SUSTAINABLE MONETARY POLICY : LESSONS AND EVIDENCE FROM THE BANK SUSPENSION PERIOD, 1797-1821

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ABSTRACT

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Lessons and Evidence from the Bank Suspension Period 1797-1821

Elisa Maria Susanna Newby

This thesis re-examines the suspension of the gold standard rule in Britain between 1797 and 1821 within the framework of the theory of credible and time consistent monetary policy. By combining both historical and theoretical analysis the thesis challenges the prevailing theory in which the gold standard is considered as a contingent rule and the suspension as an exogenously credible regime.

Firstly, the thesis analyses what made the suspension credible in the absence of the gold standard rule. It is proposed that the suspension was a credible regime, because the resumption of the gold standard at the old par value in the future was a sustainable plan. It is shown that monetary policy during the bad state – such as war – can still be time consistent in the absence of the formal commitment rule, if the policy maker's plan is to resume the original commitment rule when the economy returns to the good state. The equilibrium is based on trigger strategies

where private agents retaliate if a policy maker deviates from its policy plan to resume the gold standard rule.

Secondly, the thesis aims to establish why the gold standard rule was suspended for twenty-four years. Both historical analysis and a dynamic general equilibrium model demonstrate that the gold standard was a shock amplifier when the shocks became persistent in the 1790s, and suspension was used to restore monetary stability during the French Wars. As the suspension of cash payments was a credible regime, it maintained the value and circulation of paper currency that in turn stabilised production and consumption. Suspension increased the degree of flexibility in the economic policy as the monetary authority had an opportunity to stimulate the economy by issuing fiat money during the war, on the understanding that the fiat money so issued would be withdrawn from circulation before the gold standard resumed.

Finally, it is explained why the gold standard was resumed after the relatively successful Suspension Period. The gold standard was seen as a solution to the problem that arose from the Bank of England's ambiguous role as a public and private institution. Rules were considered to be better than discretion, and the gold convertibility was a transparent principle, which maximised the long-run welfare of the society. The thesis demonstrates how already in the eighteenth century commitment to the gold standard rule had increased the efficiency of capital markets and enabled Britain to finance its eighteenth-century wars by using deficit finance. Maintaining these abilities through the gold standard was desirable.

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Introduction

An insignificant event in military history, a badly prepared landing of a handful of French soldiers at Fishguard in Wales on 22 February 1797, was an event which precipitated one of the most fundamental developments in monetary history: the world's first successful paper money standard. When the news of this strife reached London on Saturday 25 February, the King, Prime Minister Pitt and the Privy Council of the Bank of England held an emergency meeting. Anticipating a panic and a bank run to break out on the following Monday, they decided to keep the Bank's doors closed to the public in order to prevent the bearers of the Bank of England's notes from converting them to gold and, consequently, emptying the Bank's gold reserves.

Under normal circumstances the reserves of the Bank of England would have been sufficient to meet a sudden demand for gold, but in 1797, occasioned by sightings of French fleets off the coast, people were preparing for invasion. 'The apprehension of an invasion of this country seems to have taken possession of men's minds so strongly that even in every company it becomes a subject of conversation' *The Times* had reported already on 13 September 1796. By withdrawing guineas from their local banks the public attempted to make available assets as liquid as possible. The Newcastle banks were first to run out of reserves after local farmers, on 18 February 1797, had sold their cattle cheaply and had gone, almost in one body, to their local banks to cash the notes they had received. The farmers' actions alarmed other customers, and two days later the Newcastle banks decided collectively to stop gold payments. Bank runs and subsequent suspensions of cash payments followed in the nearby towns of Sunderland and Durham,[1] while bankers from all corners of the country flocked into the Bank of England to request more gold. The public suddenly preferred the Bank of England notes to other types of paper currency, because they were convertible to gold on demand, meanwhile entrepreneurs in the City of London, the usual possessors of the Bank notes, suffered a serious shortage of the medium of payment. The decision to close the Bank's doors 'until the sense of the Parliament can be taken on that subject',[2] was therefore justified both by the necessity to protect the Bank's reserves and to secure the circulation of the Bank notes.[3]

So began the Bank Restriction Period or the Suspension Period as it came to be known and it lasted much longer than the Bank or the government had anticipated. As the war dragged on – the French Revolutionary Wars turned into the Napoleonic Wars – it became clear that resumption of the gold standard would not be possible until the hostilities had ceased. On 1 May 1821, almost six years

[1] Fetter (1965) p. 21.
[2] *The Times* 28 February 1797.
[3] The strain of events has been recorded by several economic historians, for example Fetter (1965) and Feavearyear (1963).

after the Battle of Waterloo, which had finally brought the war to an end, the gold standard was resumed. The resumption, however, turned out to be something of an anticlimax as nobody seemed to pay any attention to the fact that paper notes could again be converted to gold. The public's willingness to accept paper money was remarkable given that the country had been on a *de facto* gold standard since 1717 and on a silver standard since medieval times. Until 1797 for practical men money had been something that could be either converted into some commodity or had intrinsic value itself and fiat money had remained outside the scope of their understanding.

The institution at the heart of this new monetary system, the suspension of cash payments, was the Bank of England – a central bank without the powers of the central bank. According to Fetter (1965) the Bank of England was not established in 1694 to perform central banking functions any more than the goldsmiths.[4] The Bank was a private monied company that issued shares, paid dividends and made profits. Its role as a trusted organ of the London merchants and an agency of government finance was ambiguous. The Bank provided ready cash for merchants by granting them loans and discounting, buying their bills of exchange, and supported the government by buying its short-term paper, sometimes by direct demand of the Treasury. Its owners consisted of London merchants, but it was the Parliament that periodically confirmed its existence by passing the Bank's Charter. Yet, from its establishment in 1694 until 1797, the Bank had continuously

[4]Fetter (1965) p. 23.

followed the gold standard rule by maintaining the value of the currency in terms of a fixed weight of gold, and to a lesser extent silver, by buying and selling these metals at a fixed price on demand. But now, during the suspension of cash payments, even this straightforward operation of the Bank was redundant. And this is where the potential problems existed since the Bank, according to one observer, might become a paper-mint.[5] Without having to worry whether its notes were sufficiently backed by gold, the Bank could generate income for its owners through discounting business or it could transfer seigniorage revenue to the government.

How did the Bank use that freedom? Contemporaries were certainly not impressed, and argued that the increased money supply during the Suspension Period had an adverse effect on the price level. For centuries prices had moved according to harvests, and the public found steadily climbing prices confusing. In particular, the commercial boom of 1808-1810 resulted in fast credit expansion and led to disparity between British and overseas prices, a high premium on gold and a sharp depreciation of the exchange rate. These currency problems sparked a furious conflict of opinions over the conduct of monetary policy called the Bullion Debates. The blaming finger of the bullionists, whose leading figure was David Ricardo, pointed at the Bank of England. They considered the inconvertible pound to be something unnatural, evil and a reason for all existing monetary problems.

These rather heavy accusations of contemporaries have, to a certain extent, carried over into many modern day accounts of the Suspension Period. As a result, the

[5]Tatham (1816).

Bank's responsibility for creating the currency problems has been emphasised in the various works available. What seems sometimes to have been forgotten is that between 1797 and 1821 the Bank had to conduct monetary policy during difficult times when the war, high government expenditure, trade blockades and bad harvests made the formulation of monetary policy a difficult task. By contrast, French economic historian Peter Vilar (1976) describes the way the monetary problems during the French Wars were overcome as 'undramatic'.[6] Given that only the First and Second World Wars offer parallels in history to the French Wars, economic conditions remained relatively stable during the war; for example, Bank of England's notes were accepted as payment throughout the Suspension Period and the British government was able to borrow at home and abroad. Furthermore, long and short-term interest rates peaked only in 1797 and remained below six percent indicating that markets trusted the current monetary system. Finally, the market price of gold fell back to par two years before Parliament's planned resumption date of 1 May 1823, which enabled Parliament to resume the gold payments two years ahead of the schedule.

The suspension of cash payments was seen as credible – markets expected the government and the Bank to resume the gold standard in the future. In the existing literature, credibility has been explained by political and institutional developments: Britain had the most democratic parliament in the contemporary world, the Financial Revolution at the end of the seventeenth century had created an

[6]Vilar (1976) p. 309.

efficient system of public finance, and the country had the world's most developed private capital markets with a centralised exchange system. Furthermore, society was free, with relative freedom of press and speech that enabled the public to criticise and monitor the authorities. These factors, the argument continues, forced the government and the Bank not only to consider short-term profit opportunities, but long-term benefits to the whole country. The Directors of the Bank understood that 'the formidable weapon of unrestricted money creation'[7] had not been placed in their hands at the beginning of the Suspension Period. The Bank did not use inflationary monetary policy extensively and the war was primarily funded by fiscal innovations, such as income tax and long-term borrowing, which meant that monetary policy did not become too accommodating.

These institutional and political explanations are acknowledged in this study, but its main contribution will arise from the type of research that has not hitherto been conducted. In this thesis I will analyse the suspension of cash payments from the perspective of modern macroeconomic theory, in the framework of credible and time consistent policy. Kydland and Presscott's (1977) original contribution precipitated a vast literature that has not yet been applied in a commodity standard setting. My theoretical models of the suspension highlight explicitly how the absence of the gold convertibility rule revealed a time inconsistency problem in the conduct of monetary policy when the basis of trust in the economy changed. The gold standard had operated as a domestic monetary policy rule both by limiting

[7] Andréadès (1909) p. 191.

the monetary authority's ability to issue currency, and making the value of currency determined by direct convertibility to gold. During the Suspension Period the monetary base was flexible – in theory the money growth rate could have become infinite – and the value of paper currency was determined by the credibility of the government's promise to convert notes to gold at some future unknown date.

In this work I will consider what made the Suspension Period credible even in the presence of the obvious time inconsistency problem, but also why was the gold standard resumed even though suspension of the gold standard rule had proved to be a relatively successful regime, at least during the war. As the Suspension Period lasted for twenty-four years, the government and the public had time to interact and therefore, my theoretical models emphasise the paramount role of the public's expectations and government's reputation in making the suspension credible. Ultimately, I consider the suspension of cash payments as an example of a sustainable monetary policy plan. According to Chari and Kehoe (1990) a policy plan is sustainable if the policy maker follows it even in the presence of an obvious time inconsistency problem. The plan during the Suspension Period was to return to the gold standard at the old par value at some future – unknown – date.

Sustainability of monetary policy was not a trivial matter. During the French Wars investors bought British national debt on the understanding that debt would be paid off by currency convertible to gold, and failure to return to the gold standard would have been considered as a default which would have ruined the whole monetary system. In particular, paper currency would not have been accepted as a medium of exchange since it would not have had any value and demonetisation would have caused the credit system to collapse. The gold standard had facilitated public borrowing which had proved to be a useful tool in war finance earlier in the eighteenth century. Maintaining the access to domestic and foreign credit markets was considered important. On a practical level, the government of the day was aware of the destiny of the French *assignats,* a paper money experiment which had led to hyperinflation as a result of overissue in 1795 and severely damaged the credibility of the French economic system. As France had lost its reputation in the eyes of domestic and foreign creditors, Napoleon was dependent on heavy wartime taxation. If anything, the successful resumption of the gold standard in 1821 strengthened Britain's position as a world power. The global financial network centred on London in the nineteenth century and Britain was able to maintain leadership of the rapidly industrialising world.

Both the analytical models and historical evidence presented in this thesis will try to establish that the suspension of cash payments was a monetary regime which increased the degree of flexibility in economic policy, but again, this was conditional on the credibility of future resumption. The Bank of England had an opportunity to issue some fiat money during the war in order to stabilise economic activity and to assist government in war finance on the understanding that money had to be withdrawn from circulation before the gold standard could have been resumed. Despite this obvious opportunity to print paper money, it was taxation and debt finance, not seigniorage, that were the main sources of public income. In consequence, I disagree with some current scholars who argue that suspension maximised the government's seigniorage revenue.[8] I will employ a dynamic stochastic general equilibrium model (DSGE model) to examine the stabilisation properties of the suspension of cash payments during the war time emergency. My results suggest that the suspension did not only secure the Bank's gold reserves, but maintained the Bank notes in circulation, which in turn stabilised consumption, price levels, asset prices and production during the long, exhausting war.

It became evident that the gold standard could not be resumed immediately after the war, as some optimistic politicians had hoped, because the paper money stock was high compared with the Bank's monetary gold stock and the gap between the market and monetary price of gold was too wide. In order to bring the market price of gold back to parity, the government repaid some of its short-term debt to Bank and the Bank constrained the volume of discounts it granted to London merchants. Deflation and widely spread economic distress was not solely as a result of the adjustment back to the gold standard, but it meant that the public, especially manufacturers from industrialised regions and some Members of Parliament, questioned the desirability of resumption. The Bank of England was the target of their hostile criticism and, therefore, constraining the paper money supply during the peace required as strong will power as resisting the temptation to issue it too liberally during the war.

[8] For example see Bordo and Redish (1993).

In order to emphasise how the Suspension Period represented enduring social commitment to monetary stability in the form of a domestic institutional framework, this work will combine both theoretical and historical analysis. Modern macroeconomic methodology makes the arguments and analysis of this complex period explicit, but the historical analysis is employed in order to contextualise the results. The outcome is not a patchwork of theories that is artificially applied to episodes from the past, but throughout the thesis historical evidence supports the theoretical modelling, making the latter more intuitive than if I had simply limited the analysis to stylised models. The historical analysis focuses on the interplay of monetary and fiscal policy – in those measures that in the eighteenth century increased institutional credibility and enforced commitment to resume the gold standard rule during the Suspension Period.

The historical evidence raises the question of why the gold standard and suspension were so successful. My theoretical models suggest that agents must have regarded commitment to monetary stability as highly likely, but much of this stability was created by the gold standard rule itself. Another important contribution of my thesis is, therefore, to analyse what gave the gold standard its credibility in the eighteenth century when the gold standard did not yet function as a truly international rule, as it did during the era of the Classical Gold Standard (1880-1914). Instead of considering the gold standard as an extreme type of fixed exchange rate regime, I will analyse its equally important, but less acknowledged, role as a domestic monetary policy rule.

According to Bordo and Kydland (1995) there were fourteen suspensions and successful resumptions of the gold standard in twenty-one countries between 1717 and 1933[9] and therefore, the Suspension Period of 1797-1821 might have been the first, but it was not unique amongst monetary experiments. It was, nevertheless, one of the earliest component parts of a much wider economic and political process called ‘the development of British monetary orthodoxy’ by Fetter (1965), which reached beyond the Bullion Debates. Its key controversies, such as the desirable degree of a central bank’s independence, the best possible monetary policy rule and the impact of monetary policy on the real-economy, are still relevant today. Out of these disputes developed most of the principles of modern monetary policy, which spread from Britain to the entire Western World. Hence, although the example I use to illustrate sustainable policy is from British monetary history, the set of questions and problems this monetary experiment raises are universal, and in many cases, intemporal. From this perspective my research on the Suspension Period and sustainable plans sheds light on questions of how monetary policy should be conducted during times of crisis, what are the welfare effects of monetary policy and what institutional arrangements must be made to ensure that the policy makers commit to credible monetary policy.

[9]Bordo and Kydland (1995), Table 1. The number of suspensions would be even higher (50) if it included those suspensions of which outcome was devaluation.

The thesis is organised as follows. This introduction is followed by a review chapter, in which I will explain how this study stands at the junction of the classical analysis of the gold standard, modern macroeconomic theory on credibility and time inconsistency and historical analysis. The second chapter examines the economic environment during the era of the Pre-classical Gold Standard 1717-1797 through a DSGE model of the Bank of England's gold reserve policy. The starting point for my analysis is thus the eighteenth century gold standard, not the more familiar perspectives of the Classical Gold Standard. The third chapter examines, in a selective manner, institutional and political developments that firstly, led to the suspension of cash payments, and later on resumption of the gold standard and explores the Bullion Debates in a new light. In the fourth chapter I will examine, through a DSGE model, how the suspension of cash payments made the monetary policy more flexible and stabilised circulation, consumption and the price level during the war years. In the fifth chapter I will model the suspension of cash payments as a sustainable plan, which replaced the gold standard as a commitment mechanism and explain what made the Suspension Period credible.

Finally, in order to make a study that concerns Great Britain, Ireland and ambiguous commodity standards consistent, one will always need some geographical and terminological definitions. Firstly, cash payments were suspended in England, Wales and Ireland. Although the Bank of Ireland had an independent status, the country became fiscally integrated to England after Ireland lost its own Parliament in 1800-1801. Currency problems in Ireland were similar to those in England between 1793-1821, but they are outside of the scope of this thesis. Scotland, which had maintained its own independent banking and monetary system since the Act of Union in 1707, remained nominally on the gold standard. A fierce competition between the Bank of Scotland and the Royal Bank of Scotland ensured that paper money was not issued to the same extent as in England.[10] I will follow Fetter (1969) in that I discuss English monetary and banking problems, but the British Bullion Debates, because Scots were very keen participants in this dispute. Secondly, officially all these four nations were on the bimetallic standard until 1816, when gold was made an official unit of account by Act of Parliament[11]. In 1717, however, gold had become the *de facto* standard after the Master of the Royal Mint, Sir Isaac Newton, overvalued silver relative to gold and the more valuable silver coins disappeared, according to Gresham's law, from circulation. It was gold that was a true basis for the monetary standard: the Bank of England kept the official monetary price of gold at £3.17s.10$\frac{1}{2}$d. from 1717 to 1931 with two exceptions: the first one during the French Wars 1797-1821 and second one during the First World War 1914-1925.

[10] Scottish bank notes were a popular means of payment in bordering counties of England, although the government tried to restrict their circulation by law. Davies (1994) p. 308.
[11] The Coinage Act, Geo. III c. 68.

CHAPTER 1

The Gold Standard Rule and Credible Monetary Policy in Economic Theory and History

1.1. Introduction

Kydland and Presscott (1977) have convinced most policy makers that they have to take the question of credibility seriously when planning monetary policy. Since the publication of their seminal work, there have been a number of attempts to address the issue of credible policy and to understand what is required in order to make policy credible. The question has often been addressed by analysing periods when monetary policy has lacked credibility, but by contrast, in this thesis I focus on an era when monetary policy seemed to be very credible, even during 'difficult times'. In particular, I reassess the period of suspension of the gold standard rule during and after the French Wars (1793-1815) in the light of developments in monetary theory since the publication in 1965 of last major study of this period, F.W. Fetter's *The Development of British Monetary Orthodoxy*.

Since 1973, monetary systems in developed countries ceased to have any links with gold or other commodities. At the same time, research on the commodity standard, which without doubt was a dominant field of economic study for centuries, reduced dramatically. As a result, new macroeconomic theories and methodologies, which have developed apace since the 1970s, have not been fully applied to the commodity standard framework. This dissertation aims to begin to fill this gap in the literature by analysing the gold standard and the decision to suspend and subsequently resume the gold standard rule through one of the most significant innovations of modern macroeconomics, the development of the theory of credible and time consistent policy.

As suggested in the introductory chapter, the main theme which characterises this thesis is to explain how trust in the monetary system was maintained in the absence of the convertibility rule and why the gold standard emerged as the most desirable way to control monetary policy. Elements of the answer can be found in two very different types of literature: economic theory and economic history. Theoretical literature published before the 1970s is not short of formal models of the gold standard, but the literature after the 1970s is not short of models of credible monetary policy. Combinations of these two, however, scarcely exist, and there are no theoretical studies, to my knowledge, on the gold standard as a commitment rule. Historical analysis is necessary for supporting theoretical modelling and providing insights into policy making during this extraordinary period. The complex problems, which arose from the economic environment in which monetary policy had to be conducted during the French Wars, could not be properly addressed if historical background and evidence were ignored and the analysis completed only through stylised models of modern macroeconomics.

By summarising both the traditional analysis of the gold standard and the credibility and time inconsistency literature, this review chapter will establish the theoretical background for the models developed in this dissertation. Then I will present a rather comprehensive review of sources for historical evidence. Here I only consider the literature that is relevant to the core research objectives of this thesis. Detailed discussion of aspects of various studies are reserved for subsequent chapters. This chapter will also explain why certain bodies of research have been left out, and justifies the reason why I have taken a side-step from the dominant approach in which the gold standard is, according to the classical tradition, analysed as a self equilibrating system.

Rather than simply presenting the theory and history in separate, self contained chapters, the thesis is broken down thematically and chronologically within the time frame of Pre-classical Gold Standard (1717-1797) and the Suspension Period (1797-1821). This method was adopted to avoid repetition and, as far as possible, constant references to other parts of the text. The chronological treatment, which also allows other related issues to be discussed, is the logical choice because crucial developments in economic thought took place during this period: the principles of monetary policy, inter-linked with public finance and banking, developed from the experience before 1797, but there was a stronger element of design of monetary policy rules during the Suspension Period.

1.2. The Classical Analysis of the Gold Standard

1.2.1. Self-equilibrating System of Markers

Broadly defined the classical analysis of the commodity standard dominated over a hundred and sixty years of economic thought on money, from the publication of David Hume's model of the price specie-flow mechanism in 1752 to the collapse of the Classical Gold Standard in 1914. Early mercantilists had regarded precious metals as the sole constituents of the wealth of nations, which explains why Europeans were mainly searching for gold and silver instead of non-monetary goods during the Age of Exploration. Many late mercantilists, Hume amongst them, analysed both gold and money with much greater sophistication than their predecessors, and therefore Adam Smith's fierce criticism of the mercantilists in *The Wealth of Nations* was only partially justifiable.[1]

Together with the vision of the determinants of economic growth and wealth, the theory of the operation of markets was the most important invention of early classical thought. These new theories were partly based on the fact that the role of the precious metals in the economy evolved over time. As early as at the end of the seventeenth century British merchants supplemented metallic money with notes that were proofs of deposits or with various short-term credit instruments known as bills. As a result, by the mid-eighteenth century the value of circulating paper currency exceeded the value of existing stock of bullion and specie. Instead

[1]Smith (1776) book V.

of being exclusively used in exchange, gold and silver were also used as reserve commodities. Sufficient and stable supply of precious metals, however, was crucial for bankers and goldsmiths, as they were expected to be able to redeem their notes in gold or silver. Coins also remained as a primary medium of exchange amongst ordinary people.

The classical theory stresses impersonality and automaticity of the commodity standard. The largest class of models concerns international trade and focuses on the mechanism by which balance of payments equilibrium is restored automatically between countries which are on the commodity standard. The most influential theory has been David Hume's two country model of price-specie-flow, which emphasises the role of relative price movements in restoring the equality between imports and exports. Hume shows how the mercantilists' aim to maintain continuously a favourable trade balance is impossible: a current account surplus leads to a surplus of specie within that economy, which leads to an increase in the level of prices. The price level in another country, which has originally lost specie, decreases. As a result exports will decrease and imports increase for the economy with the initial current account surplus. The process will lead to a self-correction of the trade balances in all countries.[2] It seems like generations of economists from David Ricardo to Michael Bordo have revised Hume's model in trying to find understanding of how the balance of payments is kept in equilibrium under a system of fixed exchange rates.

[2] Hume (1711-1776) pp. 308-326.

Another doctrine of the classical thought is known as a commodity theory of money. Money, according to Ricardo, was simply a commodity such as gold or silver and therefore, the price of money was, like that of any other commodity, its cost of production.[3]

Since in this thesis I will analyse the gold standard as a domestic monetary policy rule, the international trade theory or the models of the gold standard as international monetary institution are only of tangential relevance to this work. I will devote some attention to the development of the exchange rate during the suspension of cash payments in Chapter 3, but analytically in Chapters 2, 4 and 5 the gold standard will be modelled as a domestic rule that restricts policy making instead of a system that maintains equilibrium between countries. Consequently, studies written during the heyday of the Classical Gold Standard, or after its collapse, for example Hawtrey (1939) and Hawtrey (1962) are not directly relevant in light of my approach, however important or influential their original contribution might have been. The 'rules of the game' of the Classical Gold Standard, such as free import and export of specie, did not prevail during the eighteenth and early nineteenth century and therefore, the theory that can be applied to the Classical Gold Standard is not relevant here.

Neither does this thesis address the question of the optimal commodity standard system, although in the nineteenth- and early twentieth centuries both scholars and monied men had fierce debates over the preferability of the gold, silver

[3]Ricardo (1821), p. 5 and p. 90.

or bimetallic standard. From the theoretical point of view it is irrelevant which commodity or combination of commodities is chosen as a unit of account as long as there is a fixed ratio between the metals. The gold standard became the dominant system at the end of the nineteenth century, because it was seen to deliver price and exchange rate stability.

The above discussion, nevertheless, does not indicate that this study is isolated from all classical doctrines of the gold standard. For example, the way in which money supply is determined in all three theoretical chapters of this thesis follows Ricardo (1821). The reminder of this section is devoted to highlighting this connection, but also explaining why the framework of the classical analysis without modification is not desirable for exploring time inconsistency and credibility issues.

1.2.2. The Commodity Theory of Money

As a literary methodology dominates classical economics, I use a relatively recent model by Barro (1979) to examine the determination of the price level and the monetary and non-monetary gold stocks under the gold standard. Barro's model is a useful starting point for two reasons. Firstly, although the model was developed more than half a century after the collapse of the Classical Gold Standard, the automatic adjustment properties of the model and the assumption that the underlying monetary constitution is fixed, follows the classical tradition. Secondly, Barro's contribution has meant that the classical analysis of the gold standard has not entirely been forgotten. Since its publication Barro (1979) has been the foundation of a number of contemporary models of the commodity standard that are referred to in this thesis, such as Goodfriend (1988) and McCallum (1996).

The framework of the model is a closed economy with its own gold production that can represent either a single country or the world economy under fixed exchange rates[4]. The stock of money M is denominated in nominal units such as pounds and represents a liability of the central bank. Money is assumed to take the physical form of a paper claim rather than specie. The central bank maintains the gold standard by being ready to sell or buy any amount of gold offered or demanded in exchange for paper currency at the fixed price Q. The total money supply, following Ricardo (1821), is determined by

$$M^s = \frac{1}{\eta} Q K^g, \tag{1.1}$$

where the parameter $\eta \in (0, 1]$ is the gold reserve ratio, which measures the gold backing of the monetary issue. The central bank holds a reserve stock of gold K^g and the gold reserve ratio η changes according to the central bank's gold stockpile policy. The higher η, the larger the proportion of money stock that is backed by monetary gold and the lower the fiduciary issue of money. Under the perfect gold standard, money supply equals QK^g, which indicates that paper claims represent literally warehouse certificates of gold deposits.

[4]If individuals were free to trade gold with residents of other nations, there would be only one integrated monetary system.

The demand for circulating medium M^d is proportional to the general price level of commodities P multiplied by parameters that measure the volume of transactions being conducted. These parameters are real income y and function $v\,(\pi)$ that represents the reciprocal of the velocity of circulation, where π denotes the expected rate of inflation. Formally, money demand is

$$M^d = Pyv(\underset{(-)}{\pi}), \tag{1.2}$$

where expected inflation is defined as

$$\pi \equiv E\left(\frac{\dot{P}}{P}\right). \tag{1.3}$$

A dot represents a time derivative. Expected inflation and desired money holdings are inversely related so that if expected inflation rises, the alternative assets[5] become more attractive and money demand decreases. If these assets have a fixed real rate of return, inflation measures the opportunity cost for holding money. This relationship is marked by a minus sign inside brackets underneath π.

Combining money supply (1.1) and demand (1.2) gives the price level equation

$$P = Q\left[\frac{K^g}{\eta v(\pi) y}\right]. \tag{1.4}$$

[5]Barro assumes that these 'alternative assets' consists of either capital with a fixed real rate of return or a commodity stock.

Since the equation (1.4) holds at all times, variations of P around fixed monetary price of gold Q reflect movements in the right-hand-side variables. Variables v, η and y are assumed to be exogenous although subject to disturbances and it is assumed that there is no sustained growth in y.

Barro applies Fisher's (1922)[6] definition for determination of the monetary gold stock in a dynamic context. The country's stock of monetary gold is determined by gold production and the extent to which gold is held for non-monetary purposes, for example ornamental or industrial use. Production of new gold is the only possibility of increasing the economy's existing stock. The current production function for a representative member of the gold mining industry is expressed by the real cost function $c(k)$, which describes the cost in commodity units for producing gold at rate k. The production of gold is assumed to have positive and increasing marginal cost thus $c',\ c'' > 0$. The nominal cost for producing gold at rate k is $Pc(k)$, while the nominal revenue is Qk – assuming common price for gold in monetary and non-monetary use. The gold producers consider Q and P to be exogenous and maximise profits

$$\Pi^f = Qk - Pc(k) \tag{1.5}$$

[6]Fisher, I. (1922) *The Purchasing Power of Money*, 2nd ed. Augustus Kelley as quotated by Barro (1979) p. 15.

subject to gold production at rate k. The marginal cost of gold production becomes

$$c'(k) = \left(\frac{P}{Q}\right)^{-1} \tag{1.6}$$

which implies that the quantity produced per unit time is an decreasing function of the relative price of gold P/Q. The supply function for new gold takes the form

$$k^s = k^s(\underset{(-)}{\frac{P}{Q}}). \tag{1.7}$$

Thus if the general price level increases, the ratio between the general price level and the fixed monetary price of gold (relative price of gold P/Q) rises, the gold supply decreases.

Let K denote the stock of gold that is held for non-monetary uses. Non-monetary gold is modelled here as a durable good which depreciates at the constant rate δ – the fraction δ being lost or wasted in each period – but gold held by the central bank is not assumed to depreciate as the central bank keeps the reserve safely in its vaults. Barro assumes that non-monetary use of gold increases with a higher current relative price, P/Q, but *decreases* with expectations of a higher future relative price: as Q is constant, expected future values of P/Q vary inversely with inflation expectations π. The monetary authority's target stock of privately held gold is

$$f(\underset{(+)}{P/Q}, \underset{(-)}{\pi})y, \tag{1.8}$$

which, for simplicity, assumes a unit income elasticity. The target stock increases in relation to P/Q.

By assuming Q to be always fixed, Barro rules out the need for speculative gold storages. The f-function therefore reflects only non-speculative gold demand such as industrial or ornamental use of gold, ruling out bank runs or other sudden shifts in the non-monetary gold stock.

The non-monetary demand for gold is defined in the form of a flow function as

$$k^d = \alpha \left[f(\underset{(+)}{P/Q}, \underset{(-)}{\pi})y - K \right] + \delta f(\underset{(+)}{P/Q}, \underset{(-)}{\pi})y. \tag{1.9}$$

Equation (1.9) consists of two parts: the first one describes a desired gradual adjustment of non-monetary gold stock K towards its target stock position $f(P/Q, \pi)y$ in accordance with the adjustment parameter $\alpha > 0$; the second part represents the normal replacement flow $\delta f(P/Q, \pi)y$ that would be required to maintain the target value of K. A high non-monetary stock of gold decreases the non-monetary demand for gold, thus K has a negative effect on k^d.

The net change in K at any point in time is given by the difference between the non-monetary gold demand and the depreciated existing stock

$$\dot{K} = k^d - \delta K = (\alpha + \delta) \left[f(\underset{(+)}{P/Q}, \underset{(-)}{\pi})y - K \right]. \tag{1.10}$$

The monetary authority standing ready to buy or sell any amount of gold at price Q, the change in the monetary gold stock is given by the difference between gold supply and gold demand for non-monetary use

$$\dot{K}^g = k^s - k_n^d = k^s(\underset{(-)}{P/Q}) - \alpha\left[f(\underset{(+)}{P/Q},\ \underset{(-)}{\pi})y - K\right] - \delta f(\underset{(+)}{P/Q},\ \underset{(-)}{\pi})y \tag{1.11}$$

If $y,\ \eta$ and Q and the forms of the k- and $f-$functions are fixed, the steady state of the system is described by equations (1.4), (1.10) and (1.11) and is defined by

$$\dot{P} = \dot{K} = \dot{K^g} = 0. \tag{1.12}$$

The expected inflation is assumed to be zero in the steady state.

Equations (1.10) and (1.11) imply that in a steady state gold supply equals the replacement demand for non-monetary gold

$$k^s(\underset{(-)}{\bar{P}/Q}) = \delta f(\underset{(+)}{\bar{P}/Q},\ \underset{(-)}{\bar{\pi}})y, \tag{1.13}$$

which means that the existing stock of gold will neither grow nor shrink in size when the relative price of gold equals $\bar{P}/Q$.[7] Equation (1.10) implies that the stock of non-monetary gold equals its target value

$$\bar{K} = f(\underset{(+)}{\bar{P}/Q},\ \underset{(-)}{\bar{\pi}})y \tag{1.14}$$

[7] McCallum (1996) p. 74 has a similar argument.

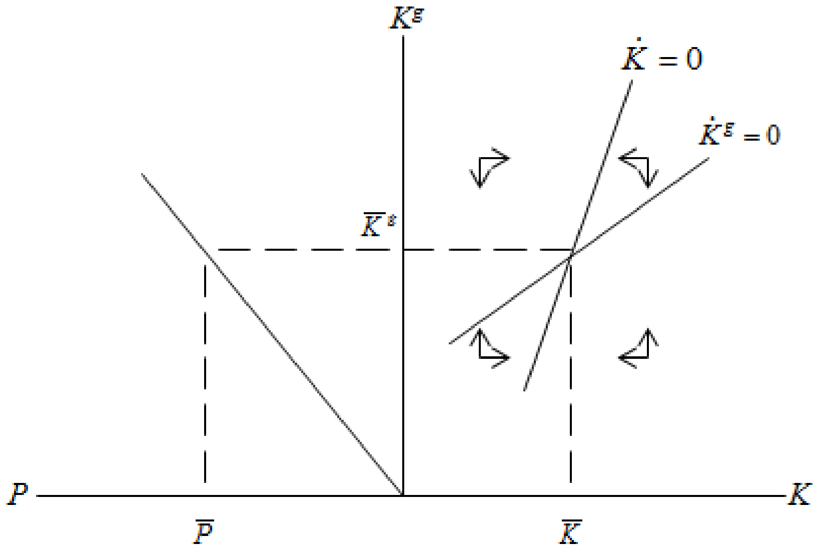

Figure 1.1. Determination of price level and gold stocks. Barro (1979) p. 17.

in the steady state and the steady state monetary gold stock from equation (1.4) becomes

$$\bar{K}^g = \eta k(\bar{\pi}) y \bar{P}/Q. \tag{1.15}$$

Once $\bar{K}^g$ is determined, the money stock in the steady state is

$$\bar{M} = \frac{1}{\eta} Q \bar{K}^g.$$

Figure 1.1 illustrates the steady state values $\bar{P}$, $\bar{K}$ and $\bar{K}^g$ and describes the dynamics of P, K and K^g. The line on the left hand side of Figure 1.1 relates the price level P to the monetary gold stock K^g as defined in the equation (1.4). On the right hand side, lines $\dot{K}^g = 0$ and $\dot{K} = 0$ indicate the combinations of K and K^g that yield $\dot{K}^g = 0$ and $\dot{K} = 0$ in equations (1.10) and (1.11) taking into account K and P from equation (1.4). Increase in K^g increases P, which decreases k^s and increases k^d. Thus $\dot{K}^g$ falls if K^g rises. Respectively, if K increases, k^d reduces and $\dot{K}^g$ falls and $\dot{K}^g = 0$ line is positively sloped. Similarly, $\dot{K} = 0$, from equation (1.10) is positively sloped. Appendix 1.A verifies that the slope of $\dot{K} = 0$ is steeper than the slope of $\dot{K}^g = 0$.

In this model the general price level of commodities becomes a determinate quantity that is subject to usual supply and demand analyses. According to the commodity theory of money the relative price of gold in relation to goods is defined by 'real forces', which in the classical analysis refer, for example, to gold production, non-monetary uses of gold or changes in preferences. As these forces are assumed to change only gradually and to a limited extent, given the physical nature of gold, price level fluctuations are expected to be fairly limited in magnitude and duration.[8]

Barro continues his analysis by using the diagram in Figure 1.1 to discuss the short- and long-run impact effects of changes in conditions of various types, such as an increase in real income or gold discoveries. Here I consider one experiment that is interesting in light of the approach of this thesis: the effect of increase in fiduciary paper money issue. As in this model the economy's total stock of gold

[8]Barro (1979), McCallum (1996) p. 77.

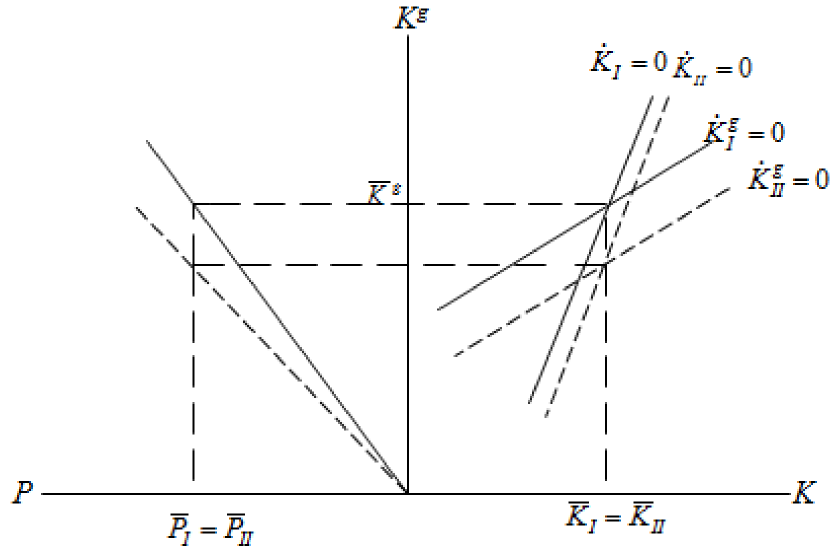

Figure 1.2. Effect of increased paper gold. Barro (1979) p. 21.

can be changed only if more gold is produced, Barro assumes that some passage of time is required for the size of the gold stock to be changed. On the contrary, circulating money stock could increase faster than the monetary gold stock if the central bank printed and issued unbacked paper currency.

As seen in equation (1.1), any issue of fiduciary paper money decreases η, the gold reserve ratio, while the monetary gold stock K^g remains unchanged. The short-run impact effect of the decrease in η is that the price level P rises in proportion to a given value of K^g and the relative price of gold, P/Q, increases. The curve that relates the price level to the monetary gold stock K^g rotates downwards as seen in Figure 1.2. As the price level rises, $\dot{K} = 0$ shifts down and right with given values of K^g and K and as indicated in the equation (1.10). Now from (1.11) $\dot{K}^g = 0$ line declines for given values of K^g and K.

In the short-run, it can be seen from equations (1.13) and (1.15) that $\bar{P}$ and $\bar{K}$ are invariant with η. The steady state money stock $\bar{M} = Q\bar{K}^g/\eta$ remains fixed as the downward movement in $\bar{K}^g$ from (1.15) is proportional to the fall in η. With K^g held fixed, the initial effect of the increase in M is to increase P in proportion. This price change induces a rise over time in K and leads also to a drop in gold production k^s. Monetary gold K^g falls because P declines from its initially higher position in proportion to the decrease in K^g. Eventually, a point is reached where K is sufficiently high and P is sufficiently reduced so that K begins to fall. The only long-term effect of the increased paper money issue is to drive out part of the monetary gold stock without affecting the price level: K and P return to their original positions. Barro argues that as long as the price of the gold Q is kept constant, the issue of paper money does not result in a change in the price level, but increases the short-run volatility of the general price level.

The above analysis can be misleading to some extent, because it indicates that the monetary authority's gold reserve policy would be a matter of indifference. According to McCallum (1996) the short-run impact effects can be sizeable and may disappear slowly, depending on the gold supply conditions.[9] In addition, creating more and more paper money would lead to an increasing amount of paper notes to be converted, which would be inconsistent with the assumption that Q

[9] McCallum (1996) p. 77.

stays fixed. In the steady state the monetary authority's seigniorage can be defined as

$$\frac{\bar{M}}{\bar{P}} - \frac{Q\bar{K}^g}{\bar{P}} = ky - \eta ky. \tag{1.16}$$

The maximum seigniorage revenue implies that if $\eta \to 0$, the seigniorage would equal $\bar{M}/\bar{P}$. The cost of seigniorage finance, as Barro points out, is that it can make the gold standard unfeasible, but it remains unclear what the implications in this framework would be.

Barro's analysis is useful in the framework of the Classical Gold Standard, but is probably too simple to address deeper or complex issues of credibility of the monetary system. Firstly, it is partly built on hypothetical assumptions and parameters that do not always have any real-life counterparts, such as the central bank's target stock for privately held gold and the adjustment parameter of private gold. Secondly, any speculative demand for gold is ruled out even though agents know that the gold backing is not perfect. Apart from the section where Barro examines the effect of change in η, the government is assumed to keep the gold reserve ratio fixed. This is a popular assumption in the framework of the Classical Gold Standard and it is due to the fact that between 1845 and 1914 the Bank of England was forced by law to keep its gold reserve ratio within a narrow range. By contrast, during the eighteenth century the gold reserve ratio was volatile and fell during the political disturbances when the public preferred specie to notes, and increased in peace, when notes and bills were willingly accepted. The Bank of England's gold reserve policy that aimed to stabilise the gold reserve ratio is analysed in the DSGE framework in Chapter 2. Thirdly, the impact of the relative price level and the expected rate of inflation to private gold demand is ambiguous, because Barro argues that gold demand *increases* if the current relative price level increases, but gold demand *decreases*, if the expected rate of inflation increases. If the price level is expected to increase in the future, the rational agents are likely to increase their gold holdings, rather than reduce them. Finally, although Barro's analysis has an element of expectations, it is predominantly a static model. During the Suspension Period the value of money was determined by a credibility of the government and the Bank of England's promise to convert currency to specie at future. Expectations and the monetary authority's reputation, which played a crucial role in determining the price level in the absence of the gold standard, would be difficult to model in Barro's framework, because if the gold backing was removed from his model, it is obscure how the price level would be determined.

1.2.3. The Question of Sufficient Reserves

How much reserves should the central bank hold under the gold standard? The desirable level of gold reserves would ensure price stability and make bank runs unlikely, but minimise dead-weight loss which occurs because gold does not bear any interest for its owner or for the central bank when kept in the bank's vaults.[10] The problem of sudden runs on reserves disappears under the prefect gold standard where the entire money stock is backed by gold, but this system might not be efficient if we imagined a case where gold would yield utility in non-monetary form for its holder. On the other hand, if the gold backing ratio were close to zero, the central bank would be able to act as financial intermediator and lend all monetary gold to private agents, but in the case of unexpected gold demand, the bank should first call in the loan to be able to convert its notes, which would increase transaction costs. Goodfriend (1988) discusses in detail the trade-off between zero and perfect gold backing and shows that the optimal gold reserve ratio is between 0 and 1. But keeping the gold reserve ratio fixed prevents the central bank from pursuing other objectives such as the stability of the price level.

Obsteld and Rogoff's (1983) model of speculative bubbles has a simple answer to the above question: the backing of the currency has to be perfect in order for bank runs to be ruled out. The central bank has to be able to redeem the money stock at fixed price Q, but the backing is partial in the sense that the fixed price of the backing commodity is above its market price. Therefore, if the market price of gold Q^m is below the mint price Q, the public satisfies its gold demand by obtaining gold from markets rather than from the central bank. Feasibility of

[10]Smith (1776) was a precursor of this discussion. He predicted that if the country were to allow banks to issue paper bank notes that were evidences of safe private indebtedness, so called real-bills, the price level would not be affected. A commodity money system is wasteful because there are better uses for the resources absorbed by a commodity money. See the discussion in Sargent and Velde (2002) p. 101 and Sargent and Wallace (1982).

this policy requires that the government has access to sufficient gold reserves to purchase the entire money stock M at the support price Q.

Throughout this thesis I depart from Barro (1979) and side with Obstfeld and Rogoff (1983) in assuming, in essence, that under the gold standard money is only regarded to have value if it has either intrinsic value, is directly convertible to gold or the private agents *expect* money to be convertible to gold. It is well known, however, that the gold backing was never perfect, not even during the Classical Gold Standard, and therefore in Chapter 2, I will present historical evidence of the Bank of England's gold stockpile policy and develop a DSGE model to elaborate on the question of how the value of partially backed paper money was maintained during the Pre-Classical Gold Standard. In subsequent chapters I will investigate how this seemingly imperfect rule emerged as the best available method to enforce the credibility of the monetary system.

1.3. Monetary Policy Rules under Fiat and Gold Standards

Although the structural credibility problem in the conduct of monetary policy was recognised only thirty years ago, social responses to this dilemma have a long history. In his recent study on the history of monetary targets Flandreau (2007) argues that the Bullion Debates during the Suspension Period were the first public discussion over relative advantages and disadvantages between credibility and flexibility. An outcome of this debate was that the gold standard was considered as the most desirable monetary policy rule, even though its predecessor, the eighteenth century gold standard, had been a result of an evolutionary process rather than active policy design. In this section my objective is to link the gold standard and the suspension of cash payments to the theory of credible monetary policy. I first discuss the time inconsistency problem and summarise solutions that are suggested in the vast literature published after Kydland and Presscott's original contribution in 1977. Then I review the existing three studies that have applied, although not through quantitative modelling, the time inconsistency theory to the commodity standard. I will conclude this section by focusing on those particular aspects of the credibility and time inconsistency theory and literature that are significant for the models developed in this study.

1.3.1. Theory of Credible Monetary Policy

Following the seminal contribution of Kydland and Presscott (1977) a contradiction between a policy makers' capacity to boost the economy transitorily and their inability to achieve this on a permanent basis was recognised and gradually accepted. Calvo (1978) and Barro and Gordon (1983a,b) have applied Kydland and Presscott's theory of discretionary policy making into the context of monetary policy. Monetary authorities are tempted to promise low future inflation now, but surprise the public with unexpectedly high inflation in the future. If there are rigidities in the economy, for example firms and workers consider expected inflation when they agree upon nominal wages beforehand, the authorities might be tempted to create surprise inflation that reduces real wages. As the firms make their employment decision based on real wages, which decreases when the price level rises, inflation increases employment and output. In general, since the government sets policy sequentially, it has an opportunity to conduct discretionary policy – subsequently revise its decisions according to private agents' plans. Eventually the rational agents recognise the monetary authority's incentive to boost the economy and adjust their inflation expectations in the wage setting process so that in equilibrium the benefits of unexpected inflation disappear and only the cost of high inflation remain.

In the presence of a time inconsistency problem, a society would benefit from having access to a commitment technology, a policy or a rule that would tie the hands of the policy maker from changing announced future policy. Solutions suggested in the literature can be roughly divided into three categories: delegation, rules and reputation. Rogoff (1985) argues that the monetary policy should be delegated to an independent agent that has a greater dislike for inflation than society, such as a conservative central banker, who is independent from the governmental policy, and who might be penalised if inflation is high and rewarded if inflation is within its target. Alternatively, society could impose external constraints on the instruments which the monetary policy maker can use, such as a fixed exchange rate regime. Inflation surprises under the fixed exchange rate would put a downward pressure on the currency which would eventually reduce a country's international competitiveness[11]. The third type of technology, first discussed in the context of

[11]This argument is put forward in Giavazzi and Pagano (1988) and is discussed in Chang (1998b).

monetary policy by Barro and Gordon (1983a), does not rely on institutions as do the above two, but on the reputation of the monetary policy authority. On the assumption that the monetary authority and the public interact for a sufficiently long time, the monetary authority can eliminate the inflation bias by developing a reputation for honouring its announcements of low inflation. The ability to make credible promises is considered to be socially valuable and maintaining this ability presumes that the policy maker does not renege on its current promises.

1.3.2. The Gold Standard: a Contingent Rule or Domestic Monetary Policy Rule

Today, three decades after Kydland and Presscott (1977), the central banks in developed countries have succeeded in bringing down inflation. New measures, namely central bank independence and inflation targeting, have brought about this change. But although tools and rules are based on recent developments in economic theory, monetary management, as argued by Flandreau (2007), is not a recent thing. Throughout the ages societies have had to find ways to limit authorities' opportunity to abuse their power over monetary systems. During the time of absolutist monarchs the commodity standard evolved as an important external constraint which aimed to restrict monetary policy decisions. As the story of the commodity money systems began in ancient times and ended in the 1970s, it is inevitable that the way in which this constraint was imposed evolved according to changing economic conditions. This process as whole is outwith the scope of this study, but instead I examine what kind of commitment mechanism the gold standard was and how it operated in the eighteenth- and early nineteenth-century, before the gold standard had become an international rule. My main argument is that during this period the gold standard functioned as a domestic rule in the framework of national monetary policy. So far only a handful of studies have examined the commodity standard and credibility issues: Bordo and Redish (1993), Bordo and Kydland (1995) and Bordo and Schwartz (1997) in their related studies, and most recently, Flandreau (2007).

According to Bordo and Kydland (1995) and Bordo and Schwartz (1997) the gold standard rule to buy or sell gold in unlimited amounts was itself a commitment mechanism that bound monetary policy by limiting the ability of current and future policy makers to conduct discretionary monetary policy. If the trade partners of the country were on a gold or silver standard, with fixed ratio between gold and silver, countries had, in fact, a fixed exchange rate regime which put an external constraint on policy in the manner explained above. Bordo and Kydland's and Bordo and Schwartz's core argument, however, is that the gold standard had a two-fold purpose: it was a commitment mechanism *per se,* but during a war or other emergency the government could change the rule by temporarily suspending the gold standard on the understanding that the convertibility would be restored at the original parity after the emergency had passed. The authors call the gold standard a contingent rule. This means that countries committed to the gold standard rule with a war or other 'difficult time' as a contingency. In all other periods the gold standard is maintained unconditionally. In a related paper, Bordo and Redish (1993) argue that during the suspension of the gold standard rule the objective of the government was to maximise seigniorage revenue. Market agents would regard successful adherence as evidence of a credible commitment and would allow the authorities access to seigniorage and bond finance at favorable terms.[12] In all other periods the gold standard is maintained unconditionally.

The gold standard as a contingent rule argument has become widely accepted and it has influenced the way suspension periods have been reassessed in recent years. Due to its contingent nature, Bordo and Kydland (1995), Bordo and Schwartz (1997) and Rolnick and Weber (1998) consider the paper money standards in the middle of the gold standard, for example in England from 1797-1821 and from 1914-1925, as continuum of the gold standard.

Flandreau's (2007) counter argument to Bordo and Kydland's theory of the gold standard's contingency is based on the fact that in 1821 the gold standard was not resumed automatically, but as an outcome of the Bullion Debates, which was the first systematic discussion of monetary policy targets. Gold convertibility was seen as a preferable target – or rule – over the policy that had been conducted during the Suspension Period when the Bank of England's Governors had been able to regulate the issue of money according to their best judgement.

The history of monetary policy targeting – the use of specific policy instruments to reach particular targets – touches, according to Flandreau (2007), on the

[12] Bordo and Kydland (1995) p. 424.

Bullion Debates, and not only on the Keynesian Revolution. Transparency of the target, the gold convertibility, was seen as important, because the Bank of England itself was not a transparent institution. In fact, it attempted to be as opaque and as difficult to monitor as possible by not releasing crucial data of its bullion levels or discounts outstanding.[13] By contrast, convertibility itself was a straightforward principle that made the government and central bank's policies observable. The public was able to test the maintenance of the rule by comparing the official mint price of gold to its market price,[14] which was the price the goldsmiths were selling out gold. If the market price was above the mint price, that was an indication of mismanagement, usually over issue, and resulted in gold flowing from the central bank and from the country. The gold standard, Flandreau continues, did have a feasible alternative: discretionary monetary policy conducted by the private central bank. This option was advocated by influential parties consisting of industrial entrepreneurs, some private bankers and some Members of Parliament. Flandreau's conclusion is that the gold standard re-emerged in 1821 as a domestic rule – an invisible hand of monetary policy – not as an historical accident, but as a result of public debate and discussion that had, as will be examined in Chapter 3, surprisingly modern features.

[13] Horsfield (1953).

[14] Flandreau (2007).

1.3.3. The Rule under the Suspension of Cash Payments

This thesis stems from the literature on time consistency and develops Bordo and Kydland's (1995) theory of the gold standard as a contingent rule and Flandreau's (2007) argument about the gold standard as an invisible hand of monetary policy in the context of the Pre-classical Gold Standard of 1717-1797 and the Suspension Period of 1797-1821. The biggest benefit of my theoretical and more abstract method of analysis over the existing studies is that arguments are explicit and less obscure by the historical and institutional facts and vested interests of historiography. The main contribution is to explain and establish theoretically how the credibility of the monetary system was maintained in the absence of gold backing. This is a crucial question which the gold standard as a contingent rule theory is not able to answer. Bordo and Kydland (1995) and Bordo and Schwartz (1997) argue that the gold standard was a superior regime which simply had no long-term alternatives in the minds of the public and the policy makers. The resumption of the gold standard was thus exogenously credible. Their argument is probably due to misspecifying the nature of the gold standard in the early eighteenth century and rather reflects the classical thought in that the monetary policy under the gold standard was essentially and entirely subjected to the imperatives of convertibility.

The suspension of cash payments was a long period of constant shocks when the monetary rule enforced by the gold standard was not in place and the government had an opportunity to conduct discretionary monetary policy. By contrast to

Bordo and Kydland (1995) and Bordo and Schwartz (1997), this thesis identifies the gold standard and the suspension of cash payments as different monetary regimes, because the monetary rules these regimes enforced were not identical. As emphasised in Chapter 4, the gold standard regime implemented the convertibility rule, but the monetary rule under the Suspension Period was replaced by a plan to return to the gold standard at some future point.

Because the Suspension Period lasted for a quarter of a century, not just a temporary time as argued by Bordo and Kydland (1995), I am able to analyse this period through a formal model of the monetary authority's reputation that is based on long-term interaction between the private and public agents. Chari and Kehoe (1990) and Stokey (1989) define how economic policy can be sustainable even in the absence of a commitment technology. The equilibrium is based on trigger strategies where private agents retaliate if a policy maker deviates from its policy plan. Ireland (1997) and Chang (1998a) have applied this theory in the context of monetary policy under the fiat standard: private agents assume that if a monetary authority makes and breaks a promise of low inflation, it will be unable to credibly promise low inflation in the future and the private agents behave according to this assumption. The suspension of cash payments offers a concrete setting and a real-life example in which these rather abstract and theoretical arguments can be tested and developed further.

My results are related to interesting comparative research between the similarity of other suspension periods – for example the Greenback era in the United

States during the Civil War (1862-1878)[15] and the suspension of the gold standard in Britain during the First World War (1914-1925) – and entries to and exits from fixed exchange rate regimes such as the Exchange Rate Mechanism or European Monetary System.[16] The question these studies raise is whether the resumption of the gold standard was a time contingent event which occurred only when the market price of gold was at par, or whether the credible commitment to resumption by the policy makers influenced expectations and caused the market price to converge. The latter answer is probably closer to the truth as both in 1821 and 1879 the market price of gold converged fully to an expected peg ahead of fixing: in Britain the gold standard was originally planned to be resumed in 1823 but the return was already possible in 1821, and the United States had a similar experience.

1.4. Historiography and Sources

Having examined the analytical background of this thesis in a critical manner, I turn to present sources for the historical evidence and some source criticism. Theoretical work in this research is informed by historical analysis, but the historical analysis will not only complement the theoretical and quantitative modelling – it is important in its own right. If the theoretical analysis can pinpoint the key issues which arose during this important juncture when gold specie and convertible

[15] Calomiris (1994) and Smith and Smith (1997).
[16] Obstfeld (1998), Miller and Sutherland (1992).

notes were successfully replaced by paper money, the historical analysis is able to contextualise them.

The nature of my research, looking to this period from the viewpoint of time inconsistency theory, means that some historical analysis and records in monographs written before the credibility and time inconsistency theory was formulated in the late 1970s, can be re-assessed. The single most valuable source for this study was the seminal monograph by Fetter (1965) which combines the complex histories and practices of monetary institutions, and connects them with doctrines, opinions, as well as personal and political factors in the eighteenth- and nineteenth-century Britain. Fetter's key observation is that before the suspension of cash payments there was 'no generally accepted theory of a monetary and banking system'[17]. What became the dominating view was the newly orthodox 'liberal' philosophy of economic policy, advocated by Ricardo and other bullionists who sought a monetary framework for the classical, self-adjusting, competitive model-economy, in which the role of central authority was reduced to a minimum by automatic rules. Another monograph I refer to extensively was Feavearyear's (1967) narrative history of pound sterling. Especially important was his research on growth of credit and credit control in the seventeenth- and eighteenth-centuries. Clapham (1944) was the first historian who had records of the Bank thrown open to him and therefore he was able to collect significant amount of detailed information of the Bank's

[17]Fetter (1965) p. 1.

history. As he wrote his two volumes at the invitation of the Bank, some of his arguments are generally thought to be too generous.

The Bank did not conduct economic policy alone. According to recent studies by Neal (2002) the British financial system, being a rich mixture of varied financial institutions and its complex interrelated markets, managed to absorb more shocks and rebound more strongly than its Continental rivals. This argument applies also to monetary policy making, which was of a result of interaction – not always harmonious – between several institutions and therefore, limiting analysis just to the Bank of England would not have been sufficient. Valuable sources in understanding the scope of this interaction were: Dickson (1967) and Hargreaves (1930), who study the development of government's long-term borrowing and the Financial Revolution in general; King (1936) and Pressnell (1956) who analyse the increasing influence of the merchant and country banks and the growth of financial intermediation provided by the money markets; and Craig (1953) whose monograph about the Royal Mint is an interesting account of the relationship of the two institutions responsible for coinage and printing: the Bank of England and the Royal Mint.

The era of the French Revolution and the Napoleonic Wars offers an unique experiment in monetary and financial history. Comparative studies between British and French experiences were especially eye-opening. Sargent and Velde (1995) analyse public finance from the perspective of modern theories of money and the government budget constraint. Bordo and White (1991) argue that at the middle of the eighteenth-century Britain and France were financially equally strong. Both countries experienced paper money periods, but the outcomes were drastically different: the French *assignats* failed, which cost France its reputation as borrower, but the paper pound succeeded, which strengthened Britain's position as a world power even further. Britain's credibility gave it access to finance on favorable terms, while France's poor reputation forced it to rely heavily on taxation. According to North and Weingast (1989) and Broz and Grossman (2003) British superiority as a borrower was explained by the evolution of constitutional arrangements after the Glorious Revolution in 1688, which allowed the government to commit credibly to upholding property rights which reduced the risk of failure.

The monetary question was a very live one throughout the Suspension Period although the strength of the debate fluctuated according to economic and political developments. Thus, there is a great deal of writing from the period both in pamphlet form, and in the pages of newspapers and journals such as *The Times and Gentleman's Magazine*. In particular, the original works of three men, David Ricardo, Henry Thornton and Sir Francis Baring have been referred to in this thesis. *The Bullion Report*, an enquiry 'into the Cause of the High Price of Gold Bullion', was the single most influential contemporary document. Other primary printed sources this thesis makes use of are those acts of Parliament that concerned the Suspension Period.

As it is generally acknowledged that Britain financed the French Wars through a combination of taxation and public borrowing, fiscal policy played as important role as monetary policy during the Suspension Period. Fiscal theory and fiscal history, however, have been developed and examined extensively by eminent economists and economic historians such as Robert Barro, Larry Neal and Patrick O'Brien in the context of the Suspension Period and therefore, it is not the purpose of this thesis to research this area in depth. Their works have been referred to extensively in subsequent chapters.

In my historical analysis I do not rely solely on verbal accounts. Quantitative data analysis in this thesis is primarily based on the unpublished microfiche appendix for Gayer, Rostow and Schwartz (1953), which I transferred to machine readable database form during the first year of my Ph.D. Together with these two volumes, their work gives voluminous amounts of information: from historical narrative to statistical analysis combined with economic theory. Some well known counter-factual statements for instance, on the impact of the French wars on economy, are explained by the broken compilation process.[18] Furthermore the authors derived or borrowed some time series from other researchers, which were not necessarily reliable or used primary sources, such as *Gentleman's Magazine*, that did not report correct information in the first place. If much better time-series have become available, I have used them instead. For example Schwartz's

[18]The main part of the work was carried out between 1936-1941, but not published until 1953 after the sudden death of Gayer in 1951.

painstaking compilation of the monthly index of British share prices from 1811 to 1850 have recently been superseded by Shea (2007) The *Handbook of 18th and Early 19th Century British Corporate Finance*. Respectively, new data about real wages have become available. The biggest benefit of Gayer et al. (1953) for this study is, however, that data is given on a quarterly or monthly basis.

To finish this section it is important to stress that this thesis is a contribution to economic theory and not an inclusive study of ideologies in the historiography of economic thought, neither have I compiled new data or presented new historical records. Whilst the thesis challenges the work of some economic historians, the primary focus is on monetary policy and theory.

1.5. Conclusions

In this review chapter I have provided an account of the theoretical and historical background of this thesis. Combining these two strains of literature provides a much richer piece of work than if I would have just concentrated on one element. An additional challenge in my research was that the theoretical base was wide: so far the research into the gold standard has been conducted through the stylised models of the Classical Gold Standard such as Barro (1979), and theoretical literature of commitment and time inconsistency in the commodity standard context has been non-existent. Historiographically, different aspects of the suspension of cash payments are emphasised in the various works available, and no consensus emerges.

The decision of the Bank of England to cease converting paper money to gold in 1797 offers a curious experiment of paper money finance. This period, as it raises many questions, has been analysed extensively during past decades so that it has forced some authors, Fetter[19] amongst them, to conclude that there is little to add to theoretical analysis concerning the Suspension Period. However, interesting research opportunities stem from the intersection between a new analytical approach and a real economic problem. The suspension of cash payments has remained a puzzle, which classical analysis has not been able to solve.

[19] Fetter (1965) p. 26.

1.5.1. Appendix 1.A

Phase plane analysis of the determination of the price level and gold stocks

The system that describes the motion of K^g and K, given constant $\eta,\ k,\ y,\ \alpha$ and δ, can be written from equations (1.11) and (1.10)

1A.1 $$\dot{K}^g = k^s - k_n^d = k^s(P/Q) - \alpha\left[f(\underset{(+)}{P/Q},\underset{(-)}{\pi})y - K\right] - \delta f(\underset{(-)}{Q/P},\underset{(-)}{\pi})y.$$

1A.2 $$\dot{K} = k^d - \delta K = (\alpha+\delta)\left[f(\underset{(+)}{P/Q},\underset{(-)}{\pi})y - K\right]$$

and rearranging equation (1.4) gives

$$\frac{P}{Q} = \left[\frac{K^g}{\eta v(\pi)y}\right].$$

As the gold supply is a decreasing function and the target level of private gold an increasing function of the relative price level, the partial derivatives with respect to the relative price level yield

$$\begin{aligned} k^{s\prime} &\equiv \frac{\partial k^s}{\partial P/Q} < 0 \\ f' &\equiv \frac{\partial f}{\partial P/Q} > 0. \end{aligned}$$

Taking the partial derivatives of (1A.1) and (1A.2) with respect to K^g and K yield:

$$\begin{aligned}
\frac{\partial \dot{K^g}}{\partial K^g} &= -\frac{1}{\eta v y}\left[(\alpha+\delta) y f' - k^{s\prime}\right] < 0 \\
\frac{\partial \dot{K^g}}{\partial K} &= \alpha > 0 \\
\frac{\partial \dot{K}}{\partial K^g} &= \frac{1}{\eta v y}\left[(\alpha+\delta) y f'\right] > 0 \\
\frac{\partial \dot{K}}{\partial K} &= -(\alpha+\delta) < 0
\end{aligned}$$

The slopes of $\dot{K}^g$ and $\dot{K}$ lines are respectively

$$-\frac{\partial \dot{K^g}/\partial K}{\partial \dot{K^g}/\partial K^g} = \frac{\alpha \eta v y}{(\alpha+\delta) y f' - k^{s\prime}} > 0, \tag{1A.9}$$

$$-\frac{\partial \dot{K}/\partial K}{\partial \dot{K}/\partial K^g} = \frac{\eta k}{f'} > 0. \tag{1A.10}$$

The stability conditions became

(1A.11) $$\frac{\partial \dot{K^g}}{\partial K^g} + \frac{\partial \dot{K}}{\partial K} < 0,$$

which is satisfied from above, and

(1A.12) $$\left(\frac{\partial \dot{K^g}}{\partial K^g}\right)\left(\frac{\partial \dot{K}}{\partial K}\right) > \left(\frac{\partial \dot{K^g}}{\partial K}\right)\left(\frac{\partial \dot{K}}{\partial K^g}\right).$$

By rearranging the left hand sides of (1A.9) and (1A.10) it can shown that the slope of the $\dot{K}$ line is steeper than $\dot{K}^g$:

$$\begin{aligned}
\frac{\eta k}{f'} &> \frac{\alpha \eta k y}{(\alpha+\delta) y f' - k^{s\prime}} \\
\frac{1}{f'} - \frac{\alpha y}{(\alpha+\delta) y f' - k^{s\prime}} &> 0 \\
\frac{(\alpha+\delta) y f' - k^{s\prime} - \alpha y f}{[(\alpha+\delta) y f' - k^{s\prime}] f'} &> 0 \\
\frac{\delta y f' - k^{s\prime}}{[(\alpha+\delta) y f' - k^{s\prime}] f} &> 0
\end{aligned}$$

which holds as $k^{s\prime} < 0$ and $f' > 0$.

CHAPTER 2

Macroeconomic Implications of the Bank of England's Gold Reserve Policy

2.1. Introduction

The threat of Stuart restoration during the Jacobite rebellions in the first half of the eighteenth century did not only cause a dynastic crisis, but financial chaos in London. This panic manifested itself in regular runs on the Bank of England of 'alarming dimensions'.[1] As the Bank was in danger of running out of gold, it employed a peculiar strategy to slow down the gold flow: the Bank paid out specie in tiny six-pence pieces, which took so long to count that time was gained for the panic to ease and gold demand to reduce to the normal level.

This example raises the question of why the Bank of England, the most powerful monetary institution of the most developed nation in the world, was forced to use such an unconventional method, not just on this occasion, but several times in the eighteenth century, to protect its gold reserves. The answer lies in two factors, which are examined in this chapter: firstly, in the limited control the Bank had both over the total money supply and the credit markets of the country; and secondly, in the importance of the gold convertibility rule that had emerged as the best method

[1] Acres (1931) Vol I p 107.

of providing stable purchasing power of currency. Inadequate and inconsistent laws restricted the Bank's ability to conduct monetary policy through methods such as restricting the growth of the money supply or controlling of the interest rate. Together with the Royal Mint, the Bank of England controlled minting of silver and gold specie, which was thus centrally decided and tightly regulated. But merchant's bills of exchange and private bank notes formed the more elastic part of the money supply –it was flexible and spontaneous and followed demand of local business and industry.

As discussed in the review chapter, Bordo and Kydland (1995) argue that the gold standard was intended as a contingent rule which could be suspended during a war.[2] The convertibility in the eighteenth century was not, however, suspended until 1797, thus England fought four wars[3] while staying on the gold standard. In this chapter I argue that the eighteenth century gold standard functioned indeed as a contingent rule, but in a different manner than argued by Bordo and Kydland (1995). The Bank did not suspend cash payments in advance of every panic; instead it imposed an adjustment cost to notes-to-gold conversion in order to reduce the outflow of gold. As both historical and theoretical analysis in this chapter shows, it was not the automatic operations of the gold standard rule, but these

[2]Bordo and Kydland (1995).

[3]The War of the Spanish Succession (1701-1714), the War of Austrian Succession (1740-1748), The Seven Years' War (1756–1763) and the American War of Independence (1775–1783). The French Revolutionary Wars started in 1793.

rather unconventional practices that evolved over time, which had a crucial role in implementing monetary policy.

The main contribution of this chapter is to examine the impact of the gold convertibility rule through economic history and theory in the context of the eighteenth century gold standard: the Pre-classical Gold Standard of 1717-1797. By contrast, the Classical Gold Standard, a method for regulating monetary arrangements between nations, lasted 'an extraordinarily short time'.[4] At the beginning of this chapter I examine the institutional development which led to the gold convertibility rule emerging as the most important monetary policy rule. According to Flandreau (2007) the benefits of the gold convertibility rule were formally acknowledged during the Suspension Period, but in this chapter I argue that the gold convertibility rule emerged as an predominant principle soon after the establishment of the Bank of England in 1694. The credible commitment to the gold convertibility rule brought benefits, such as access to public borrowing on favourable terms, but required discipline and good governance. As the Bank's control over the economy was limited, and its gold reserves were low, the Bank had to use an unconventional adjustment cost strategy to maintain the gold convertibility rule. In the final section of this chapter, I analyse the effects of this adjustment cost through the lens of a dynamic stochastic general equilibrium model which shows how the adjustment cost was potentially an efficient way to control not just gold demand but the economy as a whole.

[4]Chown (1994) p. 72.

2.2. Emergence of the Gold Convertibility Rule as a Core Monetary Policy Rule

2.2.1. Constitutional Arrangements that Improved the Credibility of Economic Policy

A history of Britain's constitutional development demonstrates clearly how important it was to reform monetary and financial practices. Although tightly interlinked, many economic historians, for example Fetter (1965), examine the development of monetary policy without much reference to fiscal policy, such as national debt. In this section I explain how the commitment to the gold convertibility rule was only possible after substantial improvement in the credibility of public institutions which had started at the end of the seventeenth century.

The establishment of the Bank of England in 1694 as a private joint stock bank that was in charge of public finance, was the most successful out of the hundreds of financial experiments of the late seventeenth century[5]. The Bank was born, 'out of the marriage of convenience' between the business community of the City and the government of the day:[6] the merchants were motivated by profit opportunities and the government needed cash to pay for its war expenditure. The establishment of a credit institution, which was under the direct control of Parliament, gradually

[5]The Bank of England's notional early rival could have been the Land Bank. Its supporters saw the Bank of England as hugely speculative, and by using the words of Daniel Defoe, thought that 'Land was the best bottom for public banks'. Clapham (1944) Vol I, p. 1.
[6]Davies (1994) p. 256.

ended the dominance of the goldsmiths over the credit market, whose business practices had largely been unregulated.[7]

But the Bank of England was not born as an historical accident, as sometimes argued, rather, its establishment was a part of wider economic development in public finance called the Financial Revolution. Until the end of the seventeenth century the English government, unlike its counterparts in wealthy continental countries such as Holland or the Italian Kingdoms, did not have access to long-term borrowing. During the Commonwealth, indirect taxation, especially custom duties, increased public revenue, and made the funding of short-term borrowing – securing interest payments of loans by taxation – possible to a limited extent.[8] Return to royal rule did not improve the state finance any further as in order to cover large and recurrent revenue deficits the crown and its government had to mainly rely on selling and renting of the Crown's lands. The existing loans were principally Crown's personal loans, being backed only by the Crown's promises and debatable reputation. By cancelling contracts and forcing loans the Crown ensured that the royal debt stayed small and costly to serve. During the short reign of James II in the 1680's the royal debt amounted to £2 million pounds[9] and the long-term interest rate was approximately eight percent.[10]

[7]Vilar (1976) p. 213.
[8]Dickson (1967) p. 42. Hargreaves (1930) p. 1.
[9]O'Brien (2001).
[10]Dickson (1967) p. 470.

The fiscal and financial revolution emerged after the Glorious Revolution of 1688, which has been seen as the starting point of the development of efficient capital markets and improved opportunities for public finance through borrowing and taxation. Long-term public borrowing was introduced by William III and his Dutch advisors, but it did not gain immediate acceptance.[11] Contemporary critics saw the public debt, modelled on Holland's public funding system, as a political trick and just one more way to raise the wealth of the aristocrats. The Bill of Rights (1689) gave Parliament control over the public spending of crown and government as it examined and censored the budget and voted on taxes. Even though Parliament was a corrupt institution and its control was introduced in order to secure support for the new regime, it increased the credibility of the state as borrower and increased the willingness of both domestic and foreign creditors to lend money in higher amounts and on a lower rate than before the Revolution.[12] The long-term rate of interest, as measured by the yield on the government stock, reduced from the war time rate of 14 percent in the 1690s to 6-7 percent in the period 1702-1714. The key evidence of this institutional success, which allowed the government to commit credibly to upholding property rights, was a rapid growth of private capital markets.[13]

According to Dickson (1967) after the War of Spanish Succession in 1714 the government's tax revenue from custom, excise and land was sufficiently high, about

[11]Dickson (1967) pp 17-18.
[12]Hargreaves (1930) p 4.
[13]North and Weingast (1989).

£6 millions per year, to cover the ordinary government expenditure. Improved indirect taxation enabled Britain to move towards tax smoothing, which meant that recurrent wars of the eighteenth century – the War of Austrian Succession (1740-1748), the Seven Years War (1756–1763) and the War of American Independence (1775–1783) – were financed by borrowing and, subsequently servicing and amortising the debt by taxation in peace time. As compared to the unpopular and slow process of collecting taxes, short-term borrowing had real advantages, especially in sudden emergencies. Some short-term credit instruments could have been issued by the Exchequer and other departments independently from the Parliament and were considered to be a temporary emergency measure. After the crisis, more expensive short-term debt was gradually converted into long-term *funded debt* and then consolidated into perpetual annuities.[14] The long-term national debt, a funded debt, took its name from the policy of backing the debt by taxation; Parliament voted for earmarked tax for each individual loan. Broz and Grossman (2003) summarise advantages of funding the loans over short-term debt. Firstly, by paying the subscribers annually over long periods helped the government to meet the immediate needs of war finance; and secondly, funded debt facilitated efficiently tax smoothing. Successful serving of the debt after one war built up the government's reputation and allowed it to build even larger debt in the following war.[15]

[14]Bordo and White (1991) p. 305. Sargent and Velde (1995) p. 478.
[15]Bordo and White (1991) p. 305.

2.2.2. The Bank as an Agent of Government Finance

After the establishment of the Bank of England, Parliament's priority was to find ways of limiting the power of the King and government over the Bank of England in lending. The Bank had to instantly stop payment 'if it had ceased to receive the interest on the sum which it had advanced to the government'[16] and the Bank was not allowed to lend to the government without the explicit consent of Parliament.

In this section, I argue that equally significant was another novel aspect of the Bank's operations: management of its own specie and bullion reserves. Given that gold and silver emerged as money in ancient times, it seems difficult to imagine that before the establishment of the Bank there were no public institutions that would be credible enough to have gold reserves and issue convertible paper money. To understand why the gold convertibility rule became so crucial, it is useful to think of a counter factual: previous monarchs had not been able to issue notes payable on demand because, unlike the Bank, they did not have reserves of any kind and, for example, Charles II's orders were payable only with eighteen months' delay.[17] Although the first balance sheet of the Bank shows that its gold reserves were low compared to its liabilities and its assets mainly consisted of government paper, the merchants accepted the notes at par in payments very soon after its establishment. The confidence of merchants was the most important determinant of the Bank's strength.[18]

[16] North and Weingast (1989) p. 821.
[17] Feavearyear (1963) pp. 126-127.
[18] Vilar (1976) p. 281.

The Bank of England was not, however, the first public institution, which had issued fiduciary currency, but the first one to be able to issue it in a sustainable manner and to learn from its own mistakes. The first lesson in the management of public finance and convertibility came as early as in 1696. Charles II had started to issue tallies, wooden sticks that had previously been used as evidence of tax payments, to persons who made either advances or gave supplies to the king, promising to redeem them later with interest.[19] Tallies were issued to such an extent that even though the interest rate on them was increased, no more could be placed. At the date of the Bank's foundation the value of tallies outstanding was around £5,000,000 and they were accepted in the City only at a considerable discount of 25 or 30 percent.[20] The Bank, however, in addition to deposits and interest-bearing notes, had the right to raise working capital through discounting the bills of exchange, which tallies practically were. The acceptance of tallies at the Bank had two immediate effects: the value of these wooden sticks rose to par, and the government was again able to issue them, using the income to pay the suppliers of the army.

The tallies resulted in a credit expansion accompanied by a fever of gambling in the stock market, increased gold and silver prices and depreciation of the currency. The price of silver and commodities increased by about 25 percent, but the price of gold and the gold guineas increased by about 40 percent. The circulating coins

[19] Feavearyear (1963) p. 110.
[20] Feavearyear (1963) p.127.

became badly clipped: during the recoinage between 1695 and 1696, £4,700,000 worth of clipped coins brought to the Royal Mint contained only £2,700,000 worth of silver.[21]

After the first credit expansion the special position of the Bank of England, as a banker to government and as a London note issuer, was recognised. The lesson learned was that the purpose of the Bank was not to absorb as much government debt as possible, but to make the government debt an attractive investment option. Since the nominal return on government debt was fixed, large purchases of the debt by the Bank were likely to increase circulating money stock, raise the price level and reduce the realised return of the government paper. In order to encourage the public to buy government paper, of which return is thus inversely related to inflation, the value of money had to stay stable and the public's confidence towards the monetary system strong. In the eighteenth century the national debt was not created by the Bank of England's direct purchases, but through the issue of bills and bonds which were traded on the London Stock Exchange. At the same time that the national debt was born, paper money came into existence, as people gradually realised that money could take forms other than just specie with intrinsic value. Because the Bank was not able to control the nation's total money supply, for the reasons that are examined in the next section, gold convertibility became the main method of maintaining the credibility and stability of the monetary system.

[21]Feavearyear (1963) p. 141.

2.2.3. The Extent of the Bank of England's Control over the Money Supply

In order to be able to examine the effectiveness of the Bank of England's monetary policy during the period of Pre-classical Gold Standard, I examine the extent to which the Bank was able to control the total money supply of the country. During the Industrial Revolution, demand for various different types of bills and notes was so high around the country that the supply of Bank of England notes alone could not satisfy the demand.

The English banking system developed as a three layered pyramid, as seen in Figure 2.1, consisting of the Bank of England, the rest of the London private banks and the country banks.[22] By the second half of the eighteenth century the Bank of England notes had become the main currency used in large payments in London. London private banks gradually ceased to issue notes because they could not compete with the interest rate paid by the Bank of England.[23] The Bank of England notes rarely circulated outside the London area, where the country bank notes were the main medium of exchange. Especially after 1750 the growth of the country banks had increased regional money supply. The system resembled the gold exchange standard of the twentieth century: the private bank notes were convertible to the Bank of England notes, which in turn were convertible to gold on demand. Many of the London bankers kept their reserves in the Bank notes or

[22]Fetter (1965). Pressnell (1956) pp. 75-76.
[23]Pressnell (1956).

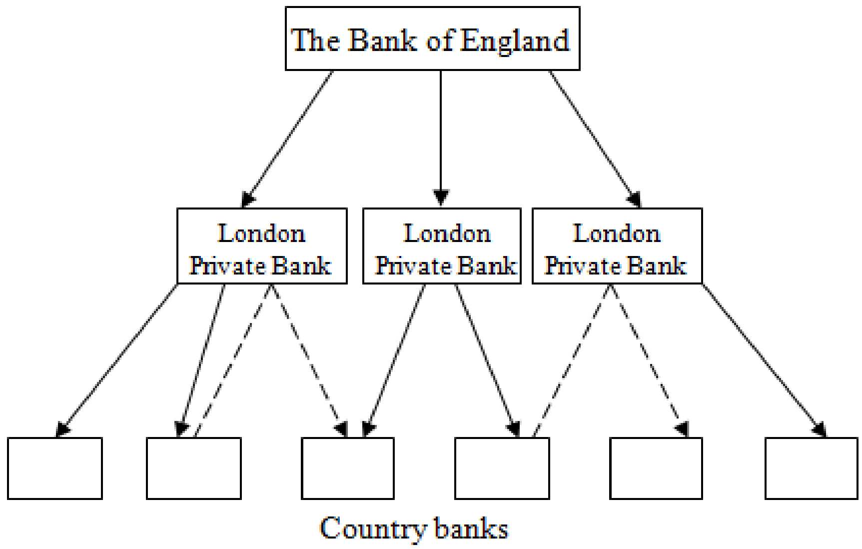

Figure 2.1. Credit Pyramid in the Eighteenth Century

towards the end of the eighteenth century, kept accounts in the Bank. They had, therefore, direct access to the Bank of England's notes and bullion. The London private banks integrated small country bank units by supplying links between country banks in agricultural areas, which had excess capital for lending, and the industrial areas, which had excess demand for capital.

The enactment of the Bubble Act of 1720[24] limited the maximum partners of banks in England and Wales to six and gave the Bank of England a monopoly in joint stock banking. The capital of any other bank was therefore limited to what could be provided by up to six partners, which meant that English banks were severely undercapitalised.[25] The number of the country banks grew hand-in-hand

[24] 6 Geo. I, c. 18.
[25] Dowd (1989) p. 118 .

with the Industrial Revolution. The growth was, however, uneven, as it was typical for the country banks that their numbers would have been brought down by a crisis and the note circulation down by a third or by half, but one or two years after each crisis both their number and note issue was again greater than ever. In 1750 there were twelve country banks outside London but in 1793, there were nearly 400.[26] The number of London private banks almost doubled in the second half of the eighteenth century. Data on the circulation of country bank notes is not available until 1804 and onwards when the law required stamp duties to be paid on private notes. The value of all notes stamped in 1805 was £10,700,000 thus the private bank notes consisted of almost forty percent of the total paper money in circulation.[27]

The Bank of England's control over the country banks was not obvious as they did not keep substantial amounts of reserves in the Bank notes or gold, but in deposits with London private banks.[28] Therefore, the main influence of the Bank over the country banks was through the London money market. If there was a small, urgent, need for money, coin was still the only form of money available as small notes were illegal in England and Wales. The country banks then drew down their gold deposits from London, and London banks drew cash from their accounts with the Bank. According to Pressnell (1956) to some extent the Bank functioned as a lender of last resort: 'when money was scarce country banks in general turned

[26]Pressnell (1956) pp. 5-7.
[27]Pressnell (1956) p. 188.
[28]Pressnell (1956) p.76.

to London much as London firms turned to the Bank of England as the lender of last resort'.[29]

In the eighteenth century it was not yet realised that convertibility alone was not sufficient to guarantee stable prices when hundreds of banks were allowed to issue their own notes. As country bank notes were convertible to gold on demand, currency should have, in theory, behave as if it was entirely of gold. David Hume's price-specie-flow mechanism, discussed in section 1.2, implied that any loss of gold to other countries should have required the country banks to reduce their note issue by the same absolute amount so that prices in Britain would fall, and foreign prices rise, together acting to restore equilibrium on the foreign exchanges and in the relative price levels. But given the uncoordinated manner by which notes were issued, the response was not quick to prevent fluctuations in finance and trade.[30]

It was widely believed at the time that the instability of English banks was not due to their undercapitalisation, lack of reserves or money supply, but to their freedom to set their own terms of redemption and issue small notes.[31] As silver and small coins were rare, notes with face value of six pence became acceptable. Therefore, the circulation was not restricted through limiting the rights of money supply as such but the face value of notes. In 1775 Parliament forbade English banks from issuing notes of less than £1 in order to protect the public, especially

[29]Pressnell (1956) p. 76.
[30]Davies (1994) p. 310.
[31]Dowd (1989) p. 118.

illiterate poor people, who commonly used the small notes. Two years later Parliament passed further laws reducing the negotiability of paper money and specifying some security measures, such as signatures and dates, on notes.

Until the Suspension Period there was no organised discussion about the relation of the credit of the private banks to the total money supply or of the potential problems resulting from the fast growth of the country banks. Fetter (1965) argues that the banking problems stayed in the background of the political agenda as more acute questions such as parliamentary reform, the American War of Independence and the French Revolution dominated the discussion.[32] It is possible that the country banks' credit issue did not bother decision makers because it did not create major inflation. Troubles lay ahead, however: between 1790 and 1793 canal mania had increased the credit demand for investments, which were particularly slow to yield return. The outbreak of the French Revolutionary war in 1793 was followed by a deep financial crisis in England, but the war rather accelerated the crisis.[33] The Bank of England, with the help of the Treasury's issues of the Exchequer Bills, was able to maintain gold convertibility for four further years, but in February 1797 the Bank ceased gold payments altogether to protect its reserves and maintain its notes in circulation.[34]

[32]Fetter (1965) p. 11.
[33]Pressnell (1956) p. 457.
[34]Fetter (1965) p. 14.

2.3. Strategies to Secure Convertibility during the Pre-classical Gold Standard

2.3.1. Gold Supply and Demand

In previous sections I examined the importance of the gold convertibility rule and the Bank's lack of control of the total money supply, which would have been, without doubt, the most efficient way to support convertibility. As this was not possible, one would assume that the Bank had ways of controlling gold markets, i.e. gold supply and demand. But again, unsystematic monetary development meant that there was a large conflict between aims and means. This was potentially problematic in the commodity standard environment, because any kind of commodity standard has to deal with the dilemma of arbitrage profits, which arises when the market price of the commodity backing the currency increases above the mint or monetary price, the price the individual has to pay to purchase the commodity from the central bank. For example, if the monetary price of gold were below the market price, gold could be purchased from the central bank and sold at a higher price in the private market. The arbitrage profit is the difference between the monetary and the market price of gold.

The theory of the Classical Gold Standard rules out these arbitrage profit opportunities by the automatic price adjustment mechanism. The circulating money stock has to decrease when people buy gold from the central bank and as a result the market price level of all commodities, including gold, falls until the original rise in the market price of gold is matched. The arbitrage automatically keeps the market price of gold equal to the mint price of gold. Under the international gold standard, disturbances in the price level in one country were wholly offset by an automatic balance-of-payments adjustment mechanism, which involved shipping of gold from one country to another.[35] As discussed in the previous chapter this and other automatic operations of the gold standard have been the focus of much economic research.

The price adjustment mechanism, however, did not work to the same extent during the Pre-classical Gold Standard as the gold standard did not yet operate as an international rule. Regular wars and revolutions in European countries caused political disturbances and commercial distress such as trade blockades. Disruptions in gold supply and shipping conditions, especially during maritime warfare, made the gold convertibility rule a challenging task to follow. Bank runs and financial panics were relatively common and demand for gold was at its highest during political disruption. If there were simultaneous gold supply blockades, the Bank of England was in danger of exhausting its gold reserves. The bullion reserves of the Bank fell especially during the wars, when the expenditure of the government increased. As seen in Figure 2.2, the gold backing of the Bank notes was far from perfect.

Strict laws prohibited the export of English bullion and coins or smelting English specie, but export of foreign gold was permitted. From 1717 to 1797 the fixed

[35]Goodfriend (1988).

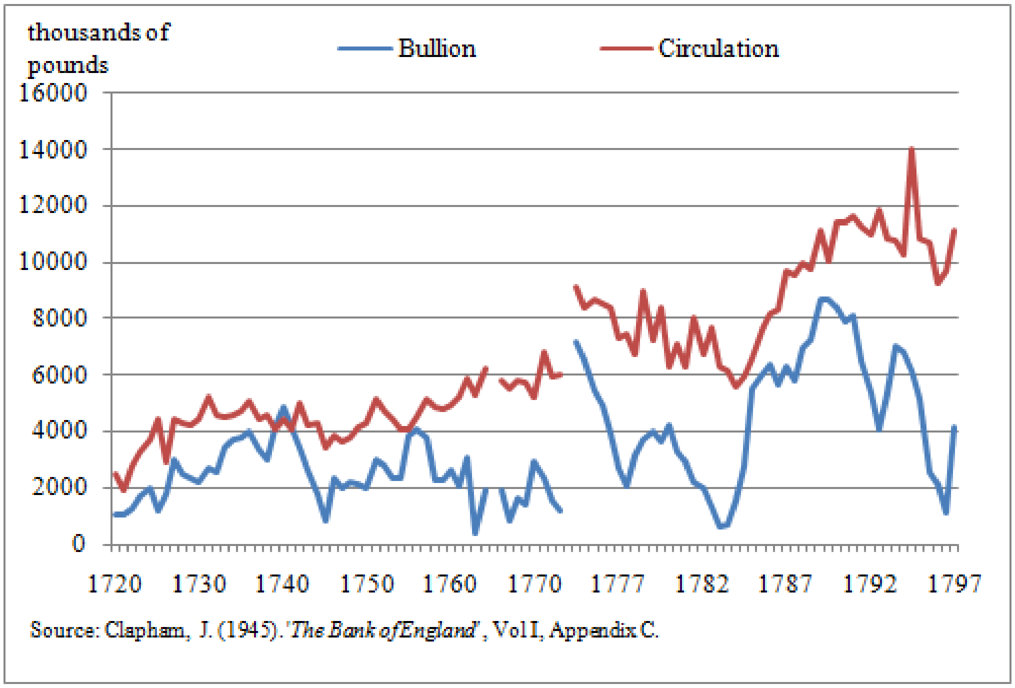

Figure 2.2. Bank of England's Bullion Reserves and Notes in Circulation 1720-1797. Annually.

monetary or mint price of gold had been at £3.17s.10$\frac{1}{2}$d. an ounce. As can be seen in Figure 2.3 the market price of gold prior to the Suspension Period had risen above the parity price only by a relatively small percentage. England's principal foreign exchange operations were with Hamburg, which was on a silver standard and the fluctuations in the London-Hamburg rate were linked to changes in the gold-silver ratio in Hamburg. According to Fetter the price changes were so small that the prices of gold and silver in London and Hamburg were generally used interchangeably. The stock of foreign coin and bullion in England was large and worked as a buffer in case there was a temporary fall in the exchange rate and hence reduced the pressure on the Bank's bullion.[36] The law, which made the export of British bullion and specie abroad illegal, was supposed to prevent the flow of gold from Britain, but as the law was difficult to implement, it did not have much effect. According to Fetter (1965) there was a general acceptance by the bankers and merchants of London of the idea that in practice British monetary gold was withdrawn from the Bank and smuggled to the continent when the exchanges were unfavorable and the price of gold abroad was higher than at home.[37]

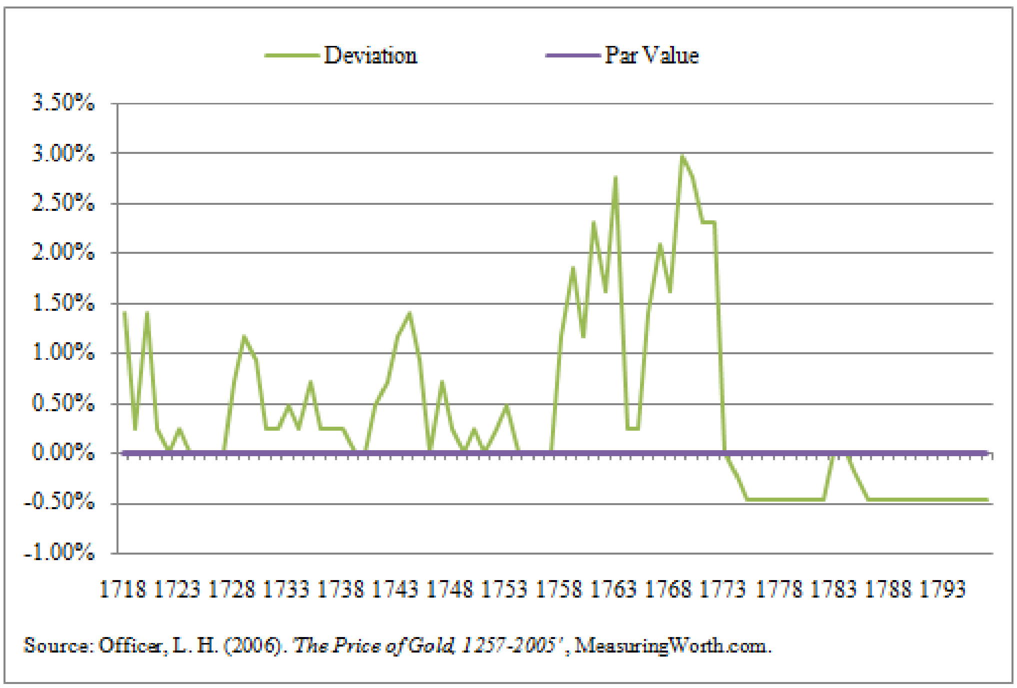

Figure 2.3. Percentage Deviation of the Market Price of Gold from Par.

[36]Fetter (1965) pp. 27-28.
[37]Fetter (1965) pp. 4-6.

Vilar (1976) argues that the stable system of gold import and minting played a crucial part in creating monetary stability in England, which lasted until the end of the eighteenth century.[38] This fact is captured by the theoretical models presented in Chapters 4 and 5. The banker who has partial reserves, but is required to convert notes on demand, has to have access to other sources of gold in case gold demand exceeds reserves. As Britain did not have any gold mines of its own, the domestic demand for new gold had to be satisfied by import. Early in the eighteenth century new gold mines were found in Brazil, which between 1721 and 1780 produced 56 percent of the world's gold[39]. The first beneficiary of the sudden increase in Brazilian gold production and gold imports into Europe was its colonial master Portugal, but it was not able to keep possession of the metal. The Anglo-Portuguese diplomatic and military alliance during the Wars of the Spanish Succession (1701-1714), and some small scale economic complementaries, such as privilege in wine import, gave Britain a great advantage in the Portuguese gold trade[40]. In the commercial triangle of Brazil, Britain and Portugal, the balance was always in Britain's favour and virtually free competition for British goods in Portugal and its colonies drained gold away from them.[41]

As the gold supply conditions were stable, the Bank of England was able to support the monetary system with a relatively low gold backing rate. Figure 2.3

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[38] Vilar (1976) p. 231.
[39] Schmitz (1979).
[40] Vilar (1976) p. 225 argues that Portugal become 'if not totally dependent on England politically, at least strongly influenced by her economically, almost to exclusion of other powers'.
[41] Vilar (1976) p. 227.

shows how, apart from an exception in 1740, the value of bullion was always below the value of depository notes. The Bank itself was an active gold trader and bought gold directly from the ships to meet immediate gold demand and employed its own gold dealers.[42] As the Bank had to exchange gold for its notes, buying gold did not increase the gold backing rate significantly, but helped to satisfy the gold demand in the short-run. Another motivation in restricting the outflow of monetary gold was to avoid the Bank making a loss on gold trade. Between 1774 and 1797 the average price of standard gold bullion had been £3.17s.7$\frac{3}{4}$d.[43] As the mint price of gold was £3.17s.10$\frac{1}{2}$d., the average market price was just 0.003 percent below the mint price. If the market price of gold was high and the Bank was forced to buy gold, it made a loss, as gold had to be sold out at a fixed price.

2.3.2. Methods to Reduce Outflow of Monetary Gold

When monetary gold was withdrawn faster than it was deposited, the Bank of England had a number of strategies to reduce the outflow of the gold. For example, the Bank offered to change its ordinary deposit notes to interest bearing notes or some other form of paper currency. In May 1696 the Governor of the Bank announced that government tallies would be given to any person 'under any uneasiness for want of his mony'[44] and people were invited to exchange their notes

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[42] Clapham (1944) Vol I, p.132.
[43] Clapham (1944) Vol I, p. 8.
[44] Acres (1931) Vol I, p. 70.

to sealed bills, which bore interest.[45] The same strategy was used again during the crisis following the South Sea Bubble in 1721.[46] As the lack of, and therefore the demand for, small change was chronic at the eighteenth century, the Bank persuaded the public to accept conversion of their large notes to the same amount of new notes which had a smaller face value.

Various delaying strategies were also common. In 1696 the Bank committed to pay all notes of £5 and under in full only alphabetically:

> beginning upon Wednesday the 28th day of October instant with Notes payable to names of A and B, and so on Wednesday of every week two letters through the alphabet.[47]

Another delaying strategy was to pay demands for cash in shillings and sixpences. The Bank adopted the strategy from the goldsmiths who had monopolised the banking business until the establishment of the Bank of England in 1694.[48] Even at the end of the eighteenth century only relatively wealthy individuals had accounts at the Bank, and ordinary people, the most likely to rush to withdraw their small savings, deposited their valuables with the goldsmiths. The goldsmiths, who had to face the first wave of the cash runs, began to delay payments during the panic caused by the second Anglo-Dutch war in 1667, when the Dutch fleet was in the Thames and threatened to attack London. They and some other City

[45] Clapham (1944) Vol I, p. 42.
[46] Acres (1931) Vol I, p. 117.
[47] Acres (1931) Vol I, pp. 73-74, as quoted in *London Gazette* 26 November 1696.
[48] Acres (1931) Vol I, p. 5.

businessmen considered the Bank of England as their competitor.[49] The leading goldsmiths remained hostile towards the Bank and could demand 'immediate payment in cash at a time when they knew the Bank was embarrassed'.[50]

Bank runs usually followed domestic disturbances such as the South Sea Bubble in 1721[51] and the Battle of Prestonpans in 1745 during the Jacobite Rebellion.[52] *Gentleman's Magazine* describes how the Jacobites had a

> 'design to hurt credit as much as was in their power, and to get gold to send to the rebels; in which the directors wisely disappointed them, by ordering payment in silver'[53].

Often it was only a general feeling of uneasiness that made people prefer cash to notes. For example the serious illness of Queen Anne in 1713, her death in 1714 and uncertainty about her successor caused runs on the Bank[54]. Panics were sometimes groundless, and it seems that it was difficult to forecast which event actually provoked a bank run. For example Clapham mentions that during the Seven Years' War (1759-63) there was no acute banking pressure and the war years were a time of relative domestic prosperity.[55]

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[49] Acres (1931) Vol I, p. 5.
[50] Acres (1931) Vol I, p. 98.
[51] Acres (1931) Vol I p. 116-117.
[52] Acres (1931) Vol I pp. 180-181. Clapham (1944) Vol I pp. 233-234.
[53] *Gentleman's Magazine* Vol. 15, Sept 1748, pp. 499-500.
[54] Acres (1931) Vol I p. 107.
[55] Clapham (1944) Vol I, p. 236.

2.4. Implications of the Adjustment Cost Policy

Although these delaying strategies and other methods the Bank used to slow down the flow of gold from its vaults might seem unconventional means of conducting monetary policy, they proved to be effective strategies in managing the gold standard during the chaotic years of the eighteenth century. The DSGE model developed in this section shows how the impact of the adjustment cost policy was not just limited to the gold reserves of the Bank, but had an effect on the economy as whole.

2.4.1. The Model

Consider an economy which has two sectors, household and the central bank, and one perishable consumption good and one durable consumption good, gold. Only gold can be stored across the periods and therefore, it has also the role of a capital good. Gold yields direct utility to the representative household and enters into its utility function. The central bank monopolises the gold trade in the country: it buys gold from abroad according to its gold stockpile policy and the only way the household is able to buy gold is to convert some notes to gold at the central bank.

The monetary price of gold, the price the household has to pay at the central bank, is always fixed at $\bar{q}$. Buying gold from the bank is associated with an adjustment cost[56] which can take the form of foregone leisure or we can think that the consumption good gets destroyed at a convex rate while the agent waits at the

[56] Adjustment costs on durable goods are examined by Bernanke (1982).

bank. The total cost of buying 'new' gold from the central bank, $q_t\left(K_t - K_{t-1}\right)$, is the sum of the monetary price of gold and the convex adjustment cost,

$$(2.1) \qquad q_t\left(K_t - K_{t-1}\right) = \bar{q}\left(K_t - K_{t-1}\right) + \theta\frac{\left(K_t - K_{t-1}\right)^{\frac{1}{\theta}}}{K_{t-1}^g},$$

where $\bar{q}$ denotes the fixed money price of the gold, K_t is the household's gold stock at period t, K_t^g is the monetary gold stock at period t and parameter θ defines the steepness of the cost curve, $0 < \theta \leq 1$. The adjustment cost is an increasing function of gold demand $\left(K_t - K_{t-1}\right)$ in period t and a decreasing function of the monetary gold stock K_{t-1}^g in period $t-1$. The larger the stock of gold in the central bank's vaults, the more willing the bank is to sell out gold.

The circulating money stock, denominated in nominal units such as pounds, represents a liability of the central bank and takes the physical form of a paper claim rather than a commodity. As in Barro's model which was presented in the first chapter, a binding law requires the central bank to be prepared to buy and sell any amount of gold offered or demanded in exchange for paper money at the fixed pound price $\bar{q}$. The money stock per capita in period t is given by

$$(2.2) \qquad M_t = \frac{\bar{q}K_t^g}{\eta_t},$$

where $\eta_t \in (0, 1]$ is the gold reserve ratio.

If (2.2) is written for K_t^g, and substituted to (2.1), the total cost of gold purchases becomes

$$q_t\left(K_t - K_{t-1}\right) = \bar{q}\left[\left(K_t - K_{t-1}\right) + \theta\frac{\left(K_t - K_{t-1}\right)^{\frac{1}{\theta}}}{\eta_t M_t}\right]. \tag{2.3}$$

The higher the circulating money stock, the lower the adjustment cost of gold purchases.

In this Lucasian economy agents are households with two specialised individuals, a producer and a shopper. The discussion is restricted to a representative household. The shopper enters period t with predetermined holdings M_{t-1} of money, which the producer had gained during the previous period. Like in the Lucas's tree model the household does not consume its own production directly, but has to sell it in markets for money. With this money the shopper buys the consumption good and gold in the following period.[57] In period t the shopper has an opportunity to purchase the consumption good at price P_t, gold at fixed monetary price $\bar{q}$ and government bonds that yield a risk free interest rate R_t. By assuming that the adjustment cost reduces available consumption directly, the adjustment cost enters the cash-in-advance constraint

$$\frac{\bar{q}}{P_t}\left(K_t - K_{t-1}\right) + C_t \leq \frac{M_{t-1}}{P_t} + \frac{\bar{q}}{P_t}\theta\frac{\left(K_t - K_{t-1}\right)^{\frac{1}{\theta}}}{\eta_{t-1} M_{t-1}}, \tag{2.4}$$

[57] Sargent (1987) pp. 156-15 9.

where C_t denotes the household's consumption. The cash-in-advance constraint states that gold and consumption purchases in period t are limited by the cash holdings and the adjustment cost at the beginning of period t. Government bonds are not subject to a cash-in-advance constraint, as we assume that gold deposits can be converted to bonds directly.

The cash-in-advance constraint, not just in this chapter, but also in Chapters 4 and 5, puts an emphasis on the fact that in this thesis I model a commodity *standard,* where money is used in exchange, rather than a commodity *money system.*[58] To date the gold standard and other commodity standards have been modelled assuming that either specie or redeemable notes alongside with coins are used as a medium of exchange. This dissertation, however, makes a departure from the prevailing literature by considering an economy where only paper money circulates and gold operates as a backing commodity if held by the central bank or as a consumable good that yields utility if held by the household. Commodity money systems have been analysed recently by Barro (1979), Sargent and Wallace (1983), Goodfriend (1988) and Bordo, Dittmar and Gavin (2003).

An infinitely lived household's preferences are described by the utility function. The total utility is taken to be the sum of expected discounted values of present

[58]Velde and Weber (2000) introduce a similar constraint which they call 'coins-in-advance constraint' in their model of bimetallism.

and future period utilities

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[u\left(C_t\right) + w\left(K_t\right) \right], \tag{2.5}$$

where $\beta \in (0,1)$ is the discount factor, E_t is an expectation conditional on information up to and including time period t and $u'(C_t) = w'(K_t) = 0$ when $C_t, K_t \to \infty$ and $u'(C_t) = w'(K_t) = \infty$ when $C_t, K_t \to 0$.

By choosing sequences for $C_t,\ B_{t+1},\ M_t$ and K_t, the representative household maximises (2.5) subject to the sequence of cash-in-advance constraints (2.4) and the following budget constraint

$$\frac{B_{t+1}}{R_t P_t} + \frac{M_t}{P_t} + \frac{\bar{q}}{P_t} K_t \leq \frac{M_{t-1}}{P_t} - C_t + \frac{\bar{q}}{P_t} K_{t-1} + \frac{Y_t}{P_t} + \frac{B_t}{P_t} \text{ for all } t, \tag{2.6}$$

where the endowment Y_t is an exogenous state variable, the government bonds are denoted by B_t and the price of bonds is defined as the inverse of the interest rate $1/R_t \in (0,1]$. Initial levels of $M_0,\ K_{0,}\ K_0^g$ and B_0 are given. The Lagrangian for the household problem is

$$\begin{aligned} \mathcal{L} \;=\; & E_0 \sum_{t=0}^{\infty} \beta^t \left[u\left(C_t\right) + w\left(K_t\right) \right] \\ & + \lambda_t \left[\frac{M_{t-1}}{P_t} - C_t + \frac{\bar{q}}{P_t} K_{t-1} + \frac{Y_t}{P_t} + \frac{B_t}{P_t} - \frac{B_{t+1}}{R_t P_t} - \frac{M_t}{P_t} - \frac{\bar{q}}{P_t} K_t \right] \\ & + \mu_t \left[\frac{M_{t-1}}{P_t} + \frac{\bar{q}}{P_t} \theta \frac{\left(K_t - K_{t-1}\right)^{\frac{1}{\theta}}}{\eta_{t-1} M_{t-1}} - \frac{\bar{q}}{P_t} \left(K_t - K_{t-1}\right) - C_t \right]. \end{aligned} \tag{2.7}$$

The first order conditions necessary for the optimality of the household's choices are

$$(2.8)\qquad C_t \;:\; u'(C_t) = \mu_t + \lambda_t$$

$$(2.9)\qquad B_{t+1} \;:\; \frac{\lambda_t}{R_t P_t} = \beta E_t \frac{\lambda_{t+1}}{P_{t+1}}$$

$$(2.10)\qquad M_t \;:\; \frac{\lambda_t}{P_t} = E_t \beta \left[\frac{\lambda_{t+1} + \mu_{t+1}}{P_{t+1}} - \mu_{t+1} \frac{\bar{q}}{P_{t+1}} \theta \frac{(K_{t+1} - K_t)^{\frac{1}{\theta}}}{\eta_t M_t^2} \right]$$

$$(2.11)\qquad K_t \;:\; 0 = w'(K_t) + \mu_t \frac{\bar{q}}{P_t} \left[\frac{(K_t - K_{t-1})^{\frac{1-\theta}{\theta}}}{\eta_{t-1} M_{t-1}} - 1 \right] - \lambda_t \frac{\bar{q}}{P_t}$$
$$+\beta E_t \left\{ \mu_{t+1} \frac{\bar{q}}{P_{t+1}} \left[1 - \frac{(K_{t+1} - K_t)^{\frac{1-\theta}{\theta}}}{\eta_t M_t} \right] + \lambda_{t+1} \frac{\bar{q}}{P_{t+1}} \right\}$$

$$(2.12)\qquad \mu_t \left[\frac{M_{t-1}}{P_t} + \frac{\bar{q}}{P_t} \theta \frac{(K_t - K_{t-1})^{\frac{1}{\theta}}}{\eta_{t-1} M_{t-1}} - \frac{\bar{q}}{P_t} (K_t - K_{t-1}) - C_t \right] \geq 0, \;\; \mu_t \geq 0$$

$$(2.13)\qquad \lim_{i \to \infty} R_{t+S} \frac{B_{t+i}}{P_{t+i}} = 0$$

$$(2.14)\qquad \lim_{i \to \infty} \frac{M_{t+i}}{P_{t+i}} = 0.$$

Combining (2.8), (2.9) and (2.10) and rearranging we get that

$$(2.15)\qquad \mu_t = u'(C_t) [R_{t-1} - 1] \left[R_{t-1} - \bar{q} \frac{(K_t - K_{t-1})^{\frac{1}{\theta}}}{\theta \eta_{t-1} M_{t-1}^2} \right]^{-1}$$

The multiplier μ_t, the shadow value of liquidity services of money, has to be non-negative in order for the cash-in-advance constraint to be binding. As $R_{t-1} \geq 1$, the second term of equation (2.15) is positive. The third term, the adjustment cost term, is positive since

$$0 \leq \bar{q}\theta \frac{(K_t - K_{t-1})^{\frac{1}{\theta}}}{\eta_{t-1} M_{t-1}^2} \leq 1. \tag{2.16}$$

If the adjustment cost term equals unity, μ_t equals the marginal utility of consumption.

Combining (2.8) and (2.9) gives the Euler equation

$$\frac{u'(C_t) - \mu_t}{R_t P_t} = \beta E_t \frac{u'(C_{t+1}) - \mu_{t+1}}{P_{t+1}}. \tag{2.17}$$

Substituting (2.15) into (2.18) gives

$$\begin{aligned} &\frac{u'(C_t)}{P_t}\left\{1 - [R_{t-1} - 1]\left[R_{t-1} - \bar{q}\theta \frac{(K_t - K_{t-1})^{\frac{1}{\theta}}}{\eta_{t-1} M_{t-1}^2}\right]^{-1}\right\} \\ &= R_t \beta E_t \frac{u'(C_{t+1})}{P_{t+1}}\left\{1 - [R_t - 1]\left[R_t - \bar{q}\theta \frac{(K_{t+1} - K_t)^{\frac{1}{\theta}}}{\eta_t M_t^2}\right]^{-1}\right\}. \end{aligned} \tag{2.18}$$

The Euler equation can be written as

$$\frac{u'(C_t)}{P_t} g(R_{t-1}, K_t) = R_t \beta E_t \left[\frac{u'(C_{t+1})}{P_{t+1}} g(R_t, K_{t+1})\right], \tag{2.19}$$

where

$$g\left(R_{t-1},K_{t}\right)=1-\left[R_{t-1}-1\right]\left[R_{t-1}-\bar{q}\theta\frac{\left(K_{t}-K_{t-1}\right)^{\frac{1}{\theta}}}{\eta_{t-1}M_{t-1}^{2}}\right]^{-1} \tag{2.20}$$

and

$$g\left(R_{t},K_{t+1}\right)=1-\left[R_{t}-1\right]\left[R_{t}-\bar{q}\theta\frac{\left(K_{t+1}-K_{t}\right)^{\frac{1}{\theta}}}{\eta_{t}M_{t}^{2}}\right]^{-1} \tag{2.21}$$

are the adjustment cost terms. As $R_t \geq 1$ and $0 \leq \bar{q}\theta\frac{(K_t-K_{t-1})^{\frac{1}{\theta}}}{\eta_{t-1}M_{t-1}^2} \leq 1$, the function $g\left(\cdot\right)_t$ decreases, when the gold demand in period t increases. If $\bar{q}\theta\frac{(K_{t+1}-K_t)^{\frac{1}{\theta}}}{\eta_t M_t^2}$ approaches one, $g\left(R_t, K_{t+1}\right)$ approaches zero.

2.4.2. Stabilisation of Consumption

With these preliminary solutions in hand we are now able to study the effect of the adjustment cost on consumption.[59] Inevitably the adjustment cost on gold conversion smooths gold consumption, but this section shows how the adjustment cost also stabilises consumption. The functional form of (2.5) and preferences follow Goodfriend (1988). In (2.5) the functional form of the utility of consumption is

$$u\left(C_t\right)=v_t\log C_t, \tag{2.22}$$

[59]This part of the model is inspired by Hansen and Singelton (1983).

where v_t is a consumption preference parameter defined as $v_t = v(1+\nu_t) > 0$; hence the consumption preference shock is denoted by ν_t and is generated by an i.i.d. white-noise processes. Respectively, the utility of gold is

$$w(K_t) = w_t \log K_t, \tag{2.23}$$

where $w_t = w(1+\omega_t) > 0$ is the gold preference parameter and the gold preference shock ω_t is generated by an i.i.d. white-noise processes. Using the functional form of the utility function, the Euler equation (2.18) can be written as

$$\beta R_t E_t \left(\frac{C_{t+1}}{C_t}\right)^{-1} \left(\frac{v_{t+1}}{v_t}\right) \left(\frac{P_{t+1}}{P_t}\right)^{-1} \left(\frac{g(R_t, K_{t+1})}{g(R_{t-1}, K_t)}\right) = 1. \tag{2.24}$$

Let

$$c_{t+1} = C_{t+1}/C_t, \tag{2.25}$$

denote the gross growth rate of consumption,

$$x_{t+1} = (v_{t+1}/v_t)(P_{t+1}/P_t)^{-1} g(R_t, K_{t+1})/g(R_{t-1}, K_t) \tag{2.26}$$

and

$$z_{t+1} \equiv c_{t+1}^{-1} x_{t+1}. \tag{2.27}$$

In what follows I assume that the joint distribution of c_{t+1} and x_{t+1} is lognormal which might, in the presence of adjustment costs, seem simplistic. This simplification seems acceptable as my aim is to examine the effect of the adjustment cost mechanism on the economy at the macroeconomic level and not to test this theory empirically. Hansen and Singelton (1983) list some restrictions that are caused by the joint distribution assumption (for example for production technology), but they are not relevant in our model.

Since the nominal rate of interest R_t is known in period t the equation (2.18) can be written as

$$E_t\left(z_{t+1}\right) = \frac{1}{\beta R_t}. \tag{2.28}$$

Next let $\hat{c}_{t+1} = \log c_{t+1}$, $\hat{x}_{t+1} = \log x_{t+1}$ and $\hat{z}_{t+1} = \log z_{t+1}$. The distribution of $\hat{z}$ is log normal, with constant variance $var\left(z\right)$ and mean $\mu_{z,t}$. Hence, the expected value of z_{t+1} is

$$E_t\left(z_{t+1}\right) = \exp\left[\mu_{z,t} + \left(var\left(z\right)/2\right)\right] \tag{2.29}$$

Equating (2.28) and (2.29) and, rearranging yields

$$\mu_{z,t} = -\log \beta R_t - \left(var\left(z\right)/2\right). \tag{2.30}$$

Define the difference between $\hat{z}_{t+1}$ and its mean $\mu_{z,t}$ as

$$V_{t+1} \equiv \hat{z}_{t+1} - \mu_{z,t}. \tag{2.31}$$

The expected value of V equals zero,

$$E(V_{t+1}) = E_t\left(\hat{z}_{t+1} - \mu_{z,t}\right) = E_t\left[\hat{x}_{t+1} - \hat{c}_{t+1} + \log\beta R_t + var(z)/2\right] = 0, \tag{2.32}$$

where $\hat{z}_{t+1} = \hat{x}_{t+1} - \hat{c}_{t+1} + \log\beta R_t$. This implies that

$$E(\hat{c}_{t+1}) = E_t\left[\hat{x}_{t+1} + \log\beta R_t + var(z)/2\right]. \tag{2.33}$$

In order to analyse the variance of $\hat{c}_{t+1}$ we can ignore the constant term $\log\beta R_t$ and $(var(z)/2)$. The predictable terms – variances of $\hat{x}_{t+1}$ and $\hat{c}_{t+1}$ – are related by the expression

$$\begin{aligned} var\left[E(\hat{c}_{t+1})\right] &= var\left[E(\hat{x}_{t+1})\right] \\ &= var\left[E\left(\log\left(\frac{v_{t+1}}{v_t}\right)\left(\frac{P_{t+1}}{P_t}\right)^{-1}\left(\frac{g(R_t, K_{t+1})}{g(R_{t-1}, K_t)}\right)\right)\right]. \end{aligned} \tag{2.34}$$

As noted above the function $g(R_t, K_{t+1})$ is a decreasing function of the demand for new gold $(K_{t+1} - K_t)$. Therefore, if the gold demand increases the adjustment cost puts downward pressure on consumption by reducing the variance of the expected consumption growth rate $var\left[E(\hat{c}_{t+1})\right]$. The higher the adjustment cost for gold, the lower the expected variance of the consumption growth rate and more stable the consumption.

The adjustment cost implies that mean consumption is lower, but the variance of expected consumption (2.34) is smaller. There is, therefore, a trade-off in which agents might be willing to reduce mean consumption for more predictable consumption and in the future, it might be interesting to analyse whether some level of adjustment costs, in some sense, might be optimal.

2.4.3. Price Level Smoothing

How does the adjustment cost together with the central bank's gold stock pile policy affect the price level? In order to solve for the price path, combine the first order conditions (2.8) and (2.11), substitute μ_t with (2.15) and use (2.20) and (2.21) to simplify the expression to yield

(2.35)

$$\begin{aligned} 0 &= w'(K_t) + \frac{u'(C_t)}{P_t}\left[1 - g(R_{t-1}, K_t)\right]\frac{\bar{q}(K_t - K_{t-1})^{\frac{1-\theta}{\theta}}}{\eta_{t-1}M_{t-1}} - \frac{\bar{q}}{P_t}u'(c_t) \\ &\quad + \beta E_t\left\{\frac{\bar{q}}{P_{t+1}}u'(C_{t+1}) - \frac{u'(C_{t+1})}{P_{t+1}}\left[1 - g(R_t, K_{t+1})\right]\left[\frac{\bar{q}(K_{t+1} - K_t)^{\frac{1-\theta}{\theta}}}{\eta_t M_t}\right]\right\}. \end{aligned}$$

Using recursive substitution and the law of iterated expectations (2.35) can be expressed as

$$\text{(2.36)}\quad \frac{\bar{q}}{P_t}u'(C_t)\left\{1-\left[1-g\left(R_{t-1},K_t\right)\right]\frac{\left(K_t-K_{t-1}\right)^{\frac{1-\theta}{\theta}}}{\eta_{t-1}M_{t-1}}\right\}$$
$$=\sum_{i=0}^{\infty}E_t\beta^i w'\left(K_{t+i}\right)$$
$$+\beta^T E_t\frac{\bar{q}}{P_{t+T}}u'\left(C_{t+T}\right)\left\{1-\left[1-g\left(R_{t-1+T},K_{t+T}\right)\right]\frac{\left(K_{t+T}-K_{t-1+T}\right)^{\frac{1-\theta}{\theta}}}{\eta_{t-1+T}M_{t-1+T}}\right\}.$$

As T approaches infinity, the transversality condition becomes

(2.37)
$$\lim_{T\to\infty}\beta^T E_t\frac{\bar{q}}{P_{t+T}}u'\left(C_{t+T}\right)\left\{1-\left[1-g\left(R_{t-1+T},K_{t+T}\right)\right]\frac{\left(K_{t+T}-K_{t-1+T}\right)^{\frac{1-\theta}{\theta}}}{\eta_{t-1+T}M_{t-1+T}}\right\}=0$$

and (2.36) becomes

$$\text{(2.38)}\quad \frac{\bar{q}}{P_t}u'(C_t)\left[1-\left[1-g\left(R_{t-1},K_t\right)\right]\frac{\left(K_t-K_{t-1}\right)^{\frac{1-\theta}{\theta}}}{\eta_{t-1}M_{t-1}}\right]=\sum_{i=0}^{\infty}E_t\beta^i w'\left(K_{t+i}\right).$$

The price path can be written as

(2.39)
$$\frac{1}{P_t}=\left[\bar{q}u'(C_t)\left\{1-\left[1-g\left(R_{t-1},K_t\right)\right]\frac{\left(K_t-K_{t-1}\right)^{\frac{1-\theta}{\theta}}}{\eta_{t-1}M_{t-1}}\right\}\right]^{-1}\sum_{i=0}^{T}E_t\beta^i w'\left(K_{t+i}\right).$$

As in Goodfriend we turn to consider the central bank's gold stockpiling policy and its effect on the price level. The stock piling policy varies stochastically according to the gold supply conditions abroad and is written in terms of its effect on the household's gold stock,

$$K_t = \frac{K}{1-\phi_t}. \tag{2.40}$$

where $\phi \sim N(0,\sigma^2)$ and $\phi_t \in [-1,1]$. Parameter ϕ_t reflects the central bank's gold stockpile policy: For example, a positive gold stockpile shock, such as gold discovery, increases the gold stock of the central bank and the stock piling parameter $\phi_t > 0$. The gold backing η from (2.2) rises which through (2.4) indicates that the adjustment cost reduces. As in Goodfriend, gold is assumed to be costlessly transformable between utility-yielding and stock-pile forms.[60] As the central bank monopolises the gold trade, the effect of the gold discovery impacts on the representative household through the central bank's policy.

Next we substitute (2.40), (2.22) and (2.23) to (2.39) and take expectations.[61] By using the covariance rule $E(XY) = EXEY + cov(X,Y)$ we can write the price path as

$$\begin{aligned} \frac{1}{P_t} &= \frac{1}{\bar{q}}\left[1-\left[1-g\left(R_{t-1},K_t\right)\right]\frac{\left(K_t-K_{t-1}\right)^{\frac{1-\theta}{\theta}}}{\eta_{t-1}M_{t-1}}\right]^{-1}\left(\frac{C_t}{v_t}\right) \\ &\quad \left(\frac{1}{K}\right)\left\{w_t\left(1-\phi_t\right)+\frac{\beta}{1-\beta}\left[w-cov\left(w,\phi\right)\right]\right\}, \end{aligned} \tag{2.41}$$

[60]Goodfriend (1988) defines gold policy as purchases of gold financed entirely by bond sales and interest on the resulting government bonds is financed with lump-sum taxes. Funds acquired from pure gold policy actions that reduce the government's gold stockpile, are used to retire existing government debt or to make new government loans. The reduced interest expense is used to reduce lump-sum taxes and the increased revenue is paid out in lump-sum transfers.

[61]See Appendix 2.A for detailed derivation of this equation.

where $1/P_t$ is the consumption price of currency in period t, i.e. inverse of the price level.

With the adjustment cost policy the central bank is able to pursue price level smoothing. If the gold demand increases, the second term in (2.41)

$$1 - [1 - g(R_{t-1}, K_t)] \frac{(K_t - K_{t-1})^{\frac{1-\theta}{\theta}}}{\eta_{t-1} M_{t-1}}$$

decreases, which puts a downward pressure to the price level P_t. A positive gold preference shock has a similar effect on the price level. On the other hand, positive covariance between the gold preference w and gold stockpile policy ϕ drives up the price level. If the household's gold demand is correlated with the gold supply conditions, i.e. there is a simultaneous gold inflow to the country and an increase in gold preference, the price level becomes less stable.

During the Classical Gold Standard the automatic adjustment mechanism reduced the outflow of monetary gold and reduced the arbitrage profit opportunities. This mechanism did not function in the eighteenth century, because the Bank of England was not fully in charge of the money supply and regular wars disturbed gold supply conditions. The adjustment cost on gold purchases had, however, similar effects on the economy. If there were an exogenous gold preference shock, the adjustment cost reduced the price level that made gold relatively more expensive. Without the adjustment cost the potential variability in consumption would have been larger: a positive gold preference shock would have increased household's gold purchases and through the cash-in-advance constraint less money would have been available for consumption purchases.

If both gold and consumption yield utility to the household, why would the central bank want to discourage gold consumption? The answer lies in the fact that the central bank's objective here may be to stabilise the economy. Gold consumption reduces the circulating money stock, which through the cash-in-advance constraint reduces consumption and the market activity. Gold preference shocks make the economy less stable: as only a small percentage of the country's money supply was backed by monetary gold, it was important that the public preferred to hold paper money and the gold preference shocks could have been controlled efficiently.

2.5. Conclusions

This chapter has addressed monetary policy during the Pre-classical Gold Standard, which provides a starting point for the analysis of the Suspension Period. After the establishment of the Bank of England in 1694 the gold convertibility rule evolved as a core monetary rule which increased the credibility of the monetary system. This monetary development was not, however, separate from other political development, but a part of larger institutional innovation called the Financial Revolution.

Two key factors challenged the feasibility of this rule: firstly, the Bank did not have a monopoly to issue paper money as country banks had a right to print and circulate their own notes. Secondly, external shocks such as political disturbances and arbitrage profit opportunities created bank runs putting pressure on reserves. The Bank of England was able to manage the gold convertibility rule despite these challenges with a simple adjustment cost policy, which increased the total cost of gold purchases. Furthermore, with the adjustment cost the central bank could manipulate the price level, stabilise consumption and encourage consumption instead of gold consumption.

One could ask why the adjustment cost policy failed in 1797 when the Bank had to suspend the gold convertibility rule for twenty-four years. Firstly, until the end of the century the stable system of gold import and minting played a crucial role in monetary stability in England, but in the early 1790s there were large gold supply shocks: the Brazilian mines, which were the main source of new gold, started to dry up and the market price of Brazilian gold increased. The war that broke out in 1793 caused disturbances on the sea and increased the insurance costs of shipping.[62] After *assignats* had failed, France tried to get back to the gold standard and in 1795 the demand for bullion in Paris was so high that the guineas bought at the mint price of £3.17s.10$\frac{1}{2}$d. per ounce from the Bank of England could be sold £4.3s.0d per ounce in Paris. The Bank tried to improve the exchange rate in February 1796 by shipping silver to Hamburg and buying Brazilian gold from Lisbon, but as the market price of gold bars were now much higher than the mint price, coinage was unprofitable and in the end, gold was sold

[62]Vilar (1976) p. 227.

as bars before the Bank had a chance to mint them.[63] Finally, the war against revolutionary France and the direct financial support for British allies increased the government's demand for credit and specie. The adjustment mechanism failed as it could not stop the drain of specie that was not caused by the general public, but by the government.

In the light of this model the Suspension Period could be seen as an extreme adjustment cost, a long slow down in gold convertibility. The suspension was never perfect in the sense that the Bank kept converting those notes it wanted to withdraw from circulation, such as old bank notes, that were easy to counterfeit. The Bank also paid its dividends in gold and even increased them from 7.5 percent to 10.5 percent in 1807. The Suspension Period, however, raises complex modelling issues, which cannot be addressed in this simple framework.

[63] Fetter (1965) p.19.

Appendix 2.A

Taking the expectations of the price path function (2.39) gives:

(2A.1)

$$\frac{1}{P_t} = \left[\bar{q}u'\left(C_t\right)\left\{1-\left[1-g\left(R_{t-1},K_t\right)\right]\frac{\left(K_t-K_{t-1}\right)^{\frac{1-\theta}{\theta}}}{\eta_{t-1}M_{t-1}}\right\}\right]^{-1}\sum_{i=0}^{T}E_t\beta^i u'\left(K_{t+i}\right)$$

$$\begin{aligned}\frac{1}{P_t} &= \bar{q}u'\left(C_t\right)\left[1-\left[1-g\left(R_{t-1},K_t\right)\right]\frac{\left(K_t-K_{t-1}\right)^{\frac{1-\theta}{\theta}}}{\eta_{t-1}M_{t-1}}\right] \\ &\quad \left[\frac{w_t}{K_t}+\sum_{i=1}^{\infty}E_{t+i}\beta^i\frac{w_{t+i}}{K_{t+i}}\right]\end{aligned} \tag{2A.2}$$

By using the covariance rule $E(XY) = EXEY + cov(X,Y)$ we can write the equation as

$$\begin{aligned}\frac{1}{P_t} &= \bar{q}u'\left(C_t\right)\left[1-\left[1-g\left(R_{t-1},K_t\right)\right]\frac{\left(K_t-K_{t-1}\right)^{\frac{1-\theta}{\theta}}}{\eta_{t-1}M_{t-1}}\right] \\ &\quad \left[\frac{w_t}{K_t}+\sum_{i=1}^{\infty}\beta^i\left(E_t w_{t+i}E_t\frac{1}{K_{t+i}}\right)+cov\left(w_{t+i},\frac{1}{K_{t+i}}\right)\right]\end{aligned} \tag{2A.3}$$

$$\begin{aligned}\frac{1}{P_t} &= \bar{q}u'\left(C_t\right)\left[1-\left[1-g\left(R_{t-1},K_t\right)\right]\frac{\left(K_t-K_{t-1}\right)^{\frac{1-\theta}{\theta}}}{\eta_{t-1}M_{t-1}}\right] \\ &\quad \left[\frac{w_t}{K_t}+\frac{\beta}{1-\beta}\left(\frac{w}{K}+\frac{1}{K}cov\left(w,1-\phi\right)\right)\right]\end{aligned} \tag{2A.4}$$

$$\begin{aligned}\frac{1}{P_t} &= \bar{q}u'\left(C_t\right)\left[1-\left[1-g\left(R_{t-1},K_t\right)\right]\frac{\left(K_t-K_{t-1}\right)^{\frac{1-\theta}{\theta}}}{\eta_{t-1}M_{t-1}}\right] \\ &\quad \frac{1}{K}\left[w_t\left(1+\phi_t\right)+\frac{\beta}{1-\beta}\left(w-cov\left(w,\phi\right)\right)\right]\end{aligned} \tag{2A.5}$$

CHAPTER 3

From Discretion to Rules: How Gold Convertibility Emerged as the Best Available Monetary Policy Rule during the Suspension Period

3.1. Introduction

During the first ten years of the Suspension Period economic conditions had remained relatively stable, but in 1808 optimism revived, turned into feverish speculation with the acquiescence of the Bank, only to be followed by a severe economic crisis in the summer of 1810. The gloom over the future of the country was captured by a contemporary French observer, who wrote that 'neither by payment nor non-payment can the British be saved'.[1] Immediate resumption of the gold standard would have brought capital gains to those who had accepted inconvertible paper currency and an opportunity to gain arbitrage profits at a great cost to the Bank. On the other hand, continuation of the paper pound regime would have increased the domestic price level and the market price of gold even further, made the trade deficit worse and eroded the credibility of the Bank of England.

[1] *The Times* 21 September 1810.

The Frenchman's prediction did not come true after all, but it took the Bank of England a further eleven years before it could start paying out gold. These years saw the first public debate over the conduct of monetary policy in British economic history, known as the 'Bullion Debates'. What was better for society, it was asked: should the experienced directors of the Bank, who, according to Sir Francis Baring, seemed to have been able to issue the right amount of money at the beginning of the Suspension Period,[2] be allowed to continue to issue according to their best knowledge; or, should gold payments be resumed as soon as possible as Ricardo and his supporters insisted, since inconvertible paper currency was something unnatural and allowed the directors to 'issue Bank Notes indefinitely'.[3]

Traditionally protagonists have been divided into 'bullionists' and 'anti-bullionists' according to whether they blamed the Bank or war-time conditions for creating inflation. Political and economic relationships within the different interest groups that participated in the debate were, however, more subtle and complex than has previously been argued. Neither the bullionists, nor the anti-bullionists were monolithic, which became obvious towards the end of the 1810s, when adjustment to the gold standard began. Members from both sides considered that there was a direct link between widespread economic depression that followed the peace in 1815, and the Bank's adjustment policy. The Bank, which had been accused of conducting inflationary policy, was now criticised for its decision to constrain

[2]Baring (1797) p. 11.
[3]*The Times* 17 August 1810.

circulation. Some Members of Parliament and representatives of private banks and industry supported the idea of continuation of the suspension or some other monetary arrangement.

According to Flandreau (2007) there was thus nothing obvious in explaining why the gold standard was chosen as the best monetary policy rule in the 1810s. The Bullion Debates challenged all known monetary arrangements and raised crucial questions of what was the most desirable monetary policy rule, what was the impact of monetary policy on the real-economy and what was the best possible way to monitor policy makers. This chapter argues that the decision to resume the gold standard rule in 1821 as an outcome of the Bullion Debates, and modern best-practice monetary policy design, namely central bank independence following the analysis of Kydland and Presscott (1977), therefore, have an underlying unity: they are both social responses to the fundamental problem of time inconsistency of monetary policy.

But why was the suspension of cash payments a credible monetary system although it had created an economic environment where the time inconsistency problem was present? The dominant explanation in the existing literature to this confidence has been that of Bordo and Kydland (1995) and Bordo and Schwartz (1997). These writers argue that the suspension was credible, because the gold standard was a contingent and superior rule, which, by contrast to Flandreau's argument, did not have any alternatives in the minds of people. In this chapter I argue that Bordo and Kydland's theory would be more plausible if the suspension of the gold standard rule had only lasted for three months, as initially planned in 1797, but by 1821 a generation of merchants and bankers had sold and bought, borrowed and lent without ever having had first-hand experience of convertible currency. These monied men would not have based their trust purely on a monetary doctrine, which seemed distant to many of them by the 1810s. Their trust was based on the government and the Bank of England's ability to conduct monetary policy even in the absence of the gold standard rule. The long-term interest rate peaked at the beginning of the Suspension Period,[4] but remained stable thereafter and domestic and foreign investors bought government consols in spite of the risk that the debt might be redeemed in paper money.

The reason that the current study reaches different conclusions to Bordo and Kydland (1995) and Bordo and Schwartz (1997) lies in our approaches to the suspension. Bordo and Kydland (1995) and Bordo and Schwartz (1997) consider the gold standard and the suspension of cash payments to be essentially similar monetary regimes – one being the continuation of the other – while I argue that the suspension of cash payments was a monetary policy regime in its own right. This chapter establishes that contemporaries considered the gold standard and the suspension to be separate systems. Under the gold standard the credibility of monetary policy had been based on rules but, under suspension, it was based on the Bank of England's reputation. The money supply, which was not fixed to monetary gold, and a floating exchange rate increased the degree of flexibility in

[4]As seen in Figure 3.1.

the economy. Flexibility, in turn, was valuable during the war-time emergency as it permitted discretionary policies, namely stabilisation, and the need for stabilisation was urgent during this long war, when one shock followed another. This non-trivial approach forms the basis of my theoretical models of the Suspension Period presented in Chapters 4 and 5.

The train of events during the Napoleonic Wars initiated this complex debate over economic doctrine, which in turn changed political practice, yet these new theories did not precipitate the Suspension Period. In February 1797 there had not been time for careful considerations, as the country was on the edge of financial ruin. Narrative historiography suggests that the gold standard was abandoned in order to protect the Bank's reserves. This theory does not explain, however, why the Bank waited for twenty-four years before resuming the gold standard, as its reserves improved considerably during the first three months of suspension. Those researchers, who have acknowledged that there were other motives which justify the continuation of suspension, have argued that inflationary policy during the Suspension Period maximised either the Bank's proprietors' private profits[5] or the government's seigniorage revenue[6]. A fault common to both these theories is that they ignore of the problem which this episode created in relation to credibility and time inconsistency. My thesis, in contrast to existing studies, proposes that the aim of the authorities was to stabilise the economy during this long and exhausting

[5]See Ricardo (1811) and Andréadès (1909).

[6]See Bordo and Kydland (1995) and Bordo and Redish (1993).

war, but the success of this policy was *conditional* on the credibility of the plan to resume the gold payments. On a practical level the Bank conducted stabilisation policy by issuing notes, especially those of small denomination, that were used all over the country as a medium of exchange,[7] by discounting bills of exchange of London merchants and granting them loans, and by buying the unfunded short-term debt of the government. Increased money supply had also indirect effects, for example real wages were likely to decrease when nominal wages reacted slowly to the changes in money supply. The impact of stabilisation policy is examined in its historical context in this chapter and in a formal theoretical framework in Chapter 4.

This chapter does not seek to present a comprehensive overview of the Suspension Period as those have been already written, for example, by Clapham (1944), Feavearyear (1963) and Fetter (1965). Rather, relevant historical episodes will be used selectively in order to motivate theoretical models presented in Chapters 4 and 5. In the first section of this chapter I analyse how the Bank's decision to suspend gold payments maintained paper money in circulation which in turn supported the credit markets and stabilised economic activity during the war. The second part of this chapter examines the Bank's monetary strategy and the government's fiscal strategy during the war. The third section investigates those structures of society

[7]Coins disappeared from circulation at the beginning of the Suspension Period. In some extent coins with insintric value were at this point seen as a good money, and notes subsequently as a bad money (the Gresham's law).

and economy which enforced the credibility and ensured resumption of the gold standard.

3.2. Deviation that Stabilised the Economy: the Suspension of Cash Payments

3.2.1. Credit, Currency and Circulation

On Monday 27 February 1797, after an emergency meeting between the King, Prime Minister Pitt and the Privy Council of the Bank, the following announcement, entitled as a message from the King, came to mark the start of the Suspension Period:

> The Bank of England should forbear issuing any cash in payment until the sense of Parliament can be taken on that subject and the proper measures adopted thereupon for maintaining the means of circulation and supporting the public and commercial credit of the kingdom at this important conjuncture.[8]

Close reading of the declaration reveals how members seemed to have been equally concerned about the state of circulation and credit, as of the bullion reserves of the Bank. The argument that the gold convertibility rule was suspended in order to secure the Bank's gold reserves seems, therefore, anomalous in the light of the above announcement. The low bullion levels and the shortage of notes resulted in different sets of problems. Bullion reserves enabled the continuation of

[8] *The Times* 28 February 1797.

gold conversion, which in turn supported the value of money. As established in Chapter 2, the outflow of gold was nothing new as domestic political disturbances had created gold demand shocks in the eighteenth century, but what had changed in 1797 was that war time conditions, especially warfare at sea, meant that the Bank was not able to import gold to replace what left its vaults. On the other hand, the credit and payment structure of the country was dependent on the circulation of the Bank of England notes. Merchants and entrepreneurs of London were connected by complex financial networks and not by bilateral agreements. Failure of one house would have been detrimental for other businesses and the crises in London would have spread elsewhere in the country, since London was a financial intermediary between industrial and agricultural counties. By suspending the gold convertibility rule the Bank was able to ensure that circulation did not fall too low and create deflationary pressure.

But how did a central bank became so closely involved with private credit? The answer lies in the fact that the Bank of England was established as a private institution, which yielded profits for its share holders and these profits came from discounting[9], purchasing bills of exchange off those London merchants who were considered credit worthy and able to pay the interest charge. Discounting large

[9]The Bank's discount policy is as old as the Bank itself: In May 1695 the Bank decided that 'any safe man might discount up to £3000, but at 4 $\frac{1}{2}$ percent even if he did not keep his cash in the Bank'. The Bank discounted promissory notes, inland and foreign bills of exchange and papers of various public and private institutions. It granted the individual loans to the public that 'were of all sizes, to all sorts of people and on a considerable variety of securities' – some of these early loans were hardly anything else than pawns, as the records mention that one man was able to receive £200 on plate. Clapham (1944) pp. 123-129.

volumes of the bills of the London merchants and private banks, not purchase of bullion, became a principal method by which the Bank put its notes into circulation by the end of the eighteenth century.[10] These commercial discounts were controlled by the Bank itself with full discretion. The Bank's Committee in Waiting had the responsibility of supervising the discounting business, but also the Court of Directors itself imposed rather detailed rules on suitable clients and their maximum limits.[11]

The discount business gave the Bank income to pay its dividends, and for businessmen it gave ready cash, but it also meant that the Bank held assets in stock which had not reached their redemption date. During a panic this was a pitfall, especially since the Bank's ability to regulate demand for credit was limited. All private discounts other than East India Bonds (and government consols) were subject to the legal prohibition of interests above five percent, even though the real market rate would have been higher. The well meaning purpose of the usury laws was to safeguard the public from speculators, but from the Bank's viewpoint, the usury laws stood in the way of effective credit control. The usury laws, condemned already by Adam Smith,[12] made the demand for the Bank of England's discounts tightly linked to the variations in market interest rates. If the market rate increased above five percent, as often happened during times of distress, the discount business

[10]King (1936) p. 12.
[11]Clapham (1944) Vol I p. 124. Clapham (1944) Vol I p. 128-129. Fetter (1967) warns that economists should be cautious when using Bank's credit data, especially series named 'Bills and Notes Discounted'.
[12]Smith (1776), Book II p. 319.

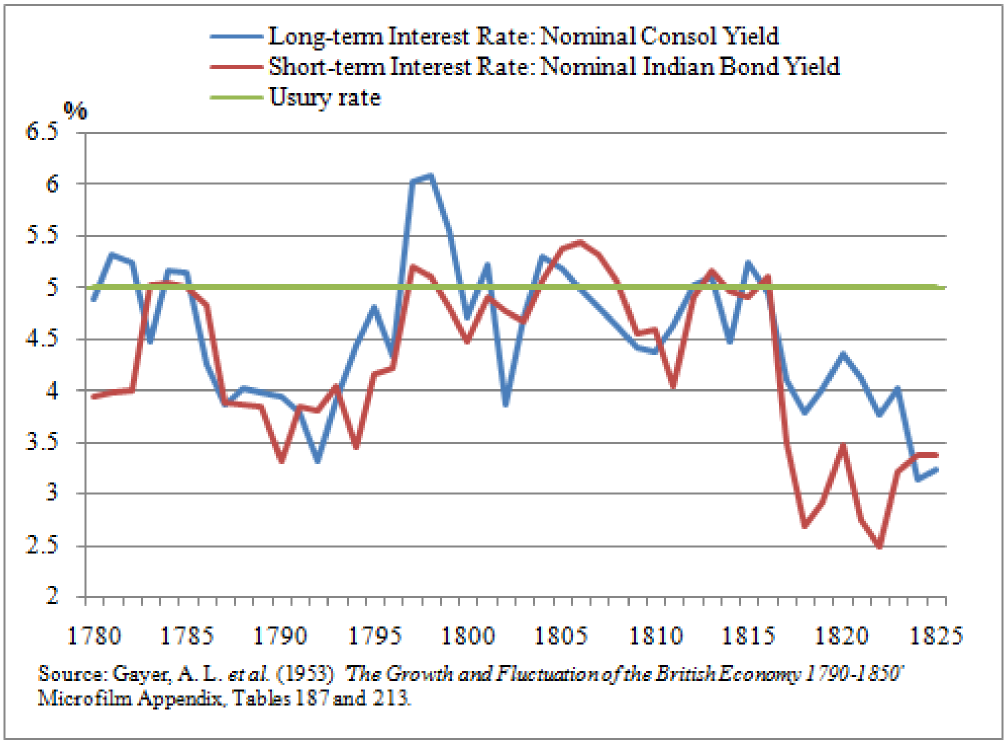

Figure 3.1. Annual Interest Rates 1780-1825.

became unprofitable for private lenders.[13] The brokers of private lenders evaded the usury law widely for example, by charging higher commission or refusing to lend money to those who did not keep high balances on their current accounts. Hence the Bank's discounts became relatively cheap when the market rate of interest rose above five percent.[14] The usury laws made the Bank expand credit, when it would have liked to limit it.

[13]Smith (1776), Book II, p. 458.
[14]Duffy (1982).

As can be seen from Figure 3.1, two decades before the Suspension Period the long and short-term interest rate[15] increased above the usury rate three times. In 1783 a combination of overheating after the peace following the War of American Independence and commercial difficulties in Holland which made Dutch investors sell their British assets, led to the external drain of bullion. Without being able to increase the interest rate to reduce demand for discounts, the Bank controlled the absolute volume of discounts it gave to the London merchants. This policy, however, worsened the crisis as many merchants were on the edge of insolvency and later in the same year the Bank felt obliged to increase its discounts as a precautionary measure.[16] Another crisis followed the outbreak of war with France in February 1793 when country banks were brought down by the runs on banks' reserves. This time, facing an internal drain, the Bank reacted by increasing, not decreasing, credit. The government set up a Committee on the State of Commercial Credit that recommended an issue of Exchequer Bills. The critical situation was eased just by the announcement of the issue plan and the Exchequer Bills provided the markets the needed emergency circulation medium.[17]

Large foreign expenditures caused the final crisis before the Suspension Period. At the end of 1794 Prime Minister Pitt made heavy calls upon the Bank to support his allies in Continental Europe by considerable sums of specie – all drawn from

[15]According to Heim and Mirowski (1987), the East India Bond rate is a good approximation to the short-term interest rate.
[16]Feavearyear (1963) p.177.
[17]Clapham (1944), Vol I, p.263.

the vaults of the Bank. The directors of the Bank became increasingly worried that lending huge sums of money to the government would clash with the Bank's original charter that forbade it to lend to the government without the permission of Parliament. The Directors, however, were powerless before the government's wartime demands as these were considered essential for the survival of the country.[18] The most efficient way the Bank could thus control its total advances was to regulate private discounts. Following the increase of the government's loans and the subsidy to the Continent, the Court of Directors voted on a discount restriction policy on 31 December 1795. The Court was supposed to decide 'to what amount the discounts should be allowed to go during the ensuing week'.[19] If the demand of discounts was higher than the weekly quota, discounting was to be done 'without regard to the respectability of the party or the solidity of the Bills'.[20] Two months later, a group of proprietors of Bank stock were protesting against this discount rationing, especially when it also concerned respectable parties.[21]

The French Revolutionary Wars resulted in more serious external gold drains than other wars in the eighteenth century. According to Neal (1990) previously the government was able to use foreign exchange bills to finance its armies on the Continent: as the British colonial and manufactured goods were much in demand in Europe, the European merchants willingly accepted the bills drawn in London and

[18] Duffy (1982).
[19] Committee of Treasury Books, 1795-1797, 31 December 1795, as quoted in Clapham (1944), Vol I, p. 269.
[20] Clapham (1944), Vol I, p. 269.
[21] Fetter (1965), p. 21.

used these bills to pay for the import of the goods from Britain. But when Britain's continental allies suffered repeated military reverses, the British merchants lost markets for their exports, and the bills of exchange drawn in London had to be extinguished increasingly by means of specie rather than goods.[22]

In late 1796 a 'class of persons subject to weak and extravagant alarms'[23] was hoarding guineas. The Committee on Treasury reported on 22 February 1797 that the gold reserves of the Bank had fallen by £622,000 since 1 January 1797 and as can be seen in Figure 3.2, were £1,086,170 on 26 February 1797, just before the decision to suspend cash payments. The run on the Bank's reserves, however, was not so much as a result of speculative panic reflecting the lack of credibility of the Bank itself, but rather as a pre-emptive measure by the country banks and individuals.[24] The Bank's position was weakened by the constant internal drain of bullion from the Bank to the country which had already started in 1795. The country bankers were rationally anticipating bank runs and built their gold reserves in order to be well prepared to meet their customers demand for specie. In addition there had been external drains of gold to Ireland, France and Britain's Continental allies. Exchange rates were unfavourable and finally, the market rate of interest increased sharply in late 1796, which distorted credit markets. Demand for the Bank of England notes was large, because they were convertible to gold on demand.

[22] Neal (1990) pp. 201-203.
[23] Thornton (1802), p. 97.
[24] Fetter (1965) and Flandreau (2007).

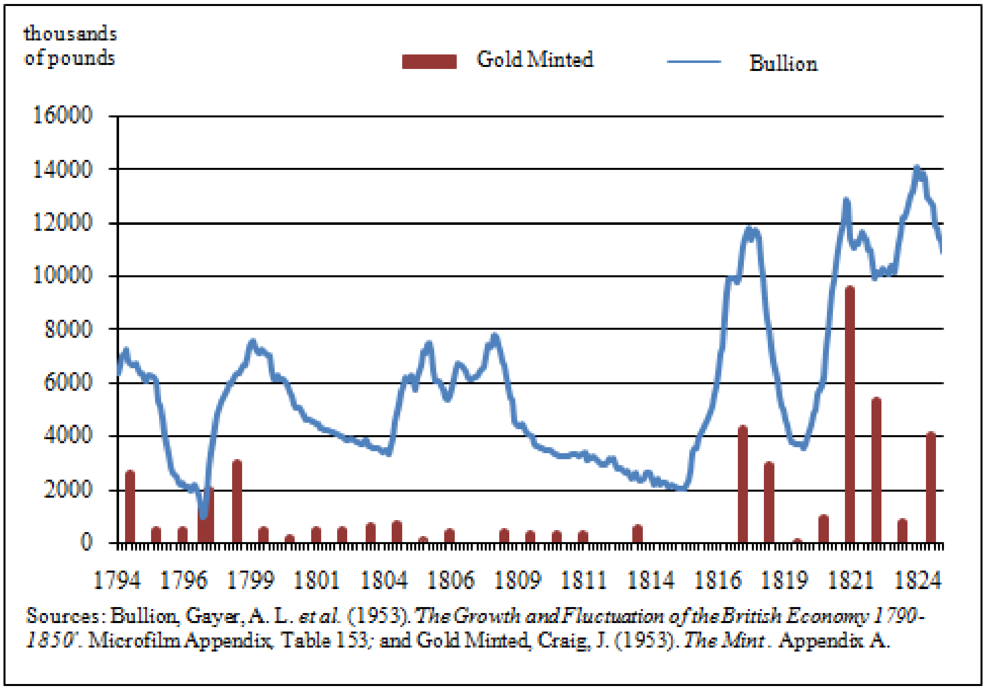

Figure 3.2. Gold Minted at the Royal Mint and the Bank's Bullion Reserves 1794-1825. Annual Averages.

The distress arising in London, according to Henry Thornton, 'was a distress for notes of the Bank of England',[25] which were by far the most important medium of exchange in this commercial and financial centre of the country. The whole credit system, 'payments which are most of them promised beforehand',[26] had been built on the Bank of England notes. For a few days before the suspension demand for the Bank of England notes was so high that interest paid on them increased to 16 or 17 percent.[27] Thornton estimated that:

[25]Thornton (1802) p. 113.
[26]Thornton (1802) p. 113.
[27]Thornton (1802) p. 113.

> A diminution, for instance, of one-third or two-fifths, might, perhaps, be sufficient to produce a very general insolvency in London, of which the effect would be the suspension of confidence, the derangement of commerce and the stagnation of manufactures throughout the country.[28]

According to Gayer et al. (1953) (Figure 3.3) the circulation of the Bank Notes fell seventeen percent between the last quarter of 1795 and last quarter of 1796, meanwhile the gold stock of the Bank reduced almost forty-five percent, shown in Figure 3.2. Despite the variations in the Bank's monetary gold stock, stabilisation of circulation was crucial for the credit markets at the most critical of times. 'If they reduce materially their notes in time of difficulty and distress, there are no other Notes which are ready to supply the deficiency in the circulation'.[29] Real alternatives to the Bank of England notes did not exist, as country bank or private bank notes did not circulate in London. Converted monetary gold did not return to circulation, as it was smuggled from the country or put away in hoards. Sir Francis Baring, London merchant banker, had recognised that the Bank notes were not just a substitute for money, but the basis of the monetary system.[30] Merchants in London were not interested in specie: 'The guineas applied for by persons in

[28]Thornton (1802) p. 114.
[29]Thornton (1802) p. 288.
[30]Fetter (1965) p. 29.

London, was, generally speaking, account of people in the country', Thornton explains.[31]

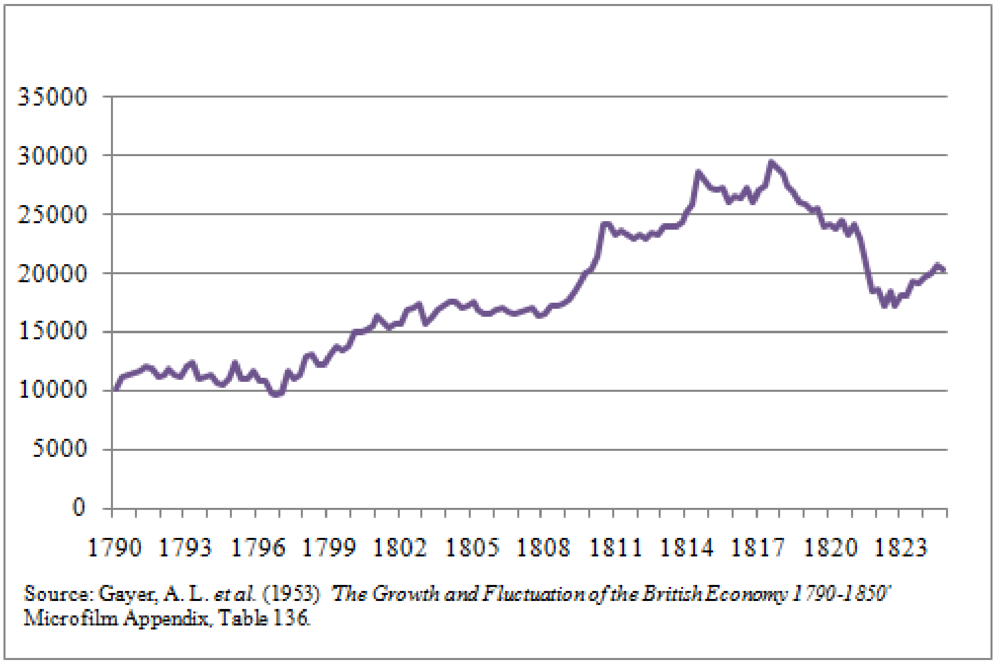

Figure 3.3. The Bank of England Notes in Circulation 1790-1925. Quaterly Averages.

3.2.2. Restoration of Confidence after the Suspension of the Cash Payments

While the order to suspend cash payments by the Privy Council was being published on Monday, 28 February 1797, the merchants and bankers of London had

[31]Thornton (1802) pp. 112-113.

their own meeting ‘to consider of a general Resolution to promote the universal Circulation of Bank of England Notes instead of Specie’.[32] They declared that:

> ...we will not refuse to receive Bank Notes in Payment of any Sum of Money to be paid to us, and we will use our utmost Endeavours to make all our Payments in the same Manner.[33]

The declaration was then published in *The Times* bearing the signatures of many hundreds of leading business houses. According *The Times* the resolution ‘did credit to the patriotism and loyalty of the Gentlemen present’ as it was supposed to ‘prevent Embarrassments to Public Credit’[34] The directors of the Bank also published a notice at the same time assuring both the public and its proprietors that ‘the Bank was in most sound condition’.[35] The merchants and bankers had undeniably common interests with the directors of the Bank. If the Bank notes had fallen on discount – not accepted at their face value – there would have been delays in payments and other obligations that would have brought down many large London houses and with them the country banks, which in turn had close links with the local industries. But on the other hand, these practical men would not have supported policy in which they did not have faith and therefore merchants’ willingness to accept the Bank notes can be seen as a testimony of the Bank’s credibility and initial success of the experiment.

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[32] *The Times* 28 February 1797.
[33] Ibid.
[34] Ibid.
[35] Clapham (1944) Vol I p. 272. Feavearyear (1963) p. 183.

A few days after the suspension the Parliament authorised the Bank to issue previously prohibited notes of a face value less than £5 to help with the shortage of circulating medium. After the gold and silver coins had disappeared to hoards, there was no legal tender currency in circulation. Those people who had used only coin in the past, were now introduced to the inconvertible paper money.[36] In many regions the Bank of England notes started to circulate alongside the country bank notes for the first time. The authorities confirmed the status of the Bank of England notes as *de facto* legal tender currency by legislation. The Bank Restriction Act passed on May 3 assured the public that:

> all Sums of Money, which now are or shall become payable for any Part of the Public revenue shall be accepted by the Collectors, Receivers and other Officers at the Revenue, authorised to receive the same, in Notes of the said Governor and Company, expressed to be payable on Demand, if offered to be to paid.[37]

According to Fetter the Bank was careful not to call the Bank of England notes legal tender currency, because they could have become associated in the public mind with the failed *assignats* in France[38] and given an impression that the monetary base had shifted permanently. Only after Lord King in 1811 had announced that he would no longer receive his tenants' payments of their rents in Bank notes at face value, but in revised value according to 'the amount of paper

[36] Clapham (1944) Vol. II p. 3.
[37] Act 37 Geo III c.45.
[38] Fetter (1965) p. 59.

money which would be required to purchase it (gold) at the present market price'[39] Bank notes were made legal tender by Act of Parliament.[40]

The transition between the monetary regimes caused relatively little disturbance and the confidence in the payment system in London and the provinces was restored. Figure 3.2 illustrates the improvement in the gold reserves of the Bank from the lowest point of £982,000 in March 1797 to over £4,000,000 in August 1797, and continued to grow for the next year and half. Figure 3.4 shows how the exchanges with Hamburg improved immediately and fluctuations in the exchange rate and price of gold were hardly different from those under convertibility. The long-term interest rate peaked in May 1798, as can be seen in Figure 3.1, but fell to the pre-suspension level by 1799. The resumption of the gold standard in 1799 was debated in Parliament, and the Bank had expressed its readiness on more than one occasion to resume the payments immediately if necessary,[41] but the government, 'for political reasons'[42], wanted Parliament to extend the Restriction Act both in June and November 1797, and three times between 1802 and 1803,[43] until in April 1803 a new war put an end to the discussions about the early resumption. These 'political reasons' meant simply that the government wanted to retain the

[39] Feavearyear (1963) p. 204.
[40] Act 51 Geo III, c. 127. It is disputable how clear-cut the Act was, but in practice it made the Bank notes legal tender.
[41] Feavearyear (1963) p. 190. Clapham (1944), Vol I, p. 272.
[42] Cannan (1925) p. xviii.
[43] The suspension of cash payments was continued repeatedly by the Acts of Parliaments: Act 37, Geo. III, c.45, 3rd May 1797; Act 37, Geo. III, c.91, 22nd June 1797; Act 38, Geo. III, c.3, 30th November 1797; Act 42, Geo. III, c.40, 30th April 1802; Act 43, Geo. III, c.18, 28th February 1803; Act 44, Geo. III, c.1, 15th December 1803;

opportunity to respond rapidly to war time disturbances which would otherwise have real effects on the economy.

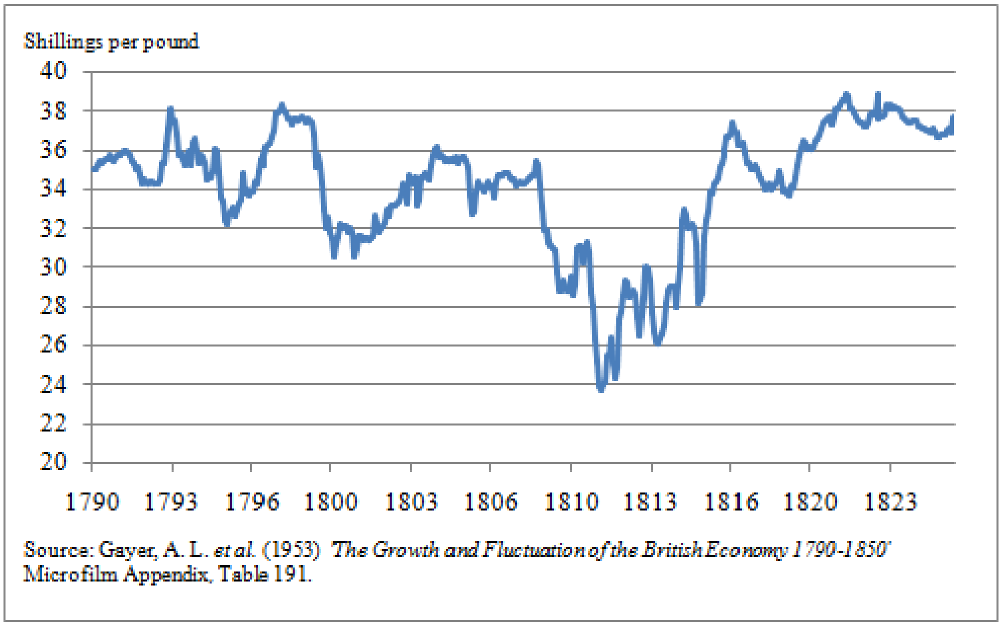

Figure 3.4. Price of Hamburg Bills on London 1790-1825. Monthly.

3.3. The Fiscal and Monetary Strategy during the French Wars

3.3.1. Fiscal Innovations: National Debt and Income Tax

It is generally acknowledged that the way in which Britain financed its wars in the eighteenth century is a classical example of deficit finance: the high levels of wartime spending were paid mainly by borrowing rather than by current taxation, but after the war, accumulated debt was served by increasing taxes.[44] Initially also

[44]Barro (1999). See also Bordo and White (1991).

the French Revolutionary War was financed according to this principle: 90 percent of expenditure between 1793 and 1798 was covered by credit.[45] Figure 3.5 shows how the scale of the government expenditure led the national debt to double from about £232 million to £509 million between 1793 and 1802 and at the climax of the war in 1815 the total national debt had exceeded £800 million, over 250 percent of the national income.

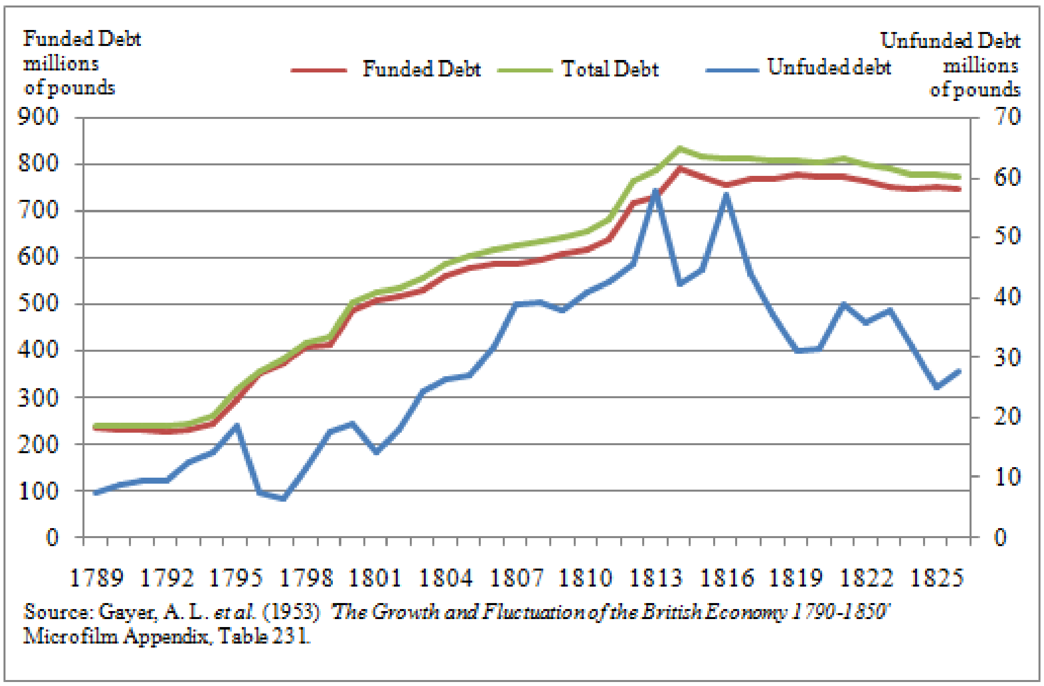

Figure 3.5. Unfunded, Funded and Total National Debt 1789-1825. Annually.

But as the war dragged on, the public expenditure increased (Figure 3.6), the budget deficit became large for a longer period of time than during previous wars, and it became clear that taxes had to be raised to meet the rising debt charge. In

[45]Bordo and White (1991).

1799 Prime Minister Pitt introduced an income tax in Parliament as it was not possible to increase the revenue from indirect taxation, such as custom duties, any further. As the debt increased steadily throughout the war, taxes also had to be raised continuously from 1799 until the end of the war in 1815. Income tax was a heavy burden which reduced the purchasing power of domestic consumers – the yield of tax revenue was 12.7 millions in 1806 and 15.6 millions in 1815[46] – but the impact of taxation was not solely negative. Firstly, income tax enabled the government to collect tax revenue from foreign merchants, who were attracted to Britain by existing liquid markets, opportunities from war supplies and relatively lower taxation compared with France.[47] Secondly, the tax revenue guaranteed interest payments of three percent consols, perpetual annuities that formed the core of national debt and were cheaper to service than unfunded, floating debt. The government's aim during the war was to reduce the proportion of unfunded debt and use it in emergencies. Most of the national debt was created in the private credit markets, at the London Exchange, and, unlike in France, there were no debt forcements. In December 1796 when the war was very unfavourable to Britain, some form of compulsory loan had been considered for those individuals with annual income above a certain level, but the idea of forcing the loan was abandoned as unnecessary and instead it was decided to appeal to the patriotic feelings of the nation.

[46] Gayer et al. (1953), pp. 137-139.
[47] Neal (1990), p. 138.

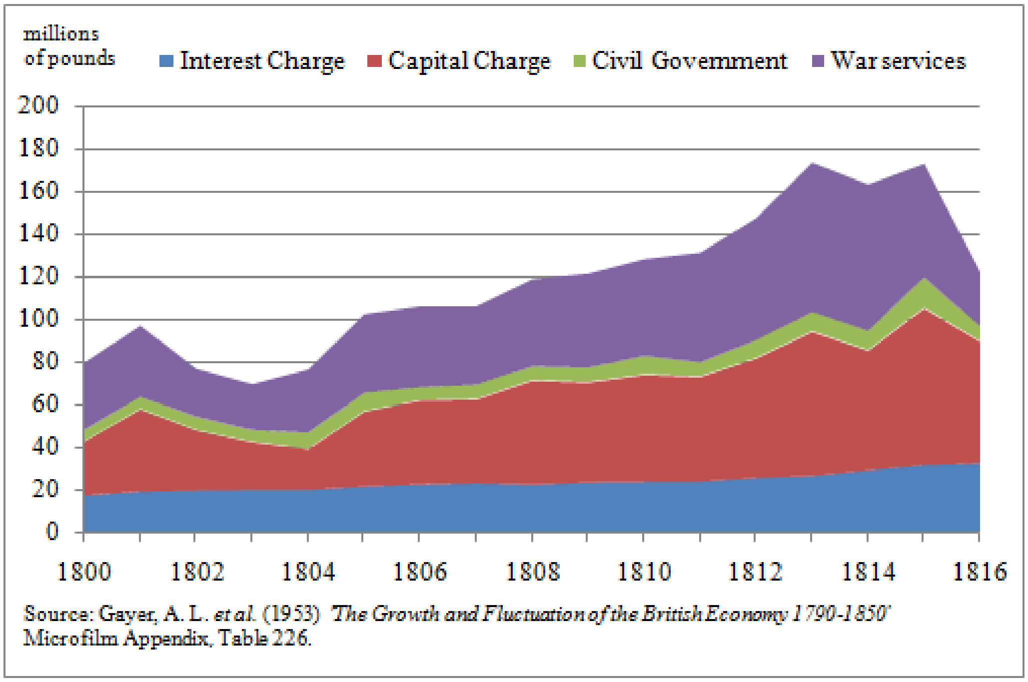

Figure 3.6. Public Expenditure of Great Britain 1800-1816. Annually.

By stabilising the payment system and credit markets the suspension of cash payments supported the government's fiscal strategy. If the production had fallen at the beginning of the war as a result of a credit constraint, entrepreneurs' ability to pay taxes would have been reduced and the nation would have lost its main method of war finance at the very beginning of war.

The British government had a good reputation as a borrower as it had not defaulted on its debt payments in the eighteenth century, and its ability to borrow during the Napoleonic Wars was ultimately based on the credibility of the government's monetary strategy to resume the gold standard in the future. The debtors must have believed firstly, that once the war had finished the country must be able to ensure a flow of revenue large enough to service the debt and secondly, the debt would be serviced by a currency that would be convertible to gold.[48] The failure to resume the gold standard or resumption at a lower par value – devaluation – would have been considered as a default.

Although Napoleon's continental system temporarily blocked British trade to the Continent, it failed to halt the British finance system. Neal (1990) estimates that eight to ten percent of British national debt was held by foreigners living abroad in 1816, but the figure would be even higher if it included immigrants living in Britain.[49] Continental merchant bankers anticipated the victory of Britain and resumption of the gold standard, and kept building their credit in London during the war. These holdings were locked in London: if the foreign capital was withdrawn suddenly in large quantities, the pound would fall and the remaining assets would be locked even more securely. According to Neal, the strength of the government stocks on the London Stock Exchange throughout the war and stable interest rates are a testimony to the credibility of the government's fiscal and monetary policy.

Nevertheless, for David Ricardo and many other contemporaries, the national debt was an evil which almost any sacrifice would not be too great to get rid of, a mill stone around the neck of the nation. In general, the state of public finance raised as much criticism as monetary policy during the Bullion Debates. Ricardo's

[48] Bordo and White (1991).
[49] Neal (1990), p. 221.

suggestion to pay away the debt in one go did not seem very realistic considering the war the country was engaged in.

Williamson (1984) has suggested that Britain's slow growth and industrialisation between the 1760s and the 1820s can be explained by the war debt, which crowded out civilian accumulation, inhibited growth, and contributed to the dismal performance in the workers' standard of living. In light of evidence compiled by Heim and Mirowski (1987) the government borrowing, however, did not have a crowding-out effect on private investments as entrepreneurs of the Industrial Revolution used regional short-term bills of exchange, not long-term financial instruments bought and sold in the London Exchange, to finance their investments.[50]

3.3.2. The Bank of England's Role in War Finance

The Bank of England exercised its discretionary monetary policy both by buying government paper and discounting London merchants' bills of exchange. Figure 3.7 includes all the assets of the Bank arising from its business with private borrowers – private advances, and its public advances, that mainly consisted of Exchequer bills. The figure shows how the private discounts in total grew faster after the suspension compared with the public advances. If the markets did not absorb as many Exchequer bills as the Treasury wished to dispose of, the Bank bought

[50]The question of whether the national debt crowded out private investments during the Napoleonic Wars has become a topic of much debate, and no consensus exists. In recent years, for example, Termin and Voth (2005) have argued against and Clark (2001) for Heim and Mirowski (1987).

Exchequer bills at the direct request of Treasury brokers.[51] The heavy responsibility of the Governors was not eased by the fact that the Bank's public advances were still subject to parliamentary control and it was technically prohibited from buying Exchequer bills or making advances to the Treasury without Parliament's permission. During time of war Parliament was not keen to enforce the law or limit Treasury's needs.[52] According to my own calculations, based on Gayer et al. (1953), the Bank's private advances made up on average 53 percent of the total unfunded national debt between 1800-1821.[53]

During the first ten years the growth of the discounts was moderate. Figure 3.3 shows how before the suspension the Bank's note issue had been about 10 to 11 millions, but increased issue straight after suspension can probably be explained by the issue of the notes of small face value. Economic activity was low and in order to maintain confidence immediately after the suspension, the Bank relaxed its private discounts.[54] Between 1800 and 1801, as seen in Figure 3.4, the pound depreciated on the Hamburg exchange, but this was due to bad harvests and deflation in Hamburg, not the Bank's credit expansion.[55] Sir Francis Baring praised the directors of the Bank writing that

[51]Clapham (1944) p. 62. Gayer et al. (1953) Microfilm appendix p. 1388.
[52]Gayer et al. (1953) Microfilm appendix p. 1386.
[53]Both Gayer et al. (1953) and Acworth (1925) warn how the contemporary national accounts were extraordinarily complicated, thus these figures are just rough estimates.
[54]Duffy (1982).
[55]Feavearyear (1963) pp. 191-192.

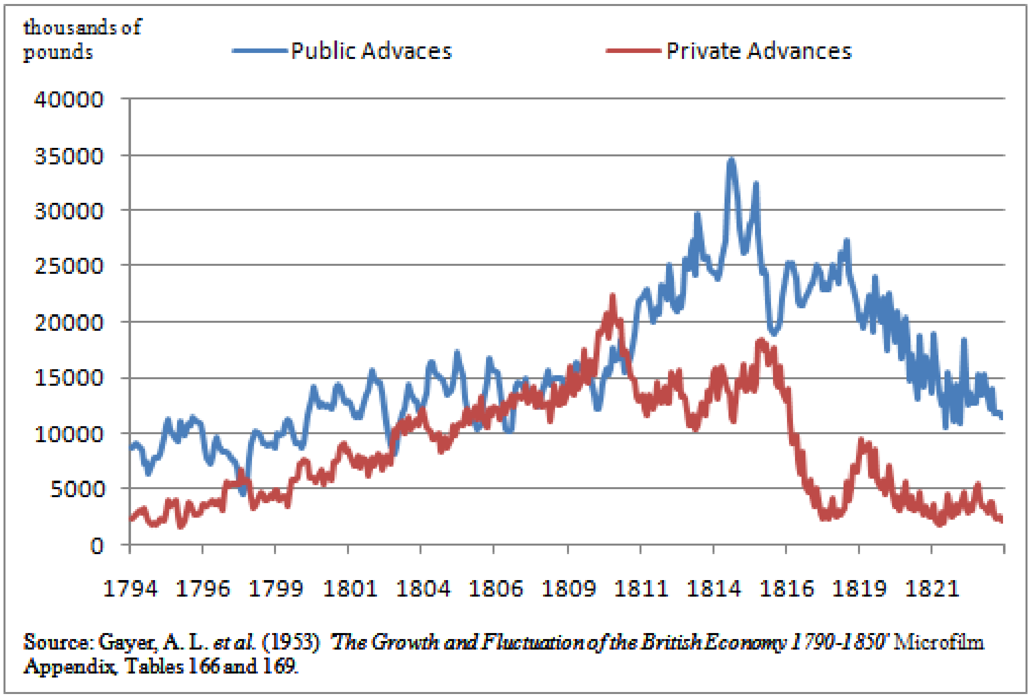

Figure 3.7. Public Advances and Bills and Notes Discounted by the Bank of England, 1794-1825. Monthly.

> From long experience, the Directors of the Bank must understand correctly the amount to which their Notes can circulate without depreciation or discount. ...they have proved that they have conducted themselves with equal judgement, by not extending their issues beyond what the currency of the country requires and can support.[56]

If during the first ten years of suspension the Bank's credit policy had been relatively restrictive, the following years were quite the opposite. By 1808 Napoleon had mastered his Continental Blockade in trying to stop the British Continental

[56]Baring (1797) p. 11.

trade, which forced British merchants to search for alternative trade channels. New markets were opened for British goods both in Northern Europe and South America, which created a wave of optimism. According to Duffy (1982), 'the Bank's acquiescence in the growing demand of discounts transformed a simple bout of speculative fever in the powerful movement of inflation'. The notes outstanding, seen in Figure 3.3, of which volume had remained relatively stable from 1806 to 1808, began to rise sharply in 1809 until the peak was reached in 1810. The commercial boom was, however, short lived. The exchange rate depreciated, the price level rose and from late 1809 onwards bankruptcies increased. The summer of 1810 saw the outbreak of several economic crises.

3.4. The Gold Convertibility Rule as an Invisible Hand of Monetary Policy

3.4.1. An Inquiry on the High Price of Bullion

Changes in the price level during the early nineteenth century, Figure 3.8, seem rather modest if compared to war time hyperinflations in the twentieth century, but for contemporaries, 'stalwart believers in the virtues of a stable value of money',[57] the general rising level of prices and the currency disorder, both comparable depreciation of the Bank of England's notes in the Continental exchanges and the 12 percent premium on gold, seemed puzzling and started a major public debate

[57] Davies (1994), p. 299.

called the Bullion Controversy or the Bullion Debates. The dispute has been labelled as a debate over a single issue, a real-bill doctrine, which aimed to establish whether or not discounting real bills was inflationary. According to Smith (1776) a real bill was 'drawn by real creditor upon a real debtor'[58] and they could not be defaulted because 'there are actual goods in existence'[59]. Anti-bullionists, the government, the directors of the Bank and some London merchants and bankers insisted that as long as the Bank only discounted real bills, it was only serving the legitimate needs of trade and could not over-issue.[60] Bullionists disagreed and argued that the source of the bill was irrelevant: the Bank's credit policy had led to over-issue. Discounting real-bills was a safe and profitable business for the Bank, but as the market rate of interest remained above the usury level during the war, more and more merchants turned to the Bank to discount their bills. Pressure for more accommodation imposed a difficult task for the monetary control of the Bank as discounting all sound paper was likely to produce over issue, but being too restrictive might produce widespread distress.[61]

In early 1810, Parliament appointed the 'Select Committee on the High Price of Bullion' to inquire into the high price of gold, so as to find out whether the Bank had issued the right amount of money or over-issued. Between February and May 1810 the Committee held thirty-one meetings and examined twenty-nine witnesses,

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[58]Smith (1776), p. 411.
[59]Thornton (1802) p. 85.
[60]Flandreau (2007) and Sargent and Wallace (1982).
[61]Duffy (1982), p. 68.

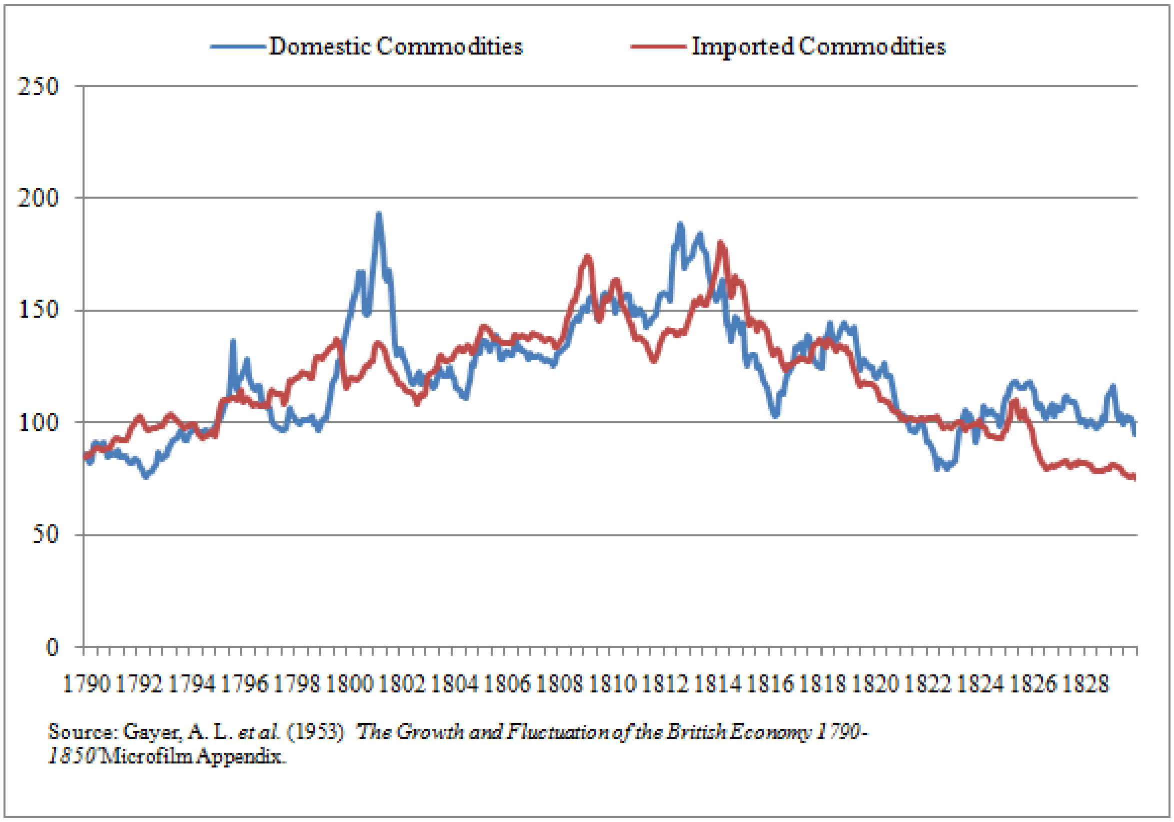

Figure 3.8. Index of Wholesale Prices of Domestic and Imported Commodities1790-1830. Monthly Averages. Base: Jan-1825=100.

including the directors of the Bank, and on 8 June 1810 the committee published its 'Report from the Select Committee of the House of Commons on the High Price of Bullion', in which it took 'into consideration the State of the Circulating Medium, and of the Exchanges between Great Britain and Foreign Parts'.[62] The Committee did not compile price indexes, but aimed to be objective by presenting time series of the market price of gold, exchange rate and the Bank of England's

[62] *Bullion Report*, reprinted in Cannan (1925) p. 3.

note circulation: the market price of gold was at £4.12s. per oz, 15 percent above the Mint price of £3.17s.10$\frac{1}{2}$d (shown in Figure 3.9) and that the exchanges, with Hamburg, Amsterdam, Paris and Portugal have correspondently depressed as low as 16 to 20 percent below the par.[63] The Committee's conclusion was that the rise in the price of bullion and the adverse exchanges had been caused solely by an over-issue by the Bank of England and accused the Bank of pursuing real bill policy by accepting all sound paper without considering 'its desirability in terms of national monetary policy'.[64] The influence of the country bank issue was noted by saying that the quantity of country bank paper was dependent upon the quantity of Bank of England paper, increasing and decreasing with it and 'by increasing its notes, the Bank made more plentiful the reserves into which every country banker was required to redeem his own notes'.[65]

The Bullion Committee's Report is inarguably one of the most important documents in British monetary history and it has been treated as an authentic piece of evidence of the Bank's monetary policy. Contemporaries and a large group of historians have interpreted testimonies given by three Directors of the Bank in front of the Bullion Committee as a sign of lack of knowledge in any monetary theory. Even Clapham (1944) admits that as economists the Directors 'came less well out of the debate' when they insisted, in a clumsy manner, that the state of the exchanges had nothing to do with issue, but was a result of war time disturbance

[63] *Bullion Report*, reprinted in Cannan (1925), pp. 3-5.
[64] Fetter (1965) p. 41.
[65] Bullion Report, reprinted in Cannan (1925) p. 61-66.

in the balance of trade.[66] Sometimes the members of the Committee appear not to have known what questions to ask of the Bank's representatives, and sometimes, when they did, the representatives were unable or unwilling to answer.[67]

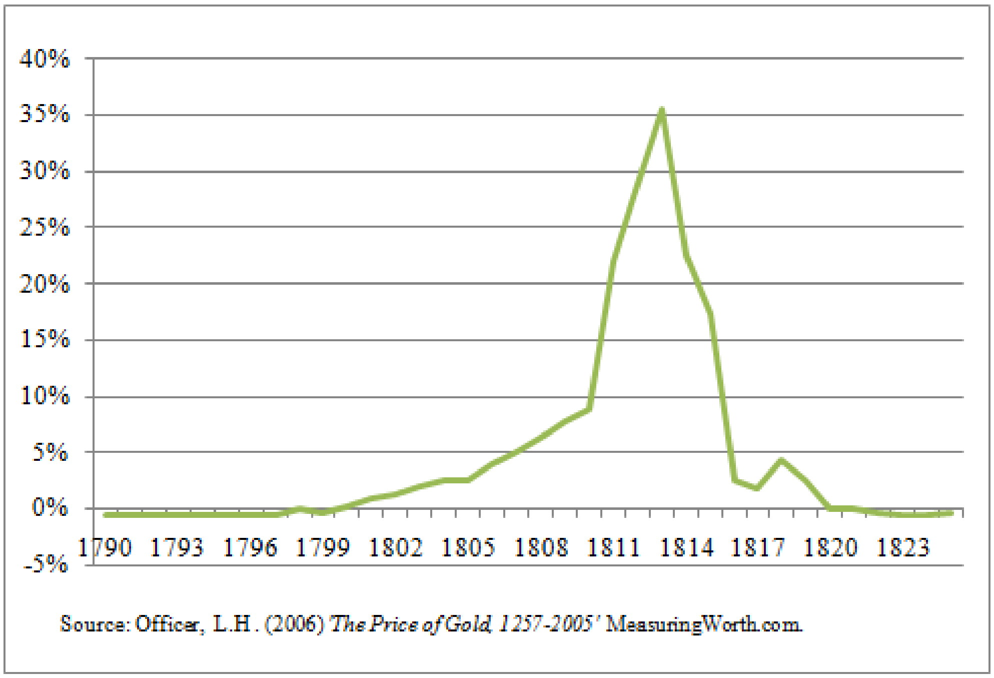

Figure 3.9. Percentage Deviation of the Market Price of Gold from the Par Price 1790-1825.

Conversely, Duffy (1982) argues that *The Bullion Report* overestimates the Bank's sentiment towards anti-bullionism and does not tell the whole truth of the Bank's credit policy. The committee's interrogation was intense and these three rather personal statements, as often stressed by the Directors themselves during the interviews,[68] presented the views of the corresponding directors at that precise

[66]Clapham (1944), Vol II, p. 26.
[67]Horsfield (1953).
[68]*Bullion Report*, reprinted in Cannan (1925) p. 33.

moment. The opinions of two of these interviewed directors changed in the following year. Duffy concludes that the Bank's regulatory policy was rather imprecise in nature. The Bank's internal Discount Committee in its own report of 1810 suggested that the fault did not lie in the regulations, but in their neglect by the Directors, who were under constant pressure from merchants and the government. The Bank had sought to dampen commercial optimism by limiting the expansion of credit, but the mechanism of setting a maximum credit limit had broken down.[69]

3.4.2. Impacts of Increased Money Supply

Whether due to mismanagement, deliberate monetary expansion, country banks' issue, war time demand or bad harvests, the pound had depreciated, the general price level increased and the Bank's profits soared. The Bullion Debates, however, did not only aim to establish a reason for the currency problems, but the dispute also revolved around the question of how the increased money supply, including that of private banks, and the increased price level, affected the real economy. The dominant 'quantity' theory, especially that of Ricardo, was based on the assumption that the economy was frictionless, with no short-run stickiness and with high capital and labour mobility. Any reduction of parliamentary intervention to a minimum would best serve the interest of the economy.[70] By contrast, Thornton (1802) and *The Bullion Report*, which was probably written by Thornton himself,

[69] Duffy (1982).
[70] Gordon (1976) p. 25.

anticipated that the ability of the economy to respond to shocks varied from sector to sector.

Contemporaries considered the ability of labour markets to adjust to changing economic conditions to be particularly slow. Adam Smith had already written that the conflict between the workers and the masters arise from the wage – profit difference, because ‘Masters are always and every where in a sort of tactic, but constant and uniform combination, not to raise the wages of labour above their actual rate’.[71] Thornton recognised that an excessive issue of paper does increase prices of goods, ‘though not the price of labour’.[72] As a result the workers may be forced ‘to consume fewer articles’.[73] Consequently, authors of *The Bullion Report* recognised that wages were sticky, especially downwards. Another evil of the general excess of currency was that:

> By far the most important portion of this effect appears to Your Committee to be that which is communicated to the wages of common country labour, the rate of which, it is well known, adapts itself more slowly to the changes which happen in the value of money than the price of any other species of labour or commodity.[74]

Alexander Baring, one of the authors of *The Bullion Report*, became a fierce critic of Ricardo's quantity theory, accusing Ricardo of treating the relationship of

[71]Smith (1776) p. 59.
[72]Thornton (1802) p. 239.
[73]Thornton (1802) p. 239.
[74]*The Bullion Report,* reprinted Cannan (1925) p. 67.

money and prices as if it were 'a mechanical operation'.[75] He warned that if the price level fell, an attempt to maintain money wage levels would lead initially to unemployment and to social unrest in the long-run,[76] whilst Robert Peel thought that stickiness might bring some benefits for the workers since 'the natural result of a return to a metallic currency must be a diminution in the profits of the master, and an increase in those of the men'.[77]

Although contemporaries were familiar with the concept of nominal rigidities, it was not yet fully understood that the effectiveness of the Bank's discretionary stabilisation policy depended on the degree of flexibility in the economy. If the economy was perfectly flexible, changes in the money supply would not have any effect on the real economy as both prices and wages would adjust immediately. But even a relatively short lag in wage or price setting would give an opportunity to a discretionary policy maker to respond to disturbances that was, indeed, desirable during the war. For example, in the case of sticky wages, if the policy maker increased money supply, the price level would rise and real wages respectively reduce. This would increase producers' profit margin, raise production, employment and ultimately private consumption. Before the eighteenth century systematic inflation had not existed thus rigidities had been visible only when the harvests had been poor and prices and wages had failed to adjust to the rising level of agricultural products.

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[75] Gordon (1976) p. 106. Alexander Baring was the second son of Sir Francis Baring.
[76] Gordon (1976) p. 107.
[77] Gordon (1976) p. 149.

Figure 3.10 shows the development of nominal wages of six occupations between 1797 and 1827. Nominal wages, although they increased during the Suspension Period, did not rise at same rate as the real value of the paper pound depreciated (Figures 3.8 and 3.9). Studies by Botham and Hunt (1987) and Lindert and Williamson (1984) suggest that real wages decreased in Britain as a whole between 1755 and 1819 but regional variations in wage levels were huge and in places where technology was particularly advanced, such as Manchester, both nominal and real wages might have risen during the Suspension Period.[78] Lindert and Williamson (1984) call the years between 1750 and 1820 as a period of 'prolonged wage stagnation'. Rogers (1908) argues that as the premium on gold increased by 30 percent, the nominal wages paid in paper money would have been 'in reality little more than two-thirds of their reputed value'.[79] The situation was probably not as grim for all wage earners, as in the first half of the nineteenth century agriculture was by far the main employment (19 percent of adult men) followed by domestic service (16 percent of adult men).[80] They were both sectors in which a part of wage was paid in kind – food, drink and accommodation – so that the changes in the price level had a smaller impact on the standards of living. Lindert and Williamson (1984) estimate that about half the adult males in England and Wales were in the pool from which full-time wage labour could be drawn. In many sectors nominal money wages were also fixed for a year so that changes in the price level had an

[78] Hamilton (1942).

[79] Rogers (1908) p. 425.

[80] Gayer et al. (1953) Microfilm appendix p. 1706.

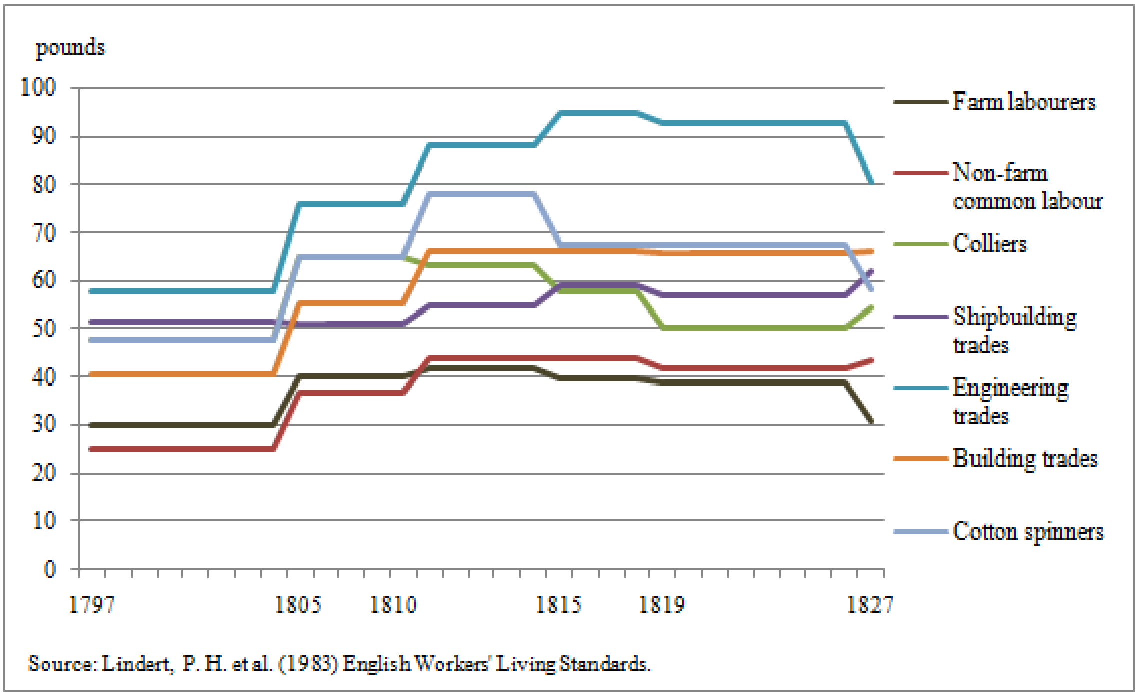

Figure 3.10. Estimates of Nominal Annual Earnings for Six Occupations, 1797-1827: Adult Males, England and Wales.

immediate effect on real wages, not nominal wages. Modern economic historians have, however, devoted a considerable amount of effort to analysing the development of real wages during the Industrial Revolution, but their focus has been on the impact of decreasing real wages on living standards rather than production.

How did the climbing level of prices and decreasing real wages affect production? A seminal, although controversial, study was conducted by Hamilton (1942), who calls the lag of wages behind prices 'profit inflation' and argues that it was a powerful promoter of industrial growth. Also Gayer et al. (1953) argue that inflationary fiscal policy stimulated the economy during the Napoleonic War, although investments were turned away from the channels that would have been followed in a period of peace and the increase in total output would have been differently distributed amongst industries.[81] Whether due to profit inflation, Figure 3.11 shows, how the industrial production grew during the French Wars. The Suspension Period was an era of almost continuous industrial growth, when domestic production in England increased by 68 percent.

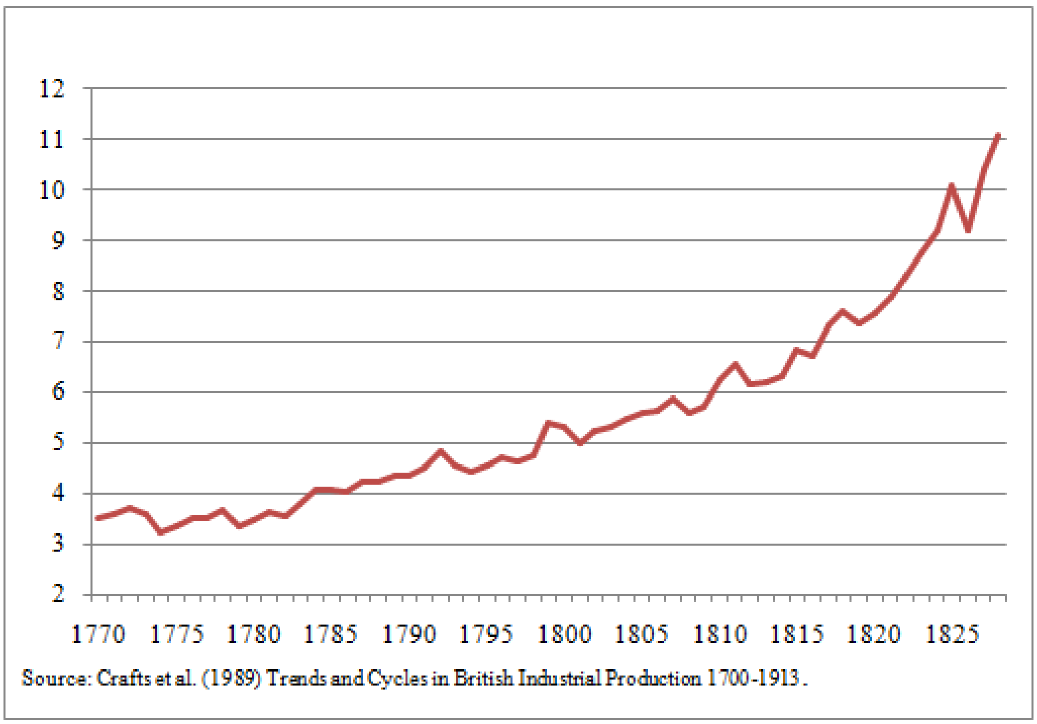

Figure 3.11. Index of Industrial Production 1770-1825.

While labour markets were gradually made more flexible in the nineteenth century, price rigidities increased when the Corn Laws were imposed in 1815. The

[81]Gayer et al. (1953) p. 648.

Corn Laws were designed to stabilise the exchange rate fluctuations caused by a large import of wheat which depreciated the exchange rate, increased the outflow of gold and could have challenged the resumption. The Laws stated that no foreign corn could be imported into Britain until domestic corn cost 80d. per quarter. Another function of the Corn Laws were probably to preserve the abnormally high profits of the Napoleonic war years for the landowners. The high price caused the cost of food to increase and consequently depressed the domestic market for manufactured goods because people spent a large part of their earnings on food rather than commodities.

3.4.3. Adjustment to the Gold Standard

The Bullion Report advocated resumption of the gold standard at the old par value within two years, but the Report itself was not discussed in Parliament until a year after its publication in July 1811.[82] This delay was partly a tactic as the government did not welcome the report wholeheartedly and it was certainly in no rush to apply the recommendations. Figure 3.3 illustrates how the Bank's issue increased rather than decreased between 1810 and 1814. A collapse in an export boom in 1811 marked a start of depression and, in order to relieve the situation, the government issued £6,000,000 worth of exchequer bills for merchants, who then discounted them at the Bank. This issue can be seen as another peak in unfunded

[82]Viner (1937) p. 171.

debt in Figure 3.5. The early resumption was opposed in Parliament, and the recommendations of *The Bullion Report* were defeated by a large majority.[83] As long as Napoleon was in power, the Bank had little choice but to make advances that the government demanded[84] and the policy of the resumption of cash payments got complicated by the indefinite character of the first peace and the Hundred Days reign of Napoleon. Once again an Act of Parliament,[85] stating that 'although resumption was highly desirable, it should be postponed until 5 July 1816' was hurried through Parliament as the Bank and the government together were opposing any definite resumption date[86].

So profound were the years between 1815 and 1822 in defining the future of the nation that Acworth (1925) named them as the era of Financial Reconstruction. The economy was in a transition from war to peace and the government had to find the means to repair the damaged finances of the country: to cut down taxation, reduce expenditure without creating undue hardship, discover some mode of dealing with the debt and restoring the currency to a stable basis.[87] Abolishment of income tax in 1816 was intended to bring relief, but as indirect taxation had to be increased, overall results are unclear. The dip in the production index in Figure 3.11 reflects the adjustment of heavy industry to the peace-time demand.

[83] Viner (1937) p. 171.
[84] Fetter (1965) p. 76.
[85] Act 54, Geo. III c.99, 18th July 1814.
[86] Fetter (1965) p. 62.
[87] Acworth (1925) p. 11.

Agricultural and industrial distress that coincided with adjustment to the gold standard created controversy over the desirability of resumption. Some men who had been most enthusiastic for a return to the gold standard began to have doubts and it was often the very same people who had initially accused the Bank of exploitation of people and inflation, but then vigorously criticised the Bank for deflation.[88] According to Fetter (1965) 'men who were far apart on most points were in agreement that somebody was making too much money from the paper money system'. The Bank, which had previously been blamed for excessive discounting, was accused of constraining credit and deepening distress; or, when the Bank refused to reduce its discount rate when the market rate fell below 5 percent in 1817 in order to dampen the demand of discounts in a legitimate way, it was blamed for trying to profit by charging a too high margin.

There were three alternative monetary arrangements that were brought forward by various bodies. Firstly, even though gold was made an official unit of account in 1816, bimetallism was seen to provide more stable conditions than monometallism, as the economy would not be dependent on the supply of a single metal. Secondly, it was suggested that the gold standard should be resumed with a smaller gold content of the pound, i.e. a higher gold price. Thirdly, the most radical was the suggestion to continue with the inconvertible paper money standard, although a pure fiat money system was not discussed.[89] The most sound arguments in favour

[88]Feavearyear (1963) pp. 224-225.
[89]These disputes are summarised by Fetter (1965) and Chown (1994) pp. 70-71.

of continuation of the Suspension Period were presented by Matthias Attwood and his brother Thomas, who represented Birmingham, which, as a centre for heavy industry, had been severely hit by the transition from war to peace.[90] According to Matthias Attwood, the nation would lose the great advantage conferred by restriction in the context of an independent monetary policy, as the actions of foreign countries could influence the value of the pound. The suspension, he argued, 'enabled the country to maintain an internal scale of prices, which had a reference to its taxes and burdthens [sic], and did not depend on the scale of prices in other countries'.[91] He opposed what he saw as a misguided attempt to '[restore] the ancient standard'. His brother Thomas Attwood protested against the manner in which the question of metallic standard was discussed.[92] 'The issue of money *will* create markets, and that it is upon the abundance or scarcity of money that the extent of all markets principally depends...'[93] He argued that painful adjustment of prices should not be ignored even during the time of peace: 'if men could live without food and clothing for two or three years, until the reduction of the circulating medium had acted alike in reducing the prices of all kinds of industry and commodities then the social system might go on again'.[94]

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[90] Fetter (1965) p. 75.

[91] As quoted in Gordon (1976) p. 107.

[92] As quoted in Gordon (1976) p. 108.

[93] Thomas Attwood, A letter to the Right Honourable Nicholas Vansittart (Birmingham, 1817) as quoted in Fetter (1965) p. 75.

[94] Thomas Attwood (1818): *Observations on Currency, Population and Pauperism*, as quoted by Fetter (1965) p. 76.

Between 1817 and 1820 *The Times* reported on a regular basis of announcements of bankruptcies, crowded workhouses and starving labourers unable to buy bread. Unemployment and starvation led to riot, lawlessness and political agitation for parliamentary reform. According to Acworth (1925), corn laws, tariffs and restrictive trade deepened the crises and made the recovery slow.[95] On 18 May 1819, 'Merchants, Bankers and Traders and others' of the City of London organised a 'meeting against the resumption of cash payments' in order to consider a petition to both Houses of Parliament. In this meeting Mr Atwood gave a statement which reveals that the possibility of a permanent paper money standard had been considered, although it was not seen as a realistic option:

> Legislature never intended the restriction to be perpetual: but another conclusion might with equal truth be drawn from the repeated renewals of the restriction, namely, that it was the intention of the legislature not to remove the restriction until threat measures could be adopted without injury or inconvenience to the public.[96]

In the same meeting he expressed his concern over the hardship which the country had to face when the debt issued in paper currency was to be redeemed in convertible currency: 'Who could think of withdrawing from trade and industry the present circulating medium, and leaving all the superstructure of debt and taxation which had been raised on that foundation in its present state?' he asked,

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[95] Acworth (1925) pp. 120-123.
[96] Ibid.

and went on to suggest that 'Those who wished for the resumption of cash payments ought first to endeavour to reduce the public debt and taxation.' According to the reported amount of applauses and hisses Atwood's speech received, the monied men of London were far from being unanimous,[97] but a petition of several hundred London merchants who were 'deeply impressed with a sense of the present distressed state of the commercial and manufacturing interests, of the general want of confidence, and of the extensive and increasing evils which are the natural consequence of this state of things' was given to Parliament in December of the same year.[98] This was all, however, in vain because, for the Bank, constraining credit during peace was a logical follow-up of the same stabilisation policy that had willingly supported the merchants during the most critical of times. During the war the Bank's policy horizon had been short as the question was the immediate survival of the country, but during peace the long-run stability was seen to be ensured by resumption of the cash payments.

Why was the gold standard resumed at the old par value, even though adjustment policy deepened the depression and it was known that the gold standard would reduce the country's ability to conduct independent monetary policy? Authors of *The Bullion Report*, as mentioned by Flandreau (2007), were sceptical about the human ability to conduct discretionary monetary policy: rules were considered to be better than discretion, and the best available rule was the gold

[97] *The Times* 19 May 1919.
[98] *The Times* 28 December 1819.

standard. Since the Bank was both a public and a private institution, the gold standard was seen as a solution to the problem that arose from this ambiguous role. According to Ricardo (1811), the currency problem during the Suspension Period was 'owing to the too intimate connexion between the Bank and the Government'[99] and by increasing discounts the Bank had been able to collect private profits, which, according to *The Bullion Report*, were 'made at a very small expense to the parties' and did not allow 'the state to participate much more largely in the profits accruing from the present system'[100]. The critics of the Bank observed that its share price, plotted in Figure 3.12, rose almost by 50 percent between 1810 and 1817 and its dividends were constantly above the pre-suspension level.

As long as currency was convertible to gold, constraints set by the gold convertibility rule ensured that even a private central bank was able to commit to credible monetary policy.[101] If the Bank overissued, the general price level and the market price of gold would rise, which would in turn lead to the drain of bullion and to trade deficit. To avoid insolvency, the Bank would be forced to constrain its issue. In equilibrium the Bank would issue the amount of money that would keep gold at par. *The Bullion Report* thus saw the gold standard as 'the natural and true control'[102] in the issue of paper. The nominal anchor of a modern central bank might be an inflation target of two percent, but in the nineteenth century – when

[99]Ricardo (1811) p. 42.
[100]Cannan (1925), re-print of *The Bullion Report* p.65.
[101]Especially as the Bank's Charter depended on renewals in Parliament.
[102]Cannan (1925) p. 66.

reliable price indices could not have been compiled – the price of gold was seen as the most suitable nominal anchor, – ‘the invisible hand of monetary policy’[103].

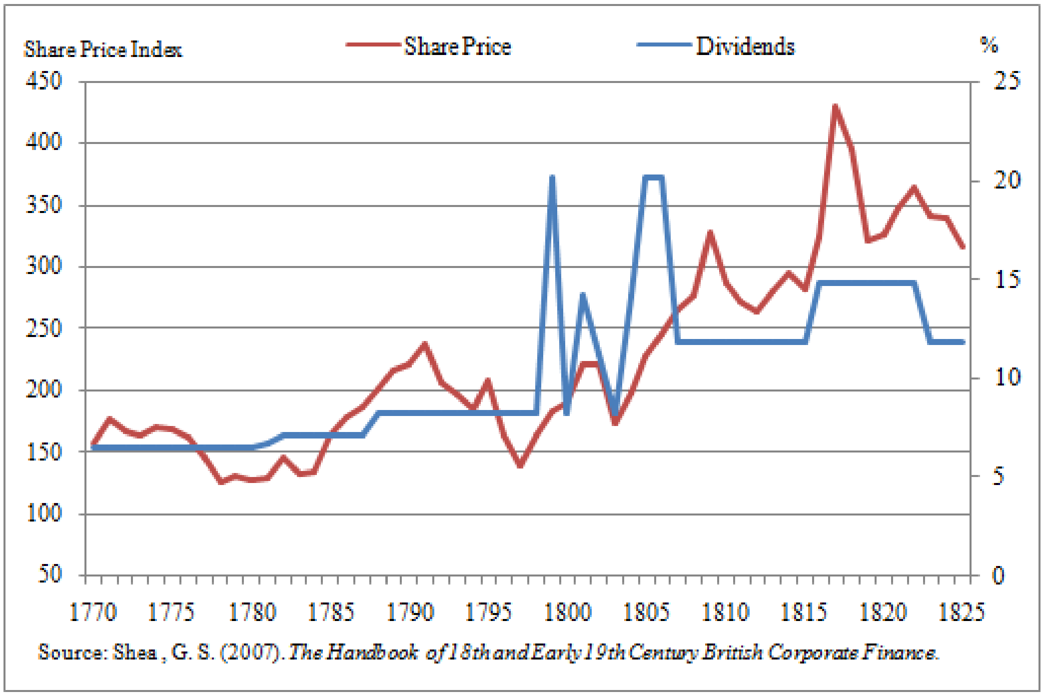

Figure 3.12. The Bank of England’s Share Price and Dividends 1770-1825.

According to Flandreau (2007) the gold standard solved the monitoring problem by increasing the transparency of the Bank. The Bank had been a difficult institution to monitor: between 1696 and 1832 not a single Committee was allowed to access the data of the Bank’s gold or ‘treasury’ holdings, and it was only after 1833 when the Bank started to supply a continuous record of its assets and liabilities.[104] Its reserve ratio had fluctuated during the eighteenth century and

[103]Flandreau (2007).
[104]Horsfield (1953), p. 50.

bank panics might have been common if the public had known how little gold the Bank had in its vaults. Even if the public could not have access to the Bank's treasury data, they would have known that the Bank had overissued if there had been a difference between the monetary and market price of gold – the latter could have been observed easily from various price lists published.[105] The discussion of sufficient reserves continued beyond the resumption of the gold standard and in 1832 the Bank announced that the ratio of cash to notes and deposits was to be 1:3. This ratio became to be known as Palmer's Rule after the Governor of the Bank, and it was considered to guarantee 'a full currency', that kept exchanges and the market price of gold at par.[106]

Although the public discussion over the monetary standard continued after the war, the price of gold had fallen close to par by 1816. The directors decided to experiment with the partial resumption of cash payments, but there was no internal demand for gold. According to Fetter (1965), the public was now so used to the notes and found them far more convenient than gold. Pressnell (1956) argues that country banks preferred notes since handling gold and silver involved transmission expenses.[107] For modern macroeconomists this explanation is not acceptable, as the paper pound and gold could have been considered as equal if their value in the future was also expected to be the same. The demand for specie was, however, dependent on the market price of gold: in summer 1817, as can be seen in Figure

[105]Flandreau (2007)
[106]Horsfield (1953) p. 51-53.
[107]Pressnell (1956) p. 156.

3.4, the exchange rate became unfavourable, and the market price of gold rose. The newly coined gold went to France which caused the failure of the partial return to convertibility. The failed experiment and the Bank's simultaneous effort to buy bullion even at a loss, conveyed a strong sense of the Bank's commitment to return to the gold standard in the near future.

Figure 3.7 shows how the government paid a substantial amount of its short-term debt back to the Bank between 1819 and 1821. In July 1819 an Act was passed in Parliament that made it illegal for the Bank to lend money to the government for more than three months without the permission of the Parliament. Parliamentary committees were established in both Houses to inquire into the expediency of resuming cash payments, and their reports in 1819 were practically identical: the plan that got accepted proposed adjustment of the mint price of gold so that on 1 February 1820 gold was to be sold at £4.1.0 per ounce and then gradually at a lower price until 1 May 1823 when all restrictions upon cash payments were to expire.[108] Ricardo's idea was to resume payments through an 'ingot exchange system' that would have prevented small notes from being converted to gold, but it was unnecessary since following the resumption plan of Parliament did not cause problems.[109] Gold was almost at parity and on 1 February 1820 when notes became redeemable for gold at £4. 1s., there was no demand and only a couple of ingots were purchased – mainly for curiosity. Even though currency was not yet fully

[108] Fetter (1965) p. 93-95.
[109] Fetter (1965) pp. 91-92 and 97-99.

convertible, gold flowed into the Bank and the Bank's reserves increased from £4,500,000 to £10,100,000, between January 1820 and January 1821. On 1 May 1821 currency dealings were restored and the monetary system of the country re-established. The fact that the Bank note was legally redeemable at a fixed price of gold seems to have meant little to the public, since it did not even get mentioned in the major papers.[110]

3.5. Conclusions

This chapter searched for an answer to the questions of why the suspension of cash payments was a credible monetary system although it gave the Bank of England an opportunity to conduct discretionary monetary policy and why was the gold standard resumed. In theory the Bank would have been capable of limitless nominal expansion without having to consider whether its gold reserves were sufficient. It was, however, understood that uncontrollable issue was going to be inflationary, worsen the trade balance and make the government debt harder to sell. Hyperinflation that followed French *assignats* was a living warning of the danger of excessive note issue and the policy of the Bank did not become too accommodating. By trial and error were the set of challenges and opportunities realised.

On the positive side, the suspension of cash payments enabled the Bank to conduct discretionary monetary policy in order to stabilise the economy during

[110] Fetter (1965) p. 96.

the war. Stabilisation policy evolved over time. Initially the suspension of cash payments was an emergency measure to calm down a panic that followed rumours of French invasion, and to prevent the general public from hoarding notes for gold conversion. If gold convertibility had been continued in February 1797, the Bank and many London merchant houses would have become insolvent; the former since its gold reserves had vanished and the latter as the payment system collapsed. Merchants and entrepreneurs were engaged in complex financial arrangements and failure of one house would have created a chain of bankruptcies. As the Bank of England did not yet operate as a lender of last resource, the role the City of London played as a financial intermediator between counties was crucial. Distress in London would have spread elsewhere in the country and damaged both agriculture and industry that would have been disastrous during the war.

The government soon realised that the need to be able to stabilise the economy during the war was continuous, and the gold standard was not resumed although the Bank's reserves improved during the three months of suspension. The Bank conducted its stabilisation policy by discounting bills of exchange of London merchants and supporting government in its war effort by buying its short-term debt. As the market rate of interest was above the usury rate of five percent, the discount policy was the most effective tool to regulate market activity in London. By contrast, seigniorage finance give the government critical flexibility, but it was never a main pillar of the war finance. The fiscal strategy promoted monetary policy since the government financed Napoleonic Wars by selling consols and covering interest charges by income tax.

My intention, however, is not to argue that the Bank or government's policy was flawless during the Suspension Period. Mistakes were made especially between 1808 and 1810, when the Bank conducted the real bills policy, the outcome of which was that the domestic price level increased and the reduced real purchasing power of the pound created a serious trade deficit. The Bank's ability to conduct discretionary policy was questioned by the Bullion Controversy, which recognised a problem of governance in the Bank's position: it was a private, profit maximising monopoly with the right to issue, but with public responsibilities. The gold convertibility was seen as a transparent principle to monitor the performance of the directors.

After the war had finished the continuation of the stabilisation policy involved constraining issue. Financial distress, which was caused by the economy's transition from war to peace, caused many powerful members of the public to question the desirability of resumption. The Suspension Period, during which monetary policy was dependent on human ability was seen to be 'prejudical to public welfare' in the long-run.[111] It was acknowledged that while the gold standard was not a perfect rule – it reduced the country's ability to conduct independent monetary policy, as the economy would be affected by volatility of the gold price abroad – it was still preferable to the suspension. The price of gold was seen as an important,

[111] *The Bullion Report,* reprinted in Cannan (1925) p. 65.

transparent nominal anchor that enforced credibility, and solved the problem of how ‘adequate discretion’ should be measured.

CHAPTER 4

The Suspension of Cash Payments as a Credible Stabilisation Policy

4.1. Introduction

The question of how changes in the monetary regime can be used to stabilise the economy has not received a great deal of attention in the literature. Furthermore, the same issue has not, in my knowledge, hitherto been analysed in the context of a commodity standard. The DSGE model developed in this chapter demonstrates explicitly how the gold standard satisfies the long-term objective of price stability during peace, but during war, when there is a stoppage in the gold trade, following the gold standard rule intensifies the volatility of the markets. Therefore, the suspension of the gold convertibility rule that increases flexibility in the conduct of monetary policy throughout the war, might be a preferable regime as it stabilises monetary conditions. The success of stabilisation policy is, however, dependent on the credible commitment to resume the gold standard once the country is again in the good state.

Treating the gold standard and the suspension of cash payments, not as a continuum, but as separate monetary policy regimes, changes the interpretation of both the Bank of England's operating procedures and monetary policy rules during the Suspension Period of 1797-1821. The gold standard enhanced credibility: the monetary base was fixed as gold reserves restricted the issue of paper currency and the exchange rate was anchored to gold. Under the gold standard the Bank's objective had been to follow the convertibility rule, which, according to the analysis presented in Chapter 2, stabilised the price level, laid the basis for positive development of capital markets and trade, and made the government debt an attractive investment option. As the Bank did not have full control over the total money supply, gold trade or interest rates, during temporary crises the Bank maintained convertibility by unconventional methods, such as imposing an adjustment cost on gold conversion. In the 1790s, however, the economy experienced a series of shocks such as the war, large government expenditure, volatile interest rates and bad harvests, which in peace occurred only occasionally. These long-lasting disruptions, combined with fears of invasion, distorted the economy and increased the public's demand for gold. The gold standard, which had enabled the Bank to absorb temporary shocks during the eighteenth century, became a shock amplifier when the shocks became persistent. Had the Bank not intervened, but allowed gold conversion to continue, the circulating money stock would have reduced at the same rate as monetary gold disappeared from the Bank's vaults. As converted gold was put into hoards, contraction in circulating medium drove many London Merchant houses to the edge of insolvency.

Initially, therefore, the suspension of gold payments was an emergency measure that restored monetary stability, but as the war continued demand for flexible policies remained. The monetary rule under the Suspension Period – to convert circulating paper currency to gold at some future point – gave the Bank an opportunity to conduct discretionary policy. As the amount of money in circulation had no link to gold reserves, the Bank was able to increase the money supply more liberally than under the gold standard – raise revenue for the government by inflationary finance.[1]

In 1810 bullionists had observed that the money supply was slipping out of the Bank's control and demanded an immediate resumption of the gold standard. As the country was in the middle of the war, any suggestions of resumption were ignored by policy makers. After the Battle of Waterloo in 1815 stabilisation was, however, no longer justified and both the Bank and the government started to take faltering steps towards resumption.[2] The government paid some of its short-term debt back to the Bank, and the Bank constrained discounts and started to store gold. The adjustment back to gold standard was not an easy process as it coincided with the industry's structural change from the war-time demand to peace. The Bank disregarded the criticism and continued its adjustment policy. The policy was credible and the market price of gold returned to par so that in 1821 the country was able to resume the gold standard two years ahead of schedule.

[1] As was discussed in Chapters 2 and 3 the Bank notes circulated in the London area and country bank notes in provinces.

[2] Fetter (1965) p.145.

The stabilisation policy can thus be divided into two phases: during the first phase – war years – the Bank was able to issue money and during the second phase, which started after the war had finished, the Bank withdrew paper money from circulation. During the French Wars the first phase lasted for nineteen years and the second phase for six years. An important benefit of the adjustment policy such as this is that the adjustment, which might be difficult both economically and politically, occurred during peace, but not during war.

In Chapter 3, I explored various channels through which stabilisation took effect during the Suspension Period: the Bank issued notes of small denomination, increased the discounts it gave for the London merchants and supported the government's urgent war efforts by buying its short-term paper, as the survival of the country was at stake. Nevertheless, there is not enough evidence to support Bordo and Redish's (1993) and Bordo and Kydland's (1995) argument that during the Suspension Period of 1797-1821 the objective of the government would have been to maximise seigniorage revenue. The war itself was financed by a combination of taxes and public borrowing and the purpose of the suspension of the gold standard rule was to keep monetary conditions stable. Furthermore, the government would not have had to rely on such a drastic measure if it only wanted to raise seigniorage revenue since the gold standard rule itself was not immune from seigniorage finance or fiduciary note issue: monetary authorities were able to reduce gold content of specie or issue fiduciary paper money without any monetary regime modifications.

In addition to these three direct channels, the Bank's stabilisation policy during the Suspension Period had indirect effects: in this chapter I focus on stabilisation policy, the effectiveness of which was dependent on rigidities in the economy. According to the evidence presented in Chapter 3, nominal wages in particular reacted slowly to the changes in price level, which gave the Bank an opportunity to stimulate the economy by issuing paper currency, that in turn increased price levels and decreased real wages. The DSGE model presented in this chapter demonstrates how the Bank's policy stabilised the price level, consumption, domestic production and asset prices during a long, exhausting war.

According to Bordo and Redish (1993) the very reason for the successful survival of the gold standard during the turmoil of the nineteenth century was that it permitted the suspension of convertibility. The theory of the gold standard as a contingent rule proposed by Bordo and Kydland (1995) suggests that the suspension was a carefully planned policy action during wartime. The source of the contingency in 1797 was not a war, but the availability of gold in monetary use: the historical analysis presented in Chapter 2 showed that in the eighteenth century England did not abandon the gold convertibility rule during every war, but only in 1797 when it became impossible to follow.

My starting point is a general DSGE model of the printing, minting, monetary and non-monetary gold demand in an economy with nominal wage rigidities. Initial results of this baseline model will function as a basis for the arguments developed both in this chapter and Chapter 5. The state of the world evolves exogenously between a good state, 'peace', and a bad state, 'war'. The aim of the central bank is to stabilise the economy.[3] The baseline model demonstrates, however, that in this particular framework, where wages are fixed for one period, an opportunity for the central bank to boost the economy in the short-run by issuing fiduciary, unbacked paper money in the good state will lead to a Barro-Gordon type equilibrium where the inflation rate is inefficiently high but does not have any benefits. However, in the second section I show that if the central bank followed the perfect gold standard rule where paper money is fully backed by gold, the time-inconsistency problem disappears. The money stock can increase or decrease only if the commodity stock in monetary use increases or decreases respectively. This argument is parallel to the commodity theory of money, which I discussed in Chapter 1 and which was advocated by classical thought. I conclude this section by demonstrating that in the good state the finite gold endowment sets bounds on the money growth rate and, therefore, also on the price level, consumption and asset prices. The perfect gold standard rule makes the stabilisation of the economy unnecessary.

As discussed in Chapter 2, the feasibility of any commodity standard relies on the availability of the backing commodity for monetary use. If the commodity flow stops for some exogenous reason, as happens in the bad state, but the country still follows the convertibility rule, the private agents satisfy their gold demand by converting paper money to gold. The money stock decreases and the price level

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[3] In order to keep the model simple, and to emphasise the fact that during the Suspension Period stabilisation was not solely achieved through seigniorage, the central bank's opportunity of raising revenue for the government through inflationary finance during the suspension is ignored.

falls. Deflationary pressure could, however, be avoided without the central bank having to take any precautionary measures in the good state if the central bank ceased to convert paper money to gold and issued only fiat money once the bad state is observed by all agents. Private agents are assumed to accept inconvertible paper money only if they believe that in the future, when the economy is again in the good state, the gold standard will be restored.

This chapter concentrates on the stabilisation properties of suspension, whilst the resumption of the gold standard rule is assumed to be exogenously credible. The questions such as what was the impact of the suspension of cash payments on social welfare, and what made the resumption of the gold standard credible are analysed in Chapter 5.

4.2. The Baseline Model

Consider an economy which contains a large number of identical households, firms and a central bank. Since households and firms behave as atomistic competitors, the discussion is restricted to a representative agent of each type. The infinitely lived household consumes the consumption good C_t and gold K_t.

There are two possible states of the world: the good state called 'peace' and the bad state 'war'. The economy switches exogenously and unexpectedly between the states. The initial state is peace and the probability of observing peace is considerably higher than the probability of war; thus peace reflects normality.

During peace the household's demand for gold, K_t, is defined through the household's optimisation problem, but during war, the demand for gold increases above the peace time demand by some exogenous amount Φ. As was seen in Chapter 2, the public's demand for gold was highest during political disturbances. More generally, according to Bordo and Kydland (1995) wars can raise a question of the central bank's solvency in the form of a potential invasion of the country and result in bank runs. The household, who has given its asset to the central bank, is concerned about the potential downside outcome: the gold stock of the central bank ending up in the hands of enemies. Therefore, the household has an incentive to salvage at least some of the gold stock it has deposited at the central bank by converting paper money to gold. In this simple framework, increased demand for gold is assumed to be exogenous and does not depend on factors such as the likelihood of winning the war.

Gold trade The gold endowment[4] gives information for all agents about the state of the world. During the time of peace the household is endowed with random amount K_t^s of new gold which is normally distributed with a positive mean and variance and measured in ounces, but during the time of war the endowment is zero. After receiving K_t^s, the household chooses what proportion of the endowment is minted to specie, deposited at the central bank in exchange for paper currency and consumed as gold. Since during the war $K_t^s = 0$, the household converts some

[4]Given the great advantage of Britain in the Portuguese gold trade (evidence presented in Chapter 2), gold endowment might be a good approximation of the gold flow into Britain.

of its paper money to gold. The household can purchase the consumption good C_t both with specie and paper money, but not by consumable gold that is assumed to depreciate fully between periods.

The central bank follows the gold standard rule by being prepared to buy or sell gold in exchange for paper currency with a fixed conversion rate Q. As in Chapters 1 and 2, money supply is backed by the monetary gold K_t^g

$$M_t^s = \frac{QK_t^g}{\eta_t}. \tag{4.1}$$

The gold reserve ratio is denoted by $\eta_t \in (0,1]$, and defines the proportion of the circulating paper money stock that is backed by monetary gold.

The net increase in the specie supply and monetary gold between periods $t+1$ and t equals the difference between the gold endowment and gold consumption. The gold endowment satisfies

$$K_t^s - K_t - \Phi = \left(S_{t+1}^s - S_t^s\right) + \left(K_{t+1}^g - K_t^g\right), \tag{4.2}$$

where $\Phi = 0$ during the peace and is positive during the war. The equation (4.2) can be expressed in terms of growth rates by rewriting it as

$$K_t^s - K_t - \Phi = \left(\frac{S_{t+1}^s}{S_t^s} - 1\right) S_t^s + \left(\frac{K_{t+1}^g}{K_t^g} - 1\right) K_t^g, \tag{4.3}$$

and defining the growth rate of specie supply as

$$z_t = \frac{S^s_{t+1}}{S^s_t} \tag{4.4}$$

and the rate of monetary expansion proportional to monetary gold as

$$x_t = \frac{K^g_{t+1}}{K^g_t}. \tag{4.5}$$

Finally, if (4.1) is written in terms of K^g_t and substituted to (4.3), the constraint (ignoring Φ) can be expressed as

$$Q\left(K^s - K_t\right) = Q\left(z_t - 1\right) S^s_t + \left(x_t - 1\right) \eta_t M^s_t. \tag{4.6}$$

I assume that $z_t \in [1, \bar{z})$ and $x_t \in (0, \bar{x})$. The lowest bound of x_t indicates that the monetary gold stock is zero. A law restricts smelting of coins back to consumable form, and therefore the lowest bound of the specie growth rate equals one[5]. The upper bound of both z_t and x_t equals $1 + QK^s_t$, which implies that private gold consumption K_t approaches zero and the household converts almost all its gold endowment to paper currency. Note that as gold in consumable form is assumed to depreciate fully between periods and gold coins cannot be smelted to consumable form, the household is not able to prepare for war by hoarding gold.

[5]As seen in Chapter 2, these laws were common during the Pre-classical Gold Standard. (In fact, smelting coins is still illegal in the UK.)

Production and Financial Intermediation The representative firm uses labour L_t it hires from the household to produce current output via its production technology $f(L_t)$. Since the firm does not have access to the gold endowment, the firm faces a cash constraint in that it starts period t without any cash or credit holdings and it has to borrow in order to be able to pay for its workers. The second potential source for paper money growth is the loan or discount the central bank gives to the firm to finance the current wage bill. The firm produces, pays for its workers, sells the output to the household on demand for consumption on a cash basis, and after receiving its revenue, the firm pays the principal and the interest on its discount to the central bank. A usury law is assumed to restrict the fixed discount rate $\bar{R} \geq 1$. In this simple model the central bank destroys its interest yield and does not transfer dividends to the household at the end of period t. The discount is defined by the value of existing monetary gold stock and a lump-sum monetary transfer from the central bank to the firm

$$W_t L_t \leq \frac{d_t}{\eta_t} Q K^g_{t+1}, \tag{4.7}$$

where d_t is the discretionary paper money growth rate. The total money supply of the economy at period $t+1$ can be defined as

$$M^T_{t+1} = g_t M^T_t, \tag{4.8}$$

where g_t is the net growth rate of money, and M^T_{t+1} can be divided into two components, specie and paper currency,

$$M^T_{t+1} = S^s_{t+1} + M^s_{t+1}, \tag{4.9}$$

where the growth rate of specie supply is defined as

$$S^s_{t+1} = z_t S^s_t \tag{4.10}$$

and the gross growth rate of the economy's *paper* money supply as

$$M^s_{t+1} = d_t x_t M^s_t. \tag{4.11}$$

The discretionary money growth rate is denoted by d_t and, as defined above, x_t is the money growth rate proportional to the growth in monetary gold. The discretionary money growth rate is the inverse of the growth rate of the gold reserve ratio[6]

$$d_t = \frac{\eta_t}{\eta_{t+1}}. \tag{4.12}$$

The higher d_t, the lower the proportion of the circulating paper money stock that is backed by gold. I assume d_t to be bounded above by printing and storage constraint $\bar{d}$, which is assumed to be higher than the upper bound of x_t or z_t. As

[6]To see that (4.11) is just an alternative way to define (4.1), write (4.11) using (4.12) and (4.5) to yield $M^s_{t+1} = d_t x_t M^s_t = \frac{\eta_t}{\eta_{t+1}} \frac{K^g_{t+1}}{K^g_t} \frac{QK^g_t}{\eta_t} = \frac{QK^g_{t+1}}{\eta_{t+1}}$.

stressed by Barro (1979), the real economy restricts gold supply, and therefore, $\bar{x}$ and $\bar{z}$, but the upper bound of paper money supply $\bar{d}$ can be taken to be arbitrarily large, i.e. $d_t \in \left(0, \bar{d}\right]$ for all $t = 0, 1, ...,$ and $\bar{x} < \bar{d} < \infty$.

The firm hires labour supplied by the household and the production takes place during the goods exchange. The firm takes its price from the market, its wage from the contract and maximises profits. The household supplies whatever labour the firm demands. The profit function of the firm becomes

$$\Pi_t^f = P_t Y_t - \bar{R} W_t L_t. \tag{4.13}$$

At the end of the period the firm returns all profits to the household. The firm's production function is

$$Y_t = f\left(L_t\right) = A L_t^{\gamma} \tag{4.14}$$

where A is the fixed stock of capital, L_t is labour demand at period t, $0 < \gamma < 1$, and therefore $f\left(L_t\right)$ is a strictly concave function. In equilibrium the real wage bill of the firm must be equal to the marginal demand for labour

$$\frac{\bar{R} W_t}{P_t} = f'\left(L_t\right). \tag{4.15}$$

Now the nominal wage rigidities[7] are introduced into the model by assuming that the firm and the household agree on wages that are set in advance for a

[7]This part of the model is inspired by Canzoneri and Dellas (1998).

period, before the period's gold endowment is realised.[8] Although the nominal wage is chosen before the state of the world is known, it is set at a level that is expected to produce the real wage which equates labour supply and labour demand and clears the goods market. The wage setting follows an exogenous process: if the current state is peace, the wage setters anticipate the following state to be peace and vice versa. To define the wage, the notional labour supply is set at one, although the actual labour supply and demand may differ from this. The contract wage for period t is

$$W_t = \frac{\Omega_t}{\bar{R}} f'(1) = \frac{\Omega_t \gamma A}{\bar{R}} \tag{4.16}$$

where Ω_t is the expected value of P_t before the gold endowment is known or the production started. If (4.16) is substituted back into (4.15) and the functional form (4.14) is used, the labour demand of the representative firm can be written as

$$L_t = \left(\frac{P_t}{\Omega_t} \right)^{\frac{1}{1-\gamma}}. \tag{4.17}$$

If (4.17) is substituted to (4.14) one obtains

$$Y_t = AL_t^{\gamma} = A \left(\frac{P_t}{\Omega_t} \right)^{\frac{\gamma}{1-\gamma}}. \tag{4.18}$$

[8] According to the historical evidence presented in Chapter 3, nominal wages were rigid in the eighteenth and nineteenth centuries.

Respectively, the real wage bill of the firm becomes

$$\frac{W_t}{P_t}L_t = \frac{\gamma A}{\bar{R}}\left(\frac{P_t}{\Omega_t}\right)^{\frac{\gamma}{1-\gamma}} \tag{4.19}$$

and the profits become

$$\Pi_t^f = (1-\gamma)\, A\Omega_t^{\frac{\gamma}{\gamma-1}} P_t^{\frac{1}{1-\gamma}}. \tag{4.20}$$

At the beginning of period t when the nominal wage is set, the wage will reflect expectations of the price level. Any unanticipated changes in the price level, whether due to a war or something else, will cause a difference between the expected and actual price level. The firm determines labour demand based on the real wage that is realised after the gold endowment. If the price level increases unexpectedly, the real wage bill of the firm decreases and the employment (4.17) increases to clear the labour market.

The Representative Household From the household's point of view each period is subdivided into two parts: the exchange with the central bank and the exchange with the firm. The household trades bonds and gold with the central bank and labour and goods with the firm. The minting process is exogenous, but subject to a minting fee, *brassage*.

The household enters period t with predetermined nominal money M_t and depreciated specie worth $Q\delta S_t$, where $\delta \in (0,1)$ is the fixed depreciation rate of specie between period t and $t+1$. The household agrees on the nominal wage with the firm and then the state of the world is realised. If it is peace, the household receives its gold endowment QK_t^s and if war, $K_t^s = 0$. Now the household is in the position to do its gold trading with the central bank, and minting: it chooses how much gold to consume, how much to mint and how much to convert to paper money. If $K_t^s = 0$, the household can convert some of its paper money to gold at the central bank. After minting gold to specie, the household's currency holdings are $M_t + Q\delta S_t + Q(1-\theta)(z_t - 1) S_t^s + (x_t - 1)\eta_t M_t^s$, where $\theta \in (0,1)$ is brassage, the exogenous cost of minting. Next the household's nominal bonds B_t mature, bringing its currency holdings to $M_t + Q\delta S_t + Q(1-\theta)(z_t - 1) S_t^s + (x_t - 1)\eta_t M_t^s + B_t$. Finally, the household receives its labour income $W_t L_t$ and uses some of its cash to purchase new bonds costing the household B_{t+1}/I_t in period t, where $I_t \geq 1$ is the gross nominal interest rate between t and $t+1$. The rest of the currency holdings are transferred to the goods market. The cash-in-advance constraint that restricts household's consumption purchases becomes

$$P_t C_t \leq M_t + Q\delta S_t + Q(1-\theta)(z_t - 1) S_t^s + (x_t - 1)\eta_t M_t^s + W_t L_t + B_t - \frac{B_{t+1}}{I_t}. \tag{4.21}$$

Since the central bank functions as a financial intermediary, labour income is available for consumption during the same period and enters into the cash-in-advance constraint.

At the end of period t the household receives the cash dividend payment Π_t^f from the firm and carries the rest of the unspent currency into period $t+1$. Hence the household's budget constraint states

$$(4.22)\quad QS_{t+1}+M_{t+1}\leq M_t+Q\delta S_t+B_t+QK^s+W_tL_t+\Pi_t^f-\frac{B_{t+1}}{I_t}-P_tC_t-QK_t.$$

The nominal variables in the cash-in-advance constraint (4.21), budget constraint (4.22), gold endowment constraint (4.6) and in the firm's problem are scaled with the economy's total money supply (4.8) so that $m_t = M_t/M_t^T$, $m_t^s = M_t^s/M_t^T$, $w_t = W_t/M_t^T$, $q = Q/M_t^T$, $b_t = B_t/M_t^T$ and $p_t = P_t/M_t^T$. In the firm's problem, equations (4.16)-(4.20), the scaled expected price level Ω_t is denoted by ω_t. The cash-in-advance constraint becomes

$$(4.23)\quad p_tC_t\leq m_t+q\delta S_t+q\left(1-\theta\right)\left(z_t-1\right)S_t^s+\left(x_t-1\right)\eta_t m^s+w_tL_t+b_t-\frac{g_tb_{t+1}}{I_t},$$

the budget constraint becomes

$$(4.24)\quad g_t\left(m_{t+1}+qS_{t+1}\right)\leq m_t+q\delta S_t+b_t+qK^s+w_tL_t+\pi_t^f-\frac{g_tb_{t+1}}{I_t}-p_tC_t-qK_t$$

and the gold endowment constraint becomes

$$(4.25)\qquad q\left(K^s-K_t\right)=q\left(z_t-1\right)S_t^s+\left(x_t-1\right)\eta_t m_t^s.$$

The household chooses, given the gold endowment K_t^s, the amount of gold it mints and consumes before the firm sets its labour demand for that period. The central bank and firm have to accept whatever z_t and x_t the household chooses.

The household's preferences are given by the value of discounted utility per period,

$$\sum_{t=0}^{\infty} \beta^t E_t U\left(C_t, K_t\right), \tag{4.26}$$

where $0 < \beta < 1$, $E_t\left(\cdot\right)$ is the expectations operator and the utility function satisfies: $\lim_{C\to\infty} U_C = \lim_{K\to\infty} U_K = 0$, $\lim_{C\to 0} U_C = \lim_{K\to 0} U_K = \infty$ and $U_{C,K} = U_{K,C} = 0$.

As in Carlstrom and Fuerst (1995) there are four markets present in this economy: the goods market, labour market, credit market and money market which in the gold standard setup is synonymous with the gold market. The private agents' problem must satisfy the market clearing conditions

$$C_t = f(L_t) \tag{4.27}$$

$$S_0 = 1 \tag{4.28}$$

$$S_t^s = S_t \tag{4.29}$$

$$M_0 = 1 \tag{4.30}$$

$$M_t^s = M_t \tag{4.31}$$

$$q(K^s - K_t) = q(z_t - 1) S_t^s + (x_t - 1)\eta_t m_t^s \tag{4.32}$$

$$b_t = b_{t+1} = 0 \tag{4.33}$$

for all $t = 0, 1, 2....$ By rewriting normalised (4.1) for K_t^g and substituting it together with (4.12) into (4.7) the wage constraint can be written in equilibrium as

$$w_t L_t \leq d_t x_t m_t^s. \tag{4.34}$$

Like in Chari and Kehoe (1990), the private agents' behaviour can be summarised by allocations (π, ψ) and allocation rules (Π, Ψ). For each period t let $\psi_t = (\psi_{1,t}, \psi_{2,t})$ be the household's allocations for the first and second stages of period t, where $\psi_{1,t} = (K_t, S_{t+1}, S_t^s)$ and $\psi_{2,t} = (C_t, m_{t+1}, m_t^s, b_{t+1})$. Let $\psi = (\psi_0, \psi_1, ...)$ denote an infinite sequence of such allocations. The firm's allocation for period t is $\pi_t = (L_t)$ and $\pi = (\pi_0, \pi_1, ...)$ denotes the infinite sequence of the firm's allocations.

Formally a policy of the central bank is a sequence $d = \{d_0, d_1...\}$ of the discretionary money growth rates where $d_t \in \left(0, \bar{d}\right]$. Allocation rules are the sequences of functions $\Psi = (\Psi_0, \Psi_1, ...)$ and $\Pi = (\Pi_0, \Pi_1, ...)$ that map policies into sequences of allocations: the household's allocation rule $\Psi(d)$ specifies the setting of $\psi_t = (K_t, S_{t+1}, C_t, m_{t+1}, b_{t+1})$, and the firm's allocation rule $\Pi(d)$ specifies the setting of $\pi_t = L_t$ for each possible $d_0, d_1, ...$ Much of the rest of the chapter, however, will be about trying to characterise these sequences and mappings in good and bad states, taking credibility as given and policies and allocations are analysed in Chapter 5.

The household's problem is to choose $C_t, K_t,\ S_{t+1},\ S_t^s,\ m_{t+1},\ m_t^s$ and b_{t+1} to maximise (4.26) subject to (4.23) and (4.24) and taking also the endowment constraint (4.25) into account. The Lagrangian for the household problem is

(4.35)

$$\begin{aligned}
\mathcal{L} &= E_t \sum_{t=0}^{\infty} \beta^t \{U(C_t, K_t) \\
&\quad + \lambda_t \left[m_t + q\delta S_t + b_t + qK^s + w_t L_t + \pi_t^f - \frac{g_t b_{t+1}}{I_t} - p_t C_t - qK_t - g_t (m_{t+1} + qS_{t+1}) \right] \\
&\quad + \mu_t \left[m_t + q\delta S_t + q(1-\theta)(z_t - 1) S_t^s + (x_t - 1)\eta_t m_t^s + w_t L_t + b_t - \frac{g_t b_{t+1}}{I_t} - p_t C_t \right] \}
\end{aligned}$$

where λ_t and μ_t are Lagrangian multipliers on the budget and cash-in-advance constraints. The first order conditions are

$$C_t \; : \; U_C(t) = p_t(\lambda_t + \mu_t) \tag{4.36}$$

$$K_t \; : \; U_K(t) = q\lambda_t \tag{4.37}$$

$$m_{t+1} \; : \; g_t\lambda_t = \beta E_t\left(\lambda_{t+1} + \mu_{t+1}\right) \tag{4.38}$$

$$S_{t+1} \; : \; g_t\lambda_t = \beta\delta E_t\left(\lambda_{t+1} + \mu_{t+1}\right) \tag{4.39}$$

$$b_{t+1} \; : \; \frac{g_t}{I_t}(\lambda_t + \mu_t) = \beta E_t\left(\lambda_{t+1} + \mu_{t+1}\right) \tag{4.40}$$

$$\lim_{t\to\infty} \beta^t (\lambda_t + \mu_t) m_t = 0 \tag{4.41}$$

$$\lim_{t\to\infty} \beta^t \{\delta(\lambda_t + \mu_t) s_t\} = 0 \tag{4.42}$$

Using market clearing conditions (4.27)-(4.33) and (4.34), the cash-in-advance constraint (4.23) can be expressed as

$$p_tC_t = m_t + q\delta S_t + q(1-\theta)(z_t - 1)S_t - \eta_t + (\eta_t + d_t)x_tm_t. \tag{4.43}$$

In equilibrium $Y_t = C_t$ and by substituting (4.18) into (4.43), the condition for the price level becomes

$$p_t = A^{\gamma-1}\omega_t^{\gamma}\{m_t + [\delta + (1-\theta)(z_t - 1)]qS_t - \eta_t + (\eta_t + d_t)x_tm_t\}^{1-\gamma} \tag{4.44}$$

and solving this for the consumption gives

$$C_t = A^{1-\gamma} \omega_t^{-\gamma} \left\{ m_t + \left[\delta + (1-\theta)(z_t - 1) \right] q S_t - \eta_t + (\eta_t + d_t) x_t m_t \right\}^{\gamma} . \tag{4.45}$$

If wages are set at the start of each period and are unresponsive to developments within the period, money – whether specie or paper currency – has an immediate effect on the level of output. If d_t, x_t or z_t increase, from (4.44), the price level rises. The actual price level is now above the expected price level. From (4.19) the firm's real wage bill reduces, which, through (4.17), increases labour demand, production, profits and consumption. The central bank has an obvious time inconsistency problem in this economy as by increasing the paper money supply it can stimulate the economy. However, as in Barro and Gordon (1983a) in equilibrium this is not possible because the household and firm adjust their expectations and the inflation becomes inefficiently high without having any short or long-run benefits.

In this model the gold standard rule is an exogenous monetary policy rule, not an outcome of an optimisation problem. Although the gold standard is a credible monetary policy rule, policy under the gold standard does not directly compare with an optimal policy under commitment, called the *Ramsey policy* analysed by Chari and Kehoe (1990), Stokey (1989), Ireland (1997) and Chang (1998a). Within the above definitions and initial solutions of the firm and household's problems in hand, we turn to consider the economy under two possible states of the world: the time of peace, when the commitment technology – the perfect gold standard – is available, and the time of war, when the gold standard becomes dysfunctional.

4.3. The Well Established Gold Standard

Consider an environment where the central bank commits to the exogenous gold standard rule at the beginning of time. In particular, the starting point is the null history at date 0 when the state of the world is peace and the central bank sets the discretionary money growth rate d_t equal to one, which implies that $\eta = 1$ and the whole paper money stock is backed by monetary gold.

In order to simplify the analysis even further I assume that under this perfect gold standard rule the utility maximising household does not mint any new specie and only the gradually depreciating initial stock of specie remains in circulation. Why would the household prefer paper currency over specie? The household is better off in terms of welfare by using paper currency as a medium of exchange, because of the minting cost and depreciation. Furthermore, since law restricts smelting of specie, minted coins cannot be transferred to consumable gold. In the real world there are physical restrictions on how small coins can be minted and used, but similar restrictions do not apply to paper currency, which can be printed in any denominations. Therefore, I assume that the stock of specie becomes arbitrarily small and insignificant in an economic sense when time goes by, and the analysis is carried out under the assumption that $S_t = S_t^s = 0$.

These two assumptions on paper money and specie imply that under the gold standard the total money growth rate (4.8) becomes $M_{t+1}^{T} \equiv M_{t+1}^{s} = x_t M_t^s$. In this perfect gold standard economy the paper currency has an important role: firstly, through the cash-in-advance constraint it facilitates transactions; secondly, through the wage constraint (4.7) it facilitates financial intermediation; and thirdly, by reducing the cost of acquiring money, it increases the representative household's welfare compared to the economy, where specie would be used as a medium of exchange.

The household chooses, given the gold endowment K_t^s, gold consumption and the money growth rate before the firm sets its labour demand for that period. The central bank and firm have to accept whatever money growth rate x_t the household chooses.

Under the gold standard the market clearing conditions become

$$C_t = f(L_t) \tag{4.46}$$

$$M_t = M_t^s \tag{4.47}$$

$$M_0 = 1 \tag{4.48}$$

$$K_t^s - K_t = \frac{(x_t - 1)}{q} \tag{4.49}$$

$$b_t = b_{t+1} = 0 \tag{4.50}$$

for all $t = 0, 1, 2....$ In terms of scaled nominal variables, the household's cash-in-advance and budget constraints under the gold standard become

$$p_t C_t \leq m_t + (x_t - 1) + w_t L_t + b_t - \frac{x_t b_{t+1}}{I_t}, \tag{4.51}$$

and

$$x_t m_{t+1} + \frac{x_t b_{t+1}}{I_t} \leq m_t + b_t + qK^s + w_t L_t + \pi_t^f - p_t C_t - qK_t. \tag{4.52}$$

The outcome under the commodity standard describes the sequences of equilibrium prices and quantities that are obtained when the central bank manages gold convertibility and the private agents respond to the stochastic, exogenous gold flow by maximising utility and profits. The Lagrangian for the household problem is

(4.53)

$$\begin{aligned} \mathcal{L} \quad = \quad & E_t \sum_{t=0}^{\infty} \beta^t \left[U \left(C_t, K_t \right) \right] \\ & + \lambda_t \left[m_t + b_t + qK^s + w_t L_t + \pi_t^f - x_t m_{t+1} - \frac{x_t b_{t+1}}{I_t} - p_t C_t - qK_t \right] \\ & + \mu_t \left[m_t + (x_t - 1) + w_t L_t + b_t - \frac{x_t b_{t+1}}{I_t} - p_t C_t \right]. \end{aligned}$$

The first order conditions are

$$C_t \quad : \quad U_C(t) = p_t(\lambda_t + \mu_t) \tag{4.54}$$

$$K_t \quad : \quad U_K(t) = q\lambda_t \tag{4.55}$$

$$m_{t+1} \quad : \quad x_t\lambda_t = \beta E_t\left(\lambda_{t+1} + \mu_{t+1}\right) \tag{4.56}$$

$$b_{t+1} \quad : \quad \frac{x_t}{I_t}(\lambda_t + \mu_t) = \beta E_t\left(\lambda_{t+1} + \mu_{t+1}\right) \tag{4.57}$$

$$\lim_{t\to\infty} \beta^t E_{t-1}(\lambda_t + \mu_t) m_t = 0 \tag{4.58}$$

where λ_t and μ_t are the Lagrangian multipliers for the period t budget and cash-in-advance constraints respectively. I assume that the central bank does not purchase any goods. In equilibrium $Y_t = C_t$, $b_t = b_{t+1} = 0$ and (4.47) implies $m_t = 1$. The wage constraint (4.34) reduces to

$$w_t L_t = x_t. \tag{4.59}$$

If the equilibrium conditions (4.47), (4.48), (4.50) and (4.59) are substituted into the cash-in-advance constraint (4.23), one obtains

$$p_t C_t = 2x_t. \tag{4.60}$$

Production and labour demand are defined as in (4.13)-(4.20).

In this economy consumption good C_t is a cash good, but gold is an endowment good. The household can either consume gold or convert it into currency in order to buy its consumption good, but gold does not directly buy the consumption good. The marginal rate of substitution of consumption for gold equals

$$\frac{U_C(t)}{U_K(t)} = \frac{p_t}{q}\left(1 + \frac{\mu_t}{\lambda_t}\right). \tag{4.61}$$

If the shadow marginal utility of money $\mu_t = 0$, lumps of gold could be used to buy the consumption good and the marginal rate of substitution between consumption and gold would equal their relative price p_t/q.

Using (4.54), (4.56) and (4.57), the value of the liquidity services becomes

$$\mu_t = \frac{U_C(t)}{p_t}\left(1 - \frac{1}{I_t}\right). \tag{4.62}$$

As in cash-in-advance models proposed by Svensson (1985) and Walsh (2003), μ is positive as long as the nominal interest rate $I_t > 1$. In steady state this implies that $x > \beta$.

Proposition 4.1 *The household's decision over K_t determines the lower and upper bounds on money growth and ensures existence of the finite monetary equilibrium. Under the gold standard rule $x_t \in (\beta, 1 + qK^s)$ for all $t = 0, 1, 2, ...$*

Proof: The lower bound on the money growth ensures that $\mu > 0$ and $I > 1$ in steady state. The upper bound is derived from the gold endowment constraint (4.25) where $S^s = 0$, and first order conditions: If K_t approaches zero, from (4.25)

x_t approaches $(1+qK^s)$. By substituting (4.54) and (4.56) into (4.55) the marginal utility of the private gold becomes

$$U_K\left(t\right) = qx_t^{-1}\beta E_t\left[\frac{U_C\left(t+1\right)}{p_{t+1}}\right]. \tag{4.63}$$

Let the utility function take a constant relative risk aversion form

$$E_t\sum_{t=0}^{\infty}\beta^t\left[\frac{C_t^{\alpha}+\rho K_t^{\alpha}}{\alpha}\right], \tag{4.64}$$

where α is the coefficient of relative risk aversion and $0<\alpha<1$. By substituting (4.64) into the marginal gold demand (4.63) we get

$$\rho K_t^{\alpha-1} = x_t^{-1}q\beta E_t\left[\frac{C_{t+1}^{\alpha-1}}{p_{t+1}}\right], \tag{4.65}$$

which implies that as $\alpha<1$, $K_t>0$ for all t. If K_t approaches zero, from (4.49) it can be seen that x_t approaches qK_t^s+1. ■

Proposition 4.2 *Under the gold standard the price level and consumption are bounded.*

Proof: In equilibrium (4.46) implies

$$C_t = A\left(\frac{p_t}{\omega_t}\right)^{\frac{\gamma}{1-\gamma}}. \tag{4.66}$$

Substituting (4.66) and normalised (4.18) into (4.60) gives a relation between the price level and the money growth rate

$$p_t A \left(\frac{p_t}{\omega_t}\right)^{\frac{\gamma}{1-\gamma}} = 2x_t. \tag{4.67}$$

Solving this for p_t gives

$$p_t = A^{\gamma-1}\omega_t^{\gamma}\left(2x_t\right)^{1-\gamma} \tag{4.68}$$

and substituting (4.68) into (4.69) gives

$$C_t = A^{1-\gamma}\omega_t^{-\gamma}\left(2x_t\right)^{\gamma}. \tag{4.69}$$

As $x_t \in \left(\beta, 1+qK^s\right),$ p_t and C_t are bounded. If x_t approaches β, the household consumes its whole gold endowment and converts some paper money into gold at the central bank. Thus the price level approaches its lowest bound

$$\underline{p} = A^{\gamma-1}\omega_t^{\gamma}\left(2\beta\right)^{1-\gamma}. \tag{4.70}$$

If x_t approaches to $\left(qK^s+1\right)$, the household only consumes an arbitrarily small amount of gold and the price level approaches its upper bound

$$\overline{p} = A^{1-\gamma}\omega_t^{-\gamma}\left[2\left(qK^s+1\right)\right]^{1-\gamma}. \tag{4.71}$$

Thus under the well functioning gold standard the price level satisfies $p_t \in \left(\underline{p}, \overline{p}\right)$. The bounds on consumption can be found respectively. The lowest bound of consumption becomes

$$\underline{C} = A^{1-\gamma}\omega_t^{-\gamma}\left(2\beta\right)^{\gamma} \tag{4.72}$$

and upper bound becomes

$$\overline{C} = A^{1-\gamma}\omega_t^{-\gamma}\left[2\left(qK^s+1\right)\right]^{\gamma}. \tag{4.73}$$

Thus under the well established gold standard consumption satisfies $C_t \in \left(\underline{C}, \overline{C}\right)$.■

How are the nominal and real interest rates defined under this well established gold standard set up? From the first order condition (4.57) the nominal yield on government bonds is

$$I_t^{-1} = x_t^{-1}\beta E_t\left(\frac{\lambda_{t+1}+\mu_{t+1}}{\lambda_t+\mu_t}\right) \tag{4.74}$$

which, by using (4.54), can be written as

$$I_t^{-1} = x_t^{-1}\beta E_t\left[\frac{U_C\left(t+1\right)}{U_C\left(t\right)}\frac{p_t}{p_{t+1}}\right]. \tag{4.75}$$

The ex-ante real rate of interest is defined as

$$R_t = I_t E_t\left(\frac{p_t}{p_{t+1}}\right). \tag{4.76}$$

Using (4.75) the real rate of interest can be written as

$$
\begin{aligned}
(4.77) \qquad R_t^{-1} &= x_t^{-1}\beta E_t\left[\frac{U_C\left(t+1\right)}{U_C\left(t\right)}\frac{p_t}{p_{t+1}}\right]/E_t\left(\frac{p_t}{p_{t+1}}\right) \\
&= R_{ft}^{-1}+\frac{cov_t\left[\frac{U_C(t+1)}{U_C(t)},\frac{p_t}{p_{t+1}}\right]}{E_t\left(\frac{p_t}{p_{t+1}}\right)}.
\end{aligned}
$$

Following Canzoneri and Dellas (1998) the ex-ante real interest rate can be decomposed into the risk-free rate and the risk premium where $R_{ft}^{-1}=x_t^{-1}\beta E_t\left[\frac{U_C(t+1)}{U_C(t)}\right]$ is the risk-free rate and the right hand side covariance term defines the risk premium, the expected return on bonds above the risk-free rate. Under the gold standard prices move pro-cyclically in the sense that the realised return on bonds is high when the gold endowment is small and low when the gold endowment is large. Positive shock to gold supply leads to a negative risk premium. Then the risk-free rate becomes

$$
(4.78) \qquad R_{ft}^{-1}=x_t^{-1}\beta E_t\left[\left(\frac{C_{t+1}}{C_t}\right)^{\alpha-1}\right]
$$

thus an increase in the expected gross growth rate of consumption, C_{t+1}/C_t, increases the risk free interest rate.

Proposition 4.3 *The nominal and real interest rates are bounded under the well established gold standard.*

Proof: If (4.68), (4.69) and the functional form of the utility function is substituted to (4.75), the nominal interest rate becomes

$$I_t^{-1} = x_t^{-\alpha\gamma} \beta E_t \left(x_{t+1}^{\gamma\alpha - 1} \right). \tag{4.79}$$

As $0 < \alpha\gamma < 1$ the nominal interest rate increases when the money growth rate in period t or the expected money growth rate increases. However, as the current and the expected money growth rates are bounded under the well established gold standard, the fluctuations in the nominal interest rate are also bounded. The nominal interest rate reaches its lowest bound 1 if both the current and the expected money growth rate are expected to be β. The nominal interest rate approaches its highest bound if the money growth rate is expected to be high in the future but low now. Thus

$$I_t \in \left(1, \left(\frac{1 + qK^s}{\beta} \right)^{1 - \alpha\gamma} \right). \tag{4.80}$$

If we now substitute (4.69) into (4.78), we get that

$$R_{ft} = \frac{1}{\beta} x_t^{1 + \gamma(\alpha - 1)} \frac{1}{E_t \left(x_{t+1}^{\gamma(\alpha - 1)} \right)}, \tag{4.81}$$

thus expected future increase in money growth increases the risk free interest rate. The real interest rate under the gold standard becomes

$$R_t = \frac{1}{\beta} x_t^{1 + \gamma(\alpha - 1)} \frac{E_t \left(x_{t+1}^{\gamma - 1} \right)}{E_t \left(x_{t+1}^{\gamma\alpha - 1} \right)}. \tag{4.82}$$

The real rate of interest increases if the money growth rate in period t increases or if the expected increase in future money growth rate increases, but again as the money growth rate is bounded, so the real interest rate is bounded:

$$R_t \in \left(1, \left(\frac{1+qK^s}{\beta}\right)^{\gamma(1-\alpha)}\right). \blacksquare$$

The interest rate risk under the gold standard is solely dependent on the risk related to the stochastic nature of the gold endowment. It is not related to government policies or labour market conditions. Interest rate targeting or money stock targeting are not feasible policies under the gold standard.

If the nominal wages are fixed for a period, money has an immediate effect on the level of output. From equation (4.69) the positive gold endowment shock increases the gold available for conversion. The money growth rate x_t increases. Now the household is able to increase its consumption purchases, which increases prices and decreases the real wage below the expected level. The firm's wage bill reduces that in turn increases labour demand and production.

The important outcome of the gold standard rule is the way in which it solves the discretionary problem which arises from the fixed wage structure. Although the gold standard does not eliminate the link between money and output, it does prevent the central bank from exploiting it by printing paper money unexpectedly. The gold standard rule makes most monetary policy procedures, such as money targeting, dysfunctional. The role of the central bank is passive in conducting the monetary policy, it simply facilitates the convertibility and provides printing services.

Another outcome of the gold standard is that as the money growth rate x is bounded through the gold endowment, the price level and consumption become bounded. Under the well established gold standard, market activity never 'disappears' as the private consumption is always positive even when the growth rate in money stock might equal one. Nevertheless, the gold standard does not eliminate the variance of private consumption, or the periods of disinflation, but as $x > \beta$ (given that β is close to one) the economy does not experience serious deflationary pressure.

One could ask, however, what would happen if the endowment K_t^s became arbitrarily large. The answer is that in such an event the monetary constitution would have to adjust as gold would not fulfil the requirements for a suitable backing commodity any more. Any commodity standard must be established on a commodity that is rare, durable and easy to identify.

4.4. The Suspension of the Convertibility Rule

4.4.1. The Regime Switch in the Bad State of the World

The exogenous switch between the states always occurs after firms and households have set wages. All agents observe that the gold endowment is zero. A bad state, a war or some natural disaster, can last for several periods, but is not known to last forever, and therefore, neither is the stoppage on the gold endowment permanent. During the bad state the household's demand for gold increases above its peace-time level K_t by Φ. The absolute amount of additional gold demanded is not important for this model, but its effects are: in particular, x_t is no longer well defined by β and the gold endowment as under the perfect gold standard. By (4.68) the price level falls and the expected price level ω is now above the actual price level. The real wage bill of the firm, defined by (4.19), increases which forces the firm to cut employment and production. By constraint (4.59) any gold conversion reduces the reserves on which the firm can borrow. Finally, from the cash-in-advance constraint (4.60), a fall in money holdings reduces private consumption and the nominal interest rate is unity, $I_t = 1$.

Following the gold standard rule in the bad state clashes with the central bank's policy objective to stabilise the economy. Gold conversion imposes deflationary pressure on the economy, which would be especially undesirable in the bad state, such as in the war time emergency, since private consumption is already low. The central bank is left with two options: either to follow the gold standard rule or change the monetary constitution of the country. What are the alternative monetary regimes to the gold standard? Firstly, given that in this model the private agents only value claims that can be converted to gold as money, the fiat regime would not be feasible. But even if fiat money was acceptable, the outcome might not be desirable, because in this sticky wage framework the government would have a temptation to increase employment and production by increasing the money growth rate. The behaviour of the money stock and price level would be incorporated into expectations and the nominal wage set at the beginning of the periods would adjust fully. Under the fiat standard the total money growth rate is defined by $M_{t+1}^s = d_t M_t^s$ where the upper bound of discretionary money growth rate $\bar{d}$ is arbitrary large. Ireland (1997) has shown that even though the central bank would be able to commit to a sustainable money growth rate, any deviation from the rate would cause the economy to revert immediately to the worst possible hyper-inflation equilibrium. The fiat money system, therefore, does not necessarily offer a solution in this particular framework.

Instead of abandoning the gold standard rule completely, the central bank, with a simple action such as closing its doors and refraining from converting any gold during the crisis, could prevent the deflationary pressure. The suspension of the convertibility rule implies that paper notes are not convertible to gold immediately, but at some future point after the crisis has passed. The gold standard will be resumed at the old par value Q. During the suspension the value of the household's paper currency is not defined by the immediate conversion to gold, but by the credibility of the central bank's promise to convert the currency in the future. If the household did not consider this promise to be credible, the circulating paper currency would lose its value immediately. In this chapter, in contrast to chapter 5, suspension is assumed to be exogenously credible.

If the gold standard rule were suspended, could the economy switch to the commodity money regime where only gold coins would be used as a medium of exchange? The expectations in the commodity money regime would not be influenced by the credibility problem, because coins have intrinsic value. In this particular framework, however, gold coins could not start circulating at the beginning of the bad state, since the household is assumed not to have a precautionary incentive to hold gold specie. The household is not able to mint any gold when it realises that $K^s = 0$ as it does not have access to gold.

4.4.2. The Stoppage Periods

As illustrated by the historical evidence, suspension consists of two stages, stoppage and adjustment periods. The former covers the bad state, war, and the latter starts when the good state, peace, re-emerges, and lasts until the resumption of the gold standard is feasible. During both stages the gold standard rule does not fully apply. In what follows I assume that period $t + N$ is the last gold standard period and period $t + N + 1 = \tau$ is the first period of suspension. Periods between τ and $\tau + j - 1$ are the stoppage periods when the gold endowment is zero, and periods between $\tau + j$ and $\tau + S$ are the adjustment periods when the gold flow is again positive. Period $\tau + S + 1$ is the first period of gold standard after resumption.

The sequence of events during the stoppage periods is as follows. The household enters period $\tau + i$, where $i = 0, ..., j - 1$, with predetermined money $M_{\tau+i}$, whilst the value of existing monetary gold $QK^g_{\tau+i}$ is proportional to the money stock only if it is the first stoppage period ($i = 0$), and smaller than $M_{\tau+i}$ in subsequent periods. Next, the representative household and the firm set the nominal wage, defined by (4.16). Then both the central bank and the private agents observe that $K^s_{\tau+i} = 0$. If it is the first time, the central bank closes its doors and announces its policy plan to convert paper currency to gold at the old par value at some future unknown point, otherwise the central bank simply does not convert any currency to gold. Then the household's bonds mature, it receives its labour income $w_{\tau+i}L_{\tau+i}$ and uses some of its cash to purchase new bonds. The rest is carried to the goods market. The cash-in-advance constraint for the first and subsequent stoppage periods is parallel to (4.60) where $x_{\tau+i}$ is set to one.

$$p_{\tau+i}C_{\tau+i} \leq m_{\tau+i} + w_{\tau+i}L_{\tau+i} + b_{\tau+i} - \frac{b_{\tau+i+1}}{I_{\tau+i}} \tag{4.83}$$

where $i = 0, ..., j-1$. The household's budget constraint in the absence of gold flow reduces to

$$\begin{aligned} p_{\tau+i}C_{\tau+i} \quad \leq \quad & w_{\tau+i}L_{\tau+i} + \pi^f_{\tau+i} \\ & -m_{\tau+i+1} + m_{\tau+i} + b_{\tau+i} - \frac{b_{\tau+i+1}}{I_{\tau+i}}, \end{aligned} \tag{4.84}$$

where $i = 0, ..., j-1$.

An important element of the suspension is the way in which it does not just remove the restriction from money market, but also the restriction from the credit market. The suspension abolishes the tie between discounts and monetary gold, namely (4.59). The central bank is now able to increase the value of the discount above the value of the monetary gold stock. As $x = 1$, the wage constraint (4.59) during the stoppage periods becomes

$$w_{\tau+i}L_{\tau+i} \leq d_{\tau+i}, \tag{4.85}$$

where $i = 0, ..., j-1$ and $d_{\tau+i}$ is the rate of money expansion – the central bank's money injection. During the stoppage periods money supply is defined as

$$M^s_{\tau+i+1} = d_{\tau+i}M_{\tau+i} \text{ for } i = 0, ..., j-1. \tag{4.86}$$

If net bonds are assumed to be zero during the stoppage periods, the cash-in-advance constraint (4.83) can be written as

$$p_{\tau+i}C_{\tau+i} = 1 + d_{\tau+i}. \tag{4.87}$$

The wage and production levels are defined as in (4.16)-(4.19). By using the equilibrium condition $C_{\tau+i} = Y_{\tau+i}$ and substituting (4.18) into (4.87) the price level in the stoppage periods becomes

$$p_{\tau+i} = A^{\gamma-1}\omega_t^{\gamma}\left(1 + d_{\tau+i}\right)^{1-\gamma} \tag{4.88}$$

and consumption

$$C_{\tau+i} = A^{1-\gamma}\omega_t^{-\gamma}\left(1 + d_{\tau+i}\right)^{\gamma}. \tag{4.89}$$

During the stoppage periods, by (4.88) and (4.89), the price level and consumption are solely determined by the central bank's discretionary policy – monetary injection $d_{\tau+i}$. The price level and consumption are bounded upwards only by the arbitrarily large printing limit $\bar{d}$. According to (4.89), during the stoppage period the central bank has an opportunity to increase money growth rate in order to stimulate consumption virtually at will.

4.4.3. The Adjustment Periods

If the stoppage in gold flow lasts between periods τ and $\tau + j - 1$, where $j \geq 1$, period $\tau + j$ is the period when the gold flow resumes and the adjustment back to the gold standard begins. I assume that the gold flow returns to the pre-suspension level.

The sequence of events during the adjustment period is as follows. The household enters period $\tau + i$ where $i = j, ..., S$ with predetermined money $M_{\tau+i}$, whilst the value of existing monetary gold $QK^g_{\tau+i}$ is smaller than $M_{\tau+i}$. Next, the representative household and the firm set the nominal wage, defined again by (4.16), and then all agents observe that $K^s_{\tau+i}$ is positive. The household makes a decision over the private gold consumption $K_{\tau+i}$. The rest can be deposited at the central bank in a similar manner as during the gold standard, but the household is not able to withdraw any gold. Given that the doors of the bank stay closed for the notes-to-gold conversion, the willingness of the household to deposit gold might not seem realistic, but according to the historical evidence presented in Chapter 3, the public was indifferent between gold and paper currency during the Suspension Period, because the resumption was credible. Then the household's bonds mature, it receives its labour income and uses some of its cash to purchase new bonds. The rest is carried to the goods market. The cash-in-advance constraint for the first and subsequent adjustment periods is

$$p_{\tau+i}C_{\tau+i} \leq m_{\tau+i} + (x_{\tau+i} - 1)\,\eta_{\tau+i} + w_{\tau+i}L_{\tau+i} + b_{\tau+i} - \frac{b_{\tau+i+1}}{I_{\tau+i}}. \tag{4.90}$$

where $i = j, ..., S$ and the wage bill under the adjustment is

$$w_{\tau+i}L_{\tau+i} = d_{\tau+i}x_{\tau+i}.$$

If (4.16) and the equilibrium condition $b_{t+i} = b_{t+i+1} = 0$ are substituted into normalised (4.90), we get that

$$p_{\tau+i}C_{\tau+i} = 1 + (x_{\tau+i} - 1)\,\eta_{\tau+i} + d_{\tau+i}x_{\tau+i} \tag{4.91}$$

for $i = j, ..., S$. Substituting (4.14) into this expression, the price level and consumption during the adjustment periods are given by

$$p_{\tau+i} = A^{\gamma-1}\omega_t^{\gamma}\left[1 - \eta_{\tau+i} + \left(\eta_{\tau+i} + d_{\tau+i}\right)x_{\tau+i}\right]^{1-\gamma} \tag{4.92}$$

and

$$C_{\tau+i} = A^{1-\gamma}\omega_t^{-\gamma}\left[1 - \eta_{\tau+i} + \left(\eta_{\tau+i} + d_{\tau+i}\right)x_{\tau+i}\right]^{\gamma} \tag{4.93}$$

where $i = j, ..., S$. The price level and consumption in the adjustment period depend both on the money growth rate $x_{\tau+i}$ proportional to monetary gold, the discretionary money 'reduction' rate $d_{\tau+i}$ and the gold reserve ration $\eta_{\tau+i}$.

The resumption of the gold standard is not immediately achievable after the gold endowment has resumed, because the circulating money stock exceeds the value of monetary gold and the gold backing is not perfect. Therefore, in the adjustment periods the central bank can still conduct discretionary policy, but now, instead of stimulating the economy with money transfers, the central bank must withdraw paper currency from circulation. The non-scaled net paper money supply in adjustment periods is defined as

$$M^s_{\tau+i+1} = d_{\tau+i} x_{\tau+i} M^s_{\tau+i} \tag{4.94}$$

where $i = j, ..., S$, $d_{\tau+i} \leq 1$ and $x_{\tau+i} \geq 1$.

4.4.4. Terminal Condition

The central bank's optimisation problem, derived in Chapter 5, defines the actual rate by which the fiat money is issued and subsequently withdrawn from circulation, but here the topic is discussed generally. Under the suspension of cash payments it is not a formal conversion rule, but a terminal condition, which restricts the central bank's issue of fiat money. If the gold standard rule is resumed at the beginning of the period $\tau + S + 1$, the policy rule of the central bank states that at the point of resumption the money stock must be proportional to the monetary gold stock

$$M_{\tau+S+1} = QK^g_{\tau+S+1}. \tag{4.95}$$

By substituting the left-hand-side for $x_{\tau+S}d_{\tau+S}M_{\tau+S} = M_{\tau+S+1}$ and rewriting the right-hand-side using

$$K^g_{\tau+i+1} = K^g_{\tau+i} + K^s_{\tau+i} - K_{\tau+i} \tag{4.96}$$

the terminal condition can be written as

$$x_{\tau+S}d_{\tau+S}M_{\tau+S} = QK^g_{\tau+S} + Q\left(K^s_{\tau+S+1} - K_{\tau+S+1}\right). \tag{4.97}$$

If the left hand side of (4.97) is solved recursively backwards until the first period of suspension, and by assuming that the gold flow resumes at period $\tau + j$, (4.97) becomes

$$x_\tau d_\tau ... x_{\tau+S-1}d_{\tau+S-1}x_{\tau+S}d_{\tau+S}M_\tau = QK^g_\tau + Q\sum_{i=j}^{S}\left(K^s_{\tau+i} - K_{\tau+i}\right).$$

If this expression is now normalised with M^s and reorganised, the terminal condition can be written as

$$\left(\prod_{i=0}^{S} d_{\tau+i}x_{\tau+i} - 1\right)m_\tau = q\sum_{i=j}^{S}\left[K^s_{\tau+i} - K_{\tau+i}\right]. \tag{4.98}$$

If the central bank's aim is to resume the perfect gold standard, the terminal condition (4.98) sets the limit for the money growth rate. Although monetary gold must be proportional to the circulating money stock by the point of the resumption, it implies that the central bank is able to issue fiat money during the suspension, but the money growth rate must drop by the point of the resumption since the perfect gold standard rule does not allow any discontinuity. On the practical level, once the gold flow resumes, the central bank must set $d_{\tau+i} \leq 1$ where $i = j, ..., S$ in order to withdraw the fiat money from circulation. In other words, the net growth in money stock must be proportional to the growth in monetary gold during the duration of the suspension period. Therefore

$$\prod_{i=0}^{S} x_{\tau+i} d_{\tau+i} = \prod_{i=0}^{S} x_{\tau+i} \tag{4.99}$$

which implies that

$$\prod_{i=0}^{S} d_{\tau+i} = 1. \tag{4.100}$$

Although fiat money has to be withdrawn from circulation, an opportunity to boost the economy by the fiat money transfers may be desirable, as during a war economic activity is likely to be low in any case. This is exactly what happened during the Suspension Period of 1797-1821. During the war years 1797-1815 the Bank of England created a substantial amount of credit, but when the gold trade resumed after the Battle of Waterloo in 1815, the credit market was constrained and the circulating money stock reduced. This can be seen in Figures 3.3 and 3.7.

By contrast to the historical evidence, the model suggests that the adjustment period does not necessarily result in deflation if the net money growth rate $x_{\tau+i}d_{\tau+i}$ during the adjustment periods is above one, i.e. the household deposits gold at the central bank and simultaneously the Bank constraints discounts. Any potential deflation under the adjustment, nevertheless, lasts only for a limited time. As the deflation reduces private consumption, it is important that the adjustment occurs when the gold has already started to flow into the country.

The central bank could prevent deflation if it just closed the doors of the central bank, but would not issue any fiat money. The benefit of this strategy is that it makes the adjustment period unnecessary and the length of the suspension is parallel to the length of the stoppage in gold flow.

In fiat regime models such as Ireland (1997) and Carlstrom and Fuerst (1995), the government gives the monetary transfer directly to the household. Under the commodity standard set up transfers are injected via firms and not households, because the latter practice would not be feasible. In order to reduce the circulating money stock to match the monetary gold stock in the adjustment period, the government would have to reduce the monetary price of gold Q that would encourage private gold consumption and reduce the paper money available for consumption purchases.

4.4.5. Interest Rates during Suspension

If the gold standard was not suspended, the nominal interest rate would be at its lower bound. Under the suspension of gold convertibility, the nominal interest rate can be written as

$$\text{(4.101)} \qquad \frac{1}{I_{\tau+i}} = (x_{\tau+i}d_{\tau+i})^{-1}\,\beta E_{\tau+i}\left[\frac{U_C(\tau+i+1)}{U_C(\tau+i)}\frac{p_{\tau+i}}{p_{\tau+i+1}}\right] \text{ for } i=0,...,S-1.$$

If we now use the CRRA utility function and use (4.88) and (4.89), the nominal interest rate becomes

$$\text{(4.102)} \qquad \begin{aligned} \frac{1}{I_{\tau+i}} &= (x_{\tau+i}d_{\tau+i})^{-1}\left[1-\eta_{\tau+i}+\left(\eta_{\tau+i}+d_{\tau+i}\right)x_{\tau+i}\right]^{1-\alpha\gamma} \\ &\quad \cdot\beta E_{\tau+i}\left\{\left[1-\eta_{\tau+i+1}+\left(\eta_{\tau+i+1}+d_{\tau+i+1}\right)x_{\tau+i+1}\right]^{\gamma\alpha-1}\right\}. \end{aligned}$$

Any expected increase in either the future money growth rate $x_{\tau+i+1}$ or discretionary money growth rate $d_{\tau+i+1}$ increases the nominal interest rate. On the other hand if fiat money is expected to be withdrawn, any expected reduction in $d_{\tau+i+1}$ decreases the nominal interest rate. The lower is the $d_{\tau+i+1}$, the higher is the rate by which the issued fiat money is withdrawn from circulation and the closer the resumption becomes. Expected resumption thus decreases the nominal interest rate.

The real interest rate is given by

$$\text{(4.103)} \qquad R_{\tau+i} = I_{\tau+i}E_{\tau+i}\left(\frac{p_{\tau+i}}{p_{\tau+i+1}}\right) \text{ for } i=0,...,S.$$

Using (4.102) and the CRRA utility function the real interest rate becomes

$$
\begin{aligned}
(4.104) \qquad R_{\tau+i} &= \left(x_{\tau+i}d_{\tau+i}\right)\left[1-\eta_{\tau+i}+\left(\eta_{\tau+i}+d_{\tau+i}\right)x_{\tau+i}\right]^{\gamma(\alpha-1)} \\
&\quad \cdot \frac{E_{\tau+i}\left\{\left[1-\eta_{\tau+i}+\left(\eta_{\tau+i}+d_{\tau+i}\right)x_{\tau+i}\right]^{\gamma-1}\right\}}{\beta E_{\tau+i}\left\{\left[1-\eta_{\tau+i}+\left(\eta_{\tau+i}+d_{\tau+i}\right)x_{\tau+i}\right]^{\gamma\alpha-1}\right\}}
\end{aligned}
$$

where $i = 0, ..., S-1$. The real interest rate increases if either $x_{\tau+i+1}$ or $d_{\tau+i+1}$ increases and again, if the public expects the adjustment to last for many periods, the interest rate is higher than it would be, if the adjustment was supposed to be short. During the stoppage period, both the nominal and real interest rate are bounded only by $\bar{d}$.

4.5. Calculations

To illustrate how the suspension of the gold standard rule stabilises the economy in the bad state of the world, I compare development of consumption, monetary gold and money: firstly, when the country stays on the gold standard; and secondly, when the gold standard is suspended. In the absence of a time series on gold export in the eighteenth and nineteenth century, I am not able to analyse whether the model would match the data. According to Clapham (1944), Appendix A, the circulation of Bank of England's depository notes grew on average 2.5 percent per year, but there were large fluctuations in the monetary gold stock and the gold reserve ratio. Figure 2.2 in chapter 2, and Figure 3.2 in Chapter 3 demonstrate how monetary gold fluctuated during the eighteenth and nineteenth centuries.

The first columns of Figures 4.1, 4.2 and 4.3 illustrate fluctuations in monetary gold, the money stock and consumption when the country follows the gold convertibility rule throughout the stoppage periods. In this simplistic example I assume that $x_t = 1.01$ in the good state when $K^s > 0$, and 0.98 in the bad state when $K^s = 0$ and the country does not suspend the gold standard. In other words, the monetary gold stock grows 1 percent in the good state and decreases 2 percent per period in the bad state if the gold standard is not suspended. The discount factor is always $\beta = 0.99$.

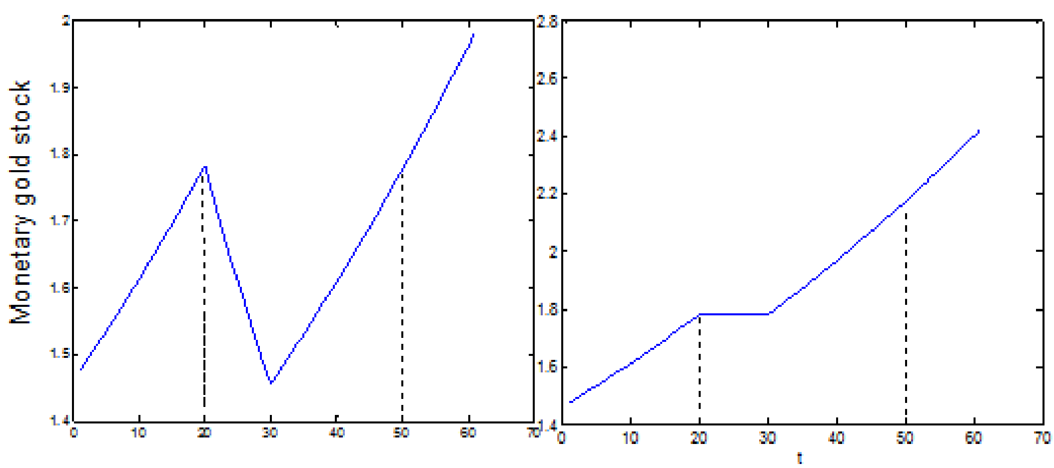

Figure 4.1. The monetary gold stock under the gold standard (LHS) and the suspension (RHS).

Between periods t and $t+20$ the gold endowment is positive and the prevailing monetary regime is the perfect gold standard. The monetary price of gold $Q = 1$ and the initial money stock and gold stock equal 1.42. As the money growth rate

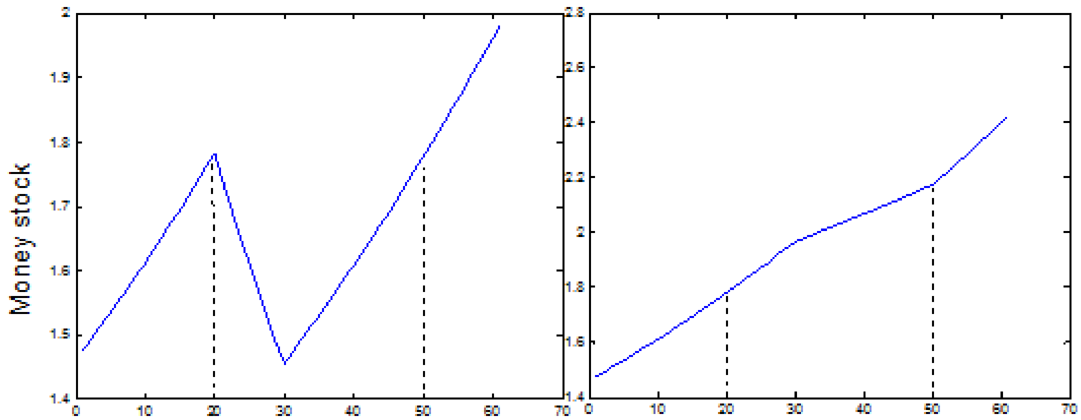

Figure 4.2. The money stock under the gold standard (LHS) and the suspension (RHS).

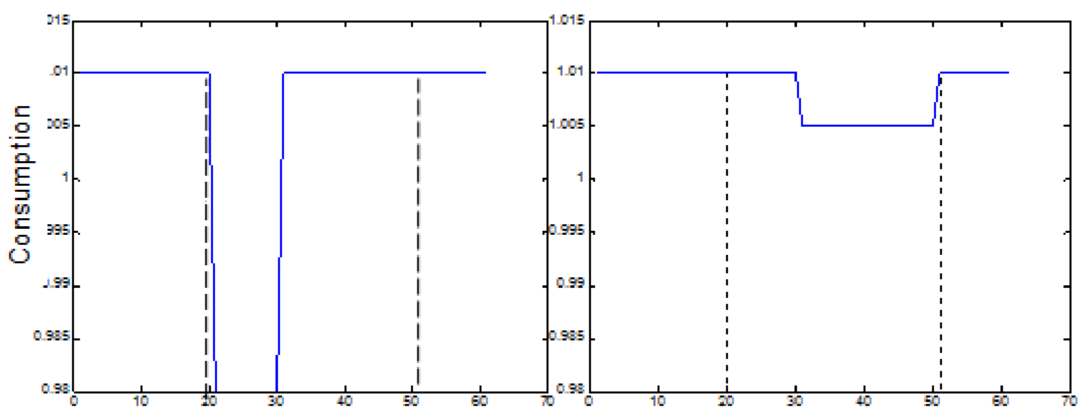

Figure 4.3. Consumption under the gold standard (LHS) and the suspension (RHS).

is constant (and incorporated in wage setting) consumption and the price level are constant over time.

At period $t+20$ there is a sudden stoppage on the gold flow. The first and second pictures on the left hand side of the Figures 4.1 and 4.2 show how both the circulating money stock and the monetary gold stock reduce 2 percent in every period as the household now converts its paper money to gold to satisfy its gold consumption. Consumption, shown in the left-hand-side of Figure 4.3 falls sharply during the stoppage periods as the household converts its paper currency to gold and less currency is available for consumption purchases. Consumption remains low until the gold endowment resumes in period $t+30$. After the gold flow has resumed, it takes 20 periods before monetary gold and the money stock are at the pre-stoppage level.

The second columns illustrates developments of monetary gold, the money stock and consumption when the gold standard rule is suspended and the central bank refuses to convert any currency to gold. The number of stoppage periods is ten as above. During the stoppage periods the discretionary money growth rate is 1 percent per period, $d = 1.01$ and equals the net money growth rate dx since $x = 1$. The right hand side column of Figure 4.1 shows the monetary gold stock: as the household cannot convert its paper money to gold, the gold stock remains fixed during the stoppage periods. The paper money supply, the first picture on the right hand side of Figure 4.2, increases at the same rate as during the gold standard as x is now replaced by d. The last figure on the right hand side of Figure 4.3 is consumption, which between periods $t+20$ and $t+30$ does not change from it gold standard level. The issue of paper money during the stoppage, made possible by the suspension of gold standard rule, maintains consumption in the bad state.

In period $t + 30$ the gold endowment resumes and the money growth rate x, which is proportional to monetary gold, is again 1 percent per period. The adjustment to the gold standard begins: the discretionary money growth rate between periods $t+30$ and $t+50$ is now $d = 0.995$, thus fiat money decreases 0.5 percent per period and the net money growth rate is close to one, $xd = 1.005$. The monetary gold stock during the adjustment period increases at the same rate as during the gold standard. The paper money growth rate increases at a slightly smaller rate until period $t + 50$, when the paper money increases again at the same rate as monetary gold stock. Given that wage expectations do not adjust fully during the first adjustment period, consumption falls slightly during the adjustment periods. However, the reduction in consumption occurs after the war, not during it, which might be the most valuable feature of suspension for the policy maker.

4.6. Conclusion

This chapter has concentrated on studying the transition from the gold standard to the suspension of cash payments and vice versa, and most specifically, the stabilisation mechanism of the suspension of cash payments. In order to tackle the issue of stabilisation explicitly, the gold standard and the suspension of cash payments were modelled in a DSGE framework. In both Chapter 3 and in this chapter I demonstrated that – contrary to the dominant view in the literature –

the gold standard and the suspension of cash payments should not be treated as similar monetary policy regimes, since the policy rules these two systems enforced were different. The suspension of the gold standard rule and its subsequent resumption offer an example of how alteration of the monetary regime can be used to stabilise the economy.

The starting point was a model of an idealised commodity standard – a well established gold standard – only feasible during the good state of the world. The gold standard restricts the central bank's ability to stimulate consumption and production by printing money. Under the gold standard the money stock can only grow if monetary gold grows in the same proportion. As the gold endowment is finite, the money growth rate was bounded and therefore, also the price level, consumption and interest rates are bounded. Although the gold standard cannot remove the variability in consumption as such, it provides a market driven mechanism to ensure the existence of these bounds.

The disadvantage of the gold standard was that it was subject to gold supply shocks as the feasibility of the standard relied on availability of gold for monetary use. This was the very problem England had to face at the end of the eighteenth century when the maritime war blocked the gold trade. The key conclusion of this chapter is that if the bad state of the world is involved with a stoppage in gold flow, the suspension of cash payments may be a preferable monetary regime to the gold standard in terms of stabilisation of consumption, price level, asset prices and production. The pre-condition is, however, that the monetary rule enforced by the suspension – to return to the gold convertibility at the old par value in the future – is credible. In this model a promise of future resumption of the gold standard represents a commitment device, which limits the issue of paper money. As the rule implies that notes will be fully convertible in the future, the suspension of cash payments ensured that paper money remained in circulation.

The model explained in detail how the stabilisation properties of the suspension functioned. Two stages, also clearly recognisable during the Suspension Period 1797-1821, were identified. During the stoppage periods – war years – when there is no gold flow, the central bank prevents the household from converting money to gold and stimulates the economy with fiat money transfers. But as the perfect gold standard does not allow any discontinuity, by the time of resumption the circulating money stock must be proportional to monetary gold. To minimise any disruptions during the war, the adjustment begins when the country is again in the good state. During the adjustment periods any fiat money issued is withdrawn from circulation, but the net money growth rate is defined as a product of the fiat money withdrawal rate and the money growth rate proportional to the growth of the monetary gold. If the net money growth rate under the adjustment periods is less than one, the adjustment causes some deflation, but only for a limited time, but potentially, if the net money growth rate during the adjustment was equal or larger than one, the stoppage of gold endowment does not cause any deflation. The biggest benefit of the suspension of the gold standard rule is that it enables the central bank to defer the potentially deflationary adjustment during the time of peace, not until the time of war.

The conclusion about the desirability of suspension in terms of stabilisation does not, at least in this particular framework, imply that the suspension would yield higher utility than the fiat money or the gold standard regime. The question of whether the suspension of cash payments also maximises the welfare of household remains to be analysed in Chapter 5.

The historiography of the Suspension Period is confused by exaggeration and anachronism on the part of the bullionists, but also on the part of anti-bullionists during the era, when for the first time in British monetary history, inconvertible paper money also circulated as a medium of exchange amongst the lower ranks of society, and the mechanism of money and stabilisation was barely understood. At first it was bullionists who were against the evils of inconvertibility after the price level had risen in 1810, but when the resumption of the gold standard started after the arrival of peace, the Bank was criticised for constraining credit. The Bank was perceived as promoting its own interests in the absence of the gold conversion rule, and this dominant opinion led the Suspension Period to be analysed in a narrow and simplified manner. For example, it has been argued that the aim of the suspension of the gold standard rule was to maximise the government's seigniorage revenue. In 1797 the cash payments were suspended, because following the convertibility rule became infeasible and the circulation of paper money fell to a level, which did not maintain consumption and production. Abstract theoretical analysis in this chapter, combined with examination of the historical evidence surrounding the nature of the suspension of cash payments in Chapter 3, shed light on the Bank of England's true – if partially subconscious – motivation to continue suspension throughout the Napoleonic Wars: the suspension enabled the Bank to use monetary policy as a buffer, which prevented a series of shocks of various origin from affecting the real economy during the most critical of times.

CHAPTER 5

The Resumption of the Gold Standard as a Sustainable Plan

5.1. Introduction

In standard economic literature a policy regime is defined as time inconsistent if the policy maker deviates from a policy plan which was expected to hold indefinitely into the future, and was chosen as an optimal policy based on the monetary authority's objectives.[1] The outcome of this discretionary, sequentially chosen, policy can be very different from the outcome suggested by the original optimal plan, because rational private agents consider policy makers' actions while making their own decisions. In an environment where a commitment technology is available, by definition the government cannot change policies in the future and the time inconsistency problem becomes irrelevant. Although in many cases commitment leads to a better outcome than discretion, designing a commitment technology that would not only tie the hands of current but also future generations of policy makers can be implausible.

[1] Kydland and Presscott (1977).

Yet for centuries the gold standard and other forms of commodity standards were commitment technologies that aimed to restrict sovereigns' power over economic policy. The monetary authority – the mint or the central bank – was prepared to maintain the value of the paper currency in terms of a fixed weight of gold and to buy and sell gold at a fixed price on demand. However, according to Bordo and Kydland (1995) and Bordo and Schwartz (1997) the gold standard, as it prevailed before 1914, should be considered as a contingent rule rather as a monolithic monetary policy rule *per se:* during a wartime emergency, when the government needed to collect seigniorage revenue, the gold standard rule could be temporarily abandoned on the understanding that after the emergency had safely passed convertibility would be restored at original parity. Along the lines of this theory, agents considered the gold standard and the suspension to be essentially the same monetary system and could not think of any feasible alternatives to gold: 'Thus, when an emergency occurred, the abandonment of the standard would be viewed by all to be temporary event since, from their [the public's] experience, only gold or gold-backed claims truly served as money.'[2]

The extensive empirical survey in Bordo and Kydland (1995) and Bordo and Schwartz (1997), consisting of over twenty countries that have suspended and subsequently resumed the gold standard, shows that the theory of the gold standard as a contingent rule is plausible, but the explanation for credibility of the monetary system in the absence of the gold standard seems simplistic, especially if applied

[2]Bordo and Kydland (1995).

to the Suspension Period of 1797-1821. In Chapters 3 and 4, I demonstrated that the credibility of the Suspension Period could not be dependent on the superiority of the gold standard rule itself, as argued by Bordo and Kydland (1995) and Bordo and Schwartz (1997): firstly, suspension was not a temporary emergency measure, but a separate monetary policy regime that lasted for twenty-four years, when Britain was engaged in war and society went through major structural change, *viz.* the Industrial Revolution. Secondly, even five years after the Battle of Waterloo, postponement of resumption and the pegging of the pound to gold at a lower par value had powerful advocates. Benefits and weaknesses of various monetary arrangements were openly debated, and before 1820 the resumption of gold standard was far from inevitable.

If it was not the superiority of the gold standard rule, then what made the suspension of cash payments credible? According to the historical evidence I presented in Chapter 3, credibility was based on the commitment of the Bank of England and the government to resume the gold standard in the future: the successful resumption was an outcome of active and determined monetary policy. In order to ensure that the market price of gold would fully converge with the monetary price of the gold – a precondition for feasible resumption – the Bank, the government and Parliament had to convince the markets of their commitment to resume gold payments in the future.[3] For example, the Bank withdrew paper money from circulation after the war, resisted its notes becoming legal tender and built gold

[3]Figure 3.9 shows how the market price of gold converted the mint price already in 1819.

reserves. Furthermore, gold was made an official unit of account by the Coinage Act in 1816 in spite of the absence of the actual gold standard. Unable to resume gold payments during the long war, Parliament extended the term of the Restriction Acts eleven times between 1797 and 1821. They were carefully worded and declared, for example, that resumption was not possible until 'One Month after the conclusion of the present War by a Definite Treaty of Peace'.[4]

Motivated by this evidence, but to avoid getting tangled with historical detail, in this chapter I characterise both the Bank and the public's decision making in a formal theoretical framework by applying the theory of credible and time consistent monetary policy to the gold standard and suspension. By building on an example first developed by Kydland and Presscott (1977), Chari and Kehoe (1990) explore whether policy can be time consistent without commitment technology. I ask the same question, but in the context of the gold standard.

My analysis produces two main conclusions. Firstly, the suspension of cash payments was a credible regime, because the future resumption of the gold standard was a sustainable plan. Given the repeated interaction between the government and private agents during suspension, the government's plan to resume the gold standard at some future point replaced the gold standard as a reputational device, which limited money creation and solved the time inconsistency problem. According to Chari and Kehoe (1990) such a plan is sustainable, because the policy maker follows it even in the presence of a time inconsistency problem. In Chapter

[4]Geo. III c.3 9th November 1797.

3, I demonstrated that the Suspension Period gave the Bank of England many opportunities to conduct time inconsistent monetary policy: the Bank could have increased its private profit by discounting the bills of exchange of London merchants or maximised the government's seigniorage revenue by buying government bonds. Furthermore, as discussed in the previous chapter, as the economy had nominal rigidities, the Bank of England could have been able to stimulate the economy by printing more paper money and when the war finally finished, the Bank could have avoided the adjustment process altogether.

The historical evidence raises the question just what was so important about the resumption of the gold standard that the Bank was willing to go through the costly adjustment process and accept a reduction in its monetary independence. The second main conclusion of this chapter implies that the gold standard was resumed, because it was seen to maximise social welfare in the long-run. In the good state the government was not able to conduct time inconsistent monetary policy without commitment technology. Sustainability of the resumption plan was crucial and it had both short-run and long-run implications. The government would not have been able to borrow and paper money would not have remained in circulation during the war, if the agents had not considered suspension to be sustainable. If the government had failed to take the necessary steps towards resumption immediately after the war, the market price of gold would have not started to converge towards the official mint price and disparity between the market and the mint price of gold have made resumption infeasible. In the long-run, if the agents had lost their faith in the monetary system, the whole monetary system in the country would have been ruined. Paper currency would have been abandoned and demonetisation would have destroyed the credit system, which was based on the stable circulation of the Bank of England notes. The pound might have followed in the footsteps of *assignats*, the value of which could not be supported even by guillotines during the Reign of Terror 1793-1794.[5]

The method I use to model decisions to suspend the gold standard rule and to subsequently resume it adapts Grossman and Van Huyck's (1988) theory of excusable deviations. The authors interpret the sovereign debt as a contingent claim: the lenders differentiate excusable defaults, which are justifiably associated with implicitly understood contingencies, from debt repudiation, which would be unjustifiable and inexcusable. An excusable default in the bad state would not damage the country's reputation to the same extent as inexcusable default in the good state. Characteristic of public debt and monetary policy management is that they both are difficult to control by formal laws. The conduct of monetary policy has been contracted to agents – independent central banks – as recently as the end of the 1990s, at least in developed countries, but the public debt is commonly managed by some governmental body. Therefore, these institutions have been able to default without having to answer to a higher enforcement authority.

My interpretation of contingent default in the context of monetary policy rules is the following. The bad state can lead to two potential defaults. The first default

[5]Sargent and Velde (1995).

is what Grossman and Van Huyck (1988) call excusable and it occurs when the authority is forced to abandon the commitment technology, the gold standard, upon arrival of the bad state. The second potential default follows the monetary authority's decision not to resume the original commitment rule even though the state of the world has switched from the bad back to the good state. This default is total and unjustified, and leads to the loss of the monetary authority's reputation. Another key objective of this chapter is to define conditions which ensure that the second default does not occur and the policy rule enforced by the commitment technology is resumed once the economy has returned to the normal good state. If the resumption of the commitment rule involves incurring a cost, as it is in this model, the authority might not have an incentive to resume the rule.

The model developed in this chapter, although it is deterministic, builds directly on the baseline model constructed at the beginning of the previous chapter. I consider the gold standard as an exogenous rule, which limits the benevolent government's ability to issue money by making the money stock proportional to monetary gold. The value of money is determined by direct convertibility to gold: the monetary authority – the mint or the central bank – is prepared to maintain the value of the paper currency in terms of a fixed weight of gold and to buy and sell it at a fixed price on demand. In this commodity standard setup only gold or gold-backed instruments are accepted as money. The monetary authority does not control the money supply, but facilitates gold conversion, prints paper money and provides financial intermediation services.

The bad state makes the gold standard infeasible, because war raises the question of the central bank's solvency in the form of a potential invasion of the country. As a result, a bank run creates a serious monetary contraction that has an impact on the real economy. In order to maintain the paper currency in circulation, the central bank ceases converting paper money to gold, but simultaneously it promises to convert paper claims at some future point, after the economy has returned to the good state. The value of money during the suspension of gold standard rule is thus determined by the promise of future convertibility.

Following Chari and Kehoe (1990), Stokey (1989), Ireland (1997) and Chang (1998a) the model adapts Abreau's (1988) optimal penal codes under discounting to policy games played between a benevolent government and private sector. Chari and Kehoe (1990) demonstrate how any sustainable policy plan can be supported by a reputational equilibrium in which private expectations display an extreme form of trigger-like behaviour: a single deviation by the government from its announced plan causes the economy to revert permanently to its worst possible outcome. In this commodity standard setup, the worst possible outcome is a commodity money regime. If the policy maker defaults on its policy plan to withdraw paper money from circulation once the gold flow resumes, the agents will abandon paper money and start using commodity money, gold specie, as a medium of exchange. Compared with the gold standard the commodity money regime is inefficient.

The theory of sustainable plans helps to explain some additional puzzles created by the suspension of the credible monetary policy rule, such as what was the optimal money growth rate during the suspension and to which factors was the long-run viability of suspension based. The theory of the gold standard as a contingent rule is not able to answer satisfactorily these questions as the theory assumes the resumption of the gold standard to be exogenously credible.

This chapter is organised as follows: the first section considers the gold standard as a commitment technology; the second section analyses the suspension of the gold standard rule; the third section defines under what conditions the resumption of the gold standard is sustainable; in the fourth I characterise decision making and sets of sustainable plans by numerical examples; and the final section summarises the key findings and results.

5.2. The Gold Standard as a Commitment Technology

The economic environment is similar to that in Chapter 4. The state of the world evolves exogenously between the good state, peace, and the bad state, war. Production and labour demand are defined as in (4.13)-(4.20) At the beginning of the period a representative firm and household agree on wages which stay fixed for that period. If the previous period had been peace, the current period is also expected to be peace, so the change of the state comes as a surprise. After the wages have been set, the household receives gold endowment K^s, which gives information about the state for all agents, and, by contrast to Chapter 4, is non-stochastic in this deterministic version of the model.

According to the baseline model presented in section 4.2, in the absence of any commitment technology the central bank has an incentive to create surprise inflation, because wages are fixed for a period, and money has real effects on the economy. In the good state the central bank is able to commit to the exogenous gold standard rule at the beginning of time and sets the discretionary money growth rate d_t equal to one. The whole paper money stock is then backed by monetary gold. Furthermore, as in section 4.3, I assume that under this perfect gold standard rule the utility maximising household does not mint any new specie and only the gradually depreciating initial stock of specie remains in circulation. In this section, I define formally the private sector's allocation and the central bank's policy under the perfect gold standard rule. Then I analyse some welfare implications of the gold standard.

Formally *the gold standard equilibrium* is a policy $d = \{d_t = 1 \mid t = 0, 1, ...\}$ and the agents' allocation rules (Π, Ψ) that satisfy the firm's problem to choose L_t to maximise profits (4.13), and the household's problem to choose $K_t,\ C_t,\ m_{t+1}$ and b_{t+1} to maximise its utility

$$\sum_{t=0}^{\infty} \beta^t U\left(C_t, K_t\right) \tag{5.1}$$

subject to cash-in-advance constraint (4.51) and budget constraint (4.52) taking K^s, p_t, $\bar{R}$, π_t^f and w_t given for all $t = 0, 1, 2....$ The market clearing conditions are given by (4.46)–(4.50) and respectively, the first order conditions are given by (4.54)-(4.58), where E_t can be omitted as the environment is deterministic. In equilibrium (4.47) implies $m_t = 1$ and $b_t = b_{t+1} = 0$. The wage constraint (4.34) reduces to

$$w_t L_t = x_t. \tag{5.2}$$

Proposition 4.1 holds also in this deterministic case: under the gold standard rule $x_t \in (\beta, 1 + qK^s)$ for all $t = 0, 1, 2, ...$ The lower bound on the money growth ensures the existence of monetary equilibrium where $\mu > 0$ and $I > 1$ in steady state. The upper bound is derived from the gold endowment constraint (4.49): If K_t approaches zero, from (4.49) x_t approaches $(1 + qK^s)$.

Proposition 5.1 *The gold standard solves the economy's time inconsistency problem and improves welfare.*

Proof: Under the gold standard the central bank cannot stimulate the economy by monetary transfers as $d_t = 1$. There is no uncertainty about the future money growth rate: K^s is fixed and the household chooses x_t so that $\omega_t = p_t$ for all $t = 0, 1, 2, ...$ This implies that $L_t = 1$ and $Y_t = C_t = A$ for all $t = 0, 1, 2, ...$ To demonstrate why the household does not have an incentive to choose x_t which would yield an actual money growth rate to be above the expected money growth rate, consider the following: assume now that household takes more gold to the central bank to be converted to gold than was assumed during the wage bargain and the price level increases so that $\omega_t < p_t$. Substituting (5.2) and (4.18) into (4.60) gives now a familiar relation between the price level and the money growth rate, thus

$$p_t = A^{\gamma-1}\omega_t^{\gamma}\left(2x_t\right)^{1-\gamma}. \tag{5.3}$$

Respectively, substituting (5.3) into (4.14) and using (4.46) gives a relation between money growth level and consumption

$$C_t = A^{1-\gamma}\omega_t^{-\gamma}\left(2x_t\right)^{\gamma}. \tag{5.4}$$

Equations (5.3) and (5.4) imply that both the price level and consumption increase if the money growth rate x_t increases above the rate used in contract wage setting at previous period. However, (5.3) and (5.4) do not hold in equilibrium. Intuitively, if at period $t-1$ wage setters' expectation on the money growth rate at next period is x^e, but the actual money growth rate is $x_t = x^e + \Delta_t$, where $\Delta_t \in (0, \infty)$, from (5.3) the price level increases, which through (4.16) decreases real wages, through (4.17) increases labour demand and through (5.4) increases consumption. Now the wage setters would respond by adjusting their wage expectations to $x^e + \Delta_t$, then the household would have an incentive to set x_{t+1} to $x_{t+1} = x^e + \Delta_{t+1}$ where $\Delta_t < \Delta_{t+1} < \infty$. The process would continue until x_t would approach its upper bound $(1+qK^s)$ and the price expectations ω_t would approach the upper bound of the price level $\bar{p} = A^{\gamma-1}\omega^{\gamma}\left[2\left(1+qK^s\right)\right]^{1-\gamma}$. As in Barro and Gordon (1983a) any systematic benefits of inflation disappear in equilibrium. However, in this commodity standard set up there is an additional constraint, the gold endowment constraint

$$K^s - K_t = \frac{x_t - 1}{q}, \tag{5.5}$$

which limits the household's willingness to convert gold to paper money. If the money growth rate approaches its upper bound, the household converts almost its whole gold endowment to paper currency. Simultaneously, gold consumption – gold in utility yielding form – approaches zero, which reduces current period utility, while the impact of gold conversion on consumption C_t is low since expectations have been adjusted. ■

The policy $d = 1$ under the gold standard together with particular allocation $\psi_t = \Psi(1)$ and $\pi_t = \Pi(1)$ is called *the gold standard outcome* and is denoted by $(1, \pi^g, \psi^g)$. It describes the sequences of equilibrium prices and quantities that are obtained when the central bank manages gold reserves and converts gold to paper currency on demand according to the exogenous gold standard rule, and the private agents respond to the exogenous flow of gold by maximising utility and profits.

In order to examine the gold standard outcome, assume that the utility function (5.1) takes a log-separable form

$$\sum_{t=0}^{\infty} \beta^t U\left(C_t, K_t\right) = \sum_{t=0}^{\infty} \beta^t \left(\log C_t + \rho \log K_t\right), \tag{5.6}$$

where ρ is the preference parameter. The gold standard outcome can be described by the following two propositions:

Proposition 5.2 *The gold standard outcome implies that* $d_t = 1,\ L_t = 1,\ C_t = Y_t = A$ *and* $K_t = K^s - \frac{x^g - 1}{q}$ for all $t = 0, 1, \ldots$.

Proof: By combining all four first order conditions (4.54)-(4.57) we get the Euler equation.

$$x_t \frac{\rho}{q} U_K\left(t\right) = \beta \frac{U_C\left(t+1\right)}{p_{t+1}}. \tag{5.7}$$

By Proposition 5.1 the household does not have an incentive to surprise economy by increasing x_t, and the gold standard outcome corresponds to the steady state equilibrium where $Y_t = C_t = A$ and $K_t = K^s - (x^g - 1)q^{-1}$ for all $t = 0, 1, 2, \ldots$. If the utility function takes the log-separable form (5.6), (5.7) can be written as

$$2x^{g2} \frac{\rho}{q} = \beta \left(K^s - \frac{x^g - 1}{q} \right), \tag{5.8}$$

The optimal x^g is the positive root of the quadratic equation

$$2\rho x^{g2} + \beta x^g - \beta\left(K^s q + 1\right) = 0 \tag{5.9}$$

i.e.

$$x^g = \frac{-\beta + \left[\beta^2 + 8\rho\beta\left(K^s q + 1\right)\right]^{\frac{1}{2}}}{4\rho}. \tag{5.10}$$

The negative root can be ignored as by definition x^g has to be non-negative. Appendix 5.A establishes that if $\rho \to \frac{1}{2}\left(\frac{1+qK^s}{\beta} - 1\right)$, $x^g \to \beta$ for all $t = 0, 1, ...$

Lemma 5.1 $U(A, x^g)$ is strictly decreasing on $(\underline{x}^g, \overline{x}^g) = (\beta, qK^s + 1)$.

Proof: Note first that $U(A, x^g) =$ $(\log A + \rho \log K_t)$ where $K_t = K^s - \frac{x^g - 1}{q}$ for all $t = 0, 1, ...$ $U_x(A, x^g) < 0$[6] for all $x^g \in (\underline{x}^g, \overline{x}^g)$ and $U_{xx}(A, x^g) < 0$[7] for all $x^g \in (\underline{x}^g, \overline{x}^g)$.

Proposition 5.3 *Welfare under the gold standard is maximised when x^g approaches β for all $t = 0, 1, 2, ...$*

Proof: As under the gold standard rule consumption is independent of the money growth rate x^g in equilibrium, but gold demand K_t decreases when x^g increases, welfare increases when x^g approaches its lower bound β. When x^g approaches β for all $t = 0, 1, 2, ...$ the total discounted utility in gold standard approaches $U(A, \underline{x}^g) = \frac{1}{1-\beta}\left(\log A + \rho \log\left(K^s - \frac{\beta - 1}{q}\right)\right)$. ■

Under the perfect gold standard rule the household consumes its whole gold endowment and converts some of its existing paper currency to gold. The outcome under the gold standard is not necessarily the optimal Ramsey equilibrium analysed in Chari and Kehoe (1990) and Ireland (1997) since the gold standard equilibrium

[6] $U_x(A, x^g) = -\frac{\rho}{qK^s + 1 - x^g}$.
[7] $U_{xx}(A, x^g) = -\frac{\rho}{(qK^s + 1 - x^g)^2}$

is not the date 0 competitive equilibrium. The rule $d = 1$ is given exogenously, not modelled explicitly as the outcome of an optimisation problem. When the central bank commits to the gold standard at the beginning of time, it loses the ability to increase production and employment by increasing the discretionary money growth rate, thus the gold standard rule solves the discretionary problem which arises from the sticky wage structure.

5.3. Abandonment of the Commitment Rule

In section 4.4, I demonstrated that the gold standard increases the economy's volatility in the bad state. To restore monetary stability, the central bank deviates from its monetary policy rule – the gold convertibility rule. It stops converting specie to gold on demand in the bad state, but promises to resume convertibility at the old par value q once the country is again in the good state and it has withdrawn fiat money from circulation. This deviation is what Grossman and Van Huyck (1988) call an excusable default: it is justifiably associated with exogenous contingencies such as a war. As in section 4.4, the suspension of the gold standard is divided in two stages: during the bad state the gold endowment stops and the central bank stimulates the economy by fiat money transfers, and once the economy is again in the good state – the gold flow has resumed – the central bank starts withdrawing paper money from circulation. The gold standard is resumed when each note is fully backed by gold.

In what follows I assume again that between the periods τ and $\tau + j - 1$ the gold endowment is zero, from period $\tau + j$ forward it is positive and period $\tau + S$ is the final suspension period. At the beginning of period τ the firm and household agree on the wage level, then the bad state of the world is observed by all agents. The central bank then stops converting notes to gold and announces its policy plan to resume the gold standard at par value q at some future point.

This policy plan of the central bank to resume the gold standard at par value q in the future induces future histories, and the policy plan together with agents' allocation rules induces future utilities. For each $i = 0, 1, 2, ..., S$, denote the history of the central bank's policy through time $\tau + i$ by $h_{\tau+i} = \{d_{\tau+k} \mid k = 0, 1, ...i - 1\}$, and $h_{-1} = \{d_t = 1 \mid t = 0, 1, ..., \tau - 1\}$. For any policy plan $\sigma = \{\sigma_0, \sigma_1, ...\}$ let $\sigma^{\tau+i} = \{\sigma_{\tau+i} \mid i = 0, ..., S\}$ denote a sequence of policy plans from time τ onward and $\sigma^{\tau+i}$ the continuation of σ. Policy plan $\sigma = \{\sigma_0, \sigma_1, ...\}$ thus specifies money growth during suspension conditional on the realisation of history $h_{\tau+i}$.

The sequence of events between periods τ and $\tau + S$ is the following: at the beginning of the first stage of suspension, household and firms agree on nominal wages, then K^s is observed by all. Next, faced with the history $h_{\tau+i-1}$, the household chooses the first-stage allocation of $\psi_{1,\tau+i}(h_{\tau+i-1})$ and a contingency plan for setting future actions for all possible future histories. By definition, if $K^s = 0$, $\psi_{1,\tau+i}(h_{\tau+i-1}) = \emptyset$ as $K_{\tau+i} = 0$. The central bank, faced with the history $h_{\tau+i-1}$, sets time $\tau + i$ discretionary money growth rate $\sigma_{\tau+i}(h_{\tau+i-1}) = d_{\tau+i}$ and chooses a contingency plan for setting future money growth rates. At the second stage of period $\tau + i$, both the household and the firm face the history $h_{\tau+i} = [h_{\tau+i-1}, \sigma(h_{\tau+i-1})] = (h_{\tau+i-1}, d_{t+i})$. The household chooses its second stage allocation $\psi_{2,\tau+i}(h_{\tau+i})$ and the contingency plan for all future histories, and the firm chooses its allocation $\pi_{t+i}(h_{\tau+i})$ conditional on realisation of history $h_{\tau+i}$. These definitions recognise that the household makes its decision in two stages and firm in one.

As in Ireland (1997) without commitment technology, the price level, the contract wage and interest rates are also functions of the history of the central bank's policy. Starting from any date after the announcement to suspend the cash payments, the private agents can forecast these variables using the recursive formula $h_{\tau+i} = [h_{\tau+i-1}, \sigma_{\tau+i}(h_{\tau+i-1})]$ where $i = 0, 1, ..., S$; and their knowledge of price level, interest rate and wage determination processes.

Consider first the household's problem during the suspension of the gold standard rule. The household chooses $C_{\tau+i},\ K_{\tau+i},\ m_{\tau+i}$ and $b_{\tau+i}$ to maximise

$$\sum_{i=0}^{S} \beta^i U\left[C_{\tau+i}(h_{\tau+i}), K_{\tau+i}(h_{\tau+i-1})\right] \tag{5.11}$$

subject to

$$p_{\tau+i}C_{\tau+i} \leq m_{\tau+i} + (x_{\tau+i} - 1)\,\eta_{\tau+i} + w_{\tau+i}L_{\tau+i} + b_{\tau+i} - \frac{d_{\tau+i}x_{\tau+i}b_{\tau+i+1}}{I_{\tau+i}} \tag{5.12}$$

and

(5.13)

$$d_{\tau+i}x_{\tau+i}m_{\tau+i+1} \leq m_{\tau+i}+b_{\tau+i}+qK_{\tau+i}+w_{\tau+i}L_{\tau+i}+\pi^{f}_{\tau+i}-\frac{d_{\tau+i}x_{\tau+i}b_{\tau+i+1}}{I_{\tau+i}}-p_{\tau+i}C_{\tau+i}-qK_{\tau+i},$$

where $\psi_{1,\tau+i}(h_{\tau+i-1}) = \emptyset$ if $i = 0, ..., j-1$ and $\psi_{1,\tau+i}(h_{\tau+i-1}) > 0$ if $i = j, ..., S$. The gold endowment constraint satisfies

$$q\left(K^{s}_{\tau+i} - K_{\tau+i}\right) = \left(x_{\tau+i} - 1\right)\eta_{\tau+i} \text{ for } i = j, ..., S. \tag{5.14}$$

The representative firm's problem is to choose $L_{\tau+i}(h_{\tau+i})$ to maximise

$$\Pi^{f}_{\tau+i} = p_{\tau+i}Y_{\tau+i} - \bar{R}w_{\tau+i}L_{\tau+i} \tag{5.15}$$

for each $i = 0, 1, ..., S$ taking $w_{\tau+i}(h_{\tau+i})$, $p_{\tau+i}(h_{\tau+i})$ and $h_{\tau+i} = [h_{\tau+i-1}, \sigma(h_{\tau+i-1})]$ given for all $i = 0, 1, ..., S$.

At each period $\tau + i$ where $i = 0, 1, ...S$, the central bank takes $h_{\tau+j-1}$ as given and chooses a continuation policy $\sigma^{\tau+i}$ to solve the following problem: choose $d_{\tau+i}$ to maximise (5.11), where $C_{\tau+i}$ and $K_{\tau+i}$ are determined by Ψ and Π subject to the terminal condition[8]

$$M_{\tau+S+1} = QK^{g}_{\tau+S+1}. \tag{5.16}$$

[8]See section 4.4 for the derivation of the terminal condition.

The terminal condition can be written as

$$\left(\prod_{i=0}^{S} d_{\tau+i}\left(h_{\tau+i-1}\right) x_{\tau+i}\left(h_{\tau+i-1}\right)-1\right) m_{\tau}=q \sum_{i=j}^{S}\left[K_{\tau+i}^{s}-K_{\tau+i}\left(h_{\tau+i-1}\right)\right], \tag{5.17}$$

and it states that monetary gold must be proportional to the circulating money stock by the time of the resumption. Incorporated in plan σ, the terminal condition implies that once the gold flow resumes, the central bank must set $d_{\tau+i}<1$ where $i=j,...,S$ in order to withdraw the fiat money from circulation. The suspension of the gold standard rule cannot last forever. The discretionary money growth rate satisfies

$$\prod_{i=0}^{S} d_{\tau+i}=1. \tag{5.18}$$

and $x_{t+i}=1$ for $i=0,...,j-1$ and $x_{t+i}\geq 1$ for $i=j,...,S$.

A sustainable equilibrium consists of a policy plan σ and a set of allocation rules (Π,Ψ) that satisfy: (i) given a policy plan σ and the household's allocation rule Ψ, the continuation of Π solves the firm's problem to maximise (5.15) subject to $L_{\tau+i}$ and history $h_{\tau+i}$; (ii) given σ and the firm's allocation rule Π, the continuation of Ψ solves the household's problem to maximise (5.11) subject to (5.12), (5.13) and history $h_{\tau+i-1}$ and h_{t+i}; (iii) given the allocation rules (Ψ,Π), the continuation of plan σ solves the central bank's problem to choose $d_{\tau+i}$ to maximise (5.11) for every history $h_{\tau+i-1}$ and the terminal condition (5.17).

The *sustainable outcome* (d, ψ, π) describes the sequence of equilibrium quantities and prices that are obtained when the central bank chooses d sequentially to maximise the representative household's utility subject to the terminal condition, and private agents respond optimally. The set of sustainable outcomes is formed recursively: starting from $h_{-1} = 1$, construct $h = (h_\tau, h_{\tau+1}, ...)$ and $d = (d_\tau, d_{\tau+1}, ...)$ recursively using $d_{\tau+i} = \sigma_{\tau+i}(h_{\tau+i-1})$ and $h_{\tau+i} = [h_{\tau+i-1}, \sigma_{\tau+i}(h_{\tau+i-1})]$. Then for all $i = 0, 1, ..., S$ construct $\pi = (L_\tau, L_{\tau+1}, ...)$ using $L_{\tau+i} = \Pi(h_{\tau+i})$ and $\psi = \left(\psi_\tau, \psi_{\tau+1}, ...\right)$ using $\psi_{1,\tau+i} = \Psi(h_{\tau+i-1})$ and $\psi_{2,\tau+i} = \Psi(h_{\tau+i})$ for all $i = 0, 1, ...$ These recursive definitions are used in next section to illustrate the sustainable equilibrium.

5.4. Sustainable Outcomes that Ensure Resumption of the Gold Standard

In this section I characterise allocations and policies that result from sustainable equilibria. Those allocations and policies that ensure the resumption of the gold standard are of particular interest in this chapter, but before defining them formally, consider the household's decision making problem in this framework. During the stoppage periods, from period τ to $\tau + j - 1$, the household is not able to consume any gold as $K^s = 0$. In order to be able to buy the consumption good, the household has to accept inconvertible paper currency as a medium of exchange. The cash-in-advance constraint formalises this assumption, since if the household abandoned paper money, consumption would approach zero. The cash-in-advance constraint, therefore, embodies some relevant historical evidence on paper money during the Suspension Period of 1797-1821. According to Feavearyear (1963): 'The public accepted the notes because there was nothing else and because they served the purposes of trade for the time being as well as gold'[9].

If $K^s = 0$, specie cannot be used in exchange, as the coin stock has depreciated beyond meaningful use and new specie cannot be minted. The war and the stoppage of the gold endowment, however, last for a finite time. The return of the gold endowment gives the household an opportunity to start minting coins and stop using paper money if the central bank's plan to return to the gold standard rule was not credible. The credibility of the monetary system collapses, if the central bank deviates from its policy plan, which implies that the bank has to start withdrawing paper currency from circulation by reducing discounts it gives to the firm once the economy is again in the good state. The central bank might avoid this adjustment process, because withdrawing fiat money has adverse real effects on the economy with sticky nominal wages. Yet the threat imposed by the private agents' revenge might support equilibria, the outcome of which is the resumption of the gold standard.

As in Chari and Kehoe (1990) and Ireland (1997), the set of sustainable outcomes, which in this model refers to the outcomes that support the resumption of the gold standard, can be characterised by adapting Abreu (1988) optimal penal codes to monetary policy games played between a benevolent central bank and a

[9]Feavearyear (1963) p. 184.

large number of private agents. The autarky plan σ^a is defined as follows: private agents agree on nominal wages and all sectors observe that the gold flow is resumed. The household then chooses a first-stage allocation of $\psi_{1,\tau+j}(h_{\tau+j-1}) > 0$, and a contingency plan for setting future actions for all possible future histories. The central bank, given the history $h_{\tau+j-1}$, sets the time $\tau+j$ discretionary money growth rate in following manner: for any $h_{\tau+j-1}$ let $\sigma^a(h_{\tau+j-1})$ be the optimal money growth rate in the problem: maximise

(5.19)

$$U^a(x_{\tau+j}, d_{\tau+j}) = \max_{d_{\tau+j}} U\left[\log C_{\tau+j}(h_{\tau+j}) + \rho \log\left(K^s_{\tau+j} - q^{-1}\left[x_{\tau+j}(h_{\tau+j-1}) - 1\right]\eta_{\tau+j}\right)\right]$$

subject to

$$d_{\tau+j} \leq \bar{d} \tag{5.20}$$

where $K_{\tau+j}$ is given by $\psi_{1,\tau+j}(h_{\tau+j-1})$. Next, at the second stage of period $\tau+j$, both the household and the firm face the history $h_{\tau+j} = [h_{\tau+j-1}, \sigma^a(h_{\tau+j-1})]$. The household chooses its second stage allocation $\psi_{2,\tau+j}(h_{\tau+j})$ and the contingency plan for all future histories and the firm chooses its allocation $\pi_{t+j}(h_{\tau+j})$.

Proposition 5.4 *The policy under the autarky plan is* $\sigma^a_{\tau+j}(h_{\tau+j-1}) = d^a = \bar{d}$.

Proof: $U^a(x_{\tau+j})$ is the maximum current-period utility at period $\tau+j$ that the central bank can obtain by deviating from its policy plan $\sigma_{\tau+j}(h_{\tau+j-1})$ at time $\tau+j$, given that the central bank has followed the plan in every period prior to the deviation. As during the suspension of the gold standard (5.1) is strictly increasing in $C_{\tau+i}$ and $C_{\tau+i}$ is strictly increasing in $d_{\tau+i} \in \left(0, \bar{d}\right)$, the central bank maximises utility by setting $d_{\tau+j} = \bar{d}$. ■

Instead of starting to withdraw paper money from circulation at the beginning of the adjustment period, the central bank has thus the temptation to maximise one period utility by issuing the maximum possible amount of paper money.

Propositions 5.5 *If the utility function (5.11) is logarithmic as in (5.6), the welfare under autarky is*

$$U^a\left(x_{\tau+i}\right) = \log \bar{C} + \rho \log\left(K^s_{\tau+i} - q^{-1}\left[x_{\tau+i}\left(h_{\tau+i-1}\right) - 1\right]\eta_{\tau+i}\right). \tag{5.21}$$

Proof: The policy under the autarky does not have an effect to the first stage allocation under autarky $\psi_{1,\tau+i} = \Psi\left(h_{\tau+i-1}\right)$, i.e. to gold demand, but the second stage allocation $\psi_{2,\tau+i} = \Psi\left(h_{\tau+i}\right)$ implies that consumption under the autarky becomes

$$\bar{C}^a = A^{1-\gamma}\omega^{-\gamma}_{\tau+i}\left[1 - \eta_{\tau+i} + \left(\eta_{\tau+i} + \bar{d}\right)x_{\tau+i}\left(h_{\tau+i-1}\right)\right] \tag{5.22}$$

where $x_{\tau+i}\left(h_{\tau+i-1}\right) \geq 1$ (as the gold standard has not yet been resumed). $\bar{C}^a$ is the highest current period utility achieved by deviation. Note that in the following period the gold backing ratio is arbitrarily small as $\eta_{\tau+i+1} = \eta_{\tau+i}/\bar{d}$. ■

The result of the deviation from declared policy plan σ is that the economy reverts to the static equilibrium – the commodity money system. The equilibrium is static as the allocation rules and policy plans under the commodity money system do not depend on the past history. Under the static state the household has abandoned the paper currency altogether and only specie circulates.

The static equilibrium $(\sigma^s, \Psi^s, \Pi^s)$ is defined as follows. For any history $i > j$ $h_{\tau+i-1}$, $\sigma^s_{\tau+i}(h_{\tau+i-1}) = \emptyset$. For the first stage, for every history $h_{\tau+i-1}$ the rule specifies that the household does not take any gold to the central bank, but mints some of its gold endowment to specie. With the given history h_{t+i} the household chooses $K_{\tau+i}$, $s_{\tau+i} = S_{\tau+i}/M^T_{\tau+i}$, $b_{\tau+i}$ and $C_{\tau+i}$ to maximise

$$U^s = \max_{z_{\tau+i}} \sum_{i=0}^{\infty} \beta^t U \left[C_{\tau+i}\left(z_{\tau+i}\right), K_{\tau+i}\left(z_{\tau+i}\right)\right] \tag{5.23}$$

subject to the specie-in-advance constraint (the nominal variables have been scaled with $M^T_{\tau+i+1} = S^s_{\tau+i+1} = z_{\tau+i} S^s_{\tau+i}$)

$$p_{\tau+i} C_{\tau+i} \leq q\delta S_{\tau+i} + \left[z_{\tau+i} - 1\right] + b_{\tau+i} - \frac{z_{\tau+i} b_{\tau+i+1}}{I_{\tau+i}}, \tag{5.24}$$

and the budget constraint

(5.25)

$$z_{\tau+i} S_{\tau+i+1} \leq \delta S_{\tau+i} + b_{\tau+i} + w_{\tau+i} L_{\tau+i} + \pi^f_{\tau+i} - \frac{z_{\tau+i} b_{\tau+i+1}}{I_{\tau+i}} + K^s_{\tau+i} - K_{\tau+i} - p_{\tau+i} C_{\tau+i}$$

for all $i > j$. As the paper currency has lost its value, coins are the only medium of exchange. The monetary value q of the gold has now a new meaning and it measures the gold content of coin. There are no financial intermediary services available as the central bank does not exist. The representative firm is not able to borrow to pay for its workers before the production started. The current period's wage is available for consumption purchases only in the following period. After the deviation the country is not able to return to the gold standard at any future point.

Proposition 5.6 *The static outcome* $(\emptyset, \psi^s, \pi^s)$ *implies that* $C_{\tau+i} = A,\ L_{\tau+i} = 1,\ z_{\tau+i} = z$ *and* $K = K^s - q^{-1}[z-1]$.

Proof: Under the static state the specie-in-advance constraint implies

$$p_{\tau+i}C_{\tau+i} \leq q\delta S_{\tau+i} + (1-\theta)(z_{\tau+i}-1) + b_{\tau+i} - \frac{b_{\tau+i+1}}{I_{\tau+i}} \tag{5.26}$$

where δ is the depreciation rate and θ is brassage[10]. As under the gold standard, the optimal specie growth rate can be found as a solution to the static problem. The Euler equation (5.7) becomes

$$z_{\tau+i}\frac{\rho}{q}U_K(\tau+i) = \beta\frac{U_C(\tau+i+1)}{p_{\tau+i+1}} \tag{5.27}$$

If the utility function takes the loglinear form (5.6), we can write (5.27) as

$$z\frac{\rho}{q}\left[K^s - q^{-1}(z-1)\right]^{-1} = \beta\delta\left[\delta + (1-\theta)(z-1)\right]^{-1}. \tag{5.28}$$

The amount of gold available in utility yielding form is reduced by brassage and printing cost. The optimal specie growth rate can be found as a solution to the

[10]The specie-in-advance constraint (5.24) can be derived from the cash-in-advance constraint (4.23), $p_tC_t \leq m_t + q\delta S_t + q(1-\theta)(z_t-1)S_t^s + (x_t-1)\eta_t m^s + w_tL_t + b_t - \frac{g_tb_{t+1}}{I_t}$, discussed in the baseline model in Section 4.2, by setting $m = m^s = 0$ in every period, and removing the wage bill.

quadratic equation

$$(1-\theta)\,\rho z^2 + [\delta\rho - (1-\theta)\,\rho + \beta\delta]\, z - \beta\delta\,(qK_t^s + 1) = 0. \tag{5.29}$$

$$z = \frac{-[\delta\rho - (1-\theta)\,\rho + \beta\delta] + \left[[\delta\rho - (1-\theta)\,\rho + \beta\delta]^2 + 4\,(1-\theta)\,\rho\beta\delta\,(qK_t^s + 1)\right]^{\frac{1}{2}}}{2\,(1-\theta)\,\rho} \tag{5.30}$$

The negative root can be ignored. Note that the lower bound of the specie growth rate $\underline{z}$ is higher than $\underline{x}^g$ as $z \in (1, \overline{z})$ and $x^g \in (\beta, \overline{x})$.■

Lemma 5.2 The optimal specie growth rate z under the commodity money standard is increasing in $\delta \in (0,1)$ and $\theta \in (0,1)$.

Proof: Appendix 5.B establishes that the higher the rate of depreciation or brassage, the larger the amount of gold the household has to mint.

Proposition 5.7 *Welfare under the static equilibrium is lower than under the gold standard.*

Proof: The optimal money growth rate under the gold standard x^g approaches β that is less than unity, but the lowest bound of z equals unity. Under the static equilibrium gold specie is used as a medium of exchange and the depreciation δ and brassage θ reduce the amount of consumable gold, gold in utility yielding form.■

In the next proposition I characterise the entire set of sustainable outcomes which ensure the resumption of the gold standard. For an arbitrary sequence of policies and allocations (d, π, ψ) , the revert-to-static policy plans specify continuation with the plan to resume the gold standard as long as the policy defined by the original plan has been chosen in the past. The allocation rule specifies that immediately after a deviation the household and the firm will follow the rule defined by the static allocation rule and stay in this static state in all subsequent periods.

Proposition 5.8 *Sustainability of the resumption of the gold standard: let d be an arbitrary policy and (π, ψ) an arbitrary allocation. Then the return to the perfect gold standard is sustainable if and only if (d, π, ψ) satisfies*

$$\sum_{i=j}^{S} \beta^{j-i} U_{\tau+i} + \sum_{i=S+1}^{\infty} \beta^{j-i} U^{g}_{\tau+i} \geq U^{a} + \frac{\beta}{1-\beta} U^{s}, \tag{5.31}$$

where $K_{\tau+i}$, $C_{\tau+i}$, $s_{\tau+i+1,}$ $m_{\tau+n+1}$ and $b_{\tau+i+1}$ are given by ψ, and $L_{\tau+i}$ is given by π.

Proposition 5.8 implies that the resumption of the gold standard is sustainable, if the adjustment to the gold standard between periods $\tau + j$ and $\tau + S$ and gold standard thereafter will yield at least as much utility as default on period $\tau + j$ and static state thereafter.

Inequality (5.31) completely characterises the conditions under which an arbitrary sequence of policies and allocations is sustainable. The resumption of the gold standard rule between periods $\tau+j$ and $\tau+S$ and the gold standard thereafter must provide at least as much utility from $\tau + j$ forward than what is obtained by deviating from much the plan in date $\tau+j$ and reverting to the autarky thereafter.

Inequality (5.31) is the key result of this chapter. It suggests that in 1821 the gold standard was resumed because the benefits of the gold standard did outweigh the cost of adjustment, which was a necessary procedure for resumption: the gold standard was seen to maximise social utility in the long-run. Autarky policy in the context of the Suspension Period meant that either the Bank would have attempted to make the most of its paper money creation powers by issuing large amount of paper money, or the Bank would have caused unnecessary delay before starting to adjust the economy to the gold standard after the arrival of peace. During the Suspension Period deviation to specie standard was seen as a serious threat. According to *The Bullion Report* there was evidence that in 1810 some merchants illegally charged higher prices from those who wished to pay with Bank notes rather than specie.

5.5. The Discretionary Money Growth Rate and Welfare: Some Examples

In this section, my objective is to show that viewing suspension through the lens of theory is useful. I present some simple but suggestive numerical examples of optimal monetary policy during suspension. I do not attempt to develop fully calibrated models that might reflect, for example, monetary policy between 1797 and 1821; this is left for future research.

The first example analyses whether issuing fiat money during the stoppage period improves social welfare. The overall welfare effect of fiat money supply is ambiguous. As discussed in Chapter 4 issuing paper money during the stoppage period increases utility during those periods, but subsequently withdrawing paper money from circulation decreases utility during the adjustment periods. The second example illustrates how *brassage* and depreciation of specie decrease the welfare of the commodity money regime and support the resumption of the gold standard: the higher the cost of the commodity money regime, the more likely the resumption.

Example 1: The Discretionary Money Growth Rate This exercise analyses whether the total discounted utility of the representative household increases or decreases if the central bank issues fiat money during the stoppage periods. In the bad state, in absence of the gold endowment, consumption and welfare increases if the fiat money growth rate increases, but during the adjustment periods withdrawing issued fiat money from circulation reduces consumption and welfare. As discussed in section 4.5, if issuing paper money would decrease total welfare, the central bank would not issue any fiat money and only prevent the household from converting currency to gold during the stoppage periods. The benefit of this strategy is that once the war has finished, there is no need for adjustment and the gold standard can be resumed immediately.

The parametric form of the utility function during the suspension is

(5.32)

$$\begin{aligned}\sum_{i=0}^{S}\beta^{t}U\left(C_{\tau+i},K_{\tau+i}\right) &= \sum_{i=0}^{j}\beta^{i}\left[\log C_{\tau+i}\left(d_{\tau+i}\right)\right] \\ &\quad+\sum_{i=j+1}^{S}\beta^{i}\left[\log C_{\tau+i}\left(d_{\tau+i},x_{\tau+i}\right)+\rho\log K_{\tau+i}\left(d_{\tau+i},x_{\tau+i}\right)\right],\end{aligned}$$

where $\sum_{i=0}^{j}\beta^{i}\left[\log C_{\tau+i}\left(d_{\tau+i}\right)\right]$ is the discounted utility of the stoppage periods and $\sum_{i=j+1}^{S}\beta^{i}\left[\log C_{\tau+i}\left(d_{\tau+i},x_{\tau+i}\right)+\rho\log K_{\tau+i}\left(d_{\tau+i},x_{\tau+i}\right)\right]$ is discounted utility of the adjustment periods. The starting point is to solve for private agents' allocations as a function of $x_{\tau+i}$ and $d_{\tau+i}$. In this deterministic model it is known that period $\tau+S$ is the final suspension period. The Euler equation (5.7) can be written as

$$d_{\tau+S}x_{\tau+S}\rho\frac{U_{K}\left(\tau+S\right)}{q}=\beta\frac{U_{C}\left(\tau+S+1\right)}{p_{\tau+S+1}} \tag{5.33}$$

where $U_K\left(\tau+S\right)$ is the marginal utility of gold during the final suspension period and $U_C\left(\tau+S+1\right)$ is the marginal utility of consumption during the period when the country returns to the gold standard. When the gold standard is resumed the money growth rate is x^g. Given (5.32), consumption, gold demand and price level are derived in Appendix 5.C. During the final suspension period, the money growth rate proportional to net change in monetary gold is

$$x_{\tau+S}=\frac{\beta\left(qK^{s}+\eta_{\tau+S}\right)}{2x^{g}d_{\tau+S}\rho+\beta\eta_{\tau+S}}. \tag{5.34}$$

The money growth rate proportional to monetary gold $x_{\tau+i}$ can be solved backwards recursively for given $d_{\tau+i}$ and $\eta_{\tau+i}$. The central bank's problem is to choose $d_{\tau+i}$ to maximise (5.32) subject to the terminal condition

$$\prod_{i=0}^{S} d_{\tau+i} = 1. \tag{5.35}$$

Exercise 1.A The Discretionary Money Growth Rate when Suspension Lasts for Two Periods: Let $S = 2$ and $j = 1$ which indicates the most simple case, where the stoppage and adjustment only last one period each. Any fiat money issued at period $i = 1$ must be withdrawn from circulation at period $i = S = 2$. This implies that the discretionary money growth rate and the gold reserve ratios during adjustment are defined by the discretionary money growth rate during the stoppage period. In other words, the discretionary money growth rates during the adjustment period is the inverse of the discretionary money growth rate during the stoppage period, i.e. $d_2 = 1/d_1$. By (4.12) the discretionary money growth rate is an inverse of the growth rate of the gold reserve ratio, i.e.

$$d_1 = \frac{\eta_1}{\eta_2}. \tag{5.36}$$

At the beginning of the stoppage period the gold backing is still perfect thus $\eta_1 = 1$, but at the beginning of the adjustment period it is smaller than unity as some fiat money has been issued, i.e. $\eta_2 = 1/d_1 \geq 1$. The central bank's problem in this two period example is to choose d_1 to maximise

$$
\begin{aligned}
(5.37)\quad U(d_1) &= \log C_1 + \beta\left[\log C_2 + \rho \log K_2\right] \\
&= \log(A^{1-\gamma}\omega_1^{-\gamma}(1+d_1)^{\gamma}) \\
&\quad +\beta \log\left[A^{1-\gamma}\omega_2^{-\gamma}(1-\eta_2+(\eta_2+d_2)\,x_2)^{\gamma}\right] + \rho \log\left[K^s - q^{-1}(x_2-1)\,\eta_2\right],
\end{aligned}
$$

where both the discretionary money growth rate and the gold backing ration can be written using d_1

$$\eta_2 = d_2 = \frac{1}{d_1}, \tag{5.38}$$

subject to the terminal condition

$$d_1 d_2 = 1. \tag{5.39}$$

By substituting (5.38) into (5.34), the money growth rate proportional to the gold stock at the adjustment period can be written as a function of the discretionary money growth rate d_1 and the money growth rate under the gold standard x^g

$$x_2 = \frac{\beta\,(qK^s d_1 + 1)}{(2x^g\rho + \beta)}. \tag{5.40}$$

Under the suspension, x_2 is bounded by

$$x_2 \in [1,\ qK^s + 1)\,. \tag{5.41}$$

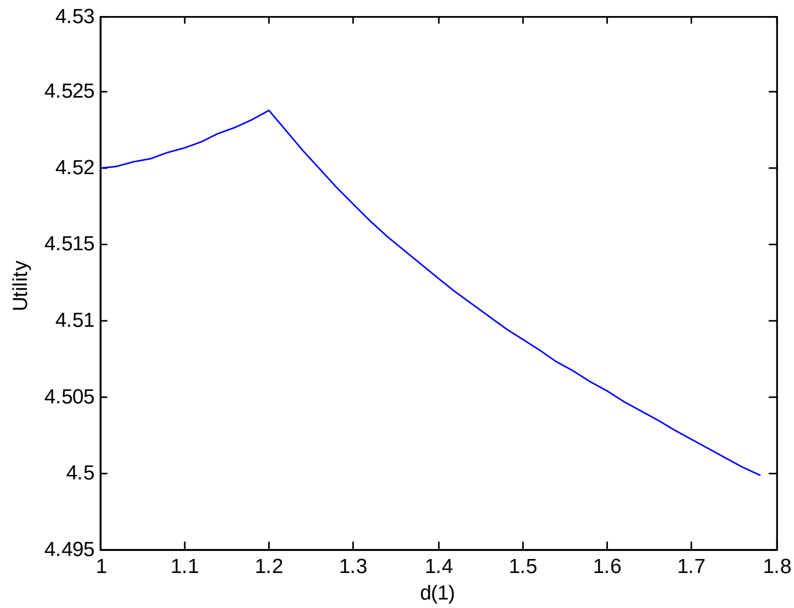

Figure 5.1. Total discounted utility (5.37) when the suspension lasts for two periods

Figure (5.1) plots total utility against d_1.[11] I assume the following parametric values: $\beta = 0.95,\ A = 10,\ p_1 > \omega_1,\ p_1 = \omega_2 > p_2,\ q = 1$ and $K^s = 1$. It can be seen that the total discounted utility increases until $d_1 = 1.2$ but decreases when d_1 is above 1.2. Note that this result does not indicate that $d_1 = 1.2$ would be the sustainable money growth rate, as that would depend on the relative disutility of the commodity money regime.

[11]See Appendix 5.E for the code.

Exercise 1.B Discretionary Money Growth Rate when Suspension Lasts for Several Periods: Solving for the optimal d is tedious if there is more than one stoppage and adjustment period. To make the process easier, I simplify the problem slightly by asking what would be the optimal money growth rate during the stoppage periods if the money growth rate were fixed across stoppage periods and the withdrawal rate is fixed across adjustment periods.[12] This case is identical to the example analysed in section 4.5. Now the gold backing ratio $\eta_{\tau+i}$, and discretionary money growth rate $d_{\tau+i}$ during the adjustment become functions of $d_{\tau+i}$ during the stoppage periods, and the relative number of stoppage and adjustment periods (see Appendix 5.D). The war is assumed to last for two periods and adjustment for eight periods. I assume that $\omega_{\tau+i} = p_{\tau+i-1}$.

First, as seen in Figure 5.2 for low enough values of the discount factor, $\beta < 0.89$ the total discounted utility increases when the money growth rate increases. Second, from Figure 5.3, if $\beta = 0.89$ the total utility seems to decrease for relatively low discretionary money growth rates but increases for relatively higher money growth rates. Finally, Figure 5.4 shows how for high enough discount factors the total discounted utility decreases if d increases. Also in Chari and Kehoe (1990) the outcome is sensitive for the discount factor β.

[12]See Appendix 5.E for the code.

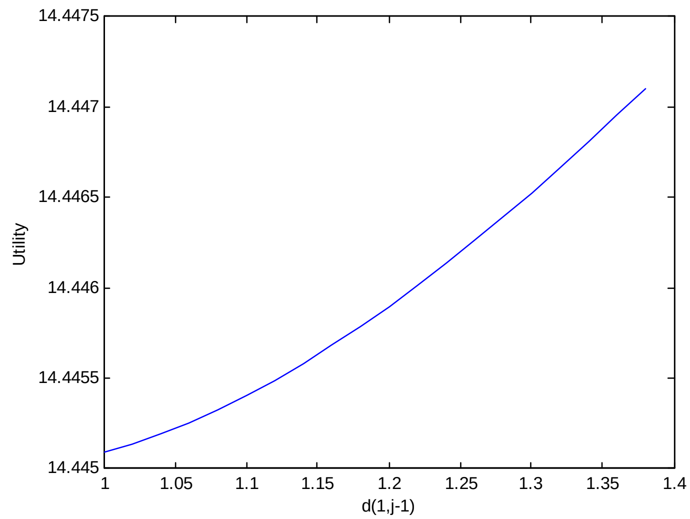

Figure 5.2 Total discounted utility vs. the discretionary money growth rate during the stoppage periods when $\beta < 0.89$.

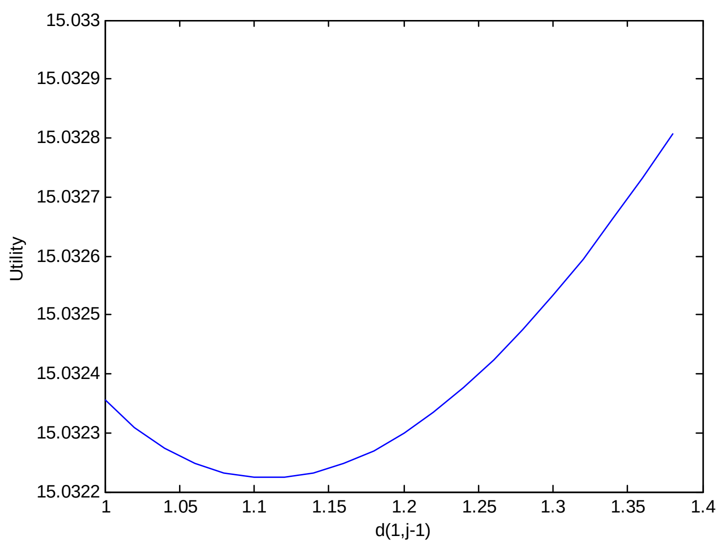

Figure 5.3 Total discounted utility vs. the discretionary money growth rate during the stoppage periods when $\beta = 90$.

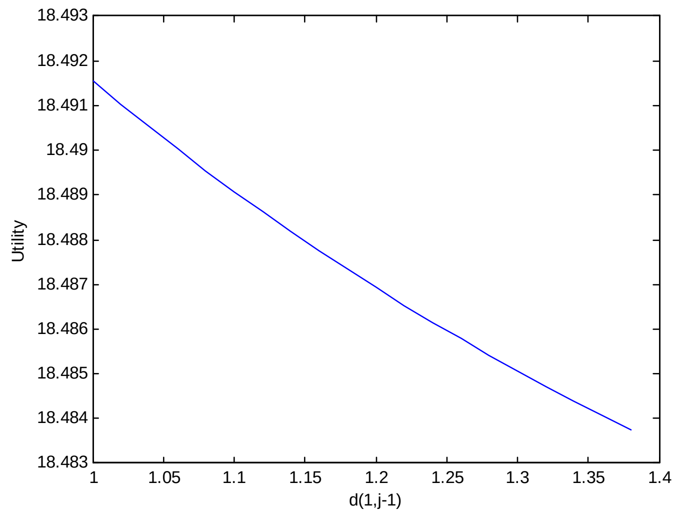

Figure 5.4 Total discounted utility vs. the discretionary money growth rate during the stoppage periods when $\beta > 0.95$.

Example 2 With this example my aim is to illustrate how the sustainability of the central bank's policy is dependent on the inefficiency of the specie standard.[13] Parametric values are: $\beta = 0.9$, $\delta = 0.98$, $K^s = 1$, $q = 1$, $A = 10$. From inequality (5.31) it is obvious that the lower is static utility relative to utility under the gold standard, the more likely the monetary authority is to follow its monetary policy plan to resume the gold standard. Thus whether some particular policy is sustainable depends not just on the money growth rate during the war or on the discount rate, but also on welfare losses under the commodity money system.

[13] See Appendix 5.E for the code.

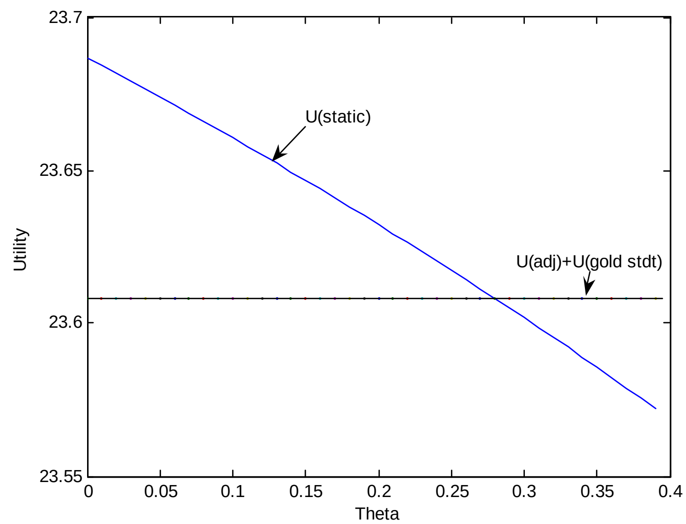

Figure 5.5 Utilities from deviation and resumption of the gold standard v.s minting cost.

Figure (5.5) plots both sides of inequality (5.31) as a function of θ, *brassage*. The schedule marked as $U(static)$ plots discounted utility from deviation and static state thereafter for different values of θ. The horizontal line plots utilities from adjustment and gold standard which is independent on given θ. Given these parametric values, as long as $\theta > 0.28$ – i.e. *brassage* equals 28 percent of the gold the household takes to the mint to be coined – resumption of the gold standard is a sustainable plan that yields higher discounted utility than default and deviation to static state thereafter.

5.6. Conclusions

The main purpose of this chapter was to analyse what made the suspension of cash payments a credible monetary policy regime. I showed that suspension was credible, because the resumption of the gold standard in the future was a sustainable plan, which replaced the gold standard as a commitment technology during the time of war. The gold standard was resumed, because it was seen to maximise long-run social welfare. This conclusion was a result of the model, which built on the theory of sustainable plans by Chari and Kehoe (1990).

My starting point was to model the gold standard as a commitment technology that solved the monetary authority's time inconsistency problem in a good state of the world, but not in a bad state. The chapter defined under what conditions policy in the bad state, in absence of the gold convertibility rule, can still be sustainable, i.e. solve the policy maker's time inconsistency problem. This sustainable equilibrium associated with the plan is a sequence of history-contingent policies and allocations that are supported both by reputation and extreme trigger strategies. The policy maker's policy plan defines that after the gold flow has resumed the policy maker has to start adjusting the economy back to the gold standard, which is a process that might reduce social welfare temporarily. At the particular moment when the gold flow resumes, the policy maker has a temptation to deviate, i.e. maximise current period's utility by printing an arbitrarily large amount of money. The outcome of the default is that the economy deviates permanently to the static state in which paper money has lost its value and only gold specie circulates as a medium of exchange. This commodity money standard is inefficient: it does not facilitate financial intermediation and utility is reduced as specie is involved with depreciation and minting costs.

Although the gold standard can be seen as a contingent rule that was abandoned in the war time emergency, the resumption of the gold standard in 1821 was not such a self-evident truth as Bordo and Kydland (1995) and Bordo and Schwartz (1997) have argued. Absence of the commitment rule made the economy's underlying rigidities visible and gave the central bank an opportunity to stimulate the economy with fiat money transfers. This chapter showed that it was not the superiority of the gold standard rule, but the active monetary policy conducted by the Bank of England that ensured the successful resumption. The gold standard was seen to maximise social welfare, although deviation, i.e. maximising one period utility by issuing large amount of money would have been possible but not desirable.

According to one of many memorable quotations by John Maynard Keynes, the gold standard is a barbaric relic. So it might have been, if compared with modern fiat monetary systems. But the gold standard, as it evolved in Britain from 1717 until 1914, offered significant benefits over commodity money systems that had existed since ancient times. The gold standard facilitated public borrowing, financial intermediation and reduced costs of acquiring money. During the suspension of cash payments from 1797 to 1821 reversion to the commodity money system was seen as a real threat by monetary authorities, because that is exactly what had happened in France after *assignats* had failed as a result of over issue. The credibility of the French financial system was lost during the revolution, and Napoleon, the most powerful monarch of contemporary Europe, had to finance his wars by tax collection practices of the Old Regime.[14] If anything, the successful resumption of the gold standard in 1821 strengthened Britain's credibility as a borrower and made London the centre of the financial world.

[14] Sargent and Velde (1995).

Appendix 5.A

The money growth rate proportional to the monetary gold under the gold standard is a positive root of the quadratic equation

$$2\rho x^{g2}+\beta x^{g}-\beta\left(K^{s}q+1\right)=0$$

i.e.

$$x^{g}=\frac{-\beta+\left[\beta^{2}+8\rho\beta\left(K^{s}q+1\right)\right]^{\frac{1}{2}}}{4\rho}. \tag{5.42}$$

x^{g} does not have the border solution β if $\rho<\frac{(1+qK^{s})}{2\beta}-\frac{1}{2}$ thus

$$\begin{aligned}
\frac{-\beta+\left[\beta^{2}+8\rho\beta\left(K^{s}q+1\right)\right]^{\frac{1}{2}}}{4\rho} &> \beta\\
\left[\beta^{2}+8\rho\beta\left(1+qK^{s}\right)\right]^{\frac{1}{2}} &> \left(4\rho+1\right)\beta\\
\rho\beta\left(1+qK^{s}\right) &> \left(2\rho^{2}+\rho\right)\beta^{2}\\
\left(1+qK^{s}\right) &> \left(2\rho+1\right)\beta\\
& \frac{1}{2}\left(\frac{1+qK^{s}}{\beta}-1\right)>\rho.
\end{aligned}$$

Appendix 5.B

In order to show that the specie growth rate z is a strictly increasing function in δ and θ, one should show that $z_\delta > 0$, $z_{\delta\delta} > 0$ and $z_\theta > 0$ and $z_{\theta\theta} > 0$ (or as below $z_{1-\theta} < 0$ and $z_{(1-\theta)^2} < 0$).

(5.B1)

$$z = \frac{-\left[\delta\rho - (1-\theta)\rho + \beta\delta\right] + \left[\left[\delta\rho - (1-\theta)\rho + \beta\delta\right]^2 + 4(1-\theta)\rho\beta\delta\left(qK_t^s + 1\right)\right]^{\frac{1}{2}}}{2(1-\theta)\rho}$$

The solution process is straight forward but tedious and therefore, I also add the numerical example. Equation 5.B1 can be written as

$$\begin{aligned} z &= -\left[\delta\rho + \beta\delta\right]\left[2(1-\theta)\rho\right]^{-1} + \frac{1}{2} \\ &\quad + \left[\left(-\left[\delta\rho + \beta\delta\right]\left[2(1-\theta)\rho\right]^{-1} - \frac{1}{2}\right)^2 + \beta\delta\left(qK_t^s + 1\right)\left[(1-\theta)\rho\right]^{-1}\right]^{\frac{1}{2}}, \end{aligned}$$

The first order condition for $1-\theta$, $z_{1-\theta}$ becomes

$$\begin{aligned} 0 &> \frac{\left[\delta\rho + \beta\delta\right]}{2\rho(1-\theta)^2} + \frac{1}{2}\left[\left(-\frac{\left[\delta\rho + \beta\delta\right]}{\left[2(1-\theta)\rho\right]} - \frac{1}{2}\right)^2 + \frac{\beta\delta\left(qK_t^s + 1\right)}{\left[(1-\theta)\rho\right]}\right]^{-\frac{1}{2}} \\ &\quad \left\{\frac{1}{2}\left(\frac{\left[\delta\rho + \beta\delta\right]}{(1-\theta)\rho} - 1\right) - \beta\delta\left(qK_t^s + 1\right)\right\}\frac{1}{(1-\theta)^2\rho}. \end{aligned}$$

After reorganising one gets

$$\left(\frac{\left[\delta\rho + \beta\delta\right]}{\left[2(1-\theta)\rho\right]}\right)^2 + \frac{1}{2}\frac{\left[\delta\rho + \beta\delta\right]}{\left[2(1-\theta)\rho\right]} + \frac{1}{4} + \frac{\beta\delta\left(qK_t^s + 1\right)}{\left[(1-\theta)\rho\right]} > \left(\frac{1}{2(1-\theta)\rho}\right)^2$$

which holds.

The second order condition for $1-\theta$ becomes

$$z_{(1-\theta)^2} = \frac{-4\rho\left[\delta\rho+\beta\delta\right]^2}{\left[2\left(1-\theta\right)\rho\right]^3} - \frac{\left[\delta\rho+\beta\delta\right]\rho}{\left[2\left(1-\theta\right)\rho\right]^2} - \frac{\beta\delta\left(qK_t^s+1\right)}{\left[\left(1-\theta\right)\rho\right]^2} + \frac{\rho}{2\left(\left(1-\theta\right)\rho\right)^{-3}} < 0$$

which is negative.

Respectively, z_δ becomes

$$\begin{aligned} z_\delta &= -\left(\rho+\beta\right)+ \\ &+\frac{1}{2}\left[\left[\delta\left(\rho+\beta\right)-\left(1-\theta\right)\rho\right]^2+4\left(1-\theta\right)\rho\beta\delta\left(qK_t^s+1\right)\right]^{-\frac{1}{2}} \\ &\left\{\left[2\left[\delta\left(\rho+\beta\right)-\left(1-\theta\right)\rho\right]\left(\rho+\beta\right)\right]+4\left(1-\theta\right)\rho\beta\left(qK_t^s+1\right)\right\} \end{aligned}$$

$$\begin{aligned} 0 &< \left\{4\left[\delta\left(\rho+\beta\right)-\left(1-\theta\right)\rho\right]\left(\rho+\beta\right)+8\left(1-\theta\right)\rho\beta\left(qK_t^s+1\right)\right\}^2 - \\ &\left[\left[\delta\left(\rho+\beta\right)-\left(1-\theta\right)\rho\right]^2+4\left(1-\theta\right)\rho\beta\delta\left(qK_t^s+1\right)\right]\left(\rho+\beta\right)^2 \end{aligned}$$

which also holds. The second order condition is

$$\begin{aligned} &z_{\delta\delta} = 4\left\{\left[\delta\left(\rho+\beta\right)-\left(1-\theta\right)\rho\right]\left(\rho+\beta\right)+\left(1-\theta\right)\rho\beta\left(qK_t^s+1\right)\right\} \\ &-2\left\{\left[\delta\left(\rho+\beta\right)-\left(1-\theta\right)\rho\right]\left(\rho+\beta\right)+2\left(1-\theta\right)\rho\beta\left(qK_t^s+1\right)\right\} > 0 \end{aligned}$$

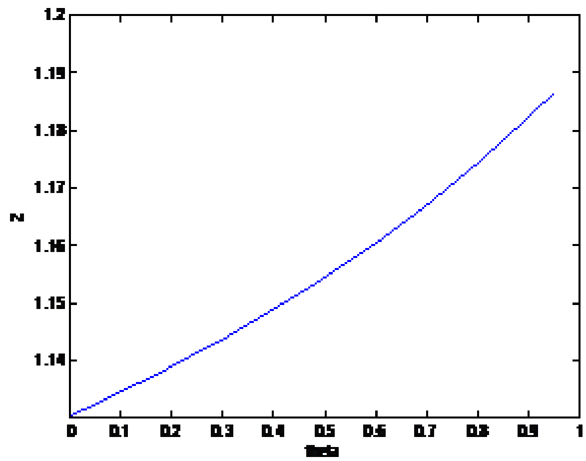

Figure 5.2. Brassage and the Specie Growth Rate

The second order condition becomes

$$z_{\delta\delta} = 32\left\{\left[\delta\left(\rho+\beta\right)-\left(1-\theta\right)\rho\right]\left(\rho+\beta\right)+2\left(1-\theta\right)\rho\beta\left(qK_t^s+1\right)\right\}$$

$$-2\left\{\left[\delta\left(\rho+\beta\right)-\left(1-\theta\right)\rho\right]\left(\rho+\beta\right)+2\left(1-\theta\right)\rho\beta\left(qK_t^s+1\right)\right\}>0.$$

As these are rather obscure expressions, I also attach numerical simulation here to highlight that the specie growth rate z is a strictly increasing function in δ and θ.

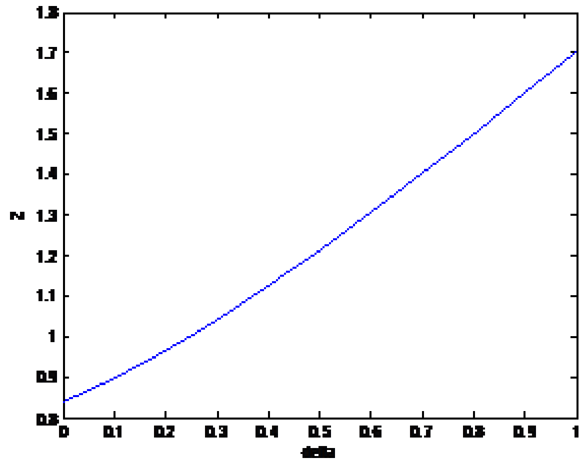

Figure 5.3. Depreciation and the Specie Growth Rate

The code for Figure 5.E.1

```
clear all

% CHECK THAT z IS AN INCREASING FUNCTION OF THETA

%initial values
beta=0.9;
delta=0.98;
gamma=0.8;
Ks=1;
q=1;
A=10;
rho=(Ks*q+1)/(2*beta)-1/2;
omega=2*(beta+0.001)/A;



S=20

VS=ones(S,1);

z=zeros(1,S);

for j=1:S
%Static state

    theta(j)=.05*(j-1); % brassage


    z(j)=(-1*((delta*rho-(1-theta(j))*rho)+beta*delta)+...
        ((delta*rho-(1-theta(j))*rho+beta*delta)^2+4*(1-
theta(j))*rho*delta*beta*(q*Ks+1))^(1/2))/(2*(1-theta(j))*rho)

end
plot(theta,z)
```

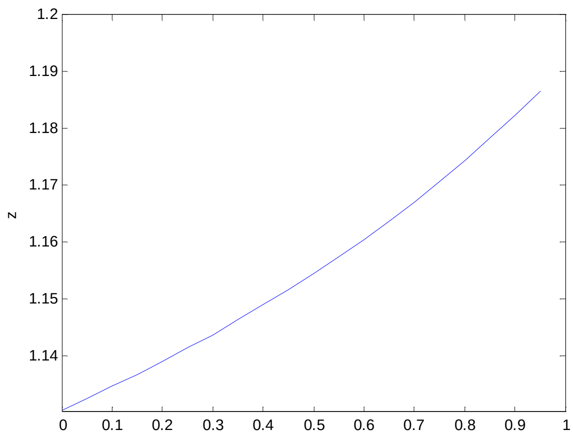

Figure 5.E.1

The code for Figure 5.E.2

```
clear all


% SHOWS THAT z IS AN INCREASING FUNCTION OF DEPRECIATION delta
beta=0.9;

gamma=0.8;
theta=0.1;
Ks=1;
q=1;
A=10;
rho=(Ks*q+1)/(2*beta)-1/2;
omega=2*(beta+0.001)/A;



S=11;

VS=ones(S,1);

z=zeros(1,S);

for j=1:S
%Static state

    delta(j)=.1*(j-1); % brassage

%z increases when brassage increases
    z(j)=((-1*((delta(j)*rho-(1-theta)*rho)+beta*delta(j))+...
        ((delta(j)*rho-(1-theta))*rho+beta*delta(j))^2+4*(1-
theta)*rho*delta(j)*beta*(q*Ks+1))^(1/2))/(2*(1-theta)*rho)


end
plot(delta,z)
```

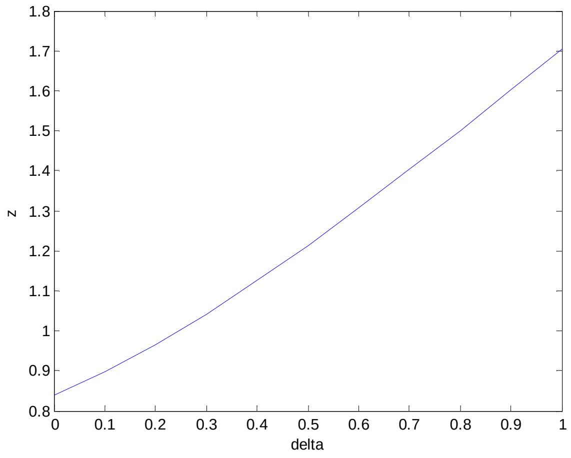

Figure 5.E.2

Appendix 5.C

Example 1 During the stoppage periods, $i \in (0, j-1)$, $x_{\tau+i} = 1$ and the price level and consumption are functions of $d_{\tau+i}$:

$$p_{\tau+i} = A^{\gamma-1}\omega_{\tau+i}^{\gamma}\left(1 + d_{\tau+i}\right)^{1-\gamma}$$

$$C_{\tau+i} = A^{1-\gamma}\omega_{\tau+i}^{-\gamma}\left(1 + d_{\tau+i}\right)^{\gamma}$$

The nominal interest rate between periods τ and $\tau + j - 2$ is

$$I_{\tau+i} = \frac{d_{\tau+i}x_{\tau+i}}{\beta}\frac{1 + d_{\tau+i+1}}{1 + d_{\tau+i}} > 1 \text{ where } i \in (0, j-2),$$

but when $i = j - 1$ the nominal interest rate becomes

$$I_{\tau+i} = \frac{d_{\tau+i}x_{\tau+i}}{\beta}\frac{1 - \eta_{\tau+i+1} + \left(\eta_{\tau+i+1} + d_{\tau+i+1}\right)x_{\tau+i+1}}{1 + d_{\tau+i}} > 1.$$

During the adjustment periods $i \in (j, S)$ the price level, consumption and the money growth rate proportional to monetary gold become:

$$p_{\tau+i} = A^{\gamma-1}\omega_{\tau+i}^{\gamma}\left[1 - \eta_{\tau+i} + \left(\eta_{\tau+i} + d_{\tau+i}\right)x_{\tau+i}\right]^{1-\gamma}$$

$$C_{\tau+i} = A^{1-\gamma}\omega_{\tau+i}^{-\gamma}\left[1 - \eta_{\tau+i} + \left(\eta_{\tau+i} + d_{\tau+i}\right)x_{\tau+i}\right]^{\gamma}$$

$$x_{\tau+i} = \frac{\beta\left[qK^{s} + \eta_{\tau+i}\right]}{d_{\tau+i}\rho\left[1 - \eta_{\tau+i+1} + \left(\eta_{\tau+i+1} + d_{\tau+i+1}\right)x_{\tau+i+1}\right] + \eta_{\tau+i}}$$

The money growth rate proportional to monetary gold is bounded during the adjustment periods by

$$x \in [1,\ qK^s + 1)\,.$$

Between periods $\tau + j$ and $\tau + S - 1$ the nominal interest rate becomes

$$I_{\tau+i} = \frac{d_{\tau+i}x_{\tau+i}}{\beta}\frac{\left[1 - \eta_{\tau+i+1} + \left(\eta_{\tau+i+1} + d_{\tau+i+1}\right)x_{\tau+i+1}\right]}{\left[1 - \eta_{\tau+i} + \left(\eta_{\tau+i} + d_{\tau+i}\right)x_{\tau+i}\right]} > 1$$

and during the final suspension period $i = S$

$$I_{\tau+i} = \frac{d_{\tau+i}x_{\tau+i}}{\beta}\frac{2x^g}{\left[1 - \eta_{\tau+i} + \left(\eta_{\tau+i} + d_{\tau+i}\right)x_{\tau+i}\right]}$$

or

$$I_{\tau+i} = 1 \text{ if } \frac{d_{\tau+i}x_{\tau+i}}{\beta}\frac{2x^g}{\left[1 - \eta_{\tau+i} + \left(\eta_{\tau+i} + d_{\tau+i}\right)x_{\tau+i}\right]} < 1.$$

Appendix 5.D

Example 1.B In this exercise the war lasts for j periods and the suspension altogether lasts for 10 periods $(S = 10)$. If, as in the example presented in Chapter 4, both the discretionary money growth rate during the war and the discretionary money 'reduction' rate during the adjustment are assumed to be fixed at every period, the discretionary money reduction rate during the adjustment can be written as a function of the discretionary money growth rate during the war and j (the number of stoppage periods) and S (the total number of suspension periods). The money reduction rate during the adjustment periods can be written as

$$d\,(adj) = \left| \frac{1}{d\,(war)}^{\frac{j}{S-j}} \right|.$$

The gold backing ratio during the war becomes

$$\eta_{\tau+i} = \left(\frac{1}{d\,(war)} \right)^{i-1}$$

and the gold backing ratio during the adjustment

$$\eta_{\tau+i} = \frac{1}{d\,(war)}^{\frac{(j+(i-j-1))j}{j-S}}.$$

As can be seen in figure (5.6) the gold backing ratio thus gradually decreases during the war when fiat money is issued, but then gradually increases during the adjustment when the central bank withdraws the fiat money from circulation. In this example the war lasts for 2 periods $(j = 2)$ and the suspension lasts for 10 periods ($S = 10$) and the central bank increases paper money supply by 38% on each stoppage period, i.e. $d\,(war) = 1.38$.

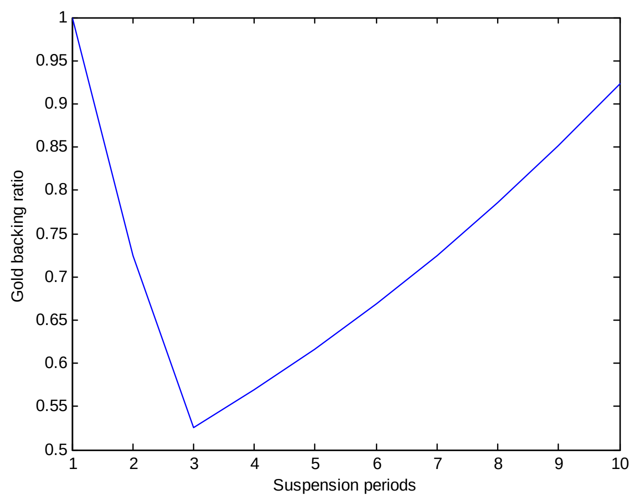

Figure 5.C.1 Gold backing ratio η when $d = 1.38$,war lasts for 2 periods ($j = 2$) and adjustment for 8 periods ($S = 2 + 8$).

Appendix 5.E

The code for Figure 5.1

```
clear all
%TOTAL DISCOUNTED UTILITY WHEN THE SUSPENSION LASTS FOR 2 PERIODS

%Initial parameter values
 A=10 %technology
beta=0.95 % discount factor
Ks=1.0 %gold endowment
q=1 %monetary price of gold
rho=0.6 % preference
gamma=0.3

xg=(-beta+(beta^2+8*rho*beta*(q*Ks+1))^(1/2))/(4*rho) % the money growth
rate under the gold standard

if xg<beta %this makes sure it is always larger than beta
   xg=beta+0.0001

end

Ug=log(A)+rho*log(Ks-(xg-1)/q) % utility under the gold standard

omega=2*xg/A % expected price level under the gold standard

 S=40

for i=1:S

    d1(i)=1+0.02*(i-1); % discretionary money growth rate during the
suspension

    x(i)=beta*(q*Ks*d1(i)+1)/(2*xg*rho+beta); % the money growth rate
proportional to monetary gold during adjustment

    if x(i)<1 ; % lower bound of x during the suspension is 1
       x(i)=1;

    end

      U1(i)=log(A^(1-gamma)*omega^(-gamma)*(1+d1(i))^gamma);
      UC2(i)=beta*log(A^(1-gamma)*omega^(-gamma)*(1-
      1/d1(i)+(2/d1(i))*x(i))^gamma);
      UK2(i)=beta*rho*log(Ks-1/q*(x(i)-1))*1/d1(i); % d2 is inverse of d1
      U(i)=U1(i)+UC2(i)+UK2(i); %Total utility during the stoppage

    I1(i)=d1(i)/beta*(1-1/d1(i)+2/d1(i)*x(i))/(1+d1(i)); %Interest rates
    I2(i)=x(i)/(beta*d1(i))*(2)/(1-1/d1(i)+(2/d1(i))*x(i));
    if I2(i)<1;
       I2(i)=1;
    end

end
% plot the discretionary money growth rate on the first period for total
utility
plot(d1,U)
```

The code for Figures 5.2, 5.3 and 5.4

```
clear all

%SOLVES TOTAL DISCOUNTED UTILITY FOR d
%d is fixed during the stoppage and adjustment periods

%Initial values
Ks=1;
beta=0.90; %Change beta
q=1;
rho=0.6;
A=10;
gamma=0.3;

%money growth rate during the gold standard
xg = beta+0.0001;
%expexted price level equals actual price level under the gold standard

omega=2*xg/A;

%one period utility under the gold standard
Ug=log(A)+rho*log(Ks-(xg-1)/q);
%discounted utility under the gold standard
Vg=1/(1-beta)*Ug;

%SUSPENSION OF THE GOLD STANDARD RULE

S=10; %Total number of suspension periods
N=2;  % Number of Stoppage Periods

K=20
TU=ones(K,1);


for j=1:K;
    d1(j)=1+.02*(j-1); % discretionary money growth rate during the
stoppage

    d=abs((1/d1(j))^(N/(S-N))); %constant money 'reduction rate' during the
adjustment

    CheckD=d1(j)^N*d^(S-N); %checks that the terminal condition holds

    % Gold reserve ratio

    ETA=ones(S,1);

    for i=1:N;
        ETA(i)=(1/d1(j))^(i-1);
    end

    for i=N+1:S;

        ETA(i)= d1(j)^(-N-(i-N-1)*(N/(N-S)));
```

```
end

%Etas have to be turned into reverse order in order to calculate x

eta=ETA(S:-1:1);
%This calculates X on its final period, (money growth rates solved
%backwards)

X=ones(1,S);

%Final x
X(1)=beta*(q*Ks+eta(i))/(2*d*rho*xg+beta*eta(i));
if X(1)< 1;
   X(1)=1;
end

%adjustment period
for i=2:S-N;
  X(i)=beta*(q*Ks+eta(i))/(d*rho*(1-eta(i-1)+(eta(i-1)+d)*X(i-
  1))+eta(i));
    if X(i) < 1;
       X(i) = 1 ;
    end
end

%stoppage periods: x always unity
for i=S-N+1:S;
    X(i)=1;

end

%first x should be last, turns x's around
x=X(S:-1:1);

if x(i)<1 % in absence of the gold convertibility rule x>=1

else

    %INTEREST RATE
    for i=1:N-1;
        I(i)=d1(j)/beta*(1+d1(j))/(1+d1(j));
    end

    for i=N:N;
        I(i)=d*x(i)/beta*(1-ETA(i)+(ETA(i)+d)*x(i))/(1+d1(j));
    end

    for i=N+1:S-1;
        I(i)=d*x(i)/beta*(1-ETA(i+1)+(ETA(i+1)+d)*x(i+1))/(1-
        ETA(i)+(ETA(i)+d)*x(i));
    end

    for i=S:S;
        I(i)=((2*xg*d*x(i))/beta)*(1-ETA(i)+(ETA(i)+d)*x(i))^(-1);
    end

    if I(S)<1;
```

```
            I(S)=1
        end

        %Consumption, gold, price level and utility during the suspension

        C=ones(S,1);
        K=ones(S,1);
        P=ones(S,1);
        U=ones(S,1);


        for i=1:S;
            if i==1; % the first stoppage period
                P(i)=A^(gamma-1)*(omega)^gamma*(1+d1(j))^(1-gamma);
                C(i)=A*(P(i)/omega)^(gamma/(1-gamma));
                K(i)=0;
            elseif i==2:N; %subsequent stoppage periods
                P(i)=A^(gamma-1)*(0.95*P(i-1))^gamma*(1+d1(j))^(1-gamma);
                C(i)=A*(P(i)/P(i-1))^(gamma/(1-gamma));
                K(i)=0;
            else i==N+1:S %adjustment periods
                P(i)=A^(gamma-1)*(0.95*P(i-1))^gamma*(1-
ETA(i)+(ETA(i)+d)*x(i))^(1-gamma);
                C(i)=A*(P(i)/P(i-1))^(gamma/(1-gamma));
                K(i)=Ks-((x(i)-1)/q)*ETA(i);
            end

        end

        for i=1:N;
        %Utility durind stoppage
            U(i)=log(C(i));
        end
        %Utility during adjustment
        for i=N+1:S;
            U(i)=log(C(i))+rho*log(K(i));
        end

        %Total Utility
        V=ones(S,1);
        for i=1:S;
            V(i)=beta^(i-1)*U(i);

        end
        TU(j)=sum(V);
    end
end
plot(d1,TU)
```

<u>The code for Figure 5.5</u>

```
clear all

% COMPARISON OF UTLITY LEVELS BETWEEN ADJUSTMENT + GOLD STANDARD AND
% DEVIATION + STATIC STATE
beta=0.9
delta=0.98
gamma=0.8
Ks=1
q=1
A=10
rho=(Ks*q+1)/(2*beta)-1/2
omega=2*(beta+0.001)/A

 S=40

VS=ones(S,1)

z=zeros(1,S)

for j=1:S
%Static state

    theta(j)=.01*(j-1); % brassage

%z increases when brassage increases
    z(j)=(-1*((delta*rho-(1-theta(j))*rho)+beta*delta)+...
        ((delta*rho-(1-theta(j))*rho+beta*delta)^2+4*(1-
theta(j))*rho*delta*beta*(q*Ks+1))^(1/2))/(2*(1-theta(j))*rho)

%gold consumption in the static state
    KS(j)=Ks-(z(j)-1);

    TestK=KS(j)-Ks+(z(j)-1);
    US(j)=log(A)+rho*log(KS(j));
    VS(j)=beta/(1-beta)*US(j) %static state discounted utility

%Gold standard
    xg=(-beta+(beta^2+8*rho*beta*(Ks*q+1))^(1/2))/(4*rho)
    Kg=Ks-(xg-1)/q

    UG=log(A)+rho*log(Kg) %gold stdt utility
    VG=(1/(1-beta))*UG        %discounted gold standard utility

 %Utility from deviation

Cd=A^(1-gamma)*omega^(-gamma)*((1+9)*1)^gamma
Ud=log(Cd)+rho*log(Kg)

% Discounted utility of deviation and static state

UDS(j)=Ud+VS(j)
end
```

```
plot(theta,UDS, theta, VG)
```

Conclusions

After twenty-four years and two months of a paper pound, with the consent of Parliament the Bank of England restored full convertibility from 1 May 1821 – exactly two years before the scheduled date. The opposition towards resumption, which had always been stronger outside than inside Parliament, faded at the same rate as trade revived and manufacturers and merchants adjusted to the new peace time condition, and the resumption went almost unnoticed.[15] Between 1820 and 1821 the question of the monetary standard fell into the background and forgery of the Bank notes was seen as the most acute monetary problem. *The Times* expressed hopes that once the one pound notes were recalled and replaced by the sovereigns, the problem of counterfeiting would disappear.[16] Optimists then assumed that since paper currency was again convertible to gold, and some other regulations, such as restrictions upon the smelting and export of coin had been abolished, the financial stability of the country would have been achieved for good. It was generally believed the Bank's gold reserves would be sufficient to secure the

[15] Acworth (1925) p. 116.
[16] *The Times* 2 March 1821.

stable value of money, and the fact that paper money was still issued by hundreds of small country banks, did not raise the public's concern.[17]

The strain of events that followed the resumption in 1821 might lead one to conclude that convertibility had been overrated during the Suspension Period. The financial crises that occurred in 1826, 1836 and 1839 made the public and politicians gradually realise that although the gold standard had the microeconomic advantage of guaranteeing to a person an opportunity of changing paper money to gold at a fixed price, convertibility could not automatically provide the macroeconomic guarantee of ensuring the country with the optimal quantity of money.[18]

During the Suspension Period all ranks of society grew accustomed to using paper money as a medium of exchange. Notes of small face value were a common method of wage payments and country banks encouraged their usage following the resumption in order to avoid transferring gold. Although the Bank of England had not issued small notes since 8 May 1821, many still remained in circulation, because the public considered the Bank notes to be more secure than the small notes of the country banks.[19] Monetary authorities did not consider the popularity of small notes to be a solely positive development: poor people were the first to bring their small notes to be converted to gold in the event of a panic, which increased the volatility of money supply. But as the agriculture – the largest sector of the economy – was still in a depressed state, the government and the

[17]Fetter (1965), p. 111. Feavearyear (1963), p. 227.
[18]Davies (1994) p. 304.
[19]Fetter (1965) p. 114.

Bank adopted expansionary monetary and fiscal policies. The original intended resumption date, 1 May 1823, had remained the date at which country banks were supposed to cease issuing small notes, but in 1822 Parliament passed an act that prolonged their circulation until 1833.[20]

Expansionary policies combined with increasing liquidity and falling market rates of interest resulted in a financial expansion, which led to export boom and to extensive – and speculative – foreign investments. New legislation encouraged incorporation, the stock market expanded and share prices soared. Country bank notes, which chiefly financed this expansion,[21] were convertible to gold on demand, yet there was only little gold in the provinces. The Bank remained a passive observer, because its own bullion reserves were large and the exchange rate favourable.

In December 1824 came a sharp change – the crises followed a similar pattern as that in 1797. According to Gayer et al. (1953) between January and June 1825 the Bank's bullion reserves fell by 43 percent, from £10,100,000 to £5,700,000 and by January 1826 the situation was almost as gloomy as in 1797: the Bank had only £1,900,000 worth of bullion in its vaults. Again, gold went abroad and the country banks withdrew their deposits from the Bank in order to be prepared for potential runs. Bankruptcies grew, as the Bank at the initial stage of the crisis refused to discount, which created a shortage of means of payment.[22] The situation was eased only when the Bank relaxed its discount policy and started itself to issue small

[20]Feavearyear (1963) p. 234. Fetter (1965) p. 107.
[21]Feavearyear (1963) p. 234.
[22]Pressnell (1956), p.491.

notes to satisfy the public's demand for a liquid medium of exchange.[23] According to Fetter (1965), the crisis was finally stopped, when the public believed that the Bank would function as a lender of the last resort.[24]

The crisis of 1825-1826 taught a lesson in that the gold convertibility rule alone was not sufficient condition to guarantee economic stability, and other additional controls over metallic money as well as paper money supply were needed. Once again the policy makers in London had to acknowledge that the crisis had not hit Scotland, where only one bank had failed since 1816. Scottish banks were stronger, because their ownership was not limited to six partners as it was in England.[25] The Act of 1826 allowed the Bank to establish local branches and other joint-stock banks to be established outside a 65-miles radius of London.

The government and Parliament were now able to carry out economic reforms more easily than before, because the Bank and its directors' attitude towards credit control had changed.[26] The passing of the Bank Charter Act on 23 August 1833 saw many reforms, which the Bank had been resisting during the bullion debates, firmly established: the Bank was made more transparent by requiring it to report its note issue and bullion reserves to the Treasury on a weekly basis, a monthly summary of which was published in *London Gazette*; the Bank notes were given an

[23]The story tells that the Bank brought the crisis to halt when the Bank officials accidentially found a box of unused one pound notes, which had not been issued in 1818. Fetter (1965) p. 114 and Feavearyear (1963) p. 237.
[24]Fetter (1965), p. 114.
[25]Davies (1994) p. 306.
[26]Feavearyear (1963) p. 246.

official legal tender status in England and Wales;[27] and finally, to help the Bank to react to internal drains more swiftly, the usury law was removed from limiting the interest rate of bills of exchange payable at or within three months.[28] This new policy instrument 'the Bank Rate', became an important means of regulating reserves and circulation between 1844 and 1914.[29]

After the resumption of the gold standard the bullionists and anti-bullionists' dispute over principles of money and monetary policy did not completely cease, but rather re-emerged in debates between two schools: the Currency and the Banking School. The Currency School followed in the footsteps of the Bullion Committee and argued that the quantity of paper money should never be higher than reserves.[30] By contrast to the 1810s when the Bank had supported the government's anti-bullionism, two of Bank of England's directors were amongst the main advocates of the Currency School and its strict principle.[31] The Banking School did not accept the old real-bills doctrine, but opposed any mechanical rules to control issue. Its members argued that the requirement to convert currency to gold would itself restrict issue. The Bank Charter Act of 1844, around which the debate evolved, became one of the pillars of the British monetary system. It divided the Bank into two departments: the Issue Department to regulate the currency and the Banking Department to follow sound commercial banking principles. The

[27]Davies (1994) p. 310.
[28]Feavearyear (1963) p. 251.
[29]Hawtrey (1962) p.1.
[30]Feavearyear (1963), p. 262-263.
[31]Davies (1994) p.311.

Issue Department's discretionary issue could only be £14,000,000, the rest had to be fully backed by bullion. The Act made the fiduciary issue of Bank notes of a fixed quantity and was designed to make the long-run maintenance of the gold standard more credible.

The epilogue of the Suspension Period was a success story once it was realised that convertibility alone could not guarantee financial stability. The combined use of the Bank Rate, open market operations and increasing the limit of fiduciary issue during the banking panics of 1847, 1857 and 1866 became the instruments the Bank used to secure its gold reserves.[32] Other countries were so impressed by the British example that gradually they switched from a silver or bimetallic standard to the gold standard. Although the sterling-centred International Classical Gold Standard in its purest form lasted for 34 years between 1880 and 1914, in Britain the gold standard helped to secure real, non-inflationary growth from 1844 until 1914. The new century, however, brought challenges which did not have parallels in the past. In 1914 history repeated itself, when the First World War resulted in the gold convertibility rule to be suspended.

[32]In 1860 a French economist Juglar, recognised that the gold standard created periodical commercial crises, which were recurrent, international and financial in nature. He identified three phases: during the first period credit was easy and the central bank accommodated liberally. As a result, bullion reserves reduced to the point where the central bank became cautious in extending credit. But such an action created the second phase: the crises. Increased alarm caused more borrowers to seek support from the central bank and more to be turned down. The third phase began with liquiditation and businesses went bankrupt. As the economy languished and velocity of money declined, the central bank began rebuilding its bullion reserve. The cycle could then start again. Flandreau (2007) and Vilar (1976).

* * *

Although the resumption of the gold standard might not have been able to solve all monetary problems immediately, the suspension of cash payments had, nevertheless, been a successful monetary policy regime during the French Wars. Unlike many other financial experiments, it did not lead to a collapse of the economy, but to the restoration of monetary stability. In this thesis I used the Suspension Period as an example of an era when monetary policy was conducted in a credible and time consistent manner even during difficult times. It was a watershed in the development of economic policy and offers a concrete example in which the rather abstract theory of sustainable plans can be developed and illustrated.

Through employing both modern macroeconomic theory and historical evidence in this thesis I analysed the extent to which the suspension of the gold convertibility rule changed the basis of trust in the monetary system when paper money was no longer convertible into gold, but only represented a promise of future convertibility at some uncertain date, and when monetary authorities could have increased the paper money supply without limit. According to Bordo and Kydland (1995) and Bordo and Schwartz (1997) this change was not critical, because the gold standard functioned as a contingent rule: the suspension of cash payments was exogenously credible, because during the suspension agents knew for certain that the gold standard would be resumed. My thesis has acknowledged that the gold standard had indeed a contingent nature – given that there have been fourteen successful suspensions and resumptions of the convertibility rule in twenty-one countries – but it attempted to provide alternative explanations for two key issues to which the gold standard as a contingent rule could not, in my opinion, satisfactorily answer. These issues, which form the main contribution of this work, were the credibility of monetary system in the absence of the gold backing, and the reason why the gold standard was resumed. The contradiction can be explained by the fundamental differences between my approach and that of Bordo and Kydland (1995) and Bordo and Schwartz (1997) towards the Suspension Period. Because the gold standard as a contingent rule theory has become a widely accepted in literature, my re-evaluation of this period is another original contribution. The re-evaluation brought up three new methodological questions that are addressed below: what is the most natural framework to analyse the Suspension Period, what were the policy objectives and rules during the gold standard and the suspension, and what was the justification to continue the suspension of cash payments for twenty-four years.

Firstly, Bordo and Kydland (1995) and Bordo and Schwartz (1997) use classical theory to study the suspension, but by contrast, in this thesis I analyse the Suspension Period of 1797-1821 from the perspective of the eighteenth-century gold standard, Pre-classical Gold Standard. In Chapter 1, I demonstrated how the classical analysis of the gold standard, such as the commodity theory of money, stressed the automaticity and impersonality of the gold standard rule and without modification was not a desirable framework to study reputation, expectations and other credibility issues. In Chapter 2, I established that the gold convertibility became an important monetary policy target already in the eighteenth century. Although Britain had been on a commodity money standard since medieval times, the gold reserve policy had important benefits: it increased credibility of the monetary and fiscal institutions during the Financial Revolution, facilitated financial intermediation and reduced the dead-weight loss of gold reserves. As the legislation developed from practice in the eighteenth century, many inconsistencies, such as usury laws, prevented the Bank from conducting monetary policy efficiently. In order to maintain convertibility, during crises the Bank had to rely on unconventional methods, such as paying the gold out in small pieces. This method, however unconventional, stabilised consumption and the price level sufficiently well until the end of the 1790s, when the shocks of different origin became large and persistent, and the stabilisation method broke down. The gold standard thus functioned as a contingent rule during the eighteenth century, but in different manner than argued by Bordo and Kydland (1995) and Bordo and Schwartz (1997).

My two remaining arguments which differ from those of Bordo and Kydland (1995) and Bordo and Schwartz (1997) are closely interrelated. In this thesis, instead of considering the gold standard and the suspension to be essentially the same systems, I have analysed the gold standard and the suspension as two independent monetary policy regimes, because the Bank of England's operating procedures, monetary policy rules and targets under these two regimes were not the same.

The exchange rate between the main trade partners was fixed under the gold standard, but floating under the suspension. The gold standard enforced credibility, the suspension flexibility as it enabled the Bank to use discretion. Under the gold standard the value of money was defined by direct convertibility to some fixed amount of gold, under the suspension money carried a promise of future convertibility. As was shown in Chapter 4, in theory under the gold standard the money stock could increase only if monetary gold increased. But when the public's demand for gold increased in the 1790s, the gold standard, which had stabilised the economy earlier in the century, became a shock amplifier.

The rumours of French invasion made the situation so critical that on 28 February 1797 the Bank of England had to cease converting its deposit notes to gold specie. The suspension of cash payments was initially an emergency measure to prevent a complete drain of the Bank's reserves and to maintain its notes in circulation. The constraint on money supply would have driven many merchants and bankers to the edge of insolvency, because long before the 1790s the importance of specie in domestic trade had reduced, and the merchants' payment system, especially in the City of London, was based on the Bank notes. As after the suspension the public did not have a motive to hold the Bank notes for gold conversion, the pressure eased and the Bank's reserves improved within a few months. A new war, however, put an end to the discussion of early resumption.

According to the gold standard as a contingent rule theory, the gold payments were not resumed after the initial emergency had passed, because in the absence of the gold standard the government was able to maximise its seigniorage revenue. It is difficult to see, though, why the private borrowers so willingly bought government debt, if the government's aim was maximising its seigniorage revenue: this would have created inflation, which would have decreased the realised return on the government paper. In this thesis, by contrast, I argued that although the suspension was initially an emergency measure, it increased a degree of flexibility in the economy and gave the monetary authorities an opportunity to stabilise the economy. Within the limits of its stabilisation policy, the Bank was able to provide the government with short-term debt finance in emergencies, but this was not ever a main source of war finance and the Napoleonic Wars were financed through public borrowing and taxation. Furthermore, the Bank was able to issue small notes, increase its discounts to the London merchants and buy the short-term paper of the government. As the economy had rigidities, increased issue had indirect effects: it stimulated production and increased employment by reducing real wages.

The success of the Bank's stabilisation policy was, however, dependent on the credibility of resumption and for example, debt was thus sold in terms of nominal value of its currency on the understanding that the debt would be eventually be paid off by gold. The model developed in Chapter 4 demonstrated how during the war years the Bank had an opportunity to issue fiat money, as long as it understood that once the war had finished, fiat money would be withdrawn from circulation. According to Feavearyear (1963) during the suspension the Bank was torn between its desire to help merchants and its promise to Parliament to resume payment as soon as possible,[33] while simultaneously facing the fierce criticism of the bullionists. After the war, when the economy was adjusting to new peace time conditions, the Bank was blamed for not discounting enough. The Bank pursued active and credible monetary policy during the suspension period and there was nothing magic in the gold standard which could explain the credibility of the suspension.

But ultimately, analysing the Suspension Period of 1797-1821 through the theory of credible and time consistent policy, this thesis has shown that suspension was credible, because the resumption of the gold standard rule at the old par value at some future unknown date was a sustainable plan. As was demonstrated in Chapter 5, the monetary authorities had an opportunity to infinite nominal expansion or avoiding the costly adjustment process altogether, which might have served to maximise utility in the very short-run. But the outcome of this deviation might have been a hyperinflation as in France between 1794 and 1795, a collapse of trust towards the monetary institutions and demonetisation, which could have brought the whole Industrial Revolution to an halt. Sustainability was crucial both during and after war: it maintained paper currency in circulation and enabled the Bank of England to conduct independent and credible stabilisation policy. The gold standard was resumed because it was seen to maximise long-term benefits of the society: it facilitated public borrowing and maintained economic conditions stable during the time of peace. Furthermore, as discussed in Chapter 3, the mint

[33]Feavearyear (1963) p. 246.

price of gold was an important nominal anchor which made the monetary policy of the Bank transparent. Debate over the resumption of the gold standard at the original parity became so heated in the 1810s that it had almost religious qualities. Lowering the standard was such an evil suggestion for bullionists that according to one contemporary observer, it 'could have been suggested by nobody but the Devil himself in person, it will not, it cannot, it must not, be adopted nor attempted'.[34]

As the stabilisation policy was relatively successful during the war, one might ask whether the Bank would have been able to issue the right amount of currency to deliver price stability with a permanent paper pound regime? The answer of Ricardo and other bullionists was strictly negative, as the Bank in their opinion would not be able to resist its temptation to increase its private profits by increasing issue. Mathias and Thomas Atwood, who had played with the idea of inconvertible paper money, put an emphasis on flexibility and independence, and believed that the Directors of the Bank could use their discretion wisely to serve the needs of trade. According to Bordo and Kydland (1995) and Bordo and Schwartz (1997) the price stability during the suspension was dependent on the gold standard functioning as a contingent rule, so a permanent paper pound regime would have been impossible. Flandreau (2007) demonstrates rather convincingly how the management of currency by a private institution such as the Bank of England, might not necessarily have been inflationary, because the private central bank should aim to minimise the opportunity cost of holding money and in the

[34]Cobbett, *Political Register,* 12 May 1821, p. 417, as quoted in Fetter (1965) p. 103.

long-run, inflation would have eroded the profits of the share owners of the private central bank. My conclusion, based on the theory of sustainable plans, is that the permanent paper pound regime would have been a deviation from the monetary policy plan. Credible stabilisation policy was only possible during war time emergency and the original plan required that the monetary rule will be resumed after the period of adjustment.

For politicians and academics alike – puzzled by stagnation and the inflation that followed the Keynesian Revolution – the gold standard rule in its simplicity has sometimes seemed appealing. Surprisingly many economists who have recently written about the gold standard, have concluded by recommending whether or not the gold standard should be adopted again.[35] This study does not make such a recommendation. Instead, I argue that the Suspension Period of 1797-1821, when the first modern monetary policy rule was designed, raises other, deeper, issues that are worth considering. In particular, it seems that the most desirable way to conduct monetary policy is to stick with narrow rules unconditionally during normal times. This helps to build the monetary authority's reputation and has an influence upon private agents' expectations. In the face of a serious, nationwide crisis, there can be a well understood deviation from the original rule. During the crisis the flexibility in conduct of monetary policy increases, but nevertheless, policy must be conducted in such a manner that resumption of the original rule

[35]See for example Barro (1979), Bordo (1981), Schnadt and Whittaker (1993) and Reisman (2000).

remains feasible. After the crisis has passed there may be an adjustment period which aims to resume the original standard. The real-life problem, however, is that the authorities do not tend to recognise that there are two sides in stabilisation which have an equal importance: stimulation as well as contraction. Ignoring monetary rules can have fatal results, as is shown by the Radcliffe report of 1959. It underestimated the importance of rules – the old fashioned convertibility rule in particular – and famously precipitated the period of the record peace time inflation in British monetary history.

In recent years societies around the world have tried to solve the monetary authority's time inconsistency problem of monetary policy by central bank independence and the inflation target rule – two hundred years earlier the gold standard emerged as the best available solution to the same dilemma. The Suspension Period of 1797-1821 deserves special attention, because it is one of those rare examples in monetary history when experiments with fiat money did not lead to rampant inflation or to economic collapse, but to a sustainable monetary policy.

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