Pulling up the Tarnished Anchor:

The End of Silver as a Global Unit of Account

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Abstract

When does a global monetary system of fixed exchange rates end? We develop a dynamic, general equilibrium model of the global economy to consider the gradual transition away from silver as a price anchor. Calibration of the model using new data on global commodity shows that silver ceased functioning as a global price anchor in the mid-1890s—nearly two decades after many important countries abandoned bimetallism. The price of silver was highly correlated with agricultural prices through the mid-1890s, but not thereafter.

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1 Introduction

When does a global monetary system of fixed exchange rates end? One way of characterizing the demise of a fixed-exchange rate systems is when countries sever their formal links to it, such as when the U.S. closed the gold window in 1971 and abandoned the Bretton Woods System, or in 1914, when England and other countries embargoed gold exports and imposed exchange controls, marking the end of the classical gold standard era. For other historical monetary systems, the transition can be slower, and the answer as to "when a system ended" is not always obvious. Individual countries can jettison an existing arrangement by changing the formal rules that bind them to the existing system, but that does not necessarily imply that the unit of account, serving as an anchor for prices, ceases to function globally. Even the exit of economically or systemically important countries from a metallic, fixed-exchange rate regime may not end the precious metal's role as a numeraire and unit of account.

To shed new light on the relationship between price dynamics and global monetary transitions, we focus on the demonetization of silver in the nineteenth century. We connect a well-studied feature of metallic standards, their use as global price anchors, with a key historical change in the global monetary system - the abandonment of the use of silver as a global unit of account. Silver's historical role as a price anchor ended as countries overwhelmingly left silver and bimetallic standards in the latter half of the century in favor of gold; however, the shift to gold was not instantaneous or coordinated, permitting us to examine how silver's declining use as a unit of account affected global prices.

We develop a dynamic, general equilibrium model of the global economy that can be used to consider the gradual transition away from silver as a price anchor. Because both gold and silver were used to back currencies, the global monetary system is modeled as bimetallic, with both precious metals having monetary and non-monetary roles in the economy. Because the abandonment of silver as a unit of account occurred gradually, we calibrate the model using data on global commodity prices to understand the price dynamics and transition away from silver. Calibration of the model shows that silver ceased functioning as a global price anchor in the mid-1890s, nearly two decades after many important countries abandoned bimetallism. That is, the price of silver was highly correlated with agricultural prices through the mid-1890s, but not so thereafter. The timing of the end of silver's role as a price anchor is consistent with several historical facts: many countries continued to use silver as a unit of account through the 1870s and 1880s (e.g., Japan, Russia, the United States, Brazil, Mexico, Spain, China) and global political currents shifted in the 1890s and conspired against continued use of silver as a price anchor (e.g., India's suspension of the free coinage of silver in 1893 and the defeat of William Jennings Bryan and the "silverites" in the U.S. presidential election of 1896).

2 Demonetization of Silver and Global Price Dynamics

The use of silver as a global price anchor gradually ended in the late nineteenth century as countries switched from silver and bimetallic standards to monometallic gold standards, either de jure or de facto (Eichengreen, 1996; Meissner, 2005). Until its demise, countries used silver, often in conjunction with gold, to fix exchange rates. Under bimetallism, both gold and silver served as numeraires, with all other goods priced relative to the mint par ratio of gold to silver. A country that legally permitted bimetallism was often effectively on either a gold or silver monometallic standard, depending on how the mint price of gold to the mint price of silver compared to the world price ratio of the two metals (Officer, 2008).[1]

Scholars have noted that, during this transition period, fixed-exchange-rate regimes seem to have delivered relatively stable long-run prices. Over the period 1870-1914, prices are characterized by a shallow U shape with the nadir occurring in the 1890s. (Figure 1 illustrates these trends using data on general prices from the U.S.) General price deflation from the 1870s until the mid-1880s is typically attributed to a rise in the demand for monetary gold as countries moved towards the gold standard as well as economic growth. The trend in prices reversed in the mid-1890s, following the discovery of gold in South Africa and the invention of the Sinai process that lowered the price of gold extraction.

Previous studies have attempted to model or estimate the demise of bimetallism by focusing on changes in the longstanding global mint ratio of 15.5 silver ounces to one gold ounce. The standard story postulates that Germany's decision to demonetize silver led many countries to drop silver and switch over to gold (Friedman and Schwartz, 1963; Gallarotti, 1994). Flandreau (1996), however, argues that France, being the largest bimetallic country in the world, was the marginal player in the bimetallic system that kept the silver-gold price

[1]However, gold and silver appear to have circulated simultaneously in France from 1852-72 (Flandreau, 1996).

ratio at 15.5:1 and that Germany's decision did not spell the end of bimetallism[2] Rather, it is suggested that France's 1873 decision to limit the coinage of silver violated bimetallism led to the eventual rise of the international gold standard and to a floating silver-gold price ratio. Meissner (2013) draws on this vein of research to argue that bimetallism would have been unsustainable after 1875. On the other hand, Morys (2007) suggests that bimetallism may have unofficially ended even earlier, suggesting that that the large gold discoveries in California and Australia in the 1850s increased the supply of gold and made the emergence of the classical gold standard imminent by the end of the 1860s.

Even though bimetallism reached its unofficial end by at least the early 1870s as countries "scrambled for gold," scholars have noted that that many countries, including Austria-Hungary, Brazil, China, Japan, Mexico, Russia and Spain, continued to back money with silver well after that date (Flandreau, 2004; Bordo and Kydland, 1995). China and Spain remained on a silver standard for the entire period, while the other countries gradually transitioned to gold.[3] Hence, silver's monetary importance persisted well after bimetallisms demise.

In comparison to analyzing bimetallism's demise, comparatively less is known about how the gradual demonetization of silver and the transition to a new global monetary system influenced price dynamics. For an individual country, once legal backing of money with silver ended (either de jure or de facto), prices were free to fluctuate relative to that metal. It no longer served as a numeraire. Commodity prices, however, were largely set in competitive, global markets, suggesting that correlations between silver and commodity prices could persist even after legal backing based on that precious metal ended for a single important country, such as France. On the other hand, eventual widespread demonetization of silver at some point likely ended silver's role as a price anchor. As Figure 2 shows, data on global agricultural commodity prices and silver prices begin to take divergent paths in the mid-1890s. The correlation between silver and agricultural prices, which was 0.92 between 1870-1896, fell to 0.23 for the period 1897-1913. We show how a micro-founded, general

[2]Friedman (1990) argues that the United States made a big mistake when it demonetized silver in 1873, referring to this episode as Crime of 1873. He argues that this legislation destabilized prices. Velde (2002) employs a general equilibrium model to test Friedman's hypothesis that the United States could have maintained the silver-gold price ratio at 15.5:1. He finds that the United States could have kept the silver-gold price ratio fixed up until the mid-1890s. Oppers (1996), on the other hand, finds that much of the deflation of the 1870s and 1880s could have been avoided if France and Belgium continued to freely coin silver.

[3]Austria-Hungary became a de facto member of the gold standard in 1892, Brazil and Mexico joined in 1905 and 1906, while Japan and Russia became members of the gold club in 1897.

equilibrium model can help account for these changing patterns and demonstrate how silver was shed as a global unit of account.

3 A Bimetallic Monetary Model

To understand silver's role as a price anchor in the global economy, consider a simple dynamic model of the international bimetallic monetary system in which time is indexed by $t \in \mathbb{N}$. The world economy is divided into two regions, gold and silver. Households must use monetary gold to purchase goods in the gold region and monetary silver to purchase goods in the silver region.

3.1 Consumption, Production, and Money

There are three goods in the world economy: silver, gold, and an agricultural consumption good. The stocks of silver and gold are durable and do not depreciate, while the agricultural consumption good is perishable and cannot be stored. The two durable metals can be held in the form of either jewelry or money, and conversion between jewelry and money is immediate and costless.

Households derive utility from consumption of the agricultural good and from their holdings of gold and silver jewelry. At the start of each period t, a new household is born and lives for the entire period before realizing its utility and then being replaced by a newborn agent at the start of period $t+1$. Households from all periods have a nested constant-elasticity-of-substitution (CES) utility, so that the utility of an agent born in period t is given by

$$u(C_{a,t}, \gamma_{s,t}, \gamma_{g,t}) = \left(\mu_a^{\frac{1}{\theta}} C_{a,t}^{\frac{\theta-1}{\theta}} + (1-\mu_a)^{\frac{1}{\theta}} \Gamma_{s,t}^{\frac{\theta-1}{\theta}}\right)^{\frac{\theta}{\theta-1}}, \tag{1}$$

where

$$\Gamma = \left(\mu_s^{\frac{1}{\delta}} \gamma_s^{\frac{\delta-1}{\delta}} + (1-\mu_s)^{\frac{1}{\delta}} \gamma_g^{\frac{\delta-1}{\delta}}\right)^{\frac{\delta}{\delta-1}}, \tag{2}$$

and $C_{a,t}$ is consumption of the agricultural consumption good, $\gamma_{s,t}$ are holdings of silver jewelry, $\gamma_{g,t}$ are holdings of gold jewelry, $\theta > 0$ is a constant measuring the elasticity of substitution between the agricultural consumption good and metallic jewelry, $\delta > 0$ is a constant measuring the elasticity of substitution between gold and silver jewelry, and μ_a and μ_s are positive constants measuring households' preferences for each good relative to the others. A nested-CES function of this kind was first introduced in the context of production by Sato (1967), and has since become relatively common in other forms for both production and utility (see, for example, Atkeson and Burstein, 2008). For our purposes, the nested CES utility structure of equations (1) and (2) is particularly appropriate since it is natural to view gold and silver jewelry as more substitutable than agricultural goods and metallic jewelry. This basic observation is incorporated into the model when we choose $\delta > \theta$ when parameterizing the model for the simulations described below.

In each region of the world, there is a separate competitive firm that produces the perishable agricultural consumption good in each period t. Households own both of these firms, which together make up the total global production of the agricultural consumption good. In order to purchase the good from the silver-region firm, households must use monetary silver, and in order to purchase the good from the gold-region firm, households must use monetary gold. These cash-in-advance constraints force households to use part of their gold and silver holdings to purchase the agricultural consumption good. We set gold to be the numeraire throughout, so all prices are quoted in terms of gold. In each period t, then, a household must satisfy the constraints:

$$M_{s,t}p_{s,t} \geq C_{s,a,t}p_{a,t}, \tag{3}$$

$$M_{g,t} \geq C_{g,a,t}p_{a,t}, \tag{4}$$

where $M_{s,t}$ is the quantity of monetary silver in period t, $M_{g,t}$ is the quantity of monetary gold in period t, $p_{s,t}$ is the common world price of silver in period t, $p_{a,t}$ is the common world price of the agricultural consumption good in period t, and $C_{i,a,t}$ is purchases of the agricultural consumption good from the firm in region $i \in \{s, g\}$ in period t.[4] Note that

$$C_{a,t} = C_{s,a,t} + C_{g,a,t}, \tag{5}$$

or total consumption of the agricultural consumption good is made up of the total purchases of this good from the two firms.

[4]Because households can purchase goods in either region, the world economy is integrated and hence the law of one price holds for all goods.

At the start of period t, a newborn household inherits the gold and silver holdings of its parent as well as its ownership of the two competitive firms. Any changes in the stocks of silver and gold from the previous period also accrue directly to the newborn household at the start of the period. With its updated gold and silver holdings, the household then chooses how much of the agricultural consumption good it wishes to purchase from the two firms using monetary gold and silver as described above. After this, the household realizes its utility from its total purchases of the consumption good and its holdings of gold and silver jewelry. At the end of period t, the household receives the profits earned by the two competitive firms it owns so that next period's newborn household inherits both monetary and non-monetary holdings of silver and gold.

In each period t, let $A_{s,t}$ and $A_{g,t}$ denote the production of the agricultural consumption good by the firms in the silver and gold regions, respectively, and let S_t and G_t denote the total stocks of silver and gold, respectively. Using this notation, the budget constraint of a household in period t is given by

$$C_{a,t}p_{a,t} + (\gamma_{s,t} + M_{s,t})p_{s,t} + \gamma_{g,t} + M_{g,t} \leq (A_{s,t} + A_{g,t})p_{a,t} + S_t p_{s,t} + G_t. \tag{6}$$

As we explain below, both the cash-in-advance constraints (3)-(4) and the budget constraint (6) are binding in equilibrium.

3.2 Equilibrium

Having presented the key properties of the economic environment, we can now characterize equilibrium in the world economy. This requires that households optimally choose how much of each good to consume or hold and that prices adjust so that all markets clear.

Definition 3.1. An equilibrium is a collection $\{C_{s,a,t}, C_{g,a,t}, \gamma_{s,t}, \gamma_{g,t}, M_{s,t}, M_{g,t}, p_{a,t}, p_{s,t}\}$ such that in each period t, (a) the newborn household maximizes (1) subject to (3), (4), (5), and (6), and (b) $C_{s,a,t} = A_{s,t}$, $C_{g,a,t} = A_{g,t}$, $\gamma_{s,t} + M_{s,t} = S_t$, and $\gamma_{g,t} + M_{g,t} = G_t$.

The household cash-in-advance constraints (3)-(4) must bind in equilibrium since there is no uncertainty within each period t and there is no benefit from holding extra monetary gold or silver.[5] Using this observation, if we substitute the market-clearing conditions from

[5] Another possibility is to model an uncertain cash-in-advance constraint as in Svensson (1985), where

above and then derive the first-order conditions from the nested CES utility-maximization problem that households face, then we obtain the following system of equations:

$$M_{s,t}p_{s,t} = A_{s,t}p_{a,t}, \tag{7}$$

$$M_{g,t} = A_{g,t}p_{a,t}, \tag{8}$$

$$M_{s,t} + \gamma_{s,t} = S_t, \tag{9}$$

$$M_{g,t} + \gamma_{g,t} = G_t, \tag{10}$$

$$\mu_s\gamma_g = (1-\mu_s)\gamma_s p_s^{\delta}, \tag{11}$$

$$\mu_a^{\delta}\Gamma^{\delta}\gamma_g^{\theta} = (1-\mu_s)^{\theta}\Gamma^{\theta}(A_{s,t}+A_{g,t})^{\delta}p_a^{\theta\delta}. \tag{12}$$

The solution to this system yields the equilibrium prices and quantities in this setup.

The system of equilibrium conditions described in our model is related to the models of bimetallism of Flandreau (1996) and Velde and Weber (2000). In particular, the models establish a relationship between the quantity of monetary gold and silver and nominal output that is very similar to equations (7) and (8). This relationship is crucial to our main qualitative results about the changing relationship between the prices of silver and the agricultural consumption good, as discussed below. However, our setup differs in that we place a greater emphasis on the intra-period price formation process and the interaction between different supply shocks on the prices of the various goods in the economy, as characterized by equations (11) and (12) above.

In general, the system of equations (7)-(12) cannot be solved analytically in closed form. However, for some values of the parameters θ and δ, we are able to obtain numerical solutions. Thus, it is possible to simulate this economy and generate correlations between the equilibrium prices $p_{a,t}$ and $p_{s,t}$.[6] These simulated correlations can then be compared with the actual correlations observed in the data. All that remains to fully specify the model, then, is some structure on the random shocks that affect the stocks of silver and gold and the total world production of the agricultural consumption good. Let A_t denote the total

households do not know in advance how much money they will need for purchases of goods. This alternative approach is unlikely to alter the model's basic results since it generates a similar positive relationship between money and nominal output.

[6]In particular, if θ and δ are chosen from the set $\{0.5, 1, 1.5, 2\}$, then numerical solutions are readily obtained. For intermediate values of these parameters, however, the system of equations (7)-(12) is of too high an order to obtain such a solution.

world production of the agricultural consumption good in period t, so that

$$A_t = A_{s,t} + A_{g,t}. \tag{13}$$

We assume that the world supplies of silver, gold, and the agricultural consumption good evolve over time according to logarithmic AR-1 processes. In each period t, the supply of each good is given by

$$\log S_t = \rho_s \log S_{t-1} + s_t \tag{14}$$

$$\log G_t = \rho_g \log G_{t-1} + g_t \tag{15}$$

$$\log A_t = \rho_a \log A_{t-1} + a_t, \tag{16}$$

where $\bar{S}, \bar{G}, \bar{A} \in \mathbb{R}$ and ρ_s, ρ_g, ρ_a are constants with values between zero and one and the shocks s_t, g_t, and a_t are all i.i.d. over time with $s_t \sim \mathrm{N}(0, \sigma_s^2)$, $g_t \sim \mathrm{N}(0, \sigma_g^2)$, and $a_t \sim \mathrm{N}(0, \sigma_s^2)$. For simplicity, we shall assume that these shocks to production are uncorrelated across different goods.[7] This assumption does not alter the basic qualitative predictions of the model.

As discussed in the simulations presented in Section 5, a key property of our bimetallic monetary model is the following: as the ratio of monetary silver to monetary gold $M_{s,t}p_{s,t}/M_{g,t}$ increases, so does the correlation between the equilibrium price of silver and the equilibrium price of the agricultural consumption good. In other words, if an economically meaningful part of the world uses silver as money, then the model predicts a high correlation between the price of silver and other goods. This result merits some discussion. It relies on essentially the same basic intuition as Fishers quantity theory of money. In an economy with a bimetallic monetary regime, an increase in the price of silver is also an increase in the quantity of money, ceteris paribus. The quantity theory establishes a direct relationship between the quantity of money and nominal output, so any shock that raises nominal output must also raise the quantity of money and will thus tend to raise the price of silver in equilibrium. It follows, then, that any shock that raises the price of commodities will also raise the price of silver, thus creating a positive correlation between these different prices. This

[7]Equations (14)-(16) also implicitly set the steady-state expected values of the natural log of the supply of each good equal to zero. This assumption is also for simplicity and does not alter the basic qualitative predictions of the model.

logic does not, however, apply to a global economy with a monometallic monetary regime based on gold since an increase in the price of silver no longer leads to an increase in the quantity of money in such an economy.

The basic intuition from the quantity theory can be seen if we combine the two binding cash-in-advance constraints from the gold and silver regions of the world. Equations (7), (8), and (13) imply that in each period t,

$$M_{g,t} + M_{s,t} p_{s,t} = A_t p_{a,t}. \tag{17}$$

According to the combined cash-in-advance constraint, equation (17), if $M_{s,t}$ is greater than zero, then any change in the world price of the agricultural consumption good, $p_{a,t}$, will lead to a corresponding change in the price of silver, $p_{s,t}$, holding all other quantities constant. This is exactly the effect described in the discussion of the previous paragraph. Furthermore, as the value of $M_{s,t}p_{s,t}$ increases relative to the value of $M_{g,t}$, the effect of a change in $p_{a,t}$ on $p_{s,t}$ should increase.

In general equilibrium, the full impact of a shock that alters the price of the agricultural consumption good under any monetary regime is of course more complex. Nevertheless, as long as the substitutability of the agricultural consumption good and metallic jewelry is low, the simulations presented in Section 5 confirm that this basic intuition from the quantity theory is, in fact, correct. In other words, the simulations confirm that there is a higher correlation between the price of silver and the agricultural good for low values of the parameter θ. To understand why the elasticity of substitution between the agricultural consumption good and metallic jewelry must be low, consider the effect of a shock to the supply of the agricultural consumption good A_t, which is a key source of fluctuations in the equilibrium price $p_{a,t}$. A shock that increases the supply of this good will decrease $p_{a,t}$, with the size of that decrease highly dependent on the elasticity of substitution θ (a standard result for CES utility). As long as θ is low, the decrease in $p_{a,t}$ will be large enough so that $A_t p_{a,t}$ also decreases. Hence, by equation (17), the price of silver $p_{s,t}$ decreases as well. This mechanism, which generates the positive correlation between the prices of the agricultural consumption good and silver as discussed above, is reversed when the elasticity of substitution θ is high.

4 Data

To carry out the simulations, we collected data on agricultural goods and silver prices. Volatility measures and other summary statistics for agricultural commodities were constructed from hand-collected data contained in the "Monthly Trade Supplement" of the *Economist*. We computed an agricultural index consisting of four commodities, whose prices appear monthly without breaks or changes in definitions between 1870 and 1913: cotton, wool, wheat, and hemp. Each commodity was indexed relative to January 1870, and then the simple average across the four was computed to create the agricultural index. The monthly silver price of gold (expressed in pound sterling) is also from the *Economist*. Data on the ratio of monetary silver to gold was constructed using a new data set of the global monetary stock data compiled from the U.S. Bureau of the Mint *Annual Report* (various years). The present estimates are based on a consistent sample of 30 countries for which monetary stock data are reported.

5 Simulations

The model suggests that the relationship between the price of silver and the non-numeraire agricultural consumption good changes as silver ceases to serve the function of a global unit of account. We now turn to data to examine this prediction. In particular, we wish to show that as silvers role as a unit of account fades during the period 1870-1913, there is a corresponding gradual change in the relationship between silver and agricultural commodity prices. Furthermore, this changing relationship matches what we observe in the data when we consider price movements on a decadal basis rather than over the entire period.

5.1 Parameterization of the Model

For this section's simulations, we set the substitutability parameters θ and δ equal to 0.5 and 2, respectively. These values reflect the fact that agricultural commodities and metallic goods are less substitutable than non-monetary gold and silver holdings. In addition, these values ensure that the model can be solved numerically in a reasonable amount of time for the 140,000 simulations that we present in this section. We also set the parameter μ_a equal to 0.9, a value that reflects the substantially larger share of total spending on agricultural commodities relative to non-monetary gold and silver, and the parameter μ_s equal to 0.5, a value that reflects equal expenditure shares on gold and silver jewelry.

The ratio of monetary silver to monetary gold, $M_{s,t}p_{s,t}/M_{g,t}$, is particularly important in the model and in this simulation exercise. Indeed, the key fact that the model uncovers and that we also observe in the data is that, as this ratio declines, there is less correlation between the price of silver and agricultural commodities—consistent with the notion that silver is ceasing its role as a unit of account. According to equations (7) and (8) above, the monetary ratio is given by

$$\frac{M_{s,t}p_{s,t}}{M_{g,t}} = \frac{A_{s,t}}{A_{g,t}}. \tag{18}$$

This equation demonstrates that the ratio of monetary silver to monetary gold is equal to the ratio of production of the agricultural consumption good in the silver and gold regions of the world.

Motivated by the relationship in equation (18), we consider several different values for the ratio of agricultural good production $A_{s,t}/A_{g,t}$ that reflect the changing values of the ratio of monetary silver to monetary gold observed in our data set. Table 3 shows that this monetary ratio ranges from around 0.9 during the 1870s through the early 1890s down to just over one third by 1913. In our simulations, then, we consider values of the agricultural production ratio that range from zero to two, with a particular emphasis on those values between zero and one. The key result in this section is that, as the ratio of monetary silver to monetary gold as measured by the agricultural production ratio in our simulations increases, so does the correlation between the price of silver and the price of the agricultural consumption good. This result matches the corresponding historical relationship between price correlations and the monetary ratio we observe in Tables 2 and 3.

A priori, an important challenge in parameterizing the model is choosing the values for the parameters that determine the behavior of the random shocks to production of the three goods as given in equations (14)-(16). We thus consider two different sets of parameter values. In Parameterization 1, we assume that the shocks affecting the supply of the three goods are drawn from the same distribution so that the standard deviations σ_s, σ_g, and σ_a are equal to each other and the autocorrelation parameters ρ_s, ρ_g, and ρ_a are also equal to each other. We choose, respectively, the plausible values 0.05 and 0.97 for these common standard deviation and autocorrelation parameters.[8] In Parameterization 2, we adjust all parameters so that the simulations closely match the average time-series statistics for the full period, 1870-1913, as reported in Tables 1 and 2.[9] The parameter values for these two parameterizations are reported in Table 4.

Parameterizations 1 and 2 provide quantitative estimates of the effect of changing monetary ratios for the role of silver as a global price anchor. These parameterizations also demonstrate the robustness of the main result of the model across different parameter values. Indeed, the basic qualitative results of our simulations are the same for both parameterizations of the model.

5.2 Results

The results from 140,000 simulations covering both parameterizations of the model and various different monetary ratios are shown in Tables 5-7. According to Table 5, an increase in the ratio of monetary silver to monetary gold in either parameterization of the model leads to an increase in the correlation between the price of silver and the price of the agricultural consumption good. This is the central result of the model and of this section's simulations, and it is consistent with the historical relationship between silver-agricultural commodity price correlations and the monetary ratio that we present in Tables 2 and 3.

The main difference between the simulation results for the two parameterizations of the model is quantitative. Table 5 shows that Parameterization 1, in which the standard deviation and autocorrelation parameters from equations (14)-(16) are set to be equal across different goods, generates a larger increase in the correlation between the price of silver and the price of the agricultural consumption good for a given increase in the ratio of monetary silver to monetary gold. In fact, the magnitude of this increase matches closely to what we observe historically in Table 2. Parameterization 2, which by construction matches the historical time-series data for the 1870-1913 period much more closely, generates slightly less positive comovement between price correlations and the monetary ratio.

The central purpose of this simulation exercise is to illustrate the mechanism by which the declining role of silver as a nominal price anchor during the 1870-1913 period changed

[8]These parameter values generate a coefficient of variation of 5% and an autocorrelation of 0.97 for the production of each good, which is similar to the parameterization exercise of Velde and Weber (2000).

[9]When choosing parameter values so that the simulations match the data, we set the ratio of monetary silver to monetary gold equal to the average value for the five observations of this ratio reported in Table 3.

the relationship between the price of silver and the price of other goods. This section's numerical results confirm that the basic intuition about this changing relationship according to the quantity theory of money is correct.

6 Conclusion

As a way of illustrating how global monetary standards anchor prices, we examine the demise of silver as a metallic standard in the late nineteenth century. We show that silver continued to exert a strong influence over world commodity prices and serve as a global unit of account into the early 1890s, since the global switch to a global monometallic gold standard was gradual, but its role as a price anchor waned thereafter. Silvers high positive correlation with commodity prices began to break down in the mid-1890s. We develop a dynamic general equilibrium to illustrate why silvers role changed. Our micro-founded model delivers a relatively simple prediction, derived from a variant of the quantity theory of money, that fits the observed patterns in the data: the correlation between agricultural commodity prices and the price of silver is positively related to silver's relative importance in the global monetary stock. With India's demonetization of silver in 1893 as well as the defeat of the "silverites" and William Jennings Bryan's bid for President of the United States in 1896, silvers role as a price anchor effectively ended. It ceased to exert a significant influence on global commodity prices and lost its role as a global unit of account.

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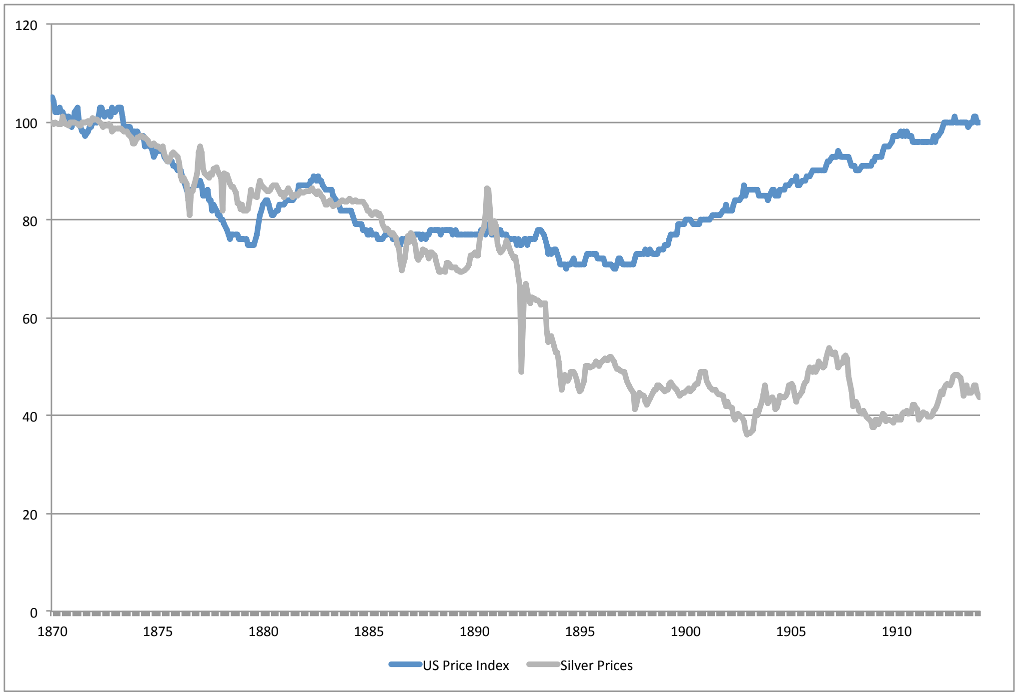

Figure 1: U.S. Price Level and Silver Prices, 1870-1913

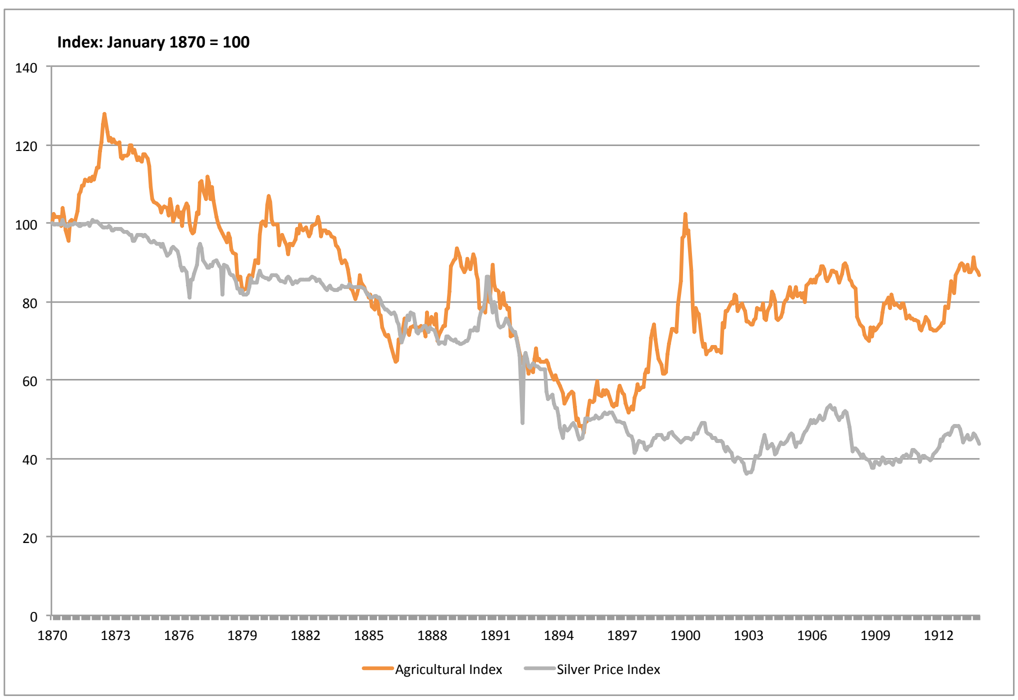

Figure 2: Monthly Agricultural Price Index and the Price of Silver, 1870-1913

Good	Time Period	Coefficient of Variation	Autocorrelation
Silver	1870-1880	0.0633	0.9674
Silver	1880-1890	0.0779	0.9886
Silver	1890-1900	0.2204	0.9726
Silver	1900-1913	0.0930	0.9739
Agricultural commodity index	1870-1880	0.0985	0.9771
Agricultural commodity index	1880-1890	0.1301	0.9804
Agricultural commodity index	1890-1900	0.1738	0.9216
Agricultural commodity index	1900-1913	0.0829	0.9057

Table 1: Coefficient of variation and autocorrelation by decade for the price of silver and the agricultural commodity price index.

Time Period	Correlation
1870-1880	0.7068
1880-1890	0.6475
1890-1900	0.6164
1900-1913	0.4914

Table 2: Correlation by decade between the price of silver and the agricultural commodity price index.

Year	Ratio of Monetary Stocks
1873	0.89
1883	0.82
1893	0.83
1903	0.51
1913	0.37

Table 3: Ratio of monetary silver to monetary gold for different years.

Parameter	Parameterization 1	Parameterization 2
θ	0.5	0.5
δ	2	2
μ_a	0.9	0.9
μ_s	0.5	0.5
ρ_s	0.97	0.97
ρ_g	0.97	0.97
ρ_a	0.97	0.92
σ_s	0.05	0.023
σ_g	0.05	0.03
σ_a	0.05	0.001

Table 4: Parameter values for the two parameterizations of the model. Parameterization 1 chooses parameter values that are equal across different goods. Parameterization 2 chooses parameter values that generate time-series statistics that match those observed in the data.

Ratio of Monetary Silver to Monetary Gold	Parameterization 1 Correlation	Parameterization 2 Correlation
0	-0.0910	0.4340
0.2	0.0636	0.5211
0.4	0.1684	0.5565
0.6	0.2290	0.5928
0.8	0.2652	0.5919
1.0	0.2804	0.6167
2.0	0.3748	0.6486

Table 5: Correlation between the price of silver and the price of the agricultural consumption good for two different parameterizations of the model and for different values of the ratio of monetary silver to monetary gold. Parameterization 1 chooses parameter values that are equal across different goods. Parameterization 2 chooses parameter values that generate time-series statistics that match those observed in the data. These results are generated by averaging the results of 10,000 simulations of the model.

Ratio of Monetary Silver to Monetary Gold	Coefficient of Variation p_a	p_s
0	0.3398	0.2219
0.2	0.3403	0.2051
0.4	0.3329	0.1992
0.6	0.3573	0.1948
0.8	0.3601	0.1941
1.0	0.3573	0.1931
2.0	0.3573	0.1948

Table 6: Coefficient of variation for the prices of silver and the agricultural consumption good for Parameterization 1 (this parameterization chooses parameter values that are equal across different goods) and for different values of the ratio of monetary silver to monetary gold. The results are generated by averaging the results of 10,000 simulations of the model.

Ratio of Monetary Silver to Monetary Gold	Coefficient of Variation p_a	p_s
0	0.1266	0.1037
0.2	0.1251	0.1021
0.4	0.1277	0.1002
0.6	0.1266	0.1012
0.8	0.1289	0.1020
1.0	0.1301	0.1031
2.0	0.1319	0.1051

Table 7: Coefficient of variation for the prices of silver and the agricultural consumption good for Parameterization 2 (this parameterization chooses parameter values that generate time-series statistics that match those observed in the data) and for different values of the ratio of monetary silver to monetary gold. The results are generated by averaging the results of 10,000 simulations of the model.