



An empirical assessment of the Swedish Bullionist Controversy

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Abstract

In the eighteenth century, a fierce political debate broke out in Sweden about the causes of an extraordinary depreciation of its currency. More specifically, the deteriorating value of the Swedish daler was discretionarily blamed on monetary causes, e.g. the overissuing of banknotes, or nonmonetary causes, such as balance of payments deficits. This paper provides a comprehensive empirical assessment of this so-called “Swedish Bullionist Controversy”. The results of vector autoregressions suggest that increasing amounts of paper money did give rise to inflation and a depreciation of the exchange rate. Conversely, nonmonetary factors were probably less important for these developments.

JEL classification: B12, B17, E42, F31, N13

Keywords: bullionism, floating exchange rate, inconvertible banknotes, paper currency, Sweden

1 Introduction

“Bullionism” commonly refers to an economic point of view in a famous controversy about the effects of inconvertible paper money in Britain during the so-called “Bank Restriction Period” (1797 - 1821). In particular, after the Bank of England had suspended the gold-convertibility of its banknotes in 1797 to deal with the major financial disturbances from the Napoleonic wars, a fierce debate broke out between a bullionist (or anti-restrictionist) and an anti-bullionist camp as to whether inconvertible paper money was responsible for the subsequent price instability for goods and foreign currency (see Viner, 1937, ch.3, ch.4).¹ According to the Bullionists, the breaking of the specie-link of Bank of England notes had paved the way towards overissuing which, in turn, resulted in a deterioration of the value of sterling (see Viner, 1937, pp.124ff.). Conversely, to explain price and exchange rate changes, the Anti-Bullionists emphasised the role of nonmonetary factors such as balance of international payments deficits caused by large food imports after bad harvests, or by extraordinary capital outflows to pay troops stationed on the European continent. Meanwhile, the upsurge of banknotes in circulation was interpreted as a symptom of these developments (Viner, 1937, pp.136ff.). This controversy matters until today, since it anticipated important questions in monetary economics about the impact of fiat money on prices or the determinants of floating exchange rates. Above all, in rudimentary form, the monetary as well as the balance of payments approach to determine the exchange rate are already encapsulated in, respectively, the bullionist and the anti-bullionist position. Furthermore, to make their case, later

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¹In a narrow sense, the controversy dealt with the question as to whether excessive amounts of banknotes had been issued and, hence, the paper pound had been depreciated relative to the benchmark of a gold-backed currency. However, insofar as a depreciation manifests itself in a premium of gold (e.g. the external currency value) over inconvertible banknotes, the answer to this question is closely intertwined with the appropriate level of the exchange rate and prices in general (Eagly, 1963, p.627; Myhrman, 1976, p.171).

monetary debates—above all between the Keynesians and Monetarists—often revisited the experiences of Britain around 1800.

Owing to the lack of sophisticated econometric tools, contemporaneous empirical assessments of the Bullionist Controversy did not go beyond subjective interpretations of data figures and tables. However, even the later empirical work is arguably prone to finding spurious correlations between times series of banknotes in circulation, exchange rates, the price level, or real output (see Officer, 2008, p.7). It was not until Officer (2000) when multivariate time series techniques, in form of vector autoregressions (VARs), were introduced to account for the potential presence of unit roots, cointegrating relationships, and to deal with the thorny identification issues when uncovering the structural interrelationships arising from inconvertible paper money during the Bank Restriction Period. Nevertheless, Hendrickson (2017, pp.14ff.) has recently argued that even this latest empirical work is flawed, by e.g. confounding Granger causality with economic causality to determine the VAR structure.² Given these methodological shortcomings, it is perhaps not surprising that the empirical literature has hitherto been inconclusive in the sense of reporting evidence in favour of the anti-bullionist (e.g. Nachane and Hatekar, 1995; Officer, 2000), but also the bullionist position (Hendrickson, 2017).

This paper focuses on the “Swedish Bullionist Controversy”, which also dealt with the interrelationship between inconvertible paper money and a deteriorating currency value, but predated its British namesake by about 50 years (see Myhrman, 1976). In particular, after an inconvertible paper currency had replaced a metallic system in the 1740s, the amount of Swedish banknotes grew rapidly resulting in a at the time completely unorthodox currency system consisting mainly of fiat money. Throughout the 1750s, the corresponding expansionary money and credit policy was accompanied by a marked increase in the average price level as well as an exceptionally large depreciation of the Swedish currency, the “daler”, relative to foreign currencies maintaining the convertibility into silver or gold. Similar to the later British case, an intense debate broke out between two political factions as to whether the increasing amount of inconvertible banknotes was the cause, or merely a consequence, of these economic phenomena.

Against this background, this paper endeavours to conduct the first, comprehensive empirical assessment of the Swedish Bullionist Controversy.³ Based on historical data including prices, exchange rates, government debt, economic growth, as well as the amount of issued paper money, VARs are employed to uncover the causes of the depreciation of the Swedish daler. In contrast to Officer (2000), the structural identification will explicitly allow for the different theories of the exchange rate invoked by the bullionists and the anti-bullionists. In any case, the results lend support to the monetary view that an overissuing of inconvertible banknotes did give rise to an upsurge of inflation and a marked depreciation of the currency. Conversely, the view that a deteriorating balance of international payments was to blame for the loss of purchasing power of the Swedish currency finds only partial support.

The paper is organised as follows. The next section provides a synoptic overview of the Swedish Bullionist Controversy. Section 3 discusses the data and the econometric strategy. Section 4 reports the empirical results. Finally, section 5 summarises and concludes.

²For the case of the Keynesians vs. Monetarists debate, the point that the temporal correlations inherent in Granger causality test are not necessarily informative about the structural connections between variables has long been made by Tobin (1970). For a more general discussion on the limited capabilities of Granger-causality tests to uncover structural relationships, see Geweke (1984).

³Some rudimentary results have been published in previous work. In particular, Eagly (1971), Myhrman (1976), and Bernholz (2003, p.41ff.) report descriptive figures, whereas Jonung (1976) calculates correlations showing a co-movement between banknotes, prices, and exchange rates for mid-eighteenth century Sweden.

2 Review of the Swedish Bullionist Controversy

Although the Swedish Bullionist Controversy was mainly a political argument about the causes of the high price of foreign currency, it also left some remarkable academic contributions to international monetary economics. In particular, Pehr Niclas Christiernin (1725-1799), who spend his entire academic career at Scandinavia's oldest University in Uppsala, anticipated many insights of later macroeconomic models with fiat money and floating exchange rates (see Niehans, 1990, pp.56ff.). However, even among economists, Christiernin's name is barely known. His main contribution, which was published in 1761 under the Swedish title "Utdrag af Föreläsningar angående den Svea Rike upstigne Wexel-Coursen", was only made available to a broader readership in 1971 through the partial translation in Robert V. Eagly's "The Swedish Bullionist Controversy—P.N. Christiernin's Lectures on the High Price of Foreign Exchange in Sweden". To prepare the ground for the empirical analysis, this section endeavours to selectively review the relevant monetary and nonmonetary conditions in the Kingdom of Sweden⁴ during the eighteenth century.⁵

Owing to a scarcity of conventional monetary metals such as gold or silver, in 1624, the Kingdom of Sweden began to mint coins made out of copper, which was abundantly available from domestic mines (Edvinsson, 2010, p.150; Heckscher, 1934, pp.85-91). In 1709, a copper standard was even officially proclaimed (Edvinsson, 2010, p.168). However, since copper is heavy compared with its value, the corresponding coins were ill-suited to settle large transactions. To economise the scarce silver and gold coins, which remained in circulation, and to avoid the transfer of massive amounts of copper coins, so-called copper notes were invented to facilitate large payments. From the mid-seventeenth century onwards, this early form of paper money gradually developed into a fiat currency, with banknotes that are only convertible into themselves (see e.g. Kindleberger, 1984, p.50; Heckscher, 1934, pp.88-92). More specifically, Swedish paper money originated in a series of banking schemes including the short-lived Stockholm Banco, which was among the first in Europe to experiment with banknotes in the early 1660s, but soon after collapsed due to overissuing. However, in 1668, the Swedish parliament intervened to replace the Stockholm Banco with the Riksens Ständers Bank,⁶ which received its name from being backed by the "estates of the realm" (Swedish: Ständers), e.g. the noble, clerical, burghes, and land-owning peasant classes of society. Initially, the purpose of this officially-supported banking scheme was to collect funds for the government (above all for war finance), but after 1701 also to issue so-called "transfer notes". Although these were originally fully backed by copper, during the 1730s, the Riksens Ständers Bank began to pursue a more expansionary loan policy by issuing paper money backed by real estate. In 1745, convertibility into copper was even suspended, which marked the beginning of a monetary era with inconvertible banknotes (Heckscher, 1934, pp.197ff.). Taken together, by the middle of the eighteenth century, the Kingdom of Sweden had already been familiar with paper money for about a century, and banknotes irredeemable in precious metal had become a normal means of payment (see e.g. Eagly, 1963, p.627).

Severing the link to gold, silver, or copper removes the in-built safeguard of metal-based currency systems against oversupplying money. Indeed, even before the Swedish Bullionist Controversy broke out, historical experiments including the Banque Royal scheme in France around 1720 had shown how easy it is to overissue inconvertible banknotes and, thereby, create endemic monetary and economic instability (see e.g. Kindleberger, 1984, pp.96-98). In the Kingdom of Sweden, signs of what would nowadays be called a lax monetary policy

⁴At the time, the Kingdom of Sweden not only covered the current Swedish territory, but also Finland, and until after the Great Northern War (1700-1721) even substantial parts of Pomerania and the Baltic States.

⁵More comprehensive discussions can be found in Eagly (1969) and Roberts (1986).

⁶In 1866, the Riksens Ständers Bank was renamed the Swedish Riksbank, which prides itself to be the oldest central bank in the world (see e.g. Kindleberger, 1984, p.50).

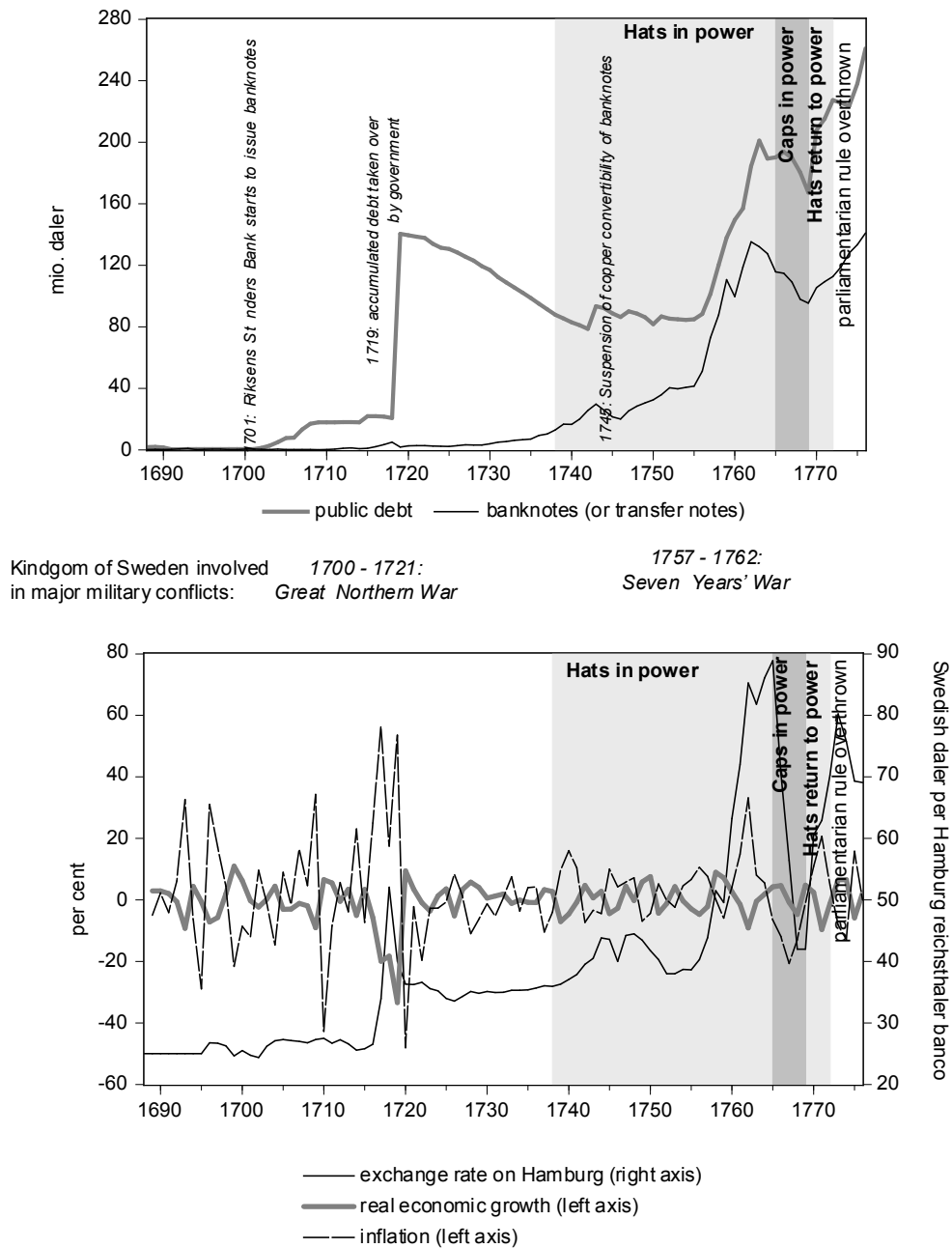
appeared soon after the establishment of the Riksbens Ständers Bank, from which the government borrowed considerable amounts to finance several wars against neighbouring powers such as Denmark or Russia, but during the eighteenth century also to pursue mercantilistic policies (Eagly, 1971, pp.13ff.). As illustrated by the top panel of Figure 1, before 1700, both the amount of public debt and of banknotes in circulation was small. However, during the eighteenth century, more generous government loans to the domestic manufacturing sector started an upward trend in the outstanding amount of banknotes and public debt. This increase was aggravated by Sweden's participation in the Great Northern War, which virtually bankrupted the country and was responsible for the jump in public debt when the accumulated financial obligations, parts of which came from the Riksbens Ständers Bank, were assumed by the government in 1719 (see Roberts, 1986, pp.15ff.; Fregert and Gustafsson, 2014, pp.204ff.). Reflecting the transition to inconvertible paper money in 1745, the impact of the Seven Years' War after 1757 was even more dramatic (Eagly, 1969, p.750). The amount of banknotes in circulation more than trebled from 41 in 1755 to 135 million daler in 1762.

With the introduction of inconvertible banknotes in 1745, the Swedish currency was no longer based on precious metal. As shown by the bottom panel of Figure 1, the newly found freedom to increase the money supply was eventually accompanied by pervasive levels of inflation and, moreover, an unprecedented depreciation of the exchange rate (Eagly, 1969, pp.743-747).⁷ Inevitably, questions were raised as regards the causes of these extraordinary economic phenomena, which did not occur elsewhere, where metal-based currency systems remained the norm. The corresponding debates fell into the Age of Liberty (1720 - 1772), when the Swedish parliament, rather than the monarch, was at the centre of political power (Roberts, 1986; Heckscher, 1934, pp.130ff.). Although only a rudimentary form of democratic rule—with voting rights being restricted to the estates of the realm—there were already two opposing factions, called the “Hat party” and the “Cap party”, competing for political power.⁸ The Hats were the traditional ruling party until 1765 and, following the economic dogmas at the time, pursued a mercantilism-inspired growth policy, whereby the Riksbens Ständers Bank provided cheap loans to develop the local manufacturing sector and finance infrastructure projects such as roads and canals. Ignoring the inflationary bias of such measures, similar to the Anti-Bullionists in Britain, the Hats remained firmly convinced that external forces resulting in balance of payments deficits were to blame for the ongoing depreciation of the Swedish daler (see Eagly, 1969, pp.747ff.). Naturally, the Caps pointed to inadequate domestic policies, above all the overissuing of banknotes, to explain the loss of domestic and international purchasing power of the daler. Hence, in many regards, the Caps were the Swedish bullionists. Rather than continuing with the money and credit expansion, they argued that stable conditions could only be restored by bringing back the amount of paper money in circulation to levels before 1745 (see Eagly, 1969, pp.751ff.). With the further deterioration of monetary stability during the Seven Years' War, price and exchange rate increases reached intolerable levels and the debate tipped into the favour of the Caps, who managed indeed to win a majority in 1765, and immediately began to implement their proposed deflationary policies. Associated with the falling prices and an appreciation of the daler was, however, an economic recession resulting in falling exports, employment, and real wages (Heckscher, 1934, p.198; Eagly, 1969, p.747). Unsurprisingly, these adverse developments quickly reversed the political fortunes and the Hats returned to power as soon as 1769. The old monetary policies were resumed by depreciating the Swedish daler by around 50 per cent. The Age of Liberty came to an end in 1772 when the monarchy managed to overthrow parliamentary rule by a coup d'état (Roberts, 1986, pp.176ff.). Finally, in

⁷The corresponding exchange rate in the bottom panel of Figure 1 refer to Hamburg, on which most Swedish bills of exchange were drawn (Kindleberger, 1982, p.50; Eagly, 1971, p.45).

⁸The Hats received their name from the tricorne hat, which was a fashion item across eighteenth century Europe. The origin of the Caps' name is less flattering in the sense of referring to the nightcap, which was chosen by the establishment as a symbol to ridicule the opposition as inherently somnolent (see Roberts, 1986, p.114).

Figure 1: Monetary and nonmonetary developments in the Kingdom of Sweden (1688 - 1776)



1776, a currency reform replaced the “daler” with the “riksdaler”, whose value was based on silver and, hence, broke the allegiance between the Swedish currency and copper (Heckscher, 1934, pp.198-199).

In terms of political economics, the Swedish Bullionist Controversy reflected a conflict between “commercial capitalists whose wealth was derived from foreign trade”, who were aligned with the Hats, and “small industrialists, small merchants, and importers”, who were by and large represented by the Caps (Eagly, 1971, p.18). Hence, finding the causes of the

instable currency value became a struggle for interpretative supremacy on the economic issue of the day. It is therefore not surprising that economic, and in particular monetary, topics entered the Swedish public debate during the 1750s and 1760s (Heckscher, 1934, pp.199ff.). With P.N. Christiernin’s “Lectures on the High Price of Foreign Exchange in Sweden”, the debate arguably even produced the first clear analysis of the interrelationships between money, prices, exchange rates, and employment under a currency system with fiat money (at the time inconvertible banknotes) and floating exchange rates (see Niehans, 1990, pp.56-59; Eagly, 1963, pp.626ff.). Despite lacking the formal rigour of current monetary theories, Christiernin’s writings are remarkably clear and concur with many modern textbook views on international monetary economics. Hence, it is worth spelling out his thoughts about the state of the Swedish economy around the year 1760 in a couple of sentences (in the following, page numbers refer to Eagly’s (1971) translation): Although P.N. Christiernin recognised that external factors resulting in balance of international payments deficits can reduce the external value of a currency (pp.57ff.), he argued that under a metal-based currency system, these effects are constrained by the costs and risks of dispatching monetary metals (pp.61ff.).⁹ Since the marked increase in the price for foreign exchange around 1760 was a uniquely Swedish phenomenon, it should hence be attributed to specific, domestic circumstances (p.62). Excluding other possible causes such as the hoarding of coins (pp.62-63), a collusion between foreign exchange traders (p.63), a balance of payments deficit (pp.63-64), or the provision of cheap loans to exporters (p.64-65), the excessive issuing of banknotes is left as the only plausible explanation (pp.66ff.). Of course, by attributing the sharp nominal depreciation of the Swedish daler to monetary factors (p.29), Christiernin sided with the Caps. However, he did not agree with their economic therapy. In particular, he correctly foresaw that bringing back the amount of paper money to levels before 1745 would create a deflation and, due to price and wage rigidities, harm the economy, or in his words, “the exchange rate cannot be reduced without economic disruptions” (p.89). He even reasoned that the effect of contractionary monetary policies are particularly severe since “it is easy for prices to adjust upward when the money supply increases, but to get prices to fall has always been more difficult. No one reduces the price of his commodities or his labour until the lack of sales necessitates him to do so” (p.90; see also Myhrman, 1976, p.176).¹⁰ In particular, deflation and an appreciating exchange rate could push up the real debt burden (p.91), depress consumption (p.93), and give rise to high unemployment (p.95). To avoid a recession, rather than appreciating the daler through a monetary contraction, Christiernin proposed to stabilise the exchange rate by providing the money supply to support the current level of economic transactions at the current level of prices and output (p.28).

3 Data and econometric strategy

3.1 Data

The following annual data have been collected to underpin an empirical analysis of the Swedish Bullionist Controversy. Recall from Section 2 that the controversy focused on the effect of paper money in form of banknotes, denoted by N , on the nominal exchange rate, denoted by S . The exchange rate refers to the price of the Swedish copper daler per Hamburg reichsthaler banco.¹¹ The impact of paper money upon inflation is measured by the percentage change of a price index, denoted by π . As regards the effect of nonmonetary

⁹This insight coincides with the price-specie flow mechanism developed by David Hume. Christiernin seems to have been familiar with Humes’ work (see. Eagly, 1963, p.627).

¹⁰Though downward price and wage inflexibility are today the hallmark of “Keynesian economics” (Eagly, 1963, p.629), this quote is a testimony to the often ignored fact that classical economists had commonly attributed high levels of unemployment to wage and price rigidities (Niehans, 1990, pp.54, 59, 103).

¹¹In eighteenth century Sweden, several copper and silver based “dalers”, as represented by different coins, circulated in parallel (Edvinsson, 2010, pp.133ff.). Officially, between 1681 and 1709, Sweden was on a silver standard and, between 1709 and 1776, on a copper standard, which was interrupted by fiat currency systems between 1716 - 1719 and 1745 - 1776 (see Edvinsson, 2010, pp.150ff.). To make the data comparable, they are here always expressed in terms of the “daler kopparmynt”.

variables, balance of payments statistics are unfortunately unavailable for eighteenth century Sweden. However, at the time, the agricultural sector was still dominant by e.g. accounting for more than half of Swedish employment in 1760 (Heckscher, 1934, p.141). Hence, even more than in Officer’s (2000, p.200) empirical investigation of the Bullionist controversy in early industrialised Britain, international trade deficits were probably correlated with a bad state of the harvest and subsequent large imports of agricultural products. Available data on the crop production in Scania, which at the time was “beginning to assume its position as granary of Sweden” (Heckscher, 1934, p. 153), are therefore likely to provide a good proxy for the quality of the harvest, denoted by HQ , and, in turn, balance of payments issues. As an alternative, available data on the real price for grain, denoted by PG , will also be used to reflect the state of the harvest. Substantial capital exports arose, among other things, from foreign military interventions, which were typically associated with an increase in real public debt, denoted by B (see Figure 1 and Jonung, 1976, p.42). Last but not least, recall that P.N. Christiernin also considered the effect of monetary variables—and in particular a monetary contraction resulting in a deflation—on economic output, which is here measured by a change in real GDP, as denoted by ΔY .

It is unclear, in which year an empirical assessment of the Swedish Bullionist Controversy should start. The common sample would go back as far as 1688, meaning 20 years after the Riksbank had been founded. However, the Riksbank began to issue transfer notes only in 1701, with amounts beginning to grow only from 1710 onwards when copper plates were minted in large quantities (Edvinsson, 2012, p.179). As mentioned above, banknotes (or transfer notes) were made inconvertible in 1745. For the baseline scenario, the intermediate starting date of 1710 is chosen as this marked the beginning of the spectacular advance of paper money, which accounted for less than 1 per cent of money in 1710, but almost 80 per cent in 1776 (see Figure 2). However, to check the robustness of the results, other starting dates will be considered. The year 1776, when the period with inconvertible paper money ended in a currency reform introducing the riksdaler, marks the obvious end of the Swedish Bullionist Controversy.

Detailed definitions of the data can be found in Table 1. The main source are two volumes of the Historical Monetary and Financial Statistics of Sweden published by the Riksbank. Concurring with Officer (2000), all variables have been transformed into logarithms implying that differences reflect percentage changes. Where necessary, the data have been transformed into monetary units referring to millions of copper daler.

In the bottom panel of Table 1, conventional Augmented Dickey Fuller (ADF) tests reject the presence of unit roots for all variables. Aside from inflation (e.g. the logarithmic growth of the price level) and economic expansion and contraction (e.g. the logarithmic growth of real GDP), variables tend to grow between 1710 and 1776, wherefore the test statistics include a deterministic trend. However, alternative unit root tests, such as the Phillips Perron (PP) test, can give rise to contradictory results. Hence, issues associated with potential non-stationary will be important when checking the results of Section 4 for robustness.

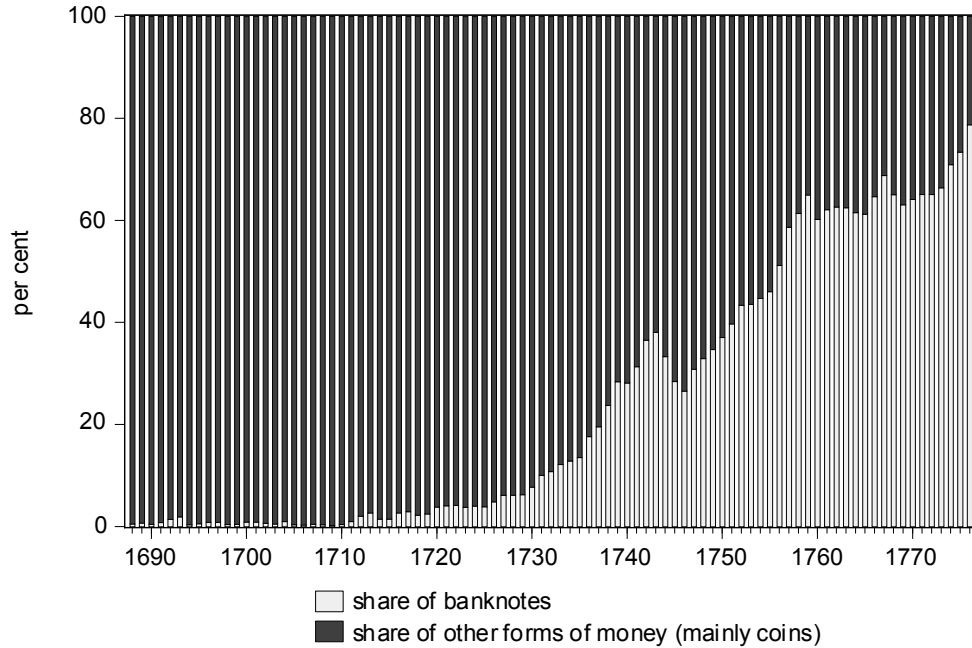
3.2 Structural identification

The complex interactions between monetary and nonmonetary variables lay at the heart of bullionist controversies. However, to resolve the thorny statistical issues of cause and effect between macroeconomic variables that are potentially highly interrelated among themselves, or endogenous, econometric methods such as structural vector autoregressions (VARs) are warranted that have only been developed during the last couple of decades. It is well known that VARs are overparameterised, e.g. the coefficient estimates, and the corresponding standard deviations, do not uniquely identify the structural relationship between the underlying variables. Thereto, some additional information, which typically draws on purely theoretical considerations and is encapsulated in a scheme to reach structural identification,

Table 1: Overview of the data (baseline sample: 1710 - 1776)

Variables	Monetary (nominal) variables		Nonmonetary (real) variables				
	N	S	HQ	PG	B	ΔY	
Variable name	Banknotes	Exchange rate	Inflation	Quality of the harvest	Price of grain	Government debt	Economic growth
Description	Banknotes in circulation in the Kingdom of Sweden (including Finland) in millions of copper daler (kopparynt).	Swedish per daler (kopparynt) in Hamburg reichsthaler (annual average). An increase is a depreciation of the Swedish currency.	Inflation measured by the percentage change of the consumer price index P for Sweden (1914=100).	Scanian crop production series in hectoliters per mantal.	Real price of grain (for barley or rye, or 50/50 if both are available). Prices are published in Swedish Kronor (SEK) per 100 litre. They have been converted into Swedish daler (1 SEK = 18 daler kopparynt) and divided by the consumer price index P .	Government debt divided by the price index P . The data are originally published in 1000s of SEK and have been converted into millions of copper daler.	Change in real GDP (GDP divided by consumer price index P) of the Kingdom of Sweden.
Data source	Historical Monetary and Financial Statistics of Sweden (2014); Volume II, Swedish money supply, Table A7.1.	Historical Monetary and Financial Statistics of Sweden (2010); Volume I, Foreign exchange rates in Sweden, Table 1658-1803; Table A5.21.	Historical Monetary and Financial Statistics of Sweden (2010); Volume I: The evolution of Swedish consumer prices 1290-2008; Table B8.1.	Historical database of Scanian agriculture 1702-1881, University of Lund. See Olsson and Svensson (2017).	Historical Monetary and Financial Statistics of Sweden (2010); Volume I, The evolution of Swedish consumer prices 1290-2008, Table B8.1.	Historical Monetary and Financial Statistics for Sweden (2014), Volume II, Fiscal statistics for Sweden 1670-2012; Table A5.1.	Historical Monetary and Financial Statistics for Sweden (2014), Volume II, The Gross Domestic Product of Sweden within present borders, Table A4.1.
Specification	intercept & trend	intercept & trend	intercept	intercept & trend	intercept & trend	intercept & trend	intercept
ADF	-5.41***	-3.72**	-8.85***	-7.25***	-3.75**	-3.25*	-6.22***
PP	-4.69***	-3.00	-8.85***	-7.25***	-3.52**	-2.83	-6.22***

Figure 2: Banknotes as a share of the money supply



Notes: The amount of banknotes (N) is defined in Table 1. The money supply (M) refers to banknotes and coins in circulation within the Kingdom of Sweden and has been taken from the Historical Monetary and Financial Statistics of Sweden (2014); Volume II, Swedish money supply 1620-2012; Table A7.1.

is warranted.¹² Because the structural identification of the VARs used by Officer (2000) to empirically assess the British Bullionist Controversy have recently been questioned by Hendrickson (2017), it is worth to carefully develop the arguments supporting the current identification strategy. Similar to Officer (2000), the identification of the VAR reflecting the Swedish Bullionist Controversy will be achieved via a theoretically informed causal ordering of the variables according to the degree of their endogeneity (the so-called Cholesky ordering). To this end, it is however important to recall that the bullionists and anti-bullionists had fundamentally opposing views, or theories, about the role of note issuing for the development of the exchange rate and other economic variables. For the Swedish case, Kindleberger (1984, p.132) has nicely summarised the argument as follows:

“Like the bullionists in England later, the Caps contented that depreciation of the exchange rate was due to expansion of the money supply. In rebuttal, the Hats insisted that depreciation had started with the balance of payments; causation had run from balance of payments to depreciation to raising prices, not from money supply to rising prices to balance of payments and depreciation.”

To determine the adequate Cholesky ordering, the distinction between whether the amount of banknotes in circulation is the cause, or merely a consequence, of the high prices for goods and foreign currency is not innocuous. In particular, in their role as Swedish bullionists, the Caps advocated a chain of causation running from inconvertible paper money, to prices, and the exchange rate (see Officer, 2008, p.3).¹³ Hence, denoting a theoretical causality between economic variables by \rightarrow , the following connection arises,

¹²For an introductory textbook discussion on VARs, see Enders (2014, ch.5-6). For a discussion at the advanced level, see Lütkepohl (2010).

¹³For the British Bullionist Controversy, Officer (2000, 2008) also considers the price of gold, which was ignored in the Swedish debate, and would be just an alternative measure of exchange rate movements. Furthermore, he suggests that for the Swedish Bullionist Controversy, the broad money supply M did not

$$N \rightarrow \pi \rightarrow S. \tag{1}$$

Conversely, the Hats had another theory in mind. They highlighted the effects of nonmonetary factors such as the need for state-sponsored economic development and of war finance, which would both increase public debt B , and other issues with the balance of payments, reflected by HQ , as explanation for price and exchange rate changes. The increase in banknotes was thought to be a mere consequence. Taken together, the Hats' chain of causation looks probably as follows (compare Officer, 2008, p.5),

$$HQ \rightarrow B \rightarrow S \rightarrow \pi \rightarrow N. \tag{2}$$

Of note, the connection between the exchange rate and inflation occurs via changes in import prices, which are here, as in Officer (2000, p.201), not separately measured. Moreover, in the British debate, the causality between inflation and the amount of banknotes in circulation was theoretically based on the real-bills doctrine, according to which it is almost impossible to overissue paper money, as long as it is used to pay for real goods and physical investment projects. Even if money would be issued for other, purely financial, purposes, this would be without consequences since it was thought that inflation would induce the public to hand back excessively issued amounts of paper money and, hence, automatically stabilise the price level (see Officer, 2000, p.200). Therefore, the causal link runs arguably from inflation to the amount of banknotes in circulation.

Finally, by attributing the depreciation of the Swedish daler to monetary factors, P.N. Christiernin sided with the Caps. However, he also allowed for short-term real economic effects of nominal price changes. In particular, introducing the possibility of having a deflation-induced recession, his chain of causation would be given by

$$N \rightarrow \pi \rightarrow S \rightarrow \Delta Y. \tag{3}$$

Of note, to account for the fact that the various camps in the Swedish Bullionist Controversy invoked specific chains of causality, which lead to different Cholesky orderings of the variables, this paper will deviate from Officer (2000), by considering the three theoretically-motivated chains of causality of (1), (2), and (3), rather than confounding economic with Granger causality (see also Hendrickson, 2017).

4 Empirical results

With stationary variables, a VAR in levels—including an exogenous constant and trend to account for the growth of some variables—is the appropriate model. Further to the discussion above about the appropriate Cholesky ordering, three version of the recursive VAR have been estimated including the following variables ranked in terms of an increasing degree of endogeneity:

1. N, π, S reflecting the Caps' model of equation (1),
2. HQ, B, S, π, N reflecting the Hats' model of equation (2), and
3. $N, \pi, S, \Delta Y$ reflecting P.N. Christiernin's model of equation (3).

matter since banknotes were the dominant means of payment. However, whereas this might be true after the massive increase in banknotes of the 1750s, Figure 2 shows that this was not the case before the 1740s. For now, the VAR is kept as parsimonious as possible ignoring the effect of the broad money supply. However, introducing the effect of the broad money supply will be taken up as robustness check in Section 4.

When estimating the reduced-form VAR, the minimum of the Schwarz Information Criterion (SIC) determined how many past observations are included. This yields a lag-length of 2 years for the Caps' model and a lag-length of 1 year otherwise. To save space, the coefficient estimates from the reduced-form VAR, which do not lend themselves to a structural interpretation, are not reported here, but are available on request.

For the three Cholesky orderings, Figure 3 depicts the impulse response functions for the impact of a 1 percentage increase of the amount of banknotes (N) upon the exchange rate of the Swedish daler as well as inflation over 20 years. Since all variables have been transformed into logarithms, the responses reported by the solid lines reflect percentage changes. Furthermore, the dashed lines delimit the corresponding 95 per cent confidence interval calculated from analytic (asymptotic) standard deviations. Consistent with the view of the Caps, a significant upsurge of the price for foreign currency, which reflects a depreciation of the daler, as well as a significant increase in inflation seem to have been caused by an expansion of the banknote supply. Across all Cholesky orderings of the VAR, both the depreciation as well as the inflationary impact are temporary in the sense of vanishing after around 10 years. Furthermore, the maximum impact upon inflation occurs after around 2 years, whereas the maximum impact upon the exchange rate occurs after around 5 years. Unsurprisingly, the effect of banknotes in circulation is particularly large for the Caps' model, which theoretically attributes the high prices of goods and foreign currency to monetary variables. What is more remarkable, although focusing on nonmonetary variables, even the Hats' model gives rise to a significant empirical link between banknotes and the average price for goods and foreign currency. The results of Figure 3 stand in sharp contrast to Officer (2000), who found only scant empirical support for the bullionist position with British data around the year 1800.

Figure 3: Response of the exchange rate (S) and inflation (π) to an impulse in the amount of banknotes in circulation (N)

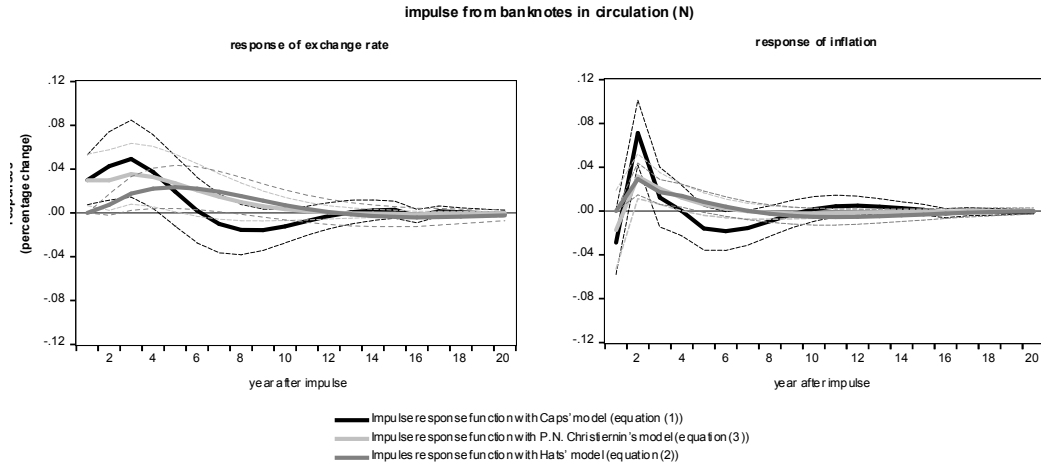


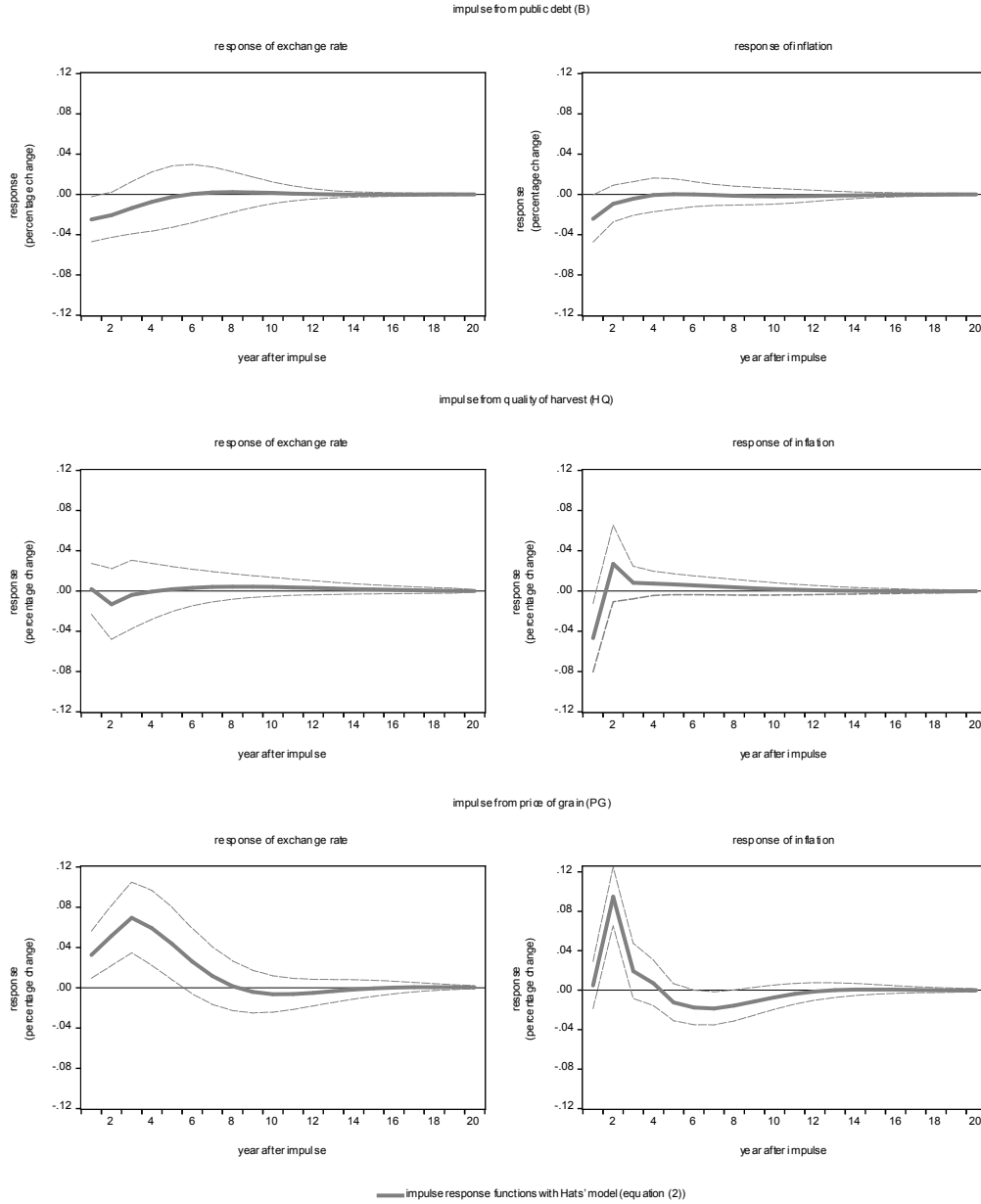
Figure 4 depicts the responses of the exchange rate and inflation to impulses in nonmonetary variables, including real public debt (B) and the quality of the harvest (HQ). Recall from the discussion above that these variables were ignored by the Caps and dismissed as by and large irrelevant by P.N. Christiernin. Hence, their models are not suited to calculate impulse response functions in Figure 4. Conversely, according to the Hats' position (e.g. equation (2)), balance of payments issues caused by large imports of agricultural products

after a bad harvest or capital exports to fund foreign military interventions (which manifest themselves in an upsurge of public debt), were arguably the main causes for the high price for foreign currency and goods. The results of Figure 4 lend only scant support to this view. In particular, according to the top panel, an increase in public debt B does not significantly affect the exchange rate and inflation, which stands in contrast to the hypothesis that the Swedish currency was weakened, since government deficits were partly financed through foreign capital. Turning to the role of agricultural imports and the quality of the harvest, recall that the corresponding effects are hard to measure due to the absence of comprehensive international trade statistics. Still, in the middle panel, there is some evidence that a large crop production during a given year did indeed significantly lower inflation. However, this effect lasts only for one year. Conversely, the corresponding decrease of the price for foreign exchange, reflecting an appreciation of the Swedish daler, is small and far from significant. When approximating the quality of the harvest through the price of grain, the results are different. In particular, as reported in the bottom panel, there is evidence that an increase in the price of grain, which could signal a bad harvest, results in a subsequent increase of the price of foreign currency (e.g. a depreciation of the daler) as well as the price level in general (e.g. inflation). This would be consistent with the view that a trade deficit, caused by large imports of agricultural products after a bad harvest, can undermine the value of a currency.

As mentioned at the outset, the empirical literature on the British Bullionist Controversy has been plagued by vagaries as regards the stationarity or non-stationarity of the data, the structural identification of the VAR, and the appropriate time period covered by the data. To deal with similar issues within the present context, the results of Figures 3 and 4 have been subject to a large number of robustness checks. In particular, the data presented in Table 1 contain a mix of variables in logarithmic levels (e.g. N , S , PG , B) and logarithmic differences, or percentage changes (e.g. π , ΔY). Similar to the specification of Officer (2000), the reduced-form VARs have been re-estimated with *all* variables transformed into logarithmic differences. Another way to deal with potential non-stationarity is to test for cointegration. Across the three models encapsulated in equations (1) to (3), and depending on the specification of the test statistic as regards the inclusion of trends and intercepts, standard Johansen tests consistently uncovered 2 to 3 cointegrating relationships. If the variables would be non-stationary (a big *if* given the test statistics of Table 1), but they are cointegrated, a vector error correction model (VECM) would be appropriate. In terms of choosing the starting date of the sample, there is a trade-off between including more observations, and having to control for more changes in the currency, economic, or political regime. However, reflecting the discussion of Section 3.1, the reduced-form VARs underpinning Figures 3 and 4 have been re-estimated with samples starting in the year 1688, 1702, 1720, and 1745. Finally, the effect of banknotes could have occurred via the money supply M , which encompasses all means of payments. To distinguish, for example, between a scenario where an increase of banknotes was associated with an increase in the money supply, or merely a replacement of coins, M could be inserted after N in the three chains of causality introduced above. Across all these modifications, the exact magnitude, the adjustment speed, as well as the standard deviations of the impulse response functions reported in Figures 3 and 4 did change to some degree. Conversely, the general pattern remained intact in the sense that the amount of banknotes almost always resulted in a significant depreciation of the Swedish daler as well as an upsurge in inflation, whereas the impact from nonmonetary variables was mixed. For the sake of brevity, all these permutations of the baseline results are not reported here, but are of course available on request.

Finally, to address one of the key questions of bullionist controversies, e.g. whether the amount of banknotes in circulation was an exogenous cause or rather an endogenous consequence to changes in economic conditions, Table 2 reports the results of forecast error variance decompositions. In particular, the top panel looks at the variance decomposition of banknotes (N) to shocks in the quality of the harvest (HQ), government debt (B), inflation

Figure 4: Response of the exchange rate (S) and inflation (π) to an impulse in public debt (B), the quality of the harvest (HQ), and the price of grain (PG)



(π), the exchange rate (S), and finally banknotes themselves. The bottom panel reverses the scenario by looking at the variance decomposition of these monetary and nonmonetary variables to shocks in banknotes. Similar to the calculation of the impulse response function, the variance decomposition depends again on the adopted Cholesky ordering. Specifically, the models of the Caps and the Hats of, respectively, equations (1) and (2) are considered (the results of P.N. Christiernien's model of equation (3) were almost identical to the Caps' model and are, hence, not separately reported). In general, the variance decompositions of Table 2 seem to lend more support to the bullionist than the anti-bullionist point of view. Above all, the development of banknotes in circulation is mainly driven by its own

Table 2: Variance decompositions as regards the amount of banknotes in circulation

Variance decomposition of... ...to shock in:	Banknotes in circulation (N)							
	HQ	B	π		S		N	
Model for identification:	Hats	Hats	Hats	Caps	Hats	Caps	Hats	Caps
Horizon (years)								
1	1.3	21.3	9.8	0	2.8	0	64.7	100
2	1.0	23.2	7.2	3.2	1.9	4.9	66.8	91.9
3	1.4	22.3	7.0	4.2	2.8	8.1	66.5	87.7
5	1.9	20.0	7.4	4.3	8.0	14.2	62.7	81.6
10	2.1	17.6	7.7	4.9	17.2	17.0	55.3	78
∞	2.1	17.8	7.6	4.9	18.1	17.0	55.3	78

Variance decomposition of... ...to shock in:	HQ	B	π		S		N	
	Banknotes in circulation (N)							
Model for identification:	Hats	Hats	Hats	Caps	Hats	Caps	Hats	Caps
Horizon (years)								
1	0	0	0	5.5	0	9.6	64.7	100
2	0.1	0	2.5	28.0	0.1	13.6	66.8	91.9
3	0.1	0.1	3.6	26.2	0.8	18.1	66.5	87.7
5	0.2	0.1	4.3	25.4	2.5	20.2	62.7	81.6
10	0.2	0.6	4.2	26.3	4.6	21.5	55.3	78
∞	0.2	1.5	4.2	26.4	4.7	21.6	55.3	78

Notes: The proportion of the forecast error variance accounted for by a typical shock is measured in per cent. A typical shock is a change of one standard deviation (which is a 1 per cent change with for the current variables, which have been transformed into logarithms). The models of the Caps and the Hats to reach structural identification are described around equations (1) and (2), respectively.

shock. For the short-term and the Caps' model, the corresponding fraction is well over 80 per cent. Even for the Hats' model and the long-term, more than half of the forecast error variance of N can be attributed to its own shock. As regards the effect of shocks in the other variables, which are reported in the top panel, the exchange rate and government debt are important in terms of accounting for around 20 per cent of the variation in banknotes during the long-term. This lends some support to the anti-bullionist point of view, in the sense that nonmonetary variables had at least a partial impact upon the supply of paper money. Conversely, shocks in inflation seem to be of little importance, which stands in contrast to the idea of a self-correcting effect of inflation on the money supply as postulated by the real-bills doctrine. In the bottom panel, the role of shocks in banknotes upon other variables depends crucially on the underlying Cholesky ordering. For the Caps' model, and in the long-term, changes in the supply of paper money exhibit considerable effects on inflation and the exchange rate of the Swedish daler. The corresponding values of the variance decomposition with the Hats' model are much smaller. Given the results of the variance decomposition, the position of the Caps as Swedish Bullionists seems to be more coherent. The amount of banknotes in circulation is largely exogenous and reacts little to average price changes. Furthermore, adopting a model with largely exogenous banknotes gives indeed rise to considerable knock-on effects on prices and nominal exchange rates. Conversely, the anti-bullionist position of the Hats, according to which the upsurge in banknotes was primarily a consequence of nonmonetary economic developments, finds mixed support at best.

5 Summary and conclusion

Bullionist controversies are a strong testimony to how important monetary issues, such as the link between money, inflation, exchange rate movements, and employment, have

been debated at a surprisingly advanced level long before monetary economics became a specialised, and highly formalised, academic discipline. This paper has provided an empirical assessment of the Swedish case, which involves a historical debate on whether inconvertible banknotes were responsible for the upsurge in inflation and the outstanding depreciation of the Swedish currency around the year 1760. By combining modern time series techniques with historical data, it is possible to shed more light into this Swedish version of a bullionist controversy. In particular, the results of an empirical assessment with structural vector autoregression techniques suggest that the increase in fiat money, at the time in form of banknotes that were no longer convertible into precious metals, caused indeed a significant upsurge in inflation and a depreciation of the exchange rate. Conversely, it is less clear whether nonmonetary factors, such as balance of payment deficits, played an important role for these developments. Despite the absence of such things as a global financial system, collective wage bargaining, or routine fiscal and monetary policy interventions to stabilise the macroeconomy, the results uncover links between money, inflation, and the exchange rate, that are, at least qualitatively, similar to those typically found in the modern world. Furthermore, the findings are also broadly in line with the most recent empirical work on the more famous British Bullionist Controversy.

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