	(0.165)	(0.000)	(0.000)	(0.000)	(0.000)
Δ Oli		0.027***	0.007	0.020***		0.077***	0.042*	0.070**
		(0.006)	(0.006)	(0.006)		(0.027)	(0.023)	(0.029)
Observations	7,459	7,353	7,374	7,353	358	335	335	335
R-squared	0.020	0.022	0.020	0.021	0.257	0.319	0.308	0.314
Number of cities	32	32	32	32	31	31	31	31
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*. Robust standard errors clustered on cities in parentheses. ***, **, 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	Bill name	Nr of obs	Coverage	City	Bill name	Nr of obs	Coverage
Florence	Scudo	882	99.9%	Besenzone	Ducat	822	93.1%
London	Pound	882	99.9%	Frankfurt	Fer	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	Groschen	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	Marauder	38	4.3%
Augusta	Soldo	868	98.3%	Seville	Marauder	36	4.1%
Genoa	Soldo	867	98.2%	Lisbon	Real	27	3.1%
Nuremberg	Guilder	865	98.0%	Messina	Soldo	15	1.7%

Appendix Figure 1: Exchange rate 12 months volatility