

Paper prepared for the Workshop on the economic history of markets organized by EconomiX/UPX and Chaire finances internationales/Sciences Po April 4 2007

# Measuring Monetary Discipline: Sweden's Monetary Internationalization under the Silver and Gold Standards, 1834 – 1913

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**Keywords:** *Balance of Payments; Central Bank Reserves; Classical Silver and Gold Standards; Foreign Debt; Monetary Base; Money Supply*

## ABSTRACT

At its core central banking is about balancing the two incompatible objects of supplying liquidity and keeping a stable value of the currency. In this paper I study two questions: What made central banks succeed in keeping sufficient monetary discipline not to endanger the classical specie standard? How did the international adjustment mechanism work in a small peripheral economy as the Swedish? To answer these questions series of central bank reserves, the monetary base, the money supply, the foreign debt and the balance of payments were constructed. What the study shows is that the commercial banking system's ability to supply liquidity allowed the central bank to preserve monetary stability whereas the increased foreign debt (denominated in foreign currencies) forced it to engage in more disciplinary monetary policy. The impact of the international economy made its mark in the working of the adjustment mechanism where domestic prices followed changes in the domestic money supply and international prices simultaneously. The international integration made both prices and money supply grow in harmony over the borders.

JEL: E42; E50; F33; N13; N23

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\* E-mail: Anders.Ogren@hhs.se. I worked on this paper during my time as a visiting researcher at the Stern School of Business, New York University. Consequently I am very grateful to my host Richard Sylla and all my colleagues there, in particular Robert E. Wright. An earlier version of this paper was presented at the Stern/NYU Financial History Seminar on January 27 and the EHF Economic History seminar at the Stockholm School of Economics on March 14, 2006. I would also like to thank Camilla Josephson, Håkan Lindgren, Mikael Lönnborg, Mikael Olsson, Duncan Ross, and Lars G Sandberg. I am grateful to Marc Flandreau, Olle Krantz and Lennart Schön for sending me data. All errors are my responsibility. Financial support has been provided by the Sweden America Foundation, the American Scandinavian Foundation and the Tom Hedelius & Jan Wallander Research Fund.

## Introduction

The value of a currency is dependent on many variables. Also under the classical gold standard different currencies under the same anchor were subject to different valuations. Countries also faced different possibilities to borrow in their own currency. From research we know that the role of public finances, foreign debt, previous defaults on such debts and a mutual relationship between international demand for the currency and to what extent the issuers of the currency could borrow in their own currency to a low interest rate was significant variables in determining the value of the currency. The choice of a monetary standard, such as the silver or gold standard also made a small difference.<sup>1</sup>

All these findings are of importance for the understanding of an international exchange rate system in general, and the classical gold standard system in particular. But, the role of the monetary authority has to be added to the picture. Modern central banking evolved from the classic dilemma in monetary economics; that off combining the value of the currency with a sufficient supply of liquidity not to inhibit economic activity.<sup>2</sup>

The one task that defined a central bank in the nineteenth century was its responsibility for the value of the currency, and after the adaptation of the gold standard to uphold this monetary regime. This was not successfully managed by all countries. It is safe to say that the monetary authority played a central role in preserving the specie standard. The monetary authority was also put under pressure to provide liquidity, not least in times of crises when the pressure on the specie standard was at its peak.<sup>3</sup> There was always a possibility to bail out of the specie standard (as any fixed exchange rate regime) but such a bail out was related to certain costs.

We do know that central banks were flexible in their monetary policy despite the constraints imposed by the gold standard as seen in the research by Bordo & McGouldrick (2005) and all the research on the (violations of) the rules of the game.<sup>4</sup>

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<sup>1</sup> Bordo, M.D. & Meissner, C.M. (2005), Eichengreen, B. & Flandreau, M. (1994), Flandreau, M. (2006), Flandreau, M. & Sussman, N (2005), Flandreau, M. and Zumer, F. (2004)

<sup>2</sup> Although the rhetoric change this is still on top of the central banks' agenda. The Swedish central bank, the Riksbank was in 2006 criticized for running a too tight monetary policy. Its focus on the value of the currency (price stability) made it pay less attention to the importance of keeping up employment. The role model for this criticism was of course the Federal Reserve Bank (Financial Times European edition November 29, 2006 p. 4).

<sup>3</sup> Ögren, A. (2007a)

<sup>4</sup> Bayoumi, T. & Eichengreen, B. (1995), Bloomfield, A.I. (1978), Bordo, M.D. (1984)

Thus, the question is how the monetary authorities under the emergence of an international exchange regime managed to balance the tasks of providing liquidity with the task of preserving the specie standard.

Usually the part of the central bank under the gold standard is explained in terms of the international adjustment mechanism which makes the working of the monetary authority either a case of automatically responding to strictly decided rules that were the same for all and in all circumstances. Or it has been explained as a case of *fingerspitzengefühl* (literally meaning feeling in the fingertips), that is the idea of the gold standard being managed by the Boards of the central bank without any particular systematic rules but as “an art and not a science”, as phrased by Jamie Reis.

The idea with this paper is that the role of the monetary authority in the maintenance of the specie standard was not automatic and the development of certain variables, such as foreign debt or a developing banking system, would impose or relax the need for monetary discipline.

Thus, I focus on two empirical questions and one methodological: 1) What factors influenced the monetary discipline of the Swedish central bank, the Riksbank? 2) How did the international adjustment mechanism work in Sweden? And 3) should we measure monetary discipline only in relation to specie reserves or should we include also other assets held as reserves? To answer these questions I have constructed new series on the monetary base, the money supply and the foreign debt in Sweden.

From the re-adoption of the silver standard in 1834 until the outbreak of World War I, Sweden experienced an unbroken period of eighty years with a fixed exchange rate system. International capital and the development of the domestic banking system came to play an increasing part in the Swedish economy from the late 1850s. The specie standard was important domestically before the middle of the nineteenth century because it ensured a stable value of the taxes that the groups represented in Parliament were financed by. As the economy became more internationally entangled, abandoning the specie standard meant overall larger costs for the economy as a whole.

Qualitative sources stress that maintaining the specie standard became more important after the foreign debt escalated. This, since the lack of trust in the Swedish currency forced the Swedish borrowers to exclusively borrow in foreign currencies. This result was also supported in a statistical test, the monetary discipline increased with the foreign debt. Private bank note issuance led to increased monetary discipline and so did the overall expansion of the banking system measured as bank's liabilities to the

public. The change from a silver to a gold standard mattered when only specie was considered as reserves. This change made no difference if foreign holdings were included as part of the reserves too. If only specie was regarded as part of the reserves the foreign debt did not impact monetary discipline.

To focus only on specie would be to flaw the analysis of the working of the silver and the gold standard in international context. Foreign holdings were a large part of the Riksbank's reserves, and the part that was most volatile. This also provided a degree of independence monetary policy wise. The use of foreign debt as reserves also lays the foundation to the analysis of how the international adjustment mechanism actually worked.

Theoretically, both the monetary approach to the balance of payments and the price specie flow mechanism focuses on an internal relationship between changes in reserves and changes in the money supply. The difference between the two lies in the causality. While the price specie flow model in conjunction with the quantity theory of money leads to the result that changes in reserves due to international capital flows induces changes in the money supply, the monetary approach to the balance of payments concludes that international price changes leads to changes in the demand for money that is met and ultimately results in changes in reserves. The causality between the domestic variables thus is the opposite.

In reality the causality was a mix of the two: domestic prices followed on changes in the domestic money supply. At the same time prices were internationally integrated, and so were growth in the money supply. The result was a causality that reminded of the price specie flow when considering only domestic variables, but that showed that changes in both the money supply as well as prices were a result of international monetary integration.

### **Monetary Measures**

I estimate the quantity of base money and the balance of payments utilizing the approach of Officer (2002) for the United States. A series for the accumulated foreign debt is estimated based on data from Schön (1999), Sveriges Riksbank (1931) and Lindahl, E., Dahlgren, E. & Kock, K. (1937).

## **The Monetary Base**

The definition of the monetary base is straightforward: It consists of those assets that actually, or potentially, could be used as reserves by the commercial banking system. It is closely related to the balance of payments, any imbalance in which constitutes the effects of international transactions on the monetary base.<sup>5</sup>

This general definition of the monetary base, however, does not make the measurement of its components a simple task. Still, three types of assets can arguably be said to have constituted the Swedish monetary base under the classical specie standard: specie, the net foreign assets of the Riksbank and Riksbank liabilities such as notes and deposits.<sup>6</sup>

Throughout this period, specie was the principal ingredient of the Riksbank's reserves. Gold was also utilized by the Enskilda banks after the implementation of the Banking Act of 1874, but only to the extent the law required. The fact that the gold holdings were a result of the law is clear since no gold was held before or after the law and no other forms of commercial banks held gold as reserves. Commercial banks only held Enskilda bank notes to a minor extent in waiting to redeem them. Quantitative evidence supports the contention that specie and Riksbank notes, but not Enskilda bank notes, served as potential commercial bank reserves.<sup>7</sup>

Notes issued by the central bank served as potential reserves for the banking system. Indeed, Riksbank liabilities other than notes formally contributed to the money stock. These included demand deposits, cheques, postal bank bills and, until 1872, a fund dedicated to certain types of loans. Deposits in the Riksbank were used as bank reserves, including as backing for Enskilda bank notes. Riksbank cheques and postal bank bills circulated just like notes and were backed by specie.<sup>8</sup> The unutilized part of the loan fund specifically dedicated to certain types of loans, which was of considerable size by its ending in 1872, should be deducted from the monetary base.

Foreign assets of the Riksbank utilized as backing for note issuance included holdings in banks and banking firms abroad, as well as foreign treasury bonds. Starting

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<sup>5</sup> Officer, L.H. (2002) pp. 114-115, 119

<sup>6</sup> Officer, L.H. (2002) p. 127. The Treasury in Sweden, the National Debt Office, only issued notes between 1789 and 1818 (see Engdahl, T. & Ögren, A. (2006) & Ögren, A. (2007c). Instead the NDO raised capital by issuing bonds from the late 1850s. This was mainly done in the capital markets of Frankfurt am Main, Hamburg, London and Paris (see Ögren, A. (2007a).

<sup>7</sup> See Ögren, A. (2006)

<sup>8</sup> Sveriges Riksbank (1931) pp. 18-31, 54-71. Regarding so called postnotes in the US, see Officer L.H. (2002) pp. 123-124.

with the crisis of 1857/58, foreign bills of exchange became part of the reserves, even though this practice had originated as a way of circumventing the demands of the specie standard. One reason it was abandoned in 1872 was that commercial banks held bank credits abroad and then had the Riksbank discount bills drawn on these credits. Ending the inclusion of these bills in the formal reserves of the Riksbank, however, did not end the discounting of such bills. Indeed, the Riksbank holdings of such bills increased throughout the period. Since the Riksbank used foreign bills of exchange to influence the exchange rate through open market operations, these bills should be included in the monetary base.<sup>9</sup>

One difficulty with the Swedish case is the absence of data on the circulation of coins, including specie. Since contemporary sources complain about the shortage of coins, I have accepted the assumption of prior works that this circulation was insignificant. Between 1834 and 1843, Riksbank notes circulating in Finland also should be deducted from the Swedish monetary base.<sup>10</sup> Thus, the net contribution of the Riksbank to the monetary base was its issue of money, minus the sum of: 1) its notes circulating abroad, 2) the “dedicated” loan fund, 3) its holdings of specie, and 4) its net foreign assets.<sup>11</sup>

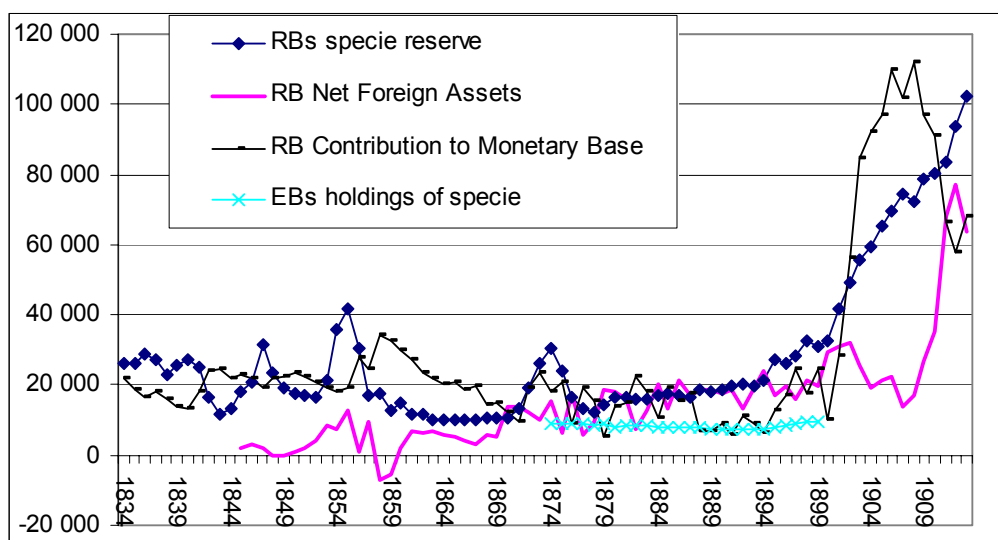
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<sup>9</sup> See Ögren, A. (2003) (2006). Regarding the active use of the bills of exchange to stabilize the exchange rate of the Swedish currency, see Lobell (2000), and about the commercial banks use of foreign credits see Söderlund, E. (1964). The locked loan fund was abandoned at the same time as bills of exchange were banned from being used as reserves in 1872, as part of the modernization of the Riksbank (see Brisman, S. (1931)).

<sup>10</sup> This was made by assuming that the entire trade deficit towards Finland was paid in Riksbank notes from 1834 until 1840, and then using Davidsson’s figures for repayments. This means that 3 million SEK was already circulating in Finland at the beginning of the period. See Davidsson, D. (1931:1) pp. 205-517

<sup>11</sup> This is one way of specifying how the monetary authorities’ adds to the stock of base money.

Figure 1: Components of the Monetary Base, 1834-1913, (1000's SEK)



Sources: Davidsson, D. (1931:1) pp. 205, 211, Sammandrag af Bankernas Uppgifter 1874-1900, Sveriges Riksbank (1931) pp. 18-31, 54-71

As figure 2 indicates, the monetary base was fairly stable until it took off during the closing years of the nineteenth century. Both specie reserves and the Bank's contribution to the monetary base, started to increase rapidly during the late 1890s. This was only partly a result of the cessation of Enskilda bank note issuance.<sup>12</sup> The specie part of the monetary base mainly increased during the booms of the 1850s and the 1870s.

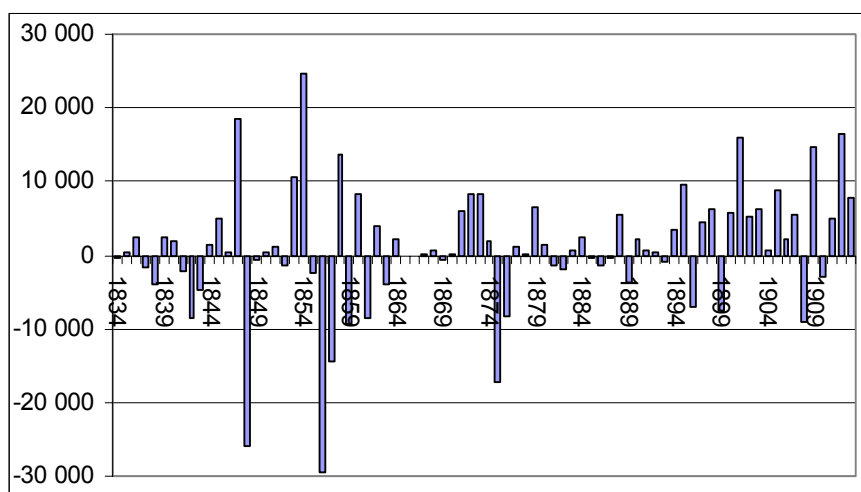
### The Monetary Balance of Payments

The monetary balance of payments is closely linked to the monetary base. Indeed, the most direct way to view the balance of payments is as changes in central bank reserves. The monetary balance of payments is defined as net specie imports plus the change in net foreign assets held by the authorities. Thus it is the sum of all international transactions that affect the size of the monetary base. The balance of payments series for the United States estimated by Officer includes net changes in the foreign holdings of both the Treasury and the central bank.<sup>13</sup>

<sup>12</sup> Ögren, A. (2003) (2006)

<sup>13</sup> Officer, L.H. (2002) pp. 132-133

Figure 2: Annual Monetary Balance of Payments, 1834-1913 (1000's SEK)



Source: Sveriges Riksbank (1931) pp. 18-31, 54-71

In Figure 2 above, the balance of payments consists of changes in the Riksbank's specie and its net foreign holdings. Capital flows related to the foreign liabilities of the National Debt Office are not included. Thus this series does not include the current account deficits financed by the importation of capital.

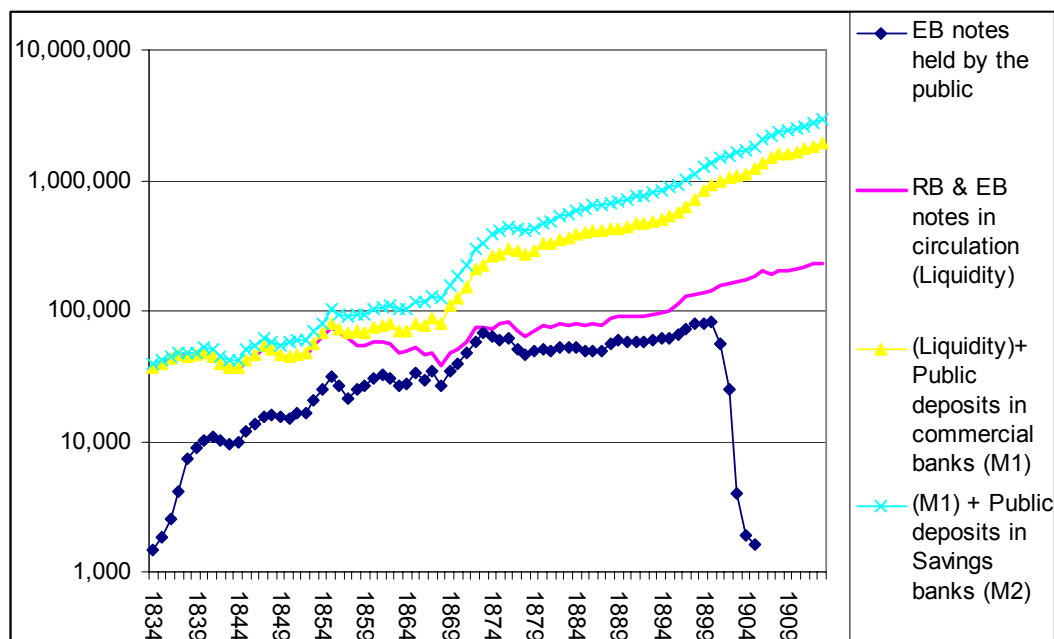
### The Money Supply

In addition to the so called monetary base, the money supply has been divided into four parts: 1) The amount of issued Enskilda banks notes. 2) A measure of the most liquid money supply, i.e the quantity of Riksbank and Enskilda bank notes outstanding, minus the Riksbank notes held as reserves by the Enskilda banks, defined as "liquidity".<sup>14</sup> 3) This measure of Liquidity plus public deposits in commercial banks, defined as M1. 4) Adding also public deposits in Savings banks to this gives the total money supply, denoted M2.

<sup>14</sup> See Ögren, A (2003) (2006)



Figure 3: The Swedish Money Supply in terms of Enskilda Bank notes, Liquidity, M1 and M2 in logarithmic form, 1834-1913 (1000's SEK)



Sources: Post & Inrikes Tidning 1835-1871, Sammandrag af Bankernas Uppgifter 1874-1900, SCB (1960) pp. 99, 102-103, Sveriges Riksbank (1931) pp. 54-71, 172-185

In practice there was a difference in liquidity between money circulating as Enskilda bank notes and being held as deposits. Under these circumstances, the above measure of the total stock of notes in circulation is labeled Liquidity. The considerable business activity of the Swedish savings banks makes M2 an interesting measure for the importance of the entire banking system in the process of monetization.<sup>15</sup> The two periods of substantial commercial bank establishment, the late 1860's and the mid 1890's, both display a marked acceleration in the growth of the two money supply measures, M1 and M2.

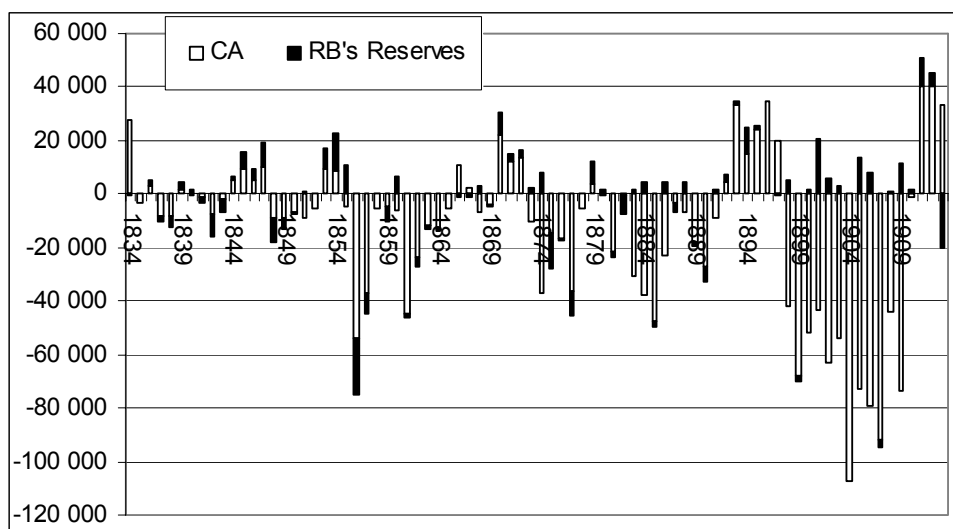
### The Foreign Debt

Starting in the late 1850's, the National Debt Office imported capital to finance the building of the national railway system. In addition, some of these loans were taken to alleviate distress on the domestic credit market. It has been estimated that by 1910 the average Swede owed more to foreign countries than did the residents of any other

<sup>15</sup> See Lilja, K. (2000), Petersson, T. (2000). The money stock 1871-1971 calculated in the study of Jonung, consisted of the volume of Enskilda and Riksbank notes held by the public plus deposits from the non-banking sector in commercial banks (Jonung, L. (1975) pp. 13, 208-211).

country in the world. Sixty years of chronic current account deficits had increased the foreign debt to an amount equal to three quarters of the Country's entire GDP.<sup>16</sup>

*Figure 4: Annual Current Account and Changes in Riksbank Reserves, 1834 – 1913. 1000's SEK*



Sources: Lindahl, E., Dahlgren, E. & Kock, K. (1937:1) pp. 268-269, Schön, L. (1999), Sveriges Riksbank (1931) pp. 54-71

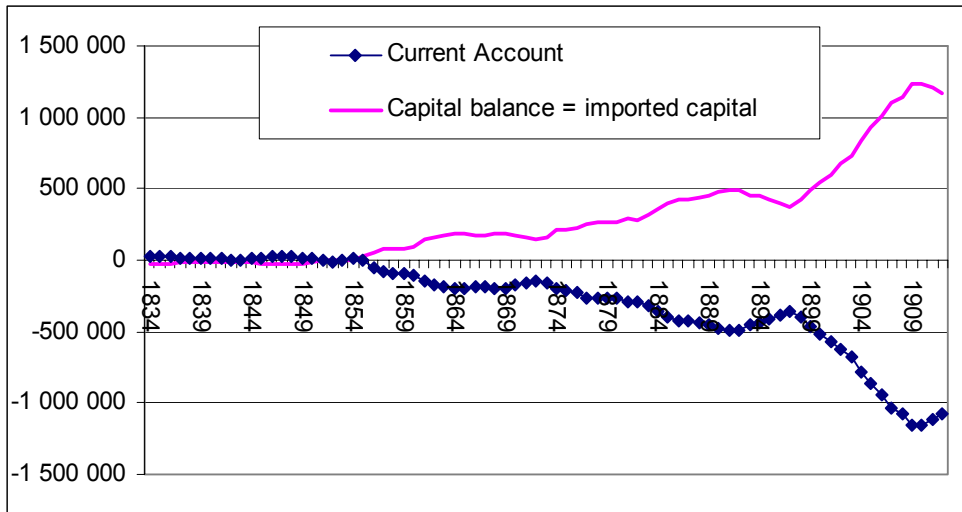
As can be seen, changes in the reserves of the Riksbank were small compared to the current account balance. Moreover, the reserves did not consistently move in the opposite direction of the current account, illustrating the importance of capital imports. Indeed, to simultaneously sustain imports, maintain the money supply and protect the specie standard would have been impossible without the international capital market. From the late 1850s foreign bond loans started to become significant in size. A new era of capital imports began and was intensified with the aim of borrowing money to invest in the building of the railroad.

To calculate the Swedish foreign debt based on figures concerning the issuance of bonds is problematic since it does not show the real point in time when the capital was imported. Nor does it reveal information about repaid debts or to what extent the bonds were actually purchased by foreign or domestic agents. Instead the total foreign debt is calculated as the sum of the annual current account plus the changes in the foreign exchange reserves, i.e. the reserves of the Riksbank. What has not been covered by

<sup>16</sup> Schön, L. (2000) p. 270. In spite of this, the National Debt Office that very same year launched a large bond loan on the foreign market to ease the constrained situation on the Swedish money market (Schön, L. (2000) p. 262). See also Ögren, A. (2007a).

changes in the foreign exchange reserves has per definition to have been covered by imported (or exported) capital.

Figure 6: Cumulative Current Account Balances and Foreign Debt, 1834-1913. 1000's SEK

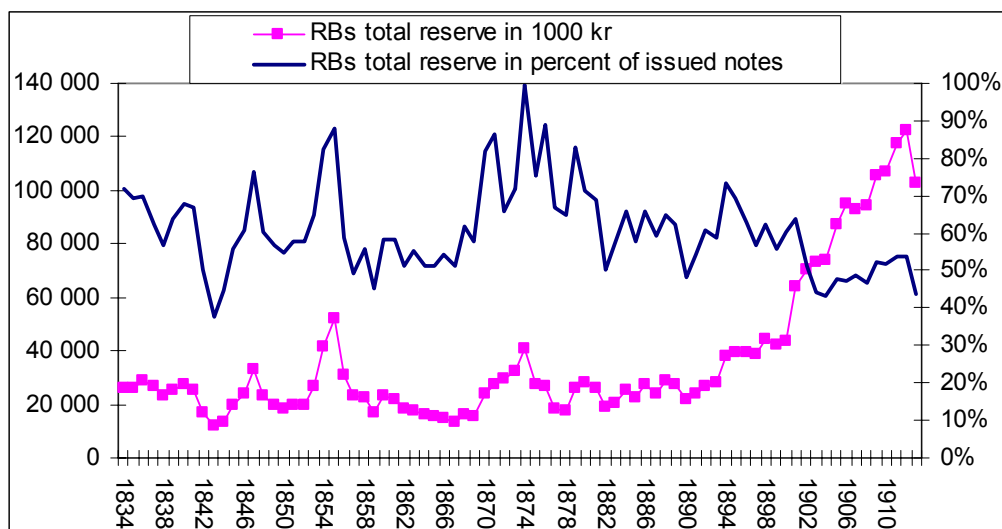


Sources: Lindahl, E., Dahlgren, E. & Kock, K. (1937:1) pp. 268-269, Schön, L. (1999), Sveriges Riksbank (1931) pp. 54-71

### **The Riksbank and the Practice of Monetary Discipline**

Try as it might, the Riksbank was not able to insulate the Swedish economy from the effects of international capital flows. This became increasingly apparent after foreign borrowing started to rapidly increase beginning during the 1850's. What the Bank could do, however, was to protect the relationship between its note issue and its reserves which served as the basis for international convertibility.

Figure 7: The Reserves of the Riksbank at Current Prices (1000 SEK), and the Percentage Reserve Backing of Its Note Issue, 1834-1913.



Source: Sveriges Riksbank (1931) pp. 54-71

Since the capital imports were long used to finance the import of good and services, the reserves of the Riksbank did not start to grow until the end of the nineteenth century. The reason that a small, capital importing, country such as Sweden could mitigate the effects of the international business cycle can possibly be traced to the composition of the Riksbank's reserves. Despite the theoretical mechanisms of the specie system, based as it was on a finite, world wide, stock of high powered money to be used as reserves and a fixed relationship between those reserves and the money supply, the system in fact had a degree of elasticity. The reserves of the Riksbank deviated from the "ideal" specie standard model in three regards:

First, the Riksbank allowed the degree of backing for its notes to vary with the size of its reserves.<sup>17</sup> Second, the Riksbank altered the composition of its formal reserves and other assets, as well as of its liabilities. In 1872, the Riksbank established a fund consisting of assets that did not qualify as reserves but which were to be used to offset, and thus sterilize, outflows of reserves.<sup>18</sup> In addition the bank utilized open market operations to preserve the Swedish currency's value and even, to the extent possible,

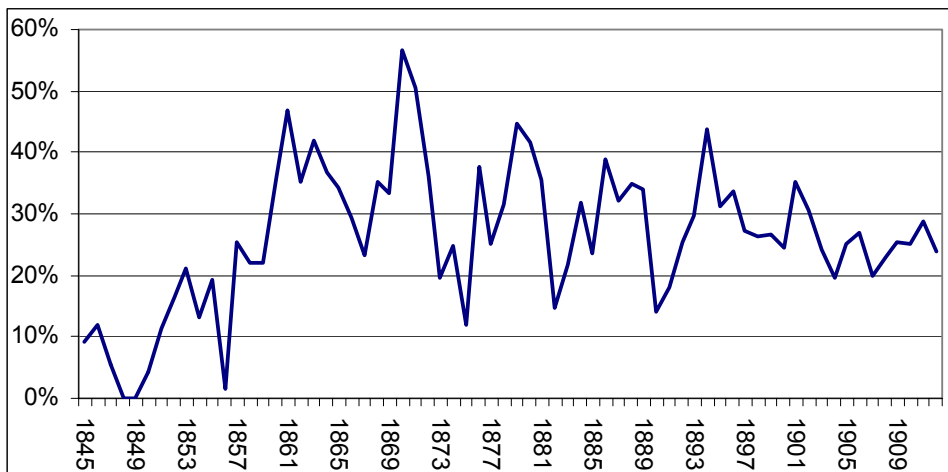
<sup>17</sup> Correlations between percentile changes in the size of the reserves and the backing of notes were highly positive and significant at the 1 % level for both the silver and the gold standard period.

<sup>18</sup> Brisman, S. (1931) pp. 116-119, 143-145, Ögren, A. (1995) pp. 22-23, 34-40. The Riksbank acted in this manner during the entire period, and it should be noted that besides ensuring convertibility the Riksbank was meant to provide credits in a stable manner. This was of course far from as important as maintaining international convertibility, but it shows that the working of the Riksbank under the classical specie standard did not admit to any 'rules of the game'.

reduce its variability.<sup>19</sup> Third, starting in 1845, foreign assets were considered to be part of the Bank's formal reserves.

It is possible that the fact that the Riksbank was the central bank of a small peripheral country allowed it make its reserves more elastic than otherwise would have been possible under the specie standard. Credit instruments outside the finite, theoretical, world stock of specie could be used as reserves. The Riksbank's foreign assets that counted were foreign national government bonds, deposits with banks and banking firms and, between 1858 and 1872, foreign bills of exchange.

*Figure 8: Foreign Holdings as a Percentage of Total Riksbank Reserves, 1845-1912*



Source: Sveriges Riksbank (1931) pp. 54-71

The Swedish experience was that if the Riksbank transferred purchasing power by purchasing the State bonds of one of the core countries of the specie standard, this would not force the Bank to reduce its note issue. It only constituted the exchange of one type of reserve for another. If the central banks of other specie standard countries also held the bonds of other specie standard governments as formal reserves, then such purchases would increase total reserves. In addition, if expectations concerning further growth of these economies were positive, then the value of these items used as reserves would also increase. Furthermore, the holding of reserves in the form of bonds and deposits had the additional advantage that they yielded interest, thus further helping to consolidate the Riksbank's reserve position.

<sup>19</sup> See Lobell, H. (2000)

### Measuring Monetary Discipline

The measure of monetary discipline used is the ratio of the monetary base to the stock of specie. The more the monetary base is allowed to expand relative to the stock of specie, the less strict the specie standard.<sup>20</sup> The specie stock used for this purpose is the sum of the specie holdings acceptable for use as reserves by the Riksbank and by the Enskilda banks.

An alternative perspective on monetary discipline results from focusing on the operations of the central bank. It can be argued that specie holdings per se are more a measure of how well the Country followed the rules of the specie standard than of how well the fixed exchange rate was protected.<sup>21</sup> It was more efficient for a small Country to maintain reserves in the form of British and German Government bonds. In reality, most international transactions were not settled with specie. Thus, holders of Swedish currency were not interested in exchanging it for specie. The measure of monetary discipline in this case is the monetary base in relation to total Riksbank reserves officially acknowledged as reserves (i.e. also including foreign holdings).

*Figure 9: Monetary Pyramid Ratios Mean Values*

<b>Mbase/Specie</b>	<b>Mean Value</b>	<b>Mbase/Rbreserves</b>	<b>Mean Value</b>
Silver Std, 1834-1873.	2,51	Silver Std, 1834-1873	2,26
Gold Std, 1874-1913 S	2,28	Gold Std, 1874-1913	1,80
Gold Std US., 1879-1913	2,17		

Sources: Davidsson, D. (1931) pp. 205, 211, Officer, L.H. (2002), Sammandrag af Bankernas Uppgifter 1874-1900, Sveriges Riksbank (1931) pp. 18-31, 54-71

Discipline was somewhat less strict under the silver than under the gold standard. Judging the entire period, discipline was strictest in connection with the readoption of the silver standard in 1834 and the most lax during the economically gloomy 1860's. During that decade, reserves flowed out during the Danish-Prussian War of 1864, as the result of international crises and to pay for the food imports required to mitigate the famine caused by the crop failures between 1866 and 1869.<sup>22</sup> The relatively low

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<sup>20</sup> Officer, L.H. (2002) pp. 136-137

<sup>21</sup> The fact that the Riksbank held sufficient British, and German, Governmental bonds in the reserves was probably more important for adhering to the silver and gold standards, than was the fact that the Enskilda banks held specie in their reserves. But the measure of monetary discipline by holding specie will conclude otherwise.

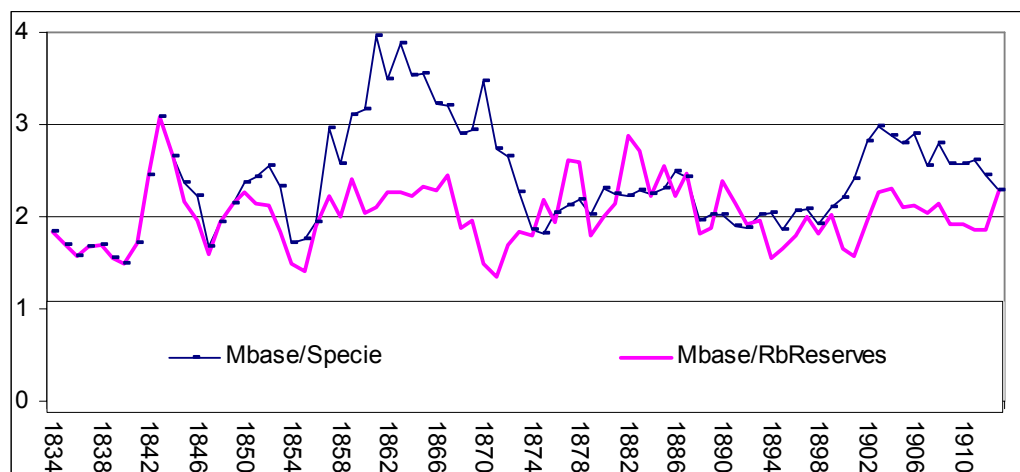
<sup>22</sup> Under the flag of Scandinavianism, Sweden had promised to support Denmark in case of war. As this war became a reality 1864, Swedish reserves rapidly decreased until Sweden withdrew this "promise". The great famine 1866 until 1868 was a supply crisis, reserves were deployed to import food, but prices

discipline observed during the early years of the twentieth century can only partly be blamed on the replacement of Enskilda bank notes since the total supply of notes in circulation increased.<sup>23</sup>

Starting in the 1850's, the measures of monetary discipline changed significantly. Overall, the gold standard was a less “pure” specie standard than was the silver standard. Interestingly enough, the National Debt Office began to borrow on international markets at about the same time that it became possible to substitute foreign assets for specie reserves.

Despite the crisis of 1857/58, and the measures the Riksbank took to deal with it, the 1850's do not seem to have been characterized by a specific lack of monetary discipline. Figure 17 below shows the monetary pyramid ratio for each year during the entire period.

Figure 10: Monetary Pyramid Ratios, 1834 – 1913



Sources: Davidsson, D. (1931) pp. 205, 211, Sammandrag af Bankernas Uppgifter 1874-1900, Sveriges Riksbank (1931) pp. 18-31, 54-71

A review of the annual monetary pyramid ratio of the monetary base to the stock of specie yields several interesting observations concerning the measurement of monetary discipline. First, the peak indicating lax monetary discipline in the early 1840's can be credited to the redemption with specie of the Riksbank notes circulating in Finland. This episode of reduced monetary discipline also coincided with the practical abandonment

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remained high and transactions low. Besides the lack of food to trade there was no capacity to transport food to the areas most in need. See Davidsson, D. (1931:2).

<sup>23</sup> See Ögren, A. (2006).

of the fixed exchange rate. Here the pyramid ratio indicates decreased monetary discipline by the central bank.

Second, the sharp rise, once again indicating reduced monetary discipline, starting with the crisis of 1857 coincides well with the actions of the Riksbank during the crisis itself.<sup>24</sup> The short term loan taken in Hamburg in January 1858 to sustain the domestic credit market, however, indicates a higher degree of monetary discipline than during the following years. Given the definition of the monetary base, raising foreign capital, thus decreasing the net foreign assets of the Riksbank, decreases the ratio of the monetary base to the stock of specie. This, in turn, indicates a higher degree of monetary discipline. When the loan is repaid, the opposite happens. This effect is doubled if the foreign loan is used to import specie. In that case, not only does the monetary base decrease, but the holdings of specie increase. Thus, when the international capital market is utilized to maintain domestic liquidity, while still preserving the fixed exchange rate, the measure of monetary discipline is distorted, or at least the effect is lagged. That is why monetary discipline appears to be at its weakest during the 1860's when the crisis loan was being repaid.<sup>25</sup>

Third, the note issuance of the private Enskilda banks coincided with increased monetary discipline, especially when the monetary discipline is related to specie. With the private banks scheduled to begin holding specie in accordance with the law of 1874, the ratio decreased rapidly from 3.5 in 1870 to less than 2.3 in 1873. Possibly this was also a consequence of the conversion to the gold standard in 1873. The ratio then remained reasonable stable until the turn of the twentieth century when the Riksbank greatly expanded its note issue. But it is also likely that the Enskilda banks' note issuance forced the Riksbank to behave more disciplinary since the Enskilda bank notes ultimately also rested upon the reserves of the Riksbank. On the other hand, the private

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<sup>24</sup> See Ögren, A. (2007a).

<sup>25</sup> The choice of how to fund increases in the monetary base affected the measure of monetary discipline. This stresses the difficulty of definitions, and their impact on results, even more. Consider the two likely scenarios: 1) the central bank selling off domestic treasury bonds abroad, then using the funds to purchase specie. This will increase monetary discipline. As specie is part of the monetary base, the monetary base as well as the central banks holdings of specie will nominally increase equally in size. But, since specie is a smaller portion than the monetary base, the relative increase in specie holding increases more than the relative increase in the monetary base increasing monetary discipline. 2) The central bank borrowing money from abroad to purchase specie. As in the former example this will increase both specie holdings and the monetary base. However, since net foreign assets of the central bank is included in the monetary base, the decrease in net foreign assets will cancel out the import of specie, that is the increase in the monetary base. Thus, in the latter example the disciplinary effect of the central bank action will be higher than in the former since the amount of specie increases but not the total amount of the monetary base.



notes also facilitated the Riksbank's monetary discipline by making it possible to supply more liquidity for daily transactions without this being the same as issuing more base money.

Differences in the results of the two measures of monetary discipline were most significant from the mid 1850's to the mid 1870's and in the early twentieth century. Measuring monetary discipline solely by specie holdings creates problems when other assets also are important. Nevertheless, as the experience of the crisis of the late 1850's demonstrates, measuring discipline by including the formal reserves allows the authorities to tamper with the size of the reserves.

### **A test on the basis for monetary discipline**

Which parameters made it possible for the Riksbank to follow the rules of the specie standard to an extent that was internationally acceptable without strangling the supply of liquidity? From 1845 the Riksbank worked with a differential reserve system, making the difference between reserves and its liabilities held by the public the target for its monetary policy. Both the monetary base minus the specie holdings of the central bank and the banking system (MBASE-SPEC) and the monetary base minus the reserves allowing the Riksbank to issue base money (MBASE-RBRES) are used as dependent variables. The former shows to what extent it was a pure specie standard and the latter to what extent it was a case of a credit system, as portrayed by Triffin. There are three kinds of independent variables: Institutional variables, Banking sector variables and Disciplinary variables approximated by the Foreign Debt.

1) The monetary regime as such, in this case the switch from the silver standard to the international gold standard in 1873. The change from the silver to the gold standard meant in reality much narrower gold points. Because of this it is tested if this change meant that the Riksbank engaged in a higher degree of monetary discipline. This variable (SPSTD) is incorporated in the model as a dummy variable.

2) A variable that is concerns both institutional variables and the Banking sector is the institutional change on bank establishment in 1864. This liberalization of bank establishment is tested also as a dummy variable (BANKEST).

3) The note issuance conducted by the private commercial banks known as the Enskilda banks is used as a measure of the banking systems ability to create liquidity (EBNOTES), which should increase monetary discipline a) as the central bank does not

need to issue as much base money for liquidity and b) forces the central bank to maintain reserves that these notes ultimately depend upon.

3) The growth of the banking system and the public's holdings in this system (PBLIAB) is believed to give room for the central bank to issue less base money on one hand since the banks take over the task of "creating money", but also to decrease monetary discipline since it indicates increased wealth in society.

4) The size of the foreign debt (FORDEBT) is believed to increase monetary discipline since it should increase the cost of bailing out of the specie standard, given that the loans ultimately were denominated in foreign currencies and/or specie.

5) The growth of the economy is represented by the GDP in volumes (GDPVOL). The variable tests to what extent economic growth allowed the central bank to be more lax in its monetary policy.

*Figure 11: OLS-Regression on the Determinants of Monetary Discipline, measured as the Monetary Base minus Specie (MBASE-SPECIE), and the Monetary Base minus Riksbank Reserves (MBASE-RBRES), 1834 - 1913 (stable prices).*

	D(MBASE- RBRES)	D(MBASE- SPECIE)	D(MBASE- RBRES)	D(MBASE- SPECIE)	D(MBASE- RBRES)	D(MBASE- SPECIE)
Constant	560.68	625.61	439.37	532.17	511.20	371.71
D(EBNOTES)	-0.68***	-0.63***	-0.68***	-0.63***	-0.68***	-0.64***
D(PBLIAB)	0.07***	0.11***	0.07***	0.10***	0.07***	0.09***
D(FORDEBT)	-0.07***	-0.02	-0.07***	-0.02	-0.08***	-0.01
D(GDPVOL)	265.37	-618.21	273.84	-611.69	-1359.65	-3007.92**
SPSTD	-1018.21	-2675.25	-1382.84	-2956.11**		
BANKEST	-525.56	-404.81				
R2	0.41	0.42	0.41	0.42	0.41	0.42
Adj R2	0.36	0.38	0.37	0.38	0.38	0.38

\*\*\* 1%, \*\* 5%, \* 10 %

The issuance of liquidity through the banking system (EBNOTES) clearly affected the monetary discipline of the Riksbank positively. The Riksbank had to take the notes of the Enskilda banks into account and these notes helped provide liquidity without making it necessary for the Riksbank to issue base money. Since the Enskilda bank notes had this effect on the monetary discipline in both cases, it was not only a result of

the law that forced them to hold specie reserves between 1878 and 1903.<sup>26</sup> The Enskilda banks issuance of notes was the most important variable for the monetary discipline of the Riksbank.

While the notes of the Enskilda banks helped maintain monetary discipline, the public's holdings in the banking system at large did not have this effect (PBLIAB). Instead the growth of public wealth in the banking system allowed a somewhat more relaxed monetary discipline by the central bank.

The foreign debt (FORDEBT) increased monetary discipline, but only if monetary discipline is measured including all the foreign assets that the Riksbank was allowed to hold as cover for its issuance of public liabilities (MBASE-RBRES). Focusing only on the specie as the central element in the specie standard leads to the result that the foreign debt did not matter for the monetary policy of the central bank.

The change from silver to gold standard (SPSTD) on the other hand, was only of importance for monetary discipline if one focuses solely on the specie reserves as important for the monetary policy. When including the foreign assets that according to the regulations were valid as reserves the switch from silver to gold did not have any impact on monetary policy.

Neither growth in the economy (GDPVOL) nor the liberalization of bank establishment in itself (BANKEST) did have any impact on monetary policy. But the importance of the latter might in reality be captured by the other two variables on the banking system; Enskilda bank note issuance and public holdings in banks.

The result shows the importance of not focusing on the specie part in the specie standard per se. Doing this and disregard all the elements of a viable international credit economy amplifies the importance of specie at the expense of the importance of credit creation and the institutions governing them.

### **The international Adjustment Mechanism**

It is not possible to dismiss the use of foreign assets as part of the Riksbank reserves. Doing so misses out on the international aspect of how the specie standard and in particular the gold standard, actually worked in a small peripheral economy as the Swedish. The importance of foreign holdings for the Riksbank's monetary policy is clearly visible in the size and volatility of these holdings.

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<sup>26</sup> Ögren, A. (2006)

We have also seen that the Riksbank to some extent could act independently of the constraints set by the specie standard, i.e. that it could choose to sterilize the effects of international capital flows.

The question is how the international adjustment mechanism worked given these premises? What was the relationship between the balance of payments, the Riksbank's reserves, the monetary base, the money supply and prices?

I have used the two most recognized explanatory models of the adjustment mechanism to structure this issue – the classical price specie flow model and the monetary approach to the balance of payments. Although they are casually different they have both been found to explain the international adjustment mechanism in Sweden under the classical gold standard.<sup>27</sup>

According to the price specie flow model, the money supply is determined by the balance of payments through changes in central bank reserves which, in accord with the quantity theory of money, then affects the domestic price level. Changes in the price level will then encourage or discourage exports, thereby correcting imbalances in the current account.

In its purest form, the monetary approach to the balance of payments assumes the law of one price, perfect international capital mobility and price flexibility in all markets.<sup>28</sup> Changes in central bank reserves, however, illustrate that the money market is not in equilibrium, the balance of payments being one of the mechanisms for restoring such equilibrium. The causality is the opposite of that in the specie flow mechanism. Increased (decreased) demand for money eventually will lead to an inflow (outflow) of reserves. Monetary policy has little or no effect. As with prices, domestic interest rates and money incomes ultimately are set in the global arena.<sup>29</sup>

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<sup>27</sup> Jonung (1975) argues that in Sweden the money supply and the stock of gold reserves grew in parallel, and that the money stock appears to have impacted prices both in the long and in the short run, thus lending support to the quantity theory of money (Jonung, L. (1975) pp. 144-146, 191-195, 203, 208-211). Under the silver standard, the money stock grew with 16.1 percent every year, in contrast to prices that only grew with 1 percent. Under the gold standard 1874-1913 the money stock increased with 5.2 percent yearly and prices with only 0.2 percent. In 1984, Jonung published a paper where he argued the contrary; that the Swedish experience under the classical gold standard fit well within the monetary approach to the balance of payments (Jonung, L. (1984) pp. 389-393). However, he did not test the direction of the causality at work.

<sup>28</sup> Although McCloskey & Zecher argues that the monetary approach can do without the law of one price (McCloskey, D.N. & Zecher, J.R. (1984) p. 122)

<sup>29</sup> Gomes, L. (1993) pp. 10, 148, 160, 163-166, Kenwood, A.G. & Loughheed, A.L. (1999) pp. 114-115, McCloskey, D.N. & Zecher, J.R. (1984) p. 126, McCloskey, D.N. & Zecher, J.R. (1985) pp. 65-66, 76

A study comparing the gold standard with other international monetary arrangements by Bayoumi and Eichengreen supports the latter view. That is, under the gold standard the money supply adjusts through the balance of payments, thereby restoring equilibrium in asset and commodity markets.<sup>30</sup>

Qualitative sources, i.e. the minutes of the Riksbank Board, as well as the Board's reports to Parliament, also support the validity of the monetary approach to the balance of payments. Sufficient notes were supplied and, initially, reserves were increased as needed. Only when convertibility was threatened would the note issue be constrained. When the outflow of reserves persisted, however, the Board was forced to decrease its notes in circulation, that is to say, the monetary base.<sup>31</sup> In order to sort the question of the causality at work it has been subjected to a VAR-model causality test.

### **A test on the causality of the adjustment mechanism**

The VAR-test shows two main results: 1) That changes in the monetary base were largely independent of changes in the reserves of the Riksbank and vice versa, and 2) That the causality of the international adjustment mechanism followed that of the price specie flow mechanism, but that there were some elements in the working of the mechanism that rather pointed in the direction of the monetary approach to the balance of payments.

The test applied to the relationship between the monetary base and the money supplied revealed no significant causality whatever. The balance of payments series in stable prices, however, had a positive effect on changes in the most liquid measure of the money supply (LIQ). This result was not statistically significant when the gold standard period was treated separately.<sup>32</sup>

The somewhat puzzling outcome of this VAR causality test is that it followed the predictions of the price specie flow mechanism to quite a good extent. Still it shows features that reminds of the opposite causality of the monetary approach to the balance of payments. The most liquid money supply (LIQ) and the broader measure including

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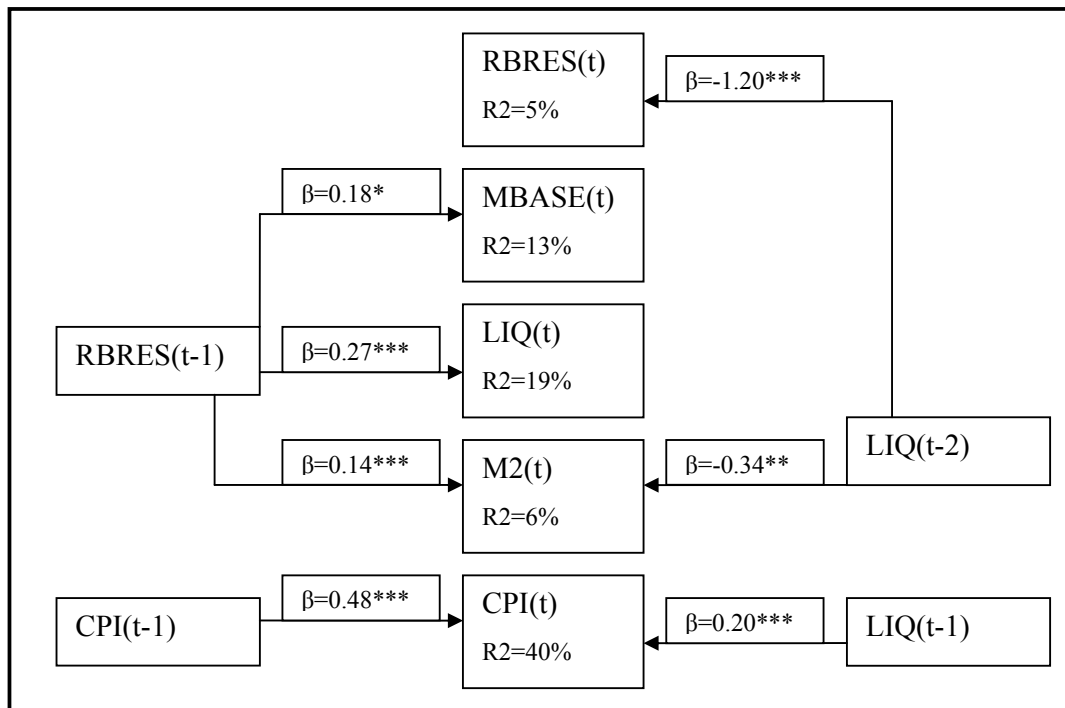
<sup>30</sup> Bayoumi, T. & Eichengreen, B. (1995) pp. 7-11, 20-21. This study included seven countries, among them Sweden

<sup>31</sup> See BaU 1834 – 1900 No 1 (Reports from the Board of the Riksbank to the Parliament), Davidsson, D. (1931:2) pp. 145-146, RbFP 1856 – 1859, 1869 – 1881, RbFSP 1869 – 1881, Ögren, A. (1995) pp. 18, 30, 36. See also Ögren, A. (2003) (2007a).

<sup>32</sup> See Appendix Figures 9, 10, 11, and 12 in Appendix B. This result stresses the difficulty of estimating the monetary base in accordance with a static set of rules and still making it a significant measure for different types of economies.

public deposits in savings and commercial banks (M2) increased in response to increased Riksbank reserves (RBRES) during the previous year. The broad measures of money supply (M2) also increased if the money supply in terms of circulating notes (LIQ) had decreased the previous year (and vice versa). Changes in circulating Riksbank and Enskilda bank notes (LIQ) after two years negatively affected reserves.<sup>33</sup>

Figure 10: Vector Auto Regression on the Consumer Price Index (CPI), Money Supply ((LIQ) and (M2)), the Monetary Base (MBASE) and Riksbank Reserves (RBRES), 1834-1913. 2 lags, variables deflated by the consumer price index and in differenced logarithmic form.



\*\*\* Denotes significant values at 1%, \*\* at 5%, \* at 10%. R2 values in boxes are adjusted R2.

Sources: Myrdal, G. & Bouvin, S. (1933) pp. 196-199, Post & Inrikes Tidning 1835-1871, Sammandrag af Bankernas Uppgifter 1874-1900, SCB (1960) pp. 99, 102-103, Sveriges Riksbank (1931) pp. 54-71, 172-185

There were significant results concerning prices (CPI). Changes in the most liquid money supply (LIQ) in terms of circulating Riksbank and Enskilda bank notes resulted in a change in consumer prices (CPI) with a one year lag. The rate of change of prices was also affected by previous prices changes, but these did not have a significant effect on the money supply. Even though the tendency was the same throughout the eighty year period, it was stronger under the gold than under the silver standard. Looking at the

<sup>33</sup> The 2-lag model was selected due to its relatively high adjusted R2 value and relatively low Akaike and Schwartz values.

explanatory value, changes in domestic prices was a dependent variable more than it led to changes in the money supply as predicted by the monetary approach to the balance of payments. But were prices really just an effect of the quantity theory at work?

### **The impact of the international economy**

The question is whether Sweden followed the causality of the price specie flow on the international arena; that is if domestic price changes were negatively correlated with price changes in other countries? But, in line with all the research showing that the rules of the game were constantly violated, the positive interlinking of price movements among countries predicted by the purchasing power parity hypothesis is supporting the monetary approach to the balance of payments.<sup>34</sup> Swedish wholesale prices and, to a slightly lesser degree, consumer prices were indeed correlated with those of the Country's trading partners.

*Table 2: Correlations Between Annual Percentage Changes in Swedish Wholesale and Consumer Prices with Those of her Principal Trading Partners, 1834-1913*

<b>Wholesale Price indices</b>	<b>France</b>	<b>Great Britain</b>	<b>Germany</b>	
Sweden, 1861-1913	0.731*	0.780*	0.753*	
<b>Consumer Price indices</b>	<b>France</b>	<b>GB (England)</b>	<b>Germany</b>	<b>Denmark</b>
Sweden, 1834-1913	0.373*	0.360*	0.515*	0.601*
Sweden, 1834-1873 Silver std	0.458*	Not significant	0.541*	0.532*
Sweden, 1874-1913 Gold std	Not significant	0.549*	0.544*	0.739*

\* Significant at least at 5 %

Sources: Mitchell, B.R. (2003) pp. 856-859, 863-865, Myrdal, G. & Bouvin, S. (1933) pp. 196-199

For the entire period 1834-1913, Swedish consumer prices closely tracked those in Germany and Denmark well. Sweden's place in the "German economic bloc" was of considerable significance. Starting with the adoption of the gold standard, Swedish consumer prices were closely synchronized with those in Denmark. During the gold standard period, the correlation with British prices increased while that of French prices became statistically insignificant.<sup>35</sup> These correlations support the existence of international integration.

<sup>34</sup> Gomes, L. (1993) pp.166-167, McCloskey, D.N & Zecher, J.R. (1985) pp. 69-71. Here it would also be expected that wholesale prices were more prone to internationally move together than consumer prices, since the latter holds a larger amount of internationally less tradable goods than the former (for instance housing).

<sup>35</sup> This might be explained with the fact of Denmark and Sweden being neighboring countries, but perhaps more significant was the Danish and Swedish establishment of the Scandinavian Currency Union (*Skandinaviska Myntunionen*) in connection with the switch from the silver to the gold standard in 1873, where also Norway joined in 1875. The union made coins convertible at par, but did not include notes. In

It is clear that changes in domestic prices were a result of changes in both international as well as domestic variables. Throughout the period from 1834 until 1913, the Riksbank's reserves were positively associated with the international business cycle as foreign crisis were reflected in Sweden through decreasing reserves.<sup>36</sup> Despite theoretical predictions to the contrary, in an international exchange rate system based on specie it was possible for reserves in various countries to shrink, or increase, simultaneously.<sup>37</sup> This development could only be possible because there was a great deal of elasticity in the exchange rate system. Such elasticity would allow the money supply to grow without corresponding growth in specie reserves.

In theory, the specie standard emphasizes specie holdings as the basis for expansion of the money supply. Even under the gold and silver standards, however, specie became a less important part of the money supply as the banking system expanded and other items increasingly served as reserves.

If the money supply grew independently of the level of specie reserves, how was the specie standard maintained? Triffin argued that the gold standard era was more a period of credit money than of gold. When the credit economy was growing, all countries with stable exchange rates were bound to experience approximately the same pace of money supply growth.<sup>38</sup>

As seen in figure 11 and table 3 below this was also the case during the Swedish gold standard period 1873 until 1913. In figure 11 we see that the money supply in various countries over the period 1873 to 1913 displayed an upward trend.

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1894 notes became convertible at par between Sweden and Norway, and in 1901 with Denmark. See Henriksen, I & Kærgård, N. (1995) and Talia, K. (2004).

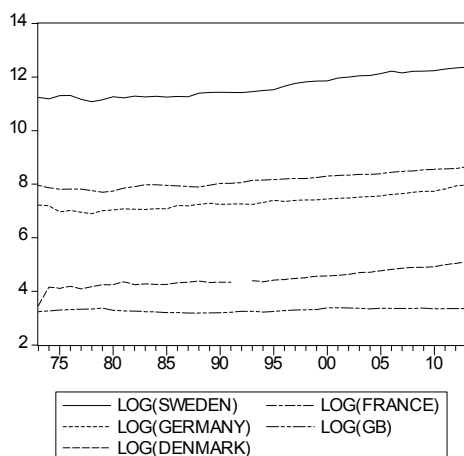
<sup>36</sup> From a pure balance of trade perspective, however, international recessions were beneficial. Between 1834 and 1913, annual changes in imports were more closely correlated with changes in GDP, measured either in current prices or in volume, than were changes in exports.

<sup>37</sup> The correlations between monthly changes in percent of the reserves of Bank of England, Banque de France and the German Reichsbank for the period 1880 until 1913 were not negative. A small positive correlation was found between the reserves of the German Reichsbank and the Banque de France (0.190), and a stronger correlation between the German Reichsbank and the Bank of England (0.463), both these were significant at the 1 % level. No significant correlation was found between the reserves of Bank of England and Banque de France. (Flandreau, M. (2000)).

<sup>38</sup> Kenwood, A.G. & Loughheed, A.L. (1999) p.118, Triffin, R. (1985) pp.121, 128-129, 133



Figure 11: Growth in the money supply (circulating notes) in Denmark, France, Germany, Great Britain and Sweden, 1873 – 1913. Logarithmic values.



Sources: Mitchell, B.R. (1998) pp.784-789, 793-195, 800-803, Post & Inrikes Tidning 1835-1871, Sammandrag af Bankernas Uppgifter 1874-1900, SCB (1960) pp. 99, 102-103, Sveriges Riksbank (1931) pp. 54-71, 172-185

Germany was the foreign economy with the greatest impact on Sweden, and Denmark and Sweden was apart from sharing the gold standard also parts of the Scandinavian Currency Union. If Triffin was right that the impact of the credit economy was larger than the focus on specie holdings; the money supplies in these economies should show a relationship in the past of growth. This interpretation is supported by a cointegration analysis.

Table 3: Result of Johansen's Cointegration pair wise test of linear deterministic trend in the series of the money supply (circulating notes) in Denmark, France, Germany, Great Britain and Sweden, 1873 – 1913. Logarithmic values. The table shows number of cointegration vectors and their significance levels.

	Log(Denmark)	Log(France)	Log(Germany)	Log(Great Britain)
Log(Sweden)	1**	-	1**	1*

\* 5% and \*\* 1% significance level

Sources: See figure 11

The fact that not only prices but also the money supply is internationally integrated explains why domestic prices can be following growth in the domestic money supply and simultaneously be internationally correlated.

The prior results can be summarized in a model designed to explain changes in domestic prices as depending on changes in domestic and international variables. The neo classical quantity theory predicts that price effects due to growth in the money supply may be off set by growth in real income. The growth of real output was related

to the growth of the money supply measured in terms of circulating notes (LIQ). Therefore, changes in real GDP is also included in the model determining price movements. Moreover, changes in consumer prices in Germany (GERCPI) is incorporated as a proxy for international price movements.

*Table 4: OLS-regression determining changes in domestic prices (CPI), as dependent on current and prior changes in the variables the German Consumer Prices (GERCPI), the Money Supply (LIQ), and GDP in stable prices, 1834-1913. Logarithmic values (DLOG).*

CPI =	C +	0.21*(LIQ(-1)) +	0.43*(CPI(-1)) -	0.14* (GDPVOL) +	0.18*(GERCPI) + ε
Prob.	0.97	0.00	0.00	0.19	0.00
t-stat.	0.04	5.45	5.24	-1.32	4.58
R2	0.55	Adj R2	0.52		

Sources: Krantz, O. (1997) pp. 20-22, Mitchell, B.R. (1998) pp. 863-865, Myrdal, G. & Bouvin, S. (1933) pp. 196-199, Post & Inrikes Tidning 1835-1871, Sammandrag af Bankernas Uppgifter 1874-1900, Sveriges Riksbank (1931) pp. 172-185

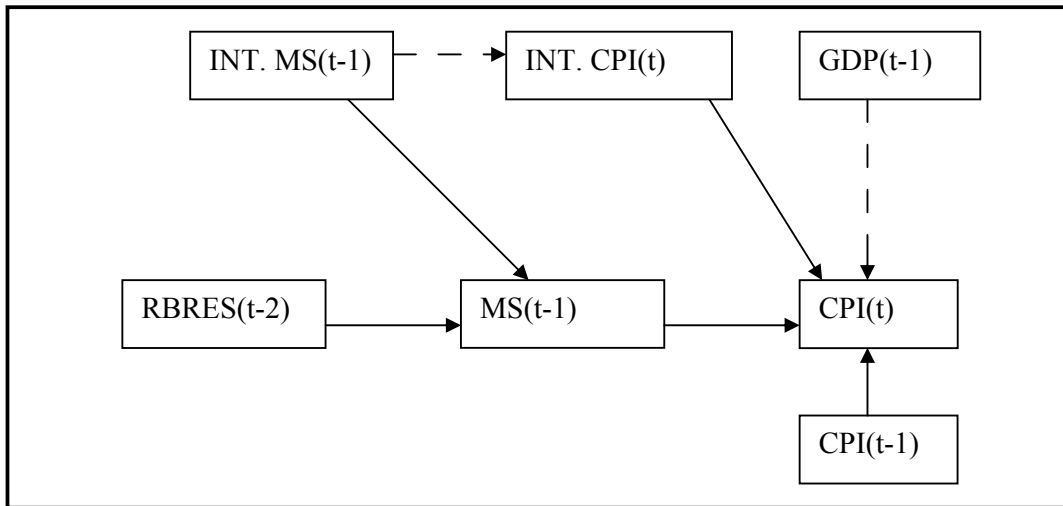
As predicted by the theory, changes in prices were related to concurrent changes in GDP (by volume). If significant, growth in the GDP acted to cushion the effect of a growing money supply on prices. Prices were positively affected by the money supply in terms of circulating notes (LIQ) lagged one year. International price movements also clearly affected domestic prices. The largest impact came from domestic price changes lagged one period.

This result is consistent with both the quantity theory, and thus with the price specie flow mechanism, and the monetary approach to the balance of payments. It concludes that prices are set in international markets. At same time, however, it was also the case that domestic price changes were connected to domestic changes in the money supply. This was a result of the simultaneous money supply growth experienced by the countries operating under the specie standard. This money supply expansion, however, was not associated with any growth in specie holdings in these countries.

It was argued above that the use of foreign financial liabilities issued in specie standard countries as formal reserves allowed the total supply of reserves to increase, subject only to the existence, as indeed was the case, of a liquid secondary market for these assets. Expectations also affected the value of the reserves. Gold standard economies experienced a simultaneous growth in their money supply. At least in the Swedish case, and in the short run, changes in the money supply preceded changes in

consumer prices. That, however, is still consistent with a large share of these consumer prices being determined in international markets.

*Figure 14: Stylized summary of the international adjustment mechanism and its impact on domestic prices*



## Conclusions

Following the lead of Officer, series of the monetary base and the balance of payments were constructed for the period 1834 - 1913. Foreign assets were a major component of the Riksbank's reserves. This reality has affected the measurement of monetary discipline. Considering only actual holdings of specie results in discipline appearing remarkably lax during the 1860's. If instead discipline is measured in terms of the monetary base to Riksbank reserves ratio, things look somewhat better. Nonetheless, monetary discipline seems to have become more stringent after the international debt became significant starting the late 1860' and early 1870's.

Monetary discipline was affected by the issuance of liquidity through the banking system which allowed the central bank to issue less base money. This was the most important variable for the monetary discipline. The public's holdings in the banking system allowed a somewhat more relaxed monetary discipline by the central bank. As expected the foreign debt increased monetary discipline. But looking only on the specie as the central element in the specie standard meant that the foreign debt did not matter for the monetary policy of the central bank. The change from silver to gold standard did not lead to increased monetary discipline, unless one focuses solely on the specie reserves as important for the monetary policy. The result shows the importance of

looking at the classical gold standard period as an international credit economy far from only being driven by gold and thus supports the argument made by Triffin.

The following section dealt with the nature of the international capital transactions that affected the Swedish economy and its level of monetary reserves. Since Sweden was dependent on international capital for imports, economic crises were actually beneficial for her trade balance. The capital flows related to trade in goods and services, however, were small compared to those connected to international borrowing, at least starting in the late 1850's. It was also noted that a common specie standard did not prevent the central bank reserves of these countries from all increasing simultaneously. This was partly due to the elasticity inherent in the system, which left the central bank with some ability to fudge the rules of the game. Of importance for the overall growth of central bank reserves was the inclusion of financial assets held in other specie standard countries.

Changes in the monetary base or in specie holdings were unrelated to changes in any of the monetary aggregates. Contrary to the qualitative evidence, the statistical tests tended to support the specie flow hypothesis. Changes in central bank reserves, as well as in the balance of payments, positively affected the money supply. Changes in the money supply, in turn, were positively related to the level of consumer prices. At the same time, however, domestic prices were changing in line with international prices, thus tending to support the monetary approach to the balance of payments hypothesis.

The Swedish money supply grew in line with that of other countries operating under the specie standard. This growth in the money supply, in turn, resulted in increasing international prices during periods of credit expansion that were not also characterized by rapid economic growth. Thus, prices, in addition to being connected to international markets, responded to prior increases in the money supply. This growth in the money supply, however, may only have been tolerated because of the similar monetary growth experienced in other specie standard countries. The result was summarized in an OLS-regression model in which current changes in domestic prices were dependent on current changes in international prices. Changes in the money supply in terms of circulating notes lagged one period and, most importantly, price changes lagged one period also affected price changes positively.

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