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The Gibson paradox: Evidence from China

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ABSTRACT

Recent literature has advanced the view that the Gibson paradox, or the positive correlation of the price *level* with nominal interest rates, is nearly always a gold standard phenomenon. We argue that the Gibson correlation is more accurately classified as a statistical artifact of commodity money systems, with the gold standard merely representing one such system. Using new evidence from Chinese monetary history, this article gives evidence that the Gibson paradox appeared during China's silver-cored metallic standard era. Estimates obtained from recursive ordinary least squares specifications and vector auto-regressions performed, using the Shanghai Yinchai Rate and the Chinese Wholesale Price Index, confirm a Gibson correlation for China during the period 1873–1924.

1. Introduction

The economist Gibson (1923) researched the relationship between interest rates and the general price level using time series data from Britain's gold standard era and discovered a *positive* correlation between these variables. The finding was dubbed "Gibson's paradox" by J.M. Keynes because it presents an empirical disconfirmation of the predictions of classical monetary doctrine.

The Gibson paradox – which Keynes' once described as "one of the most completely established empirical facts in the whole field of quantitative economics" (Keynes, 1930, 198) – has attracted the attention of many economists, including Irving Fisher, Milton Friedman, and Anna Schwartz, and more recently, Lawrence Summers. Among the questions researched are: is the Gibson paradox strictly a gold standard phenomenon? What is the nature of the mechanism that causes nominal interest rates to be positively correlated with the overall price level? The latter issue has assumed contemporary relevance in light of the unprecedented actions taken by western central banks since the start of the global financial crisis in 2008. For example, the U.S. Federal Reserve has aggressively expanded its balance sheet and, in the process, driven nominal yields of short-dated Treasury issues to near-zero levels. A sharp increase in the speculative demand for precious metals (gold prices have roughly doubled since mid-2008) is one fallout of monetary expansion and rising securities prices. While some economists believe that the present course of monetary policy in the US and the Eurozone will ignite an inflationary spiral, a recrudescence of the Gibson correlation would bring forth price *deflation*—a potentially disastrous situation for debtors. Thus, it is important to understand the institutional conditions that give rise to a Gibson paradox.

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The aim of this article is to show that the Gibson correlation is a statistical artifact of *commodity* money systems—meaning monetary regimes wherein the quantity of circulating media of exchange is regulated by the domestic stock of some commodity that possesses a positive elasticity of production. That the Gibson paradox is manifested in the context of a gold standard is explained by the fact that it is one variant of a commodity money system. This article provides new econometric evidence that the Gibson paradox appeared in China during 1873–1924—a period in which the Chinese economy operated under a silver-cored *metallic* monetary standard.

The article is organized in five sections. Section 2 argues that the Gibson correlation is indicative of commodity money regimes, the gold standard representing merely one type of commodity money system. Section 3 describes the operation of the "silver-cored" monetary standard in China. Section 4 reports the estimates obtained from recursive ordinary least squares specifications and vector auto-regressions (VAR) performed using an interest rate and price index for China. Section 5 contains concluding remarks.

2. The Gibson paradox, the gold standard, and commodity money

That the Gibson correlation is manifested in the context of a gold standard regime, and vanishes upon a switch to alternative monetary systems, is the dominant theme in the literature on the subject (see Table 1). Friedman and Schwartz (1982, 586) claimed, in their *Monetary Trends*, that "the Gibson relationship holds clearly and unambiguously for the United States and the United Kingdom only for the period from 1880 to 1914"—a period conterminous with the operation of the gold standard. This conclusion is reinforced by the work of Lee and Petruzzi (1986). Using data for the US (1730–1980) and Great Britain (1800–1981), they found no Gibson correlation outside of those years in which the gold standard was in effect. Barsky and Summers (1988), Dowd and Harrison (2000), Mills (2008), and Evans and Wang (2008) provide evidence that the Gibson correlation exists in countries during years that they operated under a gold standard. Similarly, papers by Benjamin Klein (1975), Ibrahim and Williams (1978) and Dwyer (1984) provide evidence that the statistical relation between nominal yields and price levels changed significantly on cessation of the gold standard. Chen, Chung, Lee, and Jevons (1990) found evidence of structural change in the dynamic relation between price levels and interest rates arising from a change of monetary standard.

Defining a chronology of the gold standard is problematic, and the literature (particularly concerning the US) exhibits some confusion on the matter. For example, Lee and Petruzzi (1986) uncovered a Gibson correlation for the US during 1830–1860 and 1874–1913—years, they claim, fall within the gold standard era. But the reality is more complicated. In fact, the United States did not officially adopt the gold standard until 1900.[1] It should be noted that Friedman and Schwartz (1982) paid great attention to the impact of the "Free Silver" movement in their study and did *not* claim that the existence of the Gibson paradox was exclusive to a gold standard. Rather, they claim, it was the product of a "specie standard" (1982, 587), which we interpret to mean any system in which the supply of money is regulated by the available stock of precious metals. Barsky and Summers (1988, 529) state (correctly, in our view), that "the Gibson correlation may arise as a natural concomitant of a monetary standard based on a durable commodity."

In summary, we argue that the Gibson paradox can be manifested in any system where the quantity of circulating media is constrained by the supply of a durable commodity. Wars or political crises catalyze exogenous increases in the demand for precious metals as a hedge against uncertainty about the future. The Gibson correlation is likely to vanish under these conditions —that is, the causal relations among the key variables involved is likely to undergo structural change. This fact presents a major problem for econometric investigation. As incorrect period division can give rise to misleading statistical findings, it is important to divide history into segments that, within themselves, exhibit a reasonable degree of structural stability. Thus, a main component of this paper involves the designation of periods in the nineteenth and twentieth centuries, during which China unambiguously operated on a commodity money system.

3. Overview of metallic standard of China before 1935

The use of copper coins as generally acceptable standard money in China had been into existence since the Qin Dynasty (221 B.C.). The old copper coins served as the medium of exchange, unit of account, and means of international settlement. The mint of copper coins had been always restricted to the government. It was the flow of silver into China that had changed the existing copper coinage standard to, initially, a copper-cored and, then, a silver-cored metallic standard. According to Frank (1999), silver had been exported to China from America, Europe, Malaya (now Malaysia), India and Japan since the sixteenth century, and China became known as the world's largest silver pit. Foreign traders transported large quantities of silver bullions

[1] Silver was legal tender together with gold under the U.S. Coinage Act of 1792. As gold was undervalued at the official silver-gold ratio of 15:1 (the market-price ratio of 15.5:1), silver gradually drove gold out of circulation, putting the USA on a *de facto* silver standard. With the Coinage Act of 1834, gold was overvalued at the official rate of 16:1 (which exceeded the market ratio of 15.73:1), moving the United States to a gold standard, with silver gradually being reduced to a subsidiary currency for coins of less than one dollar in the Coinage Act of 1853. Meanwhile, the silver trade dollar was introduced for foreign trade usage. In 1873, the free and unlimited coinage of silver coins was ended and the Gold Resumption Act of 1875 specified a gold-based dollar. The U.S. Treasury received legislative approval in 1878 and 1890 to resume purchases and coining of silver as backing for silver certificates circulating as paper money. The United States was *de facto* on a gold standard, and especially so after 1896. The Gold Standard Act of 1900 finally put the United States on an official gold standard.