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# Interaction of Monetary and Fiscal Policy from a Historical Perspective: Precious Metals and Venetian Government Debt

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**Summary:** Was monetary policy crucial for early sovereign debt sustainability? This paper analyses whether the availability of gold and silver drove Venetian government debt servicing costs in the late medieval period. We use an error correction model to describe changes in yields on perpetual bonds issued by the Venetian state. We document that the ability of the Venetian Republic to service its sovereign borrowing can be partially attributed to the supply of precious metals. We show that the substantial increase in debt servicing costs during the 15th century can be associated with an abrupt halt in the supply of gold and silver from mines in Serbia and Bosnia - primarily a consequence of the Ottoman expansion to the west. We control for other explanatory factors, such as mean reversion of nominal yield, real GDP growth and military conflicts.

**Keywords:** Venetian prestiti, Sovereign debt, Gold and silver, Late medieval mines, Ottoman-Venetian conflict.

**JEL:** E44, E51, F34, N23.

The interaction between the monetary and fiscal policy is essential for economic health. The 2020 pandemic showed that this link could be solid in times of crisis, with supply and demand shocks that halted the functioning of the global economy for several months. Monetary policy had a critical role in offsetting these shocks and supporting fiscal policy interventions (Jagjit S. Chadha et al. 2021).

The nexus between the monetary and fiscal policy is also intriguing from a historical perspective. Which lessons could be learned from the early days of public debt when there were no central monetary authorities? Is there a more profound link between "monetary policy" and sovereign debt sustainability? The story of late medieval Venice may provide some of the answers.

As Venice gained its independence from the Byzantine Empire, Venetian merchants began to increase their economic power and diminish the influence of the nobility (Diego Puga and Daniel Trefler 2014). Long-distance trade, one of the principal sources of that power, led to many financial innovations and spurred the development of the financial market in Venice (Luciano Pezzolo 2003, 2007). The most notable innovations were the *prestiti*, perpetual bonds issued by the Venetian state. *Prestiti*

also became a renowned international investment instrument and eventually the most crucial source of revenue for the Republic.

Since the 13th century, Venetian debt was mainly financed by importing and processing precious metals, predominantly from the Balkan Peninsula. The ore supply to the Venetian Republic was primarily mediated by Ragusan merchants, one of the region's principal suppliers of monetary metals. The ore was processed at a relatively low cost and used to mint silver and gold coins. Until the 15th century, mines in Serbia and Bosnia were one of the primary sources of silver and gold for Venice and many other European states.

This research studies whether the availability of gold and silver from the Balkans drove Venetian government debt servicing costs in the late medieval period. We use annual data on yields of *prestiti* between 1399 and 1470 and data from different available sources on silver and gold trading from principal mines in Serbia and Bosnia during the same period. We combine the aggregated data from Italian and Serbian late medieval sources with micro-data on trading activities of prominent merchant houses of Ragusa.

We document that a significant increase in debt servicing costs of the Venetian Republic in the 15th century can be attributed to an abrupt halt in the supply of precious metals from the Balkans, related to the Ottoman expansion to the west. The findings may have two important implications. Historically, they may broaden our perspective of the Ottoman-Venetian conflict. Economically, they represent the outcome of a natural experiment from which we could deepen our understanding of the relationship between monetary policy and public debt sustainability.

We document that a significant increase in debt servicing costs of the Venetian Republic in the 15th century can be attributed to an abrupt halt in supply of precious metals from the Balkans, which was to some extent related to the Ottoman western expansion. The findings may have two important implications. Historically, they may broaden our perspective of the Ottoman-Venetian conflict. Economically, they represent the outcome of a natural experiment from which we could deepen our understanding of the relationship between monetary and fiscal policy.

The paper contributes to a broader literature on sovereign borrowing and drivers of public debt servicing. John H. Munro (2003), James D. Tracy (2003) and David Stasavage (2011), analyse the origins of the financial revolution in medieval Europe, focusing on long-term state borrowing. Munro (2013) contrasts the differences between Italy and the Low Countries in terms of the role played by the usury doctrine. In a series of articles, Mauricio Drelichman and Hans-Joachim Voth (2008, 2010, 2011a, b), Carlos Álvarez-Nogal (2009) and Álvarez-Nogal and Christophe Chamley (2014, 2015) study the sovereign borrowing practices and debt sustainability in late medieval Castille and Habsburg Spain. Mark Aguiar and Manuel Amador (2013) provide a review of sovereign borrowing from both a historical and theoretical perspective, highlighting the reasons behind sovereign defaults and debt crises in general.

The remainder of the paper is organized as follows. Section 1 provides historical background for the research with an overview of main economic developments in Venice and the Balkan Peninsula during the period covered by our data. Section 2 develops

the model and presents the data and the main empirical results. Concluding remarks, as well as implications of the findings, are given in Section 3.

## 1. Historical Background

The late medieval period in Europe is characterised by a notable scarcity of gold and silver, also known as the "great bullion famine". While the volume of international trade was continuously increasing (Fernand Braudel 1946, 1979), mining and production of precious metals in Central and Western Europe reached a minimum between 1250 and 1450 (Ian Blanchard 2005). The shortage of precious metals, amongst other things, contributed to the creation of various monetary substitutes, such as bills of exchange, banknotes, letters of procuration, debentures, and other paper forms of payment (Roberto Cessi 1926). It also incited a growing interest in the exploration of alternative mining facilities. Ore extraction from Balkan mines thus gained increasing importance in the late 14$^{th}$ and early 15$^{th}$ centuries. Albeit insufficient to fill the gap created by the trade deficit with the East, gold and silver from the Balkans provided a significant contribution to partial alleviation of the monetary crisis in the Mediterranean and the rest of Europe. Production of precious metals from Serbia and Bosnia was predominantly exported through the Republic of Ragusa to Italian city-states, but mainly to Venice. This exporting route had a significant role in financing Venetian government debt.

With the Ottoman invasion of the Balkans, this supply chain was broken. Although the mines were essential for the monetary concerns of the Ottoman Empire, they were integrated into a completely different economic and social environment, remaining permanently beyond the reach of the rest of Europe. The discovery of mines in the Americas in the late 15$^{th}$ century temporarily solved the money supply issues and created a completely different balance of power in Europe.

### Venetian Money and Bonds

There were two types of currencies in circulation during the Middle Ages: golden ducats and silver *grossi*. Following the decline in the price of gold in 1326, individual borrowers in Venice had substantial difficulties in repaying their debt denominated in silver *grossi*. The Republic also faced similar challenges, increasing its liabilities to the bondholders. Venice fixed the value ratio between ducats and *grossi* using the level applied before the gold price decline to solve this issue. This ratio was maintained until the middle of the 15$^{th}$ century when the value of gold increased relative to silver. The Republic adopted the silver standard: gold coins were renamed to *zecchini*, and mass minting of silver *ducats* began (Carlo M. Cipolla 1956; Frederic C. Lane 1973; Lane and Reinhold C. Mueller 1997). The silver *ducat* became the unique unit of the denomination.

Most feudal states applied devaluation and debasement of their currencies as an alternative to seigniorage. Such debt "financing" practice became common during the bullion famine. However, faced with pressure from their powerful trading class, Venice strived to maintain the integrity of their currency and – at least symbolically – signal their dedication to fair trade principles. The Venetians publicly accused other

Mediterranean states of devaluing their ducats by issuing bad imitations on several occasions.

By preserving the value of their currency, Venice could rely on financing their public spending through a combination of relatively stable tax income and the issue of new debt. This practice increased the principal of the total debt of the Republic. Since they issued perpetual bonds, the principal was never paid back to the bondholders, but the interest expenses gradually increased. The *prestiti* paid a fixed nominal interest rate of 5% per year on the remaining face value (see Pezzolo 2003 or Sidney Homer and Richard Sylla 2005). The nominal interest of 5 per cent was paid in two annual instalments of 2½ per cent. Occasional repayments of principal were subordinated to repayments of interest.

To maintain the sustainability of ever-increasing interest costs arising from new issues, the Republic had to provide a stable inflow of minted coins, i.e., increasing the money supply. Thus, the influx of precious metals combined with the preservation of a stable currency was crucial for their public debt sustainability. In this way, the "monetary policy" of the Republic under the relatively low cost of ore processing and stable seigniorage became dependent on the steady inflow of silver and gold.

Such simplistic policy reduces to maintaining continuity of the money supply. Its link with fiscal policy can be assessed indirectly by tracking the value of bonds. As the investors in prestiti had a perception that (exogenous) inflow of monetary metals grows at a rate higher than that of debt servicing costs, the implied creditworthiness of the Republic did not change significantly. Consequently, the price of *prestiti* in the secondary market did not vary significantly, as the yield required by investors was relatively stable. The credit risk premia increased when the inflow of silver and gold had reduced during the 15$^{th}$ century. This increase indirectly leads to Venice's deterioration in the ability to issue new debt.

### Mining in the Balkans

The extraction of gold, silver, lead, copper and iron dates back to the Roman period (Slobodan Dušanić 1977). However, massive exploitation of ore in the Balkans began in the middle of the 12$^{th}$ century when Serbian King Stefan Uroš I commissioned experienced Saxon miners to develop the extraction process (Konstantin Jireček 1912). Evidence of silver trading from Serbian mines appears in Ragusan documents circa 1280 (Jireček 1879). A significant expansion of the mining industry occurs in the 1370s (Mihailo Dinić 1962, 1967; Sima Ćirković 1979), with a peak during the first half of the 15$^{th}$ century (Desanka Kovačević-Kojić 1960). A combination of the abundance of natural resources, advanced mining techniques brought by highly skilled Saxon miners, very liberal mining legislation (Biljana Marković 1981) and high demand for precious metals were the main contributors to the export of silver and gold from Balkan mines. The increasing volume of trade brought representatives of various merchant houses from Ragusa (Kovačević-Kojić and Ćirković 1982-1983), who seized the opportunity to gain from the intermediation.

According to Kovačević-Kojić (1970), 32 medieval mines were active in Serbia and Bosnia, while Ćirković (1979) lists about 50 different mines in entire South-Eastern Europe. The largest regional mine of the period, in terms of its area and production

volumes, was Novo Brdo (Saxon: Neuberghe) in Kosovo. Novo Brdo was a complex of several mining facilities with large deposits of silver, gold, lead and iron ores, active since the first decade of the 14th century. It became famous for its silver, gold and auriferous silver production[1], which peaked between 1420 and 1440 (Kovačević-Kojić 1960). The second-largest mining centre was Srebrenica in Bosnia, with seven mines active since 1352, six of which were abundant with silver. Other important mines were in Brskovo, Janjevo and Ostružnica. Silver could be extracted in 29 mines, while some facilities combined the exploitation of precious metal ores with copper, lead, and iron ore extraction.

### From Neuberghe to Rialto: Tracing the Supply Chain of Precious Metals

Most of the metals from the Balkans were exported to Venice (Blanchard 2005). Naturally, at least some fraction of it had to be transported overland. However, the actual volumes traded in this way are practically impossible to assess due to a negligible number of available sources. Boško Bojović (2013) argues that most trading had to be by the sea, especially after 1428, when King Stefan Tvrtko II of Bosnia imposed duties on silver in transit through the territories under his control. Even without the duties, trading by land was riskier, as robberies were not uncommon (Momčilo Spremić 1994). The premia required by the merchants provide additional evidence: land trade carried returns of 10 per cent, compared to the trading from Dalmatian ports to Venice, where typical returns were 2-7 per cent (Jorjo Tadić 1968). Maritime trading through Ragusa was the most significant route in this supply network (Kovačević-Kojić 1971). Trading through the port of Ragusa was a safer way, conducted indirectly through the intermediation of noble merchant families. It was additionally made attractive after being partially exempt from levies and duties by some of the rulers of Serbia and Bosnia, especially during the period of Serbian Despotate in the 15th century (Bojović 2013).

### The Intermediation Role of Ragusan Merchant Houses

The extent of precious metal trading through Ragusa is evident from the trading activity of merchant houses of the Ragusan Republic (Kovačević-Kojić 1999). The market price of silver was determined by its quality and purity. It ranged from 6 ½ Venetian golden ducats per one Ragusan pound at the beginning of the 14th century to 8-8 ½ ducats in the 1370s, eventually becoming stable at eight ducats in the first half of the 15th century[2]. The price of auriferous silver was 25-26 ducats per Ragusan pound, while the same quantity of pure gold was sold for a price ranging between 76 and 85 ducats (Vuk Vinaver 1964; Ignjat Voje 1970).

Along with Venice, other noteworthy destinations for shipments of precious metals from Ragusa were the Italian regions of Tuscany, Marche, Abruzzo, Puglia, and

[1] Auriferous silver (*argentum de glama*) is a silver ore containing up to 33% of gold – typically between 20 and 25%. Merchants and artisans who mastered techniques to separate and refine the gold from this ore could gain substantial profits.

[2] A Ragusan pound (*libra*) was a unit of weight equal to 327.93 grams (Susan Mosher-Stuard 2006). It was, in fact, the same unit of measure as the ancient Roman pound. Some sources, however, conflate it with the so-called gross pound (*libra de peso grosso*), which was equal to 372.37 grams.

Sicily (Tadić 1960; Ruža Ćuk 1990). In the second half of the 14th century, Ragusan merchants took over almost the entire market for silver, initially controlled by traders from Venice, Florence and Cattaro (the present-day town of Kotor, Montenegro). Precious metals were transported to Venice by city brigantines, indicating the Republic's importance to this trading activity. Ragusan merchants benefited from the various privileges granted by the Venetians, including the benevolence of the local authorities towards their (apparently frequent) smuggling habits. A fraction of precious metals from the Balkan mines was exported from Ragusa to Catalonia, Egypt and Syria, and even Central Europe (Bogumil Hrabak 1980), but to a much smaller extent and predominantly to be exchanged for other commodities, such as wool or grain. The trading route from the Balkans to Venice *via* Ragusa, in some sense, contested the one from African mines to Genoa and Florence by way of Barcelona (Hrabak 1980). Thus, the winners of the rivalry between Venice and other Italian city-states for access to monetary metals were the Ragusan and Catalan suppliers. They benefited from this type of monopolistic competition.

Tadić (1968) provides an excellent illustration of how lucrative intermediation was. When Catalan pirates robbed a ship from Ragusa back from Venice in 1436, the loss was estimated to be 15,000 golden ducats in coin and only about 3,000 ducats in other goods. This five-to-one ratio indicates that the primary purpose of the voyage was to sell raw silver, gold and auriferous silver for money. At the same time, exchange for other commodities was secondary.

The archives of the Ragusan Republic in Dubrovnik (Croatia) allow for some crude estimates of the actual extent of exports of precious metals from the Balkans. The Mint of Ragusa (*La Zecca di Ragusa*) registry contains exact numbers of coins minted in 1422. Based on these quantities, Bojović (2013) estimates that total exports of silver to Italian cities during that particular year were about 5.7 metric tons. Referring to Ćirković (1976), he further uses the data from the Mint on collected levies to estimate the production levels during the two following decades (the standard levy was 6%). He points out that a significant drop in production occurred in 1440, immediately after the first Ottoman conquest of the territories ruled by Serbian Despots (1439-1444).

Additional evidence on the number of exports of plain and auriferous silver and gold can be found in the trading books of the Caboga family company. The Caboga (Kabužić) family was one of the famous noble houses of Ragusa. The Caboga (Kabužić) family was one of the famous noble houses of Ragusa. The trading books of their company, covering the period between December 15, 1426, and May 25, 1433, are available in the Historical Archive of Dubrovnik. They consist of general ledger (*quaderno*), diary (*giornale*) and reminder (*squarço*). They are among the oldest available trading books to apply a double-entry bookkeeping system (Kovačević-Kojić 1999). The information available in these books is mainly related to purchasing precious metals from mines in Serbia and Bosnia and their subsequent shipment to Venice. The details allow tracking of each transaction throughout six and a half years. Along with precious metals, trading books of the Caboga Company also contain transactions involving beeswax, while other goods appear only in negligible amounts. Such

content is not merely a coincidence – Hrabak (1980) presents evidence that a common smuggling practice of the period involved hiding silver in beeswax rolls.

Based on these data, the average trading volume of Caboga Company can be estimated to be about 1770 Ragusan pounds (580 kg) per year. Out of that amount, 1340 pounds (439 kg) were plain silver, and 430 pounds (141 kg) were auriferous silver, the latter yielding about 107 pounds (35 kg) of gold after being processed. Some of the shipments included pure gold as well. The total revenue of their documented transactions was about 100,000 golden ducats, and approximately 90% of their income came from deals closed in Venice. The ships almost always carried money on their return voyage, and very rarely other commodities were purchased. Most of the revenues were reinvested (Kovačević-Kojić 1996, 1999). Such detailed information is helpful to estimate the orders of magnitude of production of precious metals during the 15th century.

### Production Volumes

Earlier estimates of silver production in Serbia and Bosnia during the 14th and 15th centuries ranged between 10 and 12 metric tons per year (Ćirković 1979; Herman Kellenbenz 1979; Kovačević-Kojić 1996). More recent research provides evidence that the total production of precious metals in the Balkans during the first half of the 15th century should be set at least at 30 metric tons per year (Ćirković, Kovačević-Kojić, and Ćuk 2002; Kovačević-Kojić 2004, 2010). An alternative lower bound of 11.5 metric tons per year could be established based on the annual income of Serbian Despots, who controlled Novo Brdo and Srebrenica as the two most important mining centres of the period (Bojović 2013). Bertrandon de la Brocquière (1807) estimated the annual income of Novo Brdo in 1433 to be around 200,000 golden *ducats*. In 1455, the income of Serbian Despot Đurađ Branković was 120,000 *ducats* (Euzebije Fermendžin 1892). Based on this evidence, Vinaver (1960) estimates that the total production of plain and auriferous silver in 1455 had to be between 7.5 and 9 metric tons. Ćirković (1976; 1979) and Kovačević-Kojić (2010) provide valuable data on rents in Srebrenica, from which we can estimate that silver production had to be around 5-6 metric tons per year at its peak. The total income of Srebrenica in 1458, at the maximum of its activity, was 30,000 ducats, split equally between the Serbian Despot and the Bosnian king. In 1464, one year after the Ottoman conquest of the territories under the control of the Bosnian King, the income dropped to 7,000 *ducats*. This pattern suggests that the Venetian demand substantially influenced mining activity and that the Ottoman invasion had a critical impact on breaking the established supply channel through Ragusa. Jovan Radonić (1930) quotes the biographer of Mehmed II the Conqueror, who argues that the sultan had political, strategic, and financial reasons to conquer the territories under Serbian control or influence, rather than keeping them as vassal states. The biographer also mentions that "Serbian gold and silver are more abundant and better quality than India". Gligorije Elezović (1932) quotes a different biographer, who indicates that Serbian lands have "inexhaustible sources of gold and silver".

Vinaver (1960) and Tadić (1968) also put the production from Serbian and Bosnian mines into a global perspective. With total European estimates ranging between 23 and 47 metric tons per year, it should have represented between 12.5 and 20% of

the total quantity extracted in the entire continent at its apex. Even if a conservative approach is taken, where the minimum quantity extracted from the Balkan mines is compared to the maximum quantity extracted from mines across entire Europe, the number should be at least 10% (cf. Bojović 2013).

Braudel (1979) provides rough orders of magnitude for the entire volume of gold and silver in Europe before the colonisation of the Americas. His estimate of the total quantity of gold in circulation was around 2,000 metric tons, and the total quantity of silver was around 20,000 tons. Suppose we assume that the average annual output of the mining industry in late medieval South-Eastern Europe was at least 10 tons. In that case, a century of production of precious metals should have resulted in a minimum of 1,000 tons extracted. This quantity would contribute to around 5% of the monetary mass in Europe during the 15th century. More recent findings of Kovačević-Kojić (2010, 2012) that estimate the annual output of mines in Serbia and Bosnia to be 30-40 tons would set this fraction to as high as 15-20%.

Irrespective of the precise numbers, the orders of magnitude of gold and silver production from the Balkan mines are negligible. Although extensively analysed by historians, such as Braudel (1946) or Lane and Mueller (1997), the Venetian economic downturn of the second half of the 15th century often tends to neglect the role of the Ottoman invasion of the Balkans, and it overlooks the sudden fall in the supply of monetary metals (Bojović 2013). Section 2 explores this link more formally.

## 2. Empirical Findings

### 2.1 Model

Due to the understandable scarcity of the relevant data, we adopt a reduced-form time-series model of Anthony D. Hall, Heather M. Anderson, and Clive W. J. Granger (1992) to forecast yields. The model is based on the cointegration approach of John Y. Campbell and Robert J. Shiller (1987). We will thus assume that the dynamics of bond yield $y_t$ is given by:

$$\Delta y_t = \sum_{i=1}^{k} \alpha_i \Delta y_{t-i} + \beta s_t + \varepsilon_t, \quad (1)$$

where $t = 1, 2, ..., T$ labels the periods (years), $s_t$ represents the spread between short-term and long-term debt instruments yields, while $\varepsilon_t$ is the short-term disturbance. The intuition for this approach is relatively straightforward and does not rely on the weak form of the Efficient Market Hypothesis. Namely, investors reflect available information about future short-term rates through the prices they are willing to pay for long-term bonds, which automatically reflects on yields. The yield spread $s_t$ can forecast investors' information about the future short-term end of the yield curve that is not contained in the past yields. Campbell and Shiller (1987) used monthly observations of one-month and 20-year bond yields between 1959 and 1983. They could not reject the hypotheses that one-period yields were I(1), and the spread was I(0), which also justified their approach empirically.

Since the only historical data available for Venetian government debt during the 14th and 15th centuries with a regular frequency are prices and yields of *prestiti*, which are perpetual bonds, we cannot rely on spreads or any point along the term structure of

interest rates to run the model. Instead, to make the model feasible, we modify the specification given by Equation (1) to an error correction model (ECM) of the form:

$$\Delta y_t = \sum_{i=1}^{k} \alpha_i \Delta y_{t-i} + \sum_{j=1}^{m} \beta_j' \Delta x_{t-j} + \gamma u_{t-1} + \varepsilon_t, \quad (2)$$

where $x_t$ represents a set of explanatory variables that capture the effect of the changes in future yields that are not contained in the historical yields, while $u_t$ is the long-term disturbance. The long-run equilibrium relationship between the yields and the explanatory variables is given by:

$$y_t = b' x_t + u_t. \quad (3)$$

One of the main explanatory variables to consider in Equations (2) and (3) is the growth rate of gross domestic product (GDP), which is closely related to the yield curve spread, at least in modern developed markets (see, for instance, Arturo Estrella and Frederic S. Mishkin 1998 or Andrew Ang, Monika Piazzesi, and Min Wei 2006).

## 2.2 Data

Our primary dependent variable is the yield on *prestiti*, expressed in per cent per annum,$y_t$. We use annual data between 1399 and 1470 available from the Global Financial Database. Table 1 presents the summary statistics. The plot of the time series is shown in Figure 1.

Table 1 suggests a very high degree of autocorrelation in yield $y_t$. In fact, the Augmented Dickey-Fuller (ADF) test statistic of –0.98 indicates that the null hypothesis of a unit root cannot be rejected. On the other hand, the first difference of the yield, $\Delta y_t$, does not exhibit unit-root non-stationarity since the corresponding ADF statistic (–8.73) is highly significant.

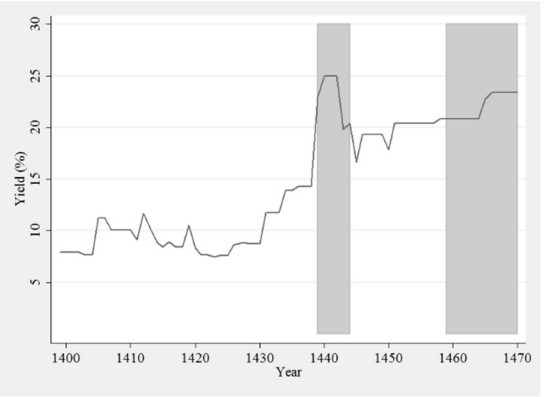
**Table 1** Summary Statistics for Yield on Venetian *prestiti* during 1399-1470

| | |
|---|---|
| Number of observations | 72 |
| Mean | 14.85 |
| Standard deviation | 6.08 |
| Minimum | 7.46 |
| Maximum | 25.00 |
| Skewness | 0.19 |
| Kurtosis | 1.40 |
| Autocorrelation (one lag) | 0.96*** |
| Ljung-Box statistic (five lags) | 265.99*** |

**Source:** Author's calculations.

As a collection of explanatory variables $x_t$ we use the time trend ($t$), real GDP growth rate, a proxy for the money supply, and a dummy indicating the Ottoman control of mines in Serbia and Bosnia. The intuition for the economic significance of the explanatory variables is the following. First, the interest rate on government debt and output should have the usual negative relationship since lower debt servicing costs would have allowed the state to invest more, resulting in higher GDP. The real GDP

growth rate for Venice will be approximated by GDP estimates for city-states in Northern Italy, available in Paolo Malanima (2011).




**Notes:** Shaded areas indicate the periods of Ottoman control of the Balkan mines.

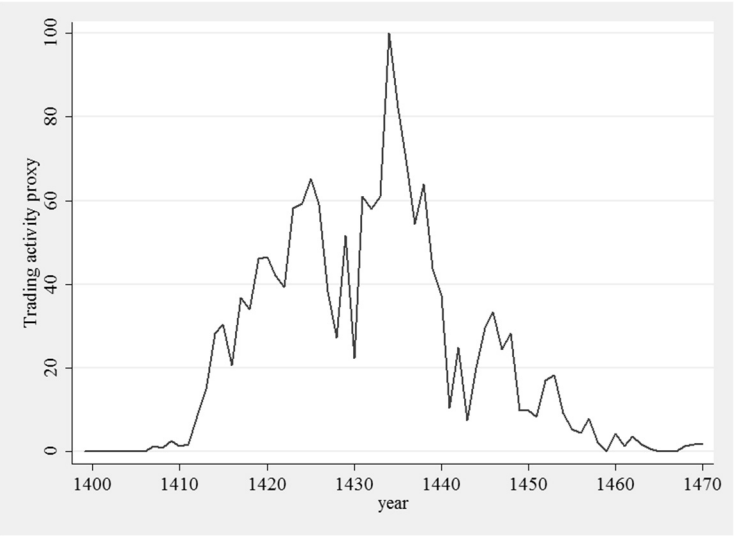
**Source:** Author's calculations.

**Figure 1** The Yield on Venetian prestiti during 1399-1470

Second, a sovereign borrower can improve debt sustainability by reducing the primary fiscal deficit (through increased tax income or reduced public expenditures), increasing output growth, or reducing the real interest rate. Theoretically, a higher money supply should put downward pressure on the real interest rates. The Venetian state did participate in the secondary market at the Rialto bridge, buying back a portion of issued securities and thus effectively paying out a fraction of the principal (see Munro 2013). However, in the absence of a monetary authority that sets the reference rate of interest, any increase in the nominal yield can be explained through a combined increase in premia for default risk, illiquidity and inflation risk. Since *prestiti* were amongst the most sought-after securities in the 14$^{th}$ and 15$^{th}$ centuries, both by Venetian nobility and European investors (Homer and Sylla 2005), it is reasonable to assume that their liquidity was relatively high, at least when compared to other available investment vehicles. Thus, we can suppose that increases in the nominal yield were predominantly driven by a combination of default and inflation risk premia. Since the government debt was financed through a combination of tax income and base money, at least some part of changes in yield should be attributed to an increase in the monetary base, i.e., the supply of *ducats* and *grossi* in circulation. Inflationary risks could not be mitigated if the economy grew slower than the money supply. The price indices available in Malanima (2011) allow us to set a crude estimate for the inflation rate in the 15$^{th}$ century's Northern Italy at 1.4% per year on average, with a standard deviation of 18.7%. With a modest nominal GDP growth rate of around 2% on average, we may expect that debt monetisation has contributed to inflation in Venice and, subsequently, to the additional risk premium required by investors. Hence, there is a combined effect of the supply of precious metals.

To capture the net effect of money supply, we use a measure of trading activity with mines in Serbia and Bosnia during 1399-1470 as a proxy. Since most of the

precious metals exported from the Balkans to Venice went through Ragusan merchants, it is reasonable to use the number of citizens of Ragusa registered near the major mining centres in a particular year as a measure of trading activity in that year. Therefore, we use the annual data on the number of Ragusan nobility and other citizens who appeared in the legal affairs in towns of Priština (the settlement closest to the mine of Novo Brdo) and Srebrenica, available from Kovačević-Kojić (2012) and Kovačević-Kojić (2010), respectively. We construct an index of trading activity in each period, $TradingActivity_t$, by setting it initially to zero and changing it with each increase in the total number of Ragusan citizens in Priština and Srebrenica combined, relative to the historical maximum of this number, which is normalized to 100. The series is displayed in Figure 2.




**Source:** Author's calculations.

**Figure 2** The Proxy for the Trading Activity in Precious Metals between Venice and the Balkans during 1399-1470

To determine the impact of the Ottoman occupation of the Balkans on Venetian debt servicing cost, we introduce a dummy variable equal to one if the Ottomans controlled the Balkan mines in a particular year and zero otherwise. The years in question were 1439-1444 and 1459-1470, also represented by the shaded areas in Figure 1[3].

[3] In 1439 the Ottoman army, led by the sultan Murad II, temporarily sacked Serbia. Serbian Despot Đurađ Branković fled to Hungary. After three months of siege, his castle Smederevo fell on August 18, 1439. The last of the cities in the region was conquered in March 1442. A broad Christian coalition of Hungarians (under the command of János Hunyadi, the White Knight of Wallachia), Romanians (under Vlad II Dracul) and Serbs (under Despot Đurađ) advanced into Serbia and Bulgaria in September 1443. The Peace of Szeged fully restored Serbian territories on August 15, 1444. This interregnum lasted until 1459 when the Ottomans reconquered Smederevo and the rest of the Despotate. The Ottomans entirely conquered the territories under the control of the Bosnian king in 1463 (Franz Babinger 1992; John V. A. Fine Jr. 1994).

These periods coincide with some of the highest yield levels on Venetian perpetual bonds.

Regarding possible explanations for why debt servicing became quite expensive for the Venetian state during the 15th century, conventional wisdom is that interest payments began falling into arrears due to frequent conflicts with neighbouring states (Homer and Sylla 2005; Munro 2013). Indeed, the reigns of Doge Tommaso Mocenigo (1413-1423) and Doge Francesco Foscari (1423-1457) were particularly marked with ongoing periods of war. To control for the potential impact of military conflicts, we introduce another dummy variable labelled $Wars_t$, equal to one if Venice was at war in a particular year and zero otherwise. The conflicts we considered include war with Sigismund of Hungary (1411-1413), maritime conflict with the Turks (1416), conflict with the Duchy of Milan (1420), four Lombardian campaigns (1423-1426; 1427-1428; 1431-1433; 1438-1441), short war with Florence and Milan (1450) and first Ottoman-Venetian war (1463-1479). We also run a set of regressions using a separate dummy for each war.

## 2.3 Results

We apply the Engle-Granger two-step procedure to assess the long-term and short-term impact of explanatory variables. First, we run a cointegrating regression given by Equation (3) using an ordinary least squares (OLS) estimator. The results are summarised in Table 2. Since the key variables in the regression are integrated, we cannot rely on OLS standard errors to interpret the significance.

The first column corresponds to the model without the war dummies. Time trend has a positive coefficient, which is not surprising for regression with nominal yield levels on its left-hand side. The logarithm of real GDP has an expected negative association. Similarly, the trading activity proxy has a negative coefficient, which corresponds to the intuition established in Section 2.2 that, *ceteris paribus*, an increase in the money supply should decrease interest expenses paid on sovereign debt. The coefficient corresponding to the dummy for Ottoman control of the mines in Serbia and Bosnia is positive, indicating that the break in the supply chain of precious metals from the Balkans to Venice had a positive long-term impact on the increase in debt servicing cost. The regressors explain 86.2 per cent of the variation in long-term yield. The null hypothesis of the Dickey-Fuller test that the estimated residuals $\hat{u}_t$ have a unit root can be rejected only at a 10 per cent significance level.

The second column of Table 2 introduces a control for military conflicts. The dummy is negative, which implies that wars were overall beneficial for reducing effective interest expenses of the Venetian debt. The $R^2$ slightly increases to 0.879, and the Dickey-Fuller statistic is now significant at the 5 per cent level.

The third column of Table 2 contains estimates for the model with dummies for each conflict, which isolates the individual impact of wars. Only the fourth Lombardian campaign (1438-1441), which counterbalanced the Venetian victories in the previous three (Niccolò Machiavelli 2016), increased interest expenses. All remaining wars led to a long-term decrease in debt servicing costs, and Venice mainly was victorious in all of them. The only exceptions are the war with Florence and Milan and the First war with the Ottoman Empire. However, despite the military defeats, the

Republic managed to gain major strategic wins. The alliance with the Kingdom of Naples following the 1450 war re-established the balance of power ultimately formalised through the Treaty of Lodi. At the end of the Ottoman-Venetian war, Venice recouped its lost territories by *de facto* acquiring the Crusader Kingdom of Cyprus (see, for instance, John Julius Norwich 1982; Daniel Goffman 2002; George Finlay 2005). The regression has an $R^2$ of 0.938, while the Dickey-Fuller test statistic is –5.435, indicating that the null hypothesis of a unit root can now be overwhelmingly rejected.

As the second step, we use the estimates of lagged residuals from the first regression, $\hat{u}_{t-1}$, to run the first-difference regression, Equation (2). We use the maximum likelihood estimator (MLE) and sort the models by lags in $\Delta y_t$ based on their Schwarz Bayesian information criterion (SBIC). The models considered for the sorting procedure had $p$-value of the $\chi^2$ statistic for joint significance not higher than 0.10. This procedure results in an ECM model with one lag in $\Delta y_t$ as the optimal choice.

Table 3 summarises the results of coefficient estimates for ECM(1). The three columns correspond to the three cointegrating regressions from Table 2. The coefficient of lagged residuals $\hat{u}_{t-1}$ is significant and negative, justifying the cointegrating relationship between the yields and the explanatory variables. Numerical values of the coefficients are between 0 and –1, while the first lag in $\Delta y_t$ is insignificant (except in the third regression, but only at 10 per cent). Thus, the integrated model would establish an autoregressive relationship between the yield and its first lag. This mean-reverting behaviour is a common property of historical yields and interest rates (Jan Willem van der End 2011).

**Table 2** Cointegrating Regressions (OLS)

| ***yt*** | **(1)** | **(2)** | **(3)** |
|---|---|---|---|
| Constant | 66.384 | 77.348 | 71.141 |
| Time trend | 0.227 | 0.229 | 0.251 |
| Log real GDP | –12.993 | –15.354 | –14.061 |
| Trading activity | –0.027 | –0.015 | –0.029 |
| Ottoman control | 2.705 | 3.413 | 2.554 |
| Wars | | –1.804 | |
| War with Hungary | | | 0.134 |
| Maritime conflict 1416 | | | –2.840 |
| War with Milan 1420 | | | –3.371 |
| First Lombardian campaign | | | –2.467 |
| Second Lombardian campaign | | | –2.799 |
| Third Lombardian campaign | | | –2.020 |
| Fourth Lombardian campaign | | | 3.672 |
| War with Florence and Milan | | | –1.081 |
| First Ottoman-Venetian war | | | –3.749 |
| Observations | 72 | 72 | 72 |
| $R^2$ | 0.862 | 0.879 | 0.938 |
| Dickey-Fuller statistic | –2.820* | –3.196** | –5.445*** |

**Notes:** The asterisks ***, **, and * indicate 1%, 5%, and 10% significance levels respectively.

**Source:** Author's calculations.

**Table 3** Short-Term Impact (MLE)

| $\Delta y_t$ | (1) | (2) | (3) |
|---|---|---|---|
| Constant | 0.160 | 0.161 | 0.174 |
| | (0.152) | (0.149) | (0.123) |
| $\Delta y_{t-1}$ | 0.076 | 0.120 | 0.154* |
| | (0.097) | (0.099) | (0.080) |
| Log real GDP | –6.960*** | –8.206*** | –8.734*** |
| | (2.007) | (2.076) | (1.727) |
| Trading activity | 0.008 | 0.007 | 0.007 |
| | (0.014) | (0.013) | (0.012) |
| Ottoman control | 4.019*** | 4.103*** | 3.286*** |
| | (0.743) | (0.733) | (0.621) |
| Wars | | –0.775** | |
| | | (0.354) | |
| War with Hungary | | | –0.428 |
| | | | (0.731) |
| Maritime conflict 1416 | | | –0.267 |
| | | | (0.752) |
| War with Milan 1420 | | | –1.814** |
| | | | (0.757) |
| First Lombardian campaign | | | –1.117 |
| | | | (0.842) |
| Second Lombardian campaign | | | –0.499 |
| | | | (0.863) |
| Third Lombardian campaign | | | –1.357* |
| | | | (0.761) |
| Fourth Lombardian campaign | | | 0.136 |
| | | | (0.719) |
| War with Florence and Milan | | | –2.045*** |
| | | | (0.725) |
| First Ottoman-Venetian war | | | –1.882* |
| | | | (1.055) |
| $\hat{u}_{t-1}$ | –0.169** | –0.195** | –0.498*** |
| | (0.071) | (0.079) | (0.092) |
| Observations | 70 | 70 | 70 |
| $R^2$ | 0.416 | 0.434 | 0.619 |
| SBIC | 3.653 | 3.681 | 3.771 |

**Notes:** Standard errors in parentheses. The asterisks ***, **, and * indicate 1%, 5%, and 10% significance levels respectively.

**Source:** Author's calculations.

The first difference in the logarithm of the real GDP (i.e., the GDP growth rate) and the Ottoman dummy are again highly significant. The coefficient corresponding to the real GDP growth rate, which is scaled by 100 in these regressions, has a negative sign, suggesting that the cost of government debt was lower in periods of higher economic growth. More precisely, a one percentage point increase in real GDP growth

rate would result in a decline in yield of 6.96 percentage points on average. Despite the lack of formal evidence, it is reasonable to assume that GDP growth exhibited a high positive correlation with consumption growth, as in modern economies. This positive correlation would result in negative beta coefficients in a regression of (excess) bond returns on consumption growth, as in John H. Cochrane and Piazzesi (2005).

When we introduce controls for wars, this value goes as high as 8.82 percentage points. The trading activity is insignificant in all three regressions. Hence, there is only a long-term impact of money supply on debt servicing costs (Table 2), while the short-term impact is negligible. The dummy for the Ottoman control of the mines in Serbia and Bosnia is again significant and positive. Thus, the break in the supply chain of precious metals from the Balkans to Venice significantly impacted the increase in short-term interest expenses.

On average, the yield on *prestiti* increased by 3.25-4.10 percentage points in the years in which the Ottomans took control over the mines. The wars had a significant short-term impact overall. The coefficient in the second model is again negative and shows that the yield on sovereign debt decreased by 78 basis points on average in years during which Venice was at war. Individually, the two military campaigns that were most beneficial for the short-term debt servicing were war with the Duchy of Milan in 1420 and the Fourth Lombardian war (1438-1441), which can be seen from the third column in Table 3.

## 3. Conclusion

This research attempts to establish a nexus between interest expenses paid on sovereign debt and money supply without a central monetary authority. We use an error correction model to describe changes in yields on *prestiti*, perpetual bonds of the Venetian Republic issued between 1399 and 1470. Our main finding is that the ability of the Republic to service its sovereign borrowing can be partially attributed to the supply of precious metals from the Balkans. The quantity of silver and gold supplied to Venice had a persistent impact on debt servicing, reducing the interest costs on average. A significant increase in yield on perpetual bonds issued by the Republic during the 15$^{th}$ century can be explained by the Ottoman control of the Balkan mines, and this had both a long-term and a short-term effect. These results hold even when we control for other explanatory factors, such as real GDP growth or military conflicts between Venice and other European states.

Therefore, the Ottoman control of the mines is among the main exogenous determinants of a sharp increase in yield on *prestiti* during the second half of the 15$^{th}$ century. Venice could not keep it sustainable with a limited ability to monetise its debt. Deprived of one of its principal sources of financing, the Republic spiralled into an economic crisis from which it never fully recovered. The discovery of the New World transformed from a Mediterranean superpower into a minor player in the global scene, engaged in frequent European conflicts and local squabbles.

The findings may broaden our understanding of an often-disregarded economic perspective of the Ottoman-Venetian conflict, an ongoing struggle that extended over two and a half centuries. The first Ottoman-Venetian war started in 1463, which was the year when the territories of the King of Bosnia fell under the Ottomans. Four years

before that, the Ottomans took control of the territories of Serbian Despots, which were only under suzerainty up to that point. Given the strategic brilliance of Mehmed II, it is not unimaginable that he may have destabilised one of his main rivals in the Mediterranean economically by seizing their primary supply of precious metals. The rule over Venetian tributary cities in Greece, commonly regarded as the casus belli, could be just a step in the broader stratagem.

## References

**Aguiar, Mark, and Manuel Amador.** 2013. "Sovereign Debt: A Review." National Bureau of Economic Research Working Paper 19388.

**Álvarez-Nogal, Carlos.** 2009. "Oferta y demanda de deuda pública en Castilla: Juros de Alcabalas (1540-1740)." Estudios de Historia Económica 55.

**Álvarez-Nogal, Carlos, and Christophe Chamley.** 2014. "Debt Policy under Constraints: Philip II, the Cortes, and Genoese Bankers." *Economic History Review*, 67(1): 192-213. http://dx.doi.org/10.1111/1468-0289.12010

**Álvarez-Nogal, Carlos, and Christophe Chamley.** 2015. "Equity Short-Term Finance under Philip II, with an Option to Long-Term Funded Debt." Universidad Carlos III de Madrid Working Paper in Economic History 15-02.

**Ang, Andrew, Monika Piazzesi, and Min Wei.** 2006. "What Does the Yield Curve Tell Us about GDP Growth?" *Journal of Econometrics*, 131(1-2): 359-403. http://dx.doi.org/10.1016/j.jeconom.2005.01.032

**Babinger, Franz.** 1992. *Mehmed the Conqueror and His Time*. Princeton, N. J.: Princeton University Press.

**Blanchard, Ian.** 2005. *Mining, Metallurgy and Minting in the Middle Ages: Continuing Afro-European Supremacy 1250-1450*. Vol. 3. Stuttgart: Franz Steiner Verlag.

**Bojović, Boško.** 2013. "From a Market Economy to a State Monopoly: Precious Metals of Serbia and Bosnia between Venice and the Ottoman Empire (15-16th Century)." *Zbornik Matice srpske za društvene nauke*, 142: 1-31. http://dx.doi.org/10.2298/ZMSDN1342007B

**Braudel, Fernand.** 1946. "Monnaies et civilisations: De l'or du Soudan à l'argent d'Amérique: Un drame méditerranéen." *Annales: Economies, Sociétés, Civilisations*, 1(1): 9-22.

**Braudel, Fernand.** 1979. *Civilisation matérielle, économie et capitalisme, XVe-XVIIIe siècle: Les structures du quotidien: le possible et l'impossible*. Vol. 1. Paris: Armand Colin.

**Campbell, John Y., and Robert J. Shiller.** 1987. "Cointegration and Tests of Present Value Models." *Journal of Political Economy*, 95(5): 1062-1088. http://dx.doi.org/10.1086/261502

**Cessi, Roberto.** 1926. "Problemi monetari e bancari veneziani del secondo XIV." *Archivio Veneto - Tridentino*, 9: 17-28.

**Chadha, Jagjit S., Luisa Corrado, Jack Meaning, and Tobias Schuler.** 2021. "Monetary and Fiscal Complementarity in the Covid-19 Pandemic." European Central Bank Working Paper 2588.

**Cipolla, Carlo M.** 1956. *Money, Prices, and Civilization in the Mediterranean World*. Princeton, N. J.: Princeton University Press.

**Ćirković, Sima.** 1976. "The Mint of Ragusa and Production of Silver in Serbia and Bosnia." *Historical Gazette*, 1(2): 91-98.

**Ćirković, Sima.** 1979. "Production of Gold, Silver and Copper in the Central Parts of the Balkans from the 13th to the 16th Century." In *Precious Metals in the Age of Expansion*, ed. Herman Kellenbenz, 41-69. Stuttgart: Beiträge zur Wirtschaftsgeschichte.

**Ćirković, Sima, Desanka Kovačević-Kojić, and Ruža Ćuk.** 2002. *Serbian Mining of Old*. Novi Sad: Prometej.

**Cochrane, John H., and Monika Piazzesi.** 2005. "Bond Risk Premia." *American Economic Review*, 95(1): 138-160. http://dx.doi.org/10.1257/0002828053828581

**Ćuk, Ruža.** 1990. "I rapporti economici fra Ragusa e Venezia nel Medio Evo." In *Ragusa e il Mediterraneo: Ruolo e funziono de una Republica marinara tra Medievo ed Età moderna*, ed. Antonio Di Vittorio and Sergio Anselmi, 115-129. Bari: Cacucci Editore.

**De la Brocquière, Bertrandon.** 1807. *The Travels of Bertrandon de la Brocquière to Palestine: And His Return from Jerusalem Overland to France, during the Years 1432 and 1433*. Oxford: Hafod Press.

**Dinić, Mihailo.** 1962. "On the History of Mining in Medieval Serbia and Bosnia II." *Special Editions of the Serbian Academy of Sciences*, 355: 1-26.

**Dinić, Mihailo.** 1967. "Trepča in the Middle Ages." *Contributions to Literature, Language, History and Folklore*, 33: 3-10.

**Drelichman, Mauricio, and Hans-Joachim Voth.** 2008. "Debt Sustainability in Historical Perspective: The Role of Fiscal Repression." *Journal of the European Economic Association*, 6(2-3): 657-667. http://dx.doi.org/10.1162/JEEA.2008.6.2-3.657

**Drelichman, Mauricio, and Hans-Joachim Voth.** 2010. "The Sustainable Debts of Philip II: A Reconstruction of Castile's Fiscal Position, 1566-1596." *Journal of Economic History*, 70(4): 813-832. http://dx.doi.org/10.1017/S0022050710000732

**Drelichman, Mauricio, and Hans-Joachim Voth.** 2011a. "Lending to the Borrower from Hell: Debt and Default in the Age of Philip II." *Economic Journal*, 121(557): 1205-1227. http://dx.doi.org/10.1111/j.1468-0297.2011.02442.x

**Drelichman, Mauricio, and Hans-Joachim Voth.** 2011b. "Serial Defaults, Serial Profits: Returns to Sovereign Lending in Habsburg Spain, 1566-1600." *Explorations in Economic History*, 48(1): 1-19. http://dx.doi.org/10.1016/j.eeh.2010.08.002

**Dušanić, Slobodan.** 1977. *Aspects of Roman Mining in Noricum, Pannonia, Dalmatia and Moesia Superior*. Berlin: De Gruyter. http://dx.doi.org/10.1515/9783110852882-003

**Elezović, Gligorije.** 1932. "Turkish Sources for the History of Yugoslavs: Two Turkish Chroniclers of XV Century." *Bratstvo*, 26: 51-125.

**Estrella, Arturo, and Frederic S. Mishkin.** 1998. "Predicting U.S. Recessions: Financial Variables as Leading Indicators." *Review of Economics and Statistics*, 80(1): 45-61. http://dx.doi.org/10.3386/w5379

**Fermendžin, Euzebije.** 1892. *Acta Bosnae potissimum ecclesiatica cum inceris editorium documentorum regestis ab ano 925 usque ad annum 1752*. Zagreb: Academia Scientiarum et Artium Slavorum Meridionalium.

**Fine Jr., John V. A.** 1994. *The Late Medieval Balkans: A Critical Survey from the Late Twelfth Century to the Ottoman Conquest*. Ann Arbor: University of Michigan Press.

**Finlay, George.** 2005. *The History of Greece under Ottoman and Venetian Domination*. Boston, M. A.: Adamant Media Corp.

**Goffman, Daniel.** 2002. *The Ottoman Empire and Early Modern Europe: New Approaches to European History*. Cambridge, M. A.: Cambridge University Press.

**Hall, Anthony D., Heather M. Anderson, and Clive W. J. Granger.** 1992. "A Cointegration Analysis of Treasury Bill Yields." *Review of Economics and Statistics*, 74(1): 116-126. http://dx.doi.org/10.2307/2109549

**Homer, Sidney, and Richard Sylla.** 2005. *A History of Interest Rates*. 4th ed. Hoboken, N. J.: Wiley & Sons.

**Hrabak, Bogumil.** 1980. "'Ragusan' Silver in Italy and in Catalonia in 14th, 15th and 16th Century." *Historical Gazette*, 1(2): 57-78.

**Jireček, Konstantin Josef.** 1879. *Die Handelsstrassen und Bergwerke von Serbien und Bosnien während des Mittelalters*. Prague: Verlag der kön. böhmischen Gesellschaft der Wissenschaften.

**Jireček, Konstantin Josef.** 1912. "Staat und Gesellschaft im mittelalterlichen Serbien: Studien zur Kulturgeschichte des 13.-15. Jahrhunderts." In *Denkschriften der kaiserlichen Akademie der Wissenschaften in Wien: Philosophisch-Historische Klasse*. Wien: Aus der Kaiserlich-Königlichen Hof- und Staatsdruckerei.

**Kellenbenz, Herman.** 1979. "Final Remarks: Production and Trade of Gold, Silver, Copper and Lead from 1450 to 1750." In *Precious Metals in the Age of Expansion*, ed. Herman Kellenbenz, 320-321. Stuttgart: Beiträge zur Wirtschaftsgeschichte.

**Kovačević-Kojić, Desanka.** 1960. "Dans la Serbie et la Bosnie médiévales: les mines d'or et d'argent." *Annales: Economies, Sociétés, Civilisations*, 2: 248-258.

**Kovačević-Kojić, Desanka.** 1970. *Il commerce raguseo di terraferma nel Medio Evo, Ragusa e il Méditerranée: Ruolo e funzioni di una republica marinara fra Medioevo ed Età moderna*. Bari: Cacucci Editore.

**Kovačević-Kojić, Desanka.** 1971. "On Export of Beeswax from Medieval Serbia and Bosnia through Ragusa." *Historical Journal*, 18: 143-153.

**Kovačević-Kojić, Desanka, and Sima Ćirković.** 1982-1983. "L'économie naturelle et la production marchande aux XIIIe-XVe siècles dans les régions actuelles de la Yougoslavie." *Balcanica*, 13-14: 45-56.

**Kovačević-Kojić, Desanka.** 1996. "Serbian Silver and Gold in European Production (14th-15th Century)." In *Europe and Serbs*, 167-173. Belgrade: Serbian Academy of Sciences and Arts.

**Kovačević-Kojić, Desanka.** 1999. "Trading Books of Caboga Brothers." *Journal of the Serbian Academy of Sciences and Arts*.

**Kovačević-Kojić, Desanka.** 2004. "Les métaux précieux de Serbie et de Bosnie: estimation de la production (XIVe-XVe siècle)." In *Die Tiroler Bergbau und die Depression der europäischen Montanwirtschaft im 14. und 15. Jahrhundert: Akten der internationalen bergbaugeschichtlichen Tagung Steinhaus*, 87-93. Innsbruck: Studienverlag.

**Kovačević-Kojić, Desanka.** 2010. "Medieval Srebrenica: 14th-15th Century." *Special Editions of the Serbian Academy of Sciences and Arts*.

**Kovačević-Kojić, Desanka.** 2012. *La Serbie et les pays serbes: l'économie urbaine XIVe-XVe siècles*. Belgrade: Maison serbe d'édition de livres scolaires.

**Lane, Frederic C.** 1973. *Venice: A Maritime Republic*. Baltimore, M. D.: The Johns Hopkins Press.

**Lane, Frederic C., and Reinhold C. Mueller.** 1997. *Money and Banking in Medieval and Renaissance Venice*. Vol. I-II. Baltimore, M. D.: The Johns Hopkins Press.

**Machiavelli, Niccolò.** 2016. *History of Florence and of the Affairs of Italy: From the Earliest Times to the Death of Lorenzo the Magnificent*. California: CreateSpace.

**Malanima, Paolo.** 2011. "The Long Decline of a Leading Economy: GDP in Central and Northern Italy 1300-1913." *European Review of Economic History*, 15(2): 169-219. http://dx.doi.org/10.1017/S136149161000016X

**Marković, Biljana.** 1981. "Certaines remarques sur la Loi sur les mines du Despote Stefan Lazarević de l'année 1412." *Balkan Studies*, 22(2): 269-274.

**Mosher-Stuard, Susan.** 2006. *Gilding the Market Luxury and Fashion in Fourteenth-Century Italy*. Philadelphia: University of Pennsylvania Press.

**Munro, John H.** 2003. "The Medieval Origins of the Financial Revolution: Usury, Rentes, and Negotiability." *International History Review*, 25(3): 505-562. http://dx.doi.org/10.2307/40109398

**Munro, John H.** 2013. "Rentes and the European 'Financial Revolution'." In *Handbook of Key Global Financial Markets, Institutions, and Infrastructure*, ed. Gerard Caprio, 235-249. Oxford: Elsevier.

**Norwich, John Julius.** 1982. *A History of Venice*. New York: Knopf.

**Pezzolo, Luciano.** 2003. "The Venetian Government Debt, 1350-1650." In *Urban Public Debts, Urban Government and the Market for Annuities in Western Europe (14th-18th centuries)*, ed. Marc Boone and Paul Janssens, 61-74. Turnhout: Brepols Publishers.

**Pezzolo, Luciano.** 2007. "Government Debts and Credit Markets in Renaissance Italy." Ca'Foscari University of Venice Working Paper 05.

**Puga, Diego, and Daniel Trefler.** 2014. "International Trade and Institutional Change: Medieval Venice's Response to Globalization." *Quarterly Journal of Economics*, 129(2): 753-821. http://dx.doi.org/10.1093/qje/qju006

**Radonić, Jovan.** 1930. "Critobulus, a Byzantine Historian from the 15th Century." *Voice of the Serbian Royal Academy of Sciences*, 138: 59-83.

**Spremić, Momčilo.** 1994. *Despot Đurađ and His Era*. Belgrade: Serbian Literary Association.

**Stasavage, David.** 2011. *States of Credit: Size, Power, and the Development of European Polities*. Princeton: Princeton University Press.

**Tadić, Jorjo.** 1960. "La Puglia e le città dalmate nei secoli XII-XIII." *Archivo storico Pugliese*, 13(1-4): 187-191.

**Tadić, Jorjo.** 1968. "Economy of Ragusa and Serbian Lands during the First Half of 15th Century." *Journal of the Faculty of Philosophy in Belgrade*, 10(1): 419-439.

**Tracy, James D.** 2003. "On the Dual Origins of Long-Term Urban Debt in Medieval Europe." In *Urban Public Debts, Urban Government and the Market for Annuities in Western Europe (14th-18th Centuries)*, ed. Marc Boone and Paul Janssens. Turnhout: Brepols Publishers.

**Van der End, Jan Willem.** 2011. "Statistical Evidence on the Mean Reversion of Interest Rates." De Nederlandsche Bank Working Paper 284.

**Vinaver, Vuk.** 1960. "Problem of Silver Production in Medieval Serbia." *Istorijski glasnik*, 3: 481-512.

**Vinaver, Vuk.** 1964. "Contributions to the History of Precious Metals, Prices and Wages (Medieval Dubrovnik)." *Istorijski zbornik*, 1(2): 51-94.

**Voje, Ignjat.** 1970. "Argentum da glama." *Istorijski glasnik*, 16(17): 15-41.