UNIVERSITÀ DEGLI STUDI FIRENZE

DISEI
DIPARTIMENTO DI SCIENZE PER L'ECONOMIA E L'IMPRESA

Working Papers - Economics

On the Relevance of the Purchasing Power Hypothesis as a Determinant of Exchange Rate Equilibrium in the Post WWI French Franc Floating Exchange Rate Period.

Giulio Cifarelli and Paolo Paesani

Working Paper N. 24/2024

DISEI, Università degli Studi di Firenze
Via delle Pandette 9, 50127 Firenze (Italia) www.disei.unifi.it

On the relevance of the purchasing power hypothesis as a determinant of exchange rate equilibrium in the post WWI French Franc floating exchange rate period.

Giulio Cifarelli^ Paolo Paesani°

26 October 2024

Summary

The French franc variability of the 1920-1926 time interval is often attributed to irrational speculation. A common view is that French investors, disregarding fundamentals, were prone to export their funds in response to adverse financial/political news, destabilizing in this way the exchange rate. Our analysis, based on a new dataset, qualifies these results. The estimates of a Markov-switching Heterogeneous Agents Model strongly support the hypothesis that informed speculators relied on the relative purchasing power parity paradigm and drove the short run exchange rate dynamics, bandwagon effects being but short lived. In line with previous analyses the impact of additional explanatory variables, real and financial, turns out to be rather limited.

JEL Codes C32, F31, F33, G15, N24

Keywords: Gold Standard, HAM French Franc pricing, Markov Switching

^ DISEI Università di Firenze; ° ALEF Università degli Studi di Roma Tor Vergata

The authors would like to thank Matteo Alessi for the exceptional help provided with the dataset, Filippo Cesarano and Giovanna Paladino for extremely useful suggestions.

Introduction

The relatively short period of floating exchange rates, which followed the end of the First World War, was carefully studied, often with a focus on Britain and France. In the early 1920s, both countries committed themselves to return to the Gold Standard, albeit in different ways and with different effects on their currencies. Movements of the British pound reflected the overall desire to reestablish the pre WWI status quo, i.e. the Gold Standard parity that was associated with the financial prosperity of this period. Additional considerations, such as internal and international turbulence and economic policy choices of differing governments played but a subordinate role. The behavior of the French franc, influenced by the difficulty of defining a new parity with gold, is of greater interest as it provides a textbook example of the impact of speculative financial flows on foreign exchange pricing.

One effect of the different strategies for returning to the Gold Standard adopted by the British and French monetary authorities is reflected in the evolution of the French franc (FF)/British pound (GBP) exchange rate (FF per 1 GBP), which rose from 40 to above 200 between 1920 and 1926, before settling at the new official parity of 125, after going through phases of particularly high volatility. These movements have been thoroughly investigated (see Pigou, 1936, Keynes, 1931, Frenkel, 1978, 1980, and Eichengreen, 1982, among many others), and the winter 1923-spring 1924 and summer 1926 upheavals attributed to speculation. Following Nurske (1944) they are assumed to provide a blatant example of the public's destabilizing behavior under flexible exchange rates. These unprecedented steep fluctuations of the exchange rate were, at times, interpreted as irrational ('psychological') phenomena (Aftalion, 1926), since they did not seem to be related to macroeconomic fundamentals.

The determination of a new Gold Standard parity in France was the outcome of a painstaking adjustment process, which took into account the evolution over time of the French vs British inflation rate differentials, in full abeyance of the relative purchasing power principle. Indeed, as suggested by Aftalion, the tenets of the price species mechanism, and hence of the purchasing power relationship, were familiar to contemporary policy makers and practitioners alike. In a relevant paper, Eichengreen (1982) provides an interpretation based on Dornbusch's (1976)

sticky prices model and reaches the (unexpected) conclusion that speculation, far from raising, reduced exchange rate variability.

The existence of a plurality of interpretations of the role of speculation in determining the fluctuations of the FF/GBP exchange rate in the early 1920s, in an extremely turbulent political and economic climate, invites us to rethink the problem, combining historical and empirical perspectives. With this objective in mind, our research is based on the re-reading of a series of French primary sources and on the construction of a new data set, analyzed with techniques suitable for identifying the various speculative components in the movement of financial variables and in particular of exchange rates.

Our empirical findings, based on a Markov-switching analysis of a simplified Heterogeneous Agents Model (HAM) foreign currency demand relationship, seem to corroborate Eichengreen's interpretation. The fluctuations of the French franc reflected the vagaries of successive French governments faced with almost impossible political and financial odds. Economic agents, buffeted by unprecedented shocks, considered relative purchasing power parity as a rough 'point de repère' for their exchange rate equilibrium perception (Mouré, 1996). Based on this evidence, evidence from the literature of the time (e.g. Aftalion, 1927), and recent empirical research on the material determinants of the exchange rate, our analysis tests the idea that relative purchasing power parity is the reference point for a part of the speculators in the market, using the clear-cut tenets of the Heterogeneous Agents financial Model.[1]

This idea is confirmed in our research along with the following results

- The exchange rate volatility regime shifts selected by the Markov-switching procedure correspond with accuracy to periods of financial stress, be they of diplomatic, political or economic origin, in line with the intuition of Hamilton (1989).[2]

[1] There is a lack of consensus on the true drivers of the equilibrium exchange rate (Sarno and Taylor, 2002). As long-run anchor value of the exchange rate, most models use either the purchasing power parity (PPP) or the uncovered interest rate parity (UIP). Several research papers - see Lothian (2016) and the literature quoted therein – find that the relative PPP performs well, using a large sample of currencies and various time spans. An exhaustive survey of the origins of this theory is provided by Officer (1982).

[2] One of the main properties of the Markov-switching procedure, which justifies its use in the investigation of business cycles, is the endogenous dating of the regime shifts. Blancheton and Maveyraud (2009) point out that the French monetary authorities did intervene in the foreign exchange maket in the exchange rate stress periods. (They used appropriately selected commercial banks, such as the Banque Lazard or the Société Générale.) The Markov high variability estimates provide thus information on the reaction of speculators to these policies.

- Deviations from relative purchasing power parity, interpreted in exchange rate determination models as a proxy of the impact of fundamentalist speculation, dampen surges in the rate of change of the FF/GBP exchange rate, an effect that becomes larger in periods of higher exchange rate volatility, in line with the results of Eichengreen.
- Evidence is found of the negative correlation between exchange rate rate of change and the rates of return of financial assets, contradicting the tenets of the 'psychological' model.
- The past inflation rate plays a relevant role in the regime switching process, which reflects the policy choices of French industrial lobbies and corroborates a stylized reaction of speculators to inflationary perceptions.

The paper is organized as follows. In section 1 a short historical summary focuses on the main challenges faced by economists and governments alike in these turbulent years. A simplified Heterogeneous Agent Model is set forth in sections 2 and 3 and estimated using constant transition probability (CTP) and time varying transition probability (TVTP) Markov-switching estimation approaches in section 4. A short discussion concludes the analysis in section 5.

1. The Historical Context

The analysis of the dynamics of the FF/GBP exchange rate, although mainly considered from a French perspective, requires a preliminary consideration of the main drivers of the British pound against currencies other than the franc, and in particular against the US dollar, given the importance of New York as a financial center competing with London. The appreciation of the British pound (GBP), which we observe from 1921 onward, is related to a desire to re-establish the Gold Standard, possibly at the pre-war exchange rate parity of 4.24 USD per GBP, irrespectively of the costs of the deflationary policies that had to be implemented.

The USD/GBP exchange rate underwent large fluctuations about a positive deterministic trend (see Figure 1.(A)). The re-establishment of the Gold Standard value of the British pound at its pre-war level was a psychological benchmark for the resumption of the traditional prominent role of the London market as the leading financial hub of the World. As is well known, the war had led to a significant rise in British prices and wages relative to those of other nations, starting with the US. Returning to the gold standard at pre-war parity without suffering a severe loss of

competitiveness would have required internal deflation, which the stickiness of wages and the opposition of British trade unions prevented. It was facilitated, however, by the decline of the British inflation rate, from 1922 onwards. The impact of the parity on the trade balance was assumed to be of little relevance and apt to be managed via internal wage compression in traditional staple industrial sectors.[3] The vagaries of the political struggle influenced the pricing of the GBP, a leftwing success, by reducing the chances of a return to the Gold Standard, bringing about a devaluation.

The 1923 elections resulted in a hung parliament, which produced the weak MacDonald labour government and a subsequent depreciation of the GBP. New elections in 1924, and Baldwin's conservative landslide victory, brought about a resumption of the appreciation of the currency towards its pre WWI gold parity. These developments stand out clearly in the analysis of the determinants of the USD/GBP exchange rate over the 1920-1925 time interval.[4]

The evolution of the French franc is different (see Figure 1, (B)). A preliminary large FF/GBP devaluation is followed by successive unprecedented steep fluctuations of the exchange rate, at times interpreted as irrational ('psychological') phenomena as discussed in the Introduction. The determination of a new Gold Standard parity was the outcome of a painstaking adjustment process, which took into account the evolution over time of the French vs British inflation rate differentials, in full abeyance of the relative purchasing power principle.

The tumultuous Versailles Treaty negotiations saw the collapse of the wartime collaboration between the Allied Powers. The problem of the German war reparations dominated the

[3] This is not to say that price competitiveness considerations were ignored. The literature on the April 1925 purchasing power parity is strongly influenced by the selection of the British and US price indexes used in the computations. On the basis of retail price indexes, Keynes (1931) concluded that the GBP was overvalued by 10%, a finding criticized by Gregory (1926), but stronly supported by Lacout (1926). As pointed out by Stolper (1948) and Morgan (1952), the sterling dollar exchange rate was mostly influenced by relative prices dynamics from 1920 to 1923. After 1923 relative interest rates and speculative expectations became the driving factors. The debate on the sterling 1925 pricing is far from settled. New estimation techniques provide new insights. Taylor (1992), with an error correction cointegration approach, and Gerlach and Kugler (2015), with a corresponding LSTAR variant, find that the GBP was not overvalued at its 1925 gold exchange rate parity.

[4] As pointed out by Moggridge (1969), the Chamberlain-Broadbury Committee, established in April 1924 allegedly to solve a monetary issue technical problem, considered, in its February 1925 report, the return to gold at the pre WWI parity as a foregone conclusion. An early accurate critique of this policy can be found in Lacout (1926). His sophisticated purchasing power studies influenced both Quesnay's and Rueff's investigations on the appropriate French franc stabilization parity. The consequences of an inaccurate parity selection were severe (see Dimsdale, 1981, for the large literature on this controversial topic). Rueff (1954), in line with Keynes (1931), among others, attributes to the GBP overvaluation the relevance and the persistence of the British pre WWII unemployment

proceedings and prevented the introduction of cooperative debt settlement procedures. The failure of international conferences (Brussels 1920, Genoa 1922) was indicative of the differing aims of the US and major European countries. The British Government's main objective was that of restoring the City's role as dominant international financial and banking center. Additional diplomatic and/or strategic considerations played but a secondary role. The French Government policies were driven by military/strategic security considerations vis-à-vis Germany. Reparations, seen as an irrational nuisance in the Anglo-Saxon countries, were central to the French (and Belgian) efforts of reconstruction of the areas devastated during the war and played the additional role of guaranteeing the solvency of the Government finances. The perception, by the French economic and political world, of the staunch refusal to pay of the German authorities strongly affected the dynamics of the FF/GBP exchange rate after the summer of 1922.

The French occupation of the Ruhr, associated with the German hyperinflation, resulted in a diplomatic impasse, which brought about the electoral victory of the 'Cartel des Gauches'. The latter coincided with the resumption of speculative pressures on the Franc. Only by accepting the 'Dawes Plan' were the French authorities able to stem the continuous weakening of the domestic currency, using Anglo-Saxon foreign currency loans. This episode was aptly labelled "la bataille du Franc". The radical governments of Herriot, Briand and Painlevé were unable to stabilize the public finances and to stem inflationary pressures. Expectations of a capital levy resulted in successive bouts of capital outflows with a corresponding bubble like exchange rate depreciation.

The 1926 electoral victory of Poincaré – well known for his fiscal conservatism - brought about a drastic shift in expectations, a sharp inflow of funds from abroad and an abrupt exchange rate re-evaluation. It resulted in a de facto exchange rate stabilization. The new de jure Gold Exchange Standard value of the franc, the 'Franc Poincaré' was determined after a lengthy and accurate analysis of realistic purchasing power restrictions (see Mouré, 1996).

The Banque de France governor, Moreau, influenced by the reports of Quesnay and Rueff, favoured a relatively low parity. Poincaré, on the other hand, desired a stronger franc, even if mellowed by the warnings of the trade unions (Jouhaux of the CGT). The trade off between a depreciated franc and a higher inflation rate explains much of the foreign exchange policy of

French heavy industry. The desire to export excess production is one of the factors which explains the overall weakness of the Franc from 1922 to 1926.[5] The idea of returning to the 1914 gold standard parity was jettisoned by the new leadership of the Banque de France (Moreau, Rist and Quesnay). The know-how acquired by Quesnay and Rist during the stabilization of the Austrian and Czech currencies, on behalf of the "Comité Financier" of the Society of Nations, influenced their mindset and percolated to the policy choices of their Banque de France colleagues. The financial stability of the country was thus successfully established at an economically sound Gold Standard FF/GBP rate.[6]

This was not a foregone conclusion. The resumption of the pre WWI parity was staunchly supported by the régents De Wendel and De Rotschild within the Banque de France and, at first, by Poincaré. A summary of the harsh infighting between financial and industrial lobbies for the selection of the franc gold parity is to be found in Gaston-Breton and Garnier (2014).

The interaction of investors with the Banque de France and the Ministère des Finances ended up by being virtuous, in spite of spectacular political and diplomatic upheavals. An accurate empirical analysis of their surprising impact on exchange rate pricing is set forth in the next sections of the research.

2. The econometric model: trading strategies and their impact on the exchange rate

When applying contemporary modelling to historical data one must be wary of providing an appropriate description of the real behavior of past economic agents. A perusal of the French financial press of the 1920s, however, points to a surprisingly alert reaction to financial and political news, which seems to justify a division of wealth holders into financially savvy agents, i.e. banks and financial operators, and naïve individual savers, mostly trend chasers with a relatively small capital. The purchasing power parity principle played a dominant role as exchange rate equilibrium attractor. Indeed, the impact of currency fluctuations on the trade balance was fully appreciated. As pointed out by Debeir (1980), heavy industry interests (streel, pig iron), keen to stimulate exports, actively lobbied for a weak French franc, assumed to

[5] See Moreau (1954) and Rueff (1959) for more details.
[6] On the appointment of the new leadership and its policy consequences see Dal-Pont Legrand and Torre (2014).

compensate for domestic inflationary pressures. Well-informed speculators, aware of this state of affairs, reacted to currency deviations from its presumed equilibrium value.[7]

In this section we discuss how changes in the trading behavior of these (heterogenous) agents affect exchange rate determination. The usual distinction (set out in Hommes, 2005, among many others) apply: if trading strategies depend only on the past history of the exchange rate, agents are defined "naïve", or "uninformed" speculators. If they depend on external information used to assess a long-term fundamental value, agents are called "fundamentalists". Naïve speculators are classified, additionally, as trend followers or contrarians according to whether they trade following the trend or against it. The final effect on the exchange rate will depend on the interaction between different types of agents and will vary over time since agents can decide to enter or exit the market.

The fundamentalists' trading strategy assumes that the actual exchange rate will revert towards its fundamental value. Their foreign currency demand function reads as follows:

$$D_t^F = a_1 (\Delta f_t - \Delta \mathrm{e}_{t-m}) \ , \qquad m = 0, 1, 2, \ldots \quad (1)$$

f_t, e_t denote, respectively, the logarithms of the fundamental and spot exchange rates, quoted as number of units of domestic currency x per British pound (GBP). In this paper f_t is the equilibrium value of the spot exchange rate according to the purchasing power parity (PPP) hypothesis.

Assuming that $f_t = (p_t^x - p_t^{GBP})$, where p_t^x and p_t^{GBP} denote the logarithms of the domestic and British wholesale price levels, the absolute purchasing power parity will hold when

$$(p_t^x - p_t^{GBP}) - e_{t-m} \equiv f_t - e_{t-m} = 0, \ m = 0, 1, 2, \ldots \qquad (2)$$

The corresponding relative purchasing power parity reads as

[7] A detailed account of the heavy industry exchange rate policy requests can be found in the O*f*CE report (O*f*CE, 2012).

$$(\Delta p_t^x - \Delta p_t^{GBP}) - \Delta e_{t-m} \equiv \Delta f_t - \Delta e_{t-m} = 0,\ m = 0, 1, 2, \ldots \qquad (3)$$

In equation (1) we assume that fundamentalists react to deviations from the relative PPP, buying foreign currency if the rate of change of the spot exchange rate Δe_t is lower than Δf_t and selling foreign currency if the reverse is true, which implies that a_1 will be positive.[8] We add a lag m to the exchange rate, to be assessed empirically. It depends upon the delay with which the perception of a purchasing power arbitrage margin is perceived by fundamentalist speculators.

Naïve traders focus on past exchange rate movements only. Their foreign currency demand function reads as

$$D_t^C = a_2\, \Delta e_t \qquad (4)$$

They will behave as trend followers when a_2 is positive or as contrarians when a_2 is negative. As is well known, exchange rate may overshoot: in this case contrarians are stabilizers since they bring about price reversals by betting against the current trend.

Exchange rates are set in an order driven market where trading positions are revised every period. Hence exchange rate changes from t to t+1 are a function of the excess demands of fundamentalist and naïve traders and are parameterized by the following log-linear function

$$e_{t+1} = e_t + \beta(D_t^F + D_t^C) + u_{t+1} \qquad (5)$$

u_{t+1} accounts for the remaining determinants of exchange rate dynamics. Inserting equations (1) and (4) into equation (5) we obtain

$$\Delta e_{t+1} = d_0 + d_1(\Delta f_t - \Delta e_{t-m}) + d_2 \Delta e_t + \varepsilon_{t+1}, \qquad m = 0, 1, 2, \ldots \qquad (6)$$

[8] Fundamentalists may however believe that the persistence of the misalignment will last for some time, in which case a_1 will be negative (i.e. they persist to buy/sell foreign currency if Δe_{t-m} is larger/smaller than Δf_t).

$d_1 = \beta a_1,\ \ d_2 = \beta a_2$. Exchange rate dynamics reflects the interactions of the orders of heterogeneous traders.

If the exchange rate rate of change is related to a financial variable rate of return, as posited by Aftalion (1926), equations (5) and (6) have to be rewritten as follows

$$e_{t+1} = e_t + \beta(D_t^F + D_t^C) + \gamma r_t^F + v_{t+1} \qquad (7)$$

and

$$\Delta e_{t+1} = d_0 + d_1(\Delta f_t - \Delta e_{t-m}) \quad + d_2 \Delta e_t + d_3 r_t^F + \varepsilon_{t+1}\,, \qquad m = 0, 1, 2, \ldots \qquad (8)$$

where $d_3 = \gamma$ and r_t^F is the rate of return of a French financial asset. As an additional (policy) variable, influencing the exchange rate, we have considered the Banque de France discount rate changes Δr_t^{Fd} and have estimated the additional relationship [9]

$$\Delta e_{t+1} = d_0 + d_1(\Delta f_t - \Delta e_{t-m}) \quad + d_2 \Delta e_t + d_3 r_t^F + d_4 \Delta r_t^{Fd} + \varepsilon_{t+1}\,, \qquad m = 0, 1, 2, \ldots \quad (8')$$

3. The Markov-Switching Estimation Procedure

3.1 The Constant Transition Probabilities Procedure

In our investigation we use, at first, a Markov-switching model with constant transition probabilities. Equation (8') is rewritten in a two-state Markov-switching framework, in which the drivers of the exchange rate rates of change are assumed to switch between two different processes determined by the state of the market

$$\Delta e_t = \theta_{0s_t} + \theta_{1s_t}(\Delta f_{t-1} - \Delta e_{t-m-1}) \quad + \theta_{2s_t} \Delta e_{t-1} + \theta_{3s_t} r_{t-1}^F + \theta_{4s_t} \Delta r_{t-1}^{Fd} + \varepsilon_{es_t}, \qquad m = 0, 1, 2, \ldots \quad (8'')$$

[9] Attempts to include UIP dynamics, adding as regressor e.g. the difference between the Banque de France discount rate and the Open Markets rates of discount for London, were ineffective. British financial factors played an unexpected subordinate role in the determination of the FF/GBP exchange rate behavior.

where $\varepsilon_{es_t} \equiv \epsilon\sigma_{s_t} \sim N(0, \sigma_{s_t}^2)$ and the unobserved random variable s_t indicates the state in which is the market.

According to the Markov hypothesis, the value of the current regime s_t is assumed to depend on the state of the previous period, s_{t-1}. The transition probability $P\{s_t = j|s_{t-1} = i\} = P_{ij}$ measures the probability that state *i* is followed by state *j*.

In the two-state case $P_{11} + P_{12} = 1$, $P_{22} + P_{21} = 1$, and the corresponding transition matrix reads as

$$\begin{bmatrix} P_{11} & 1 - P_{22} \\ 1 - P_{11} & P_{22} \end{bmatrix} \qquad (9)$$

The parameters of equation (8″) and the transition probabilities parameters of matrix (9) are jointly estimated.

The joint probability of Δe_t and s_t is given by the product

$$P(\Delta e_t, s_t = j|\vartheta_{t-1}, \emptyset) = f(\Delta e_t|s_t = j; \vartheta_{t-1}, \emptyset).P(s_t = j|\vartheta_{t-1}, \emptyset) \qquad j = 1,2 \qquad (10)$$

ϑ_{t-1} is the information set that includes all past information on the population parameters and $\emptyset = (\theta_{0s_t}, \theta_{1s_t}, \theta_{2s_t}, \theta_{3s_t}, \theta_{4s_t}, \log(\sigma_{s_t}^2))$ is the vector of parameters to be estimated, $f(.)$ is the density of Δe_t, conditional on the random variable s_t and $P(.)$ is the conditional probability that s_t will take the value j.

3.2 The Time-Varying Transition Probabilities Procedure

Following an approach originally set forth by Diebold et al. (1994) and Filardo (1994), the present model allows for time-varying logistic parameterization probabilities. It follows that $P\{s_t = j|s_{t-1} = i, Q_{t-1}, \varphi\} = P_{ij}(Q_{t-1}, \varphi)$ gives the probability that state *i* shall be followed by state *j*, where $Q_t = (1, q_{1t}, \dots, q_{n-1t})'$ is the $(n\ x\ 1)$ vector of exogenous observable variables that may affect the transition probabilities and φ is the $(n\ x\ 1)$ vector of coefficients obtained from a standard multinomial logit specification

$$P(s_t = j|s_{t-1} = i, Q_{t-1}, \varphi) = \frac{\exp(Q_{t-1}'\varphi_j)}{1+\exp(Q_{t-1}'\varphi_j)} = P_s(Q_{t-1}, \varphi) \quad s = i, j, \ i \neq j \ [10] \qquad (11)$$

[10] As pointed out by Filardo (1994, page 302), the logistic functional form for the transition probabilities maps the explanatory variables into the interval (0,1) guaranteeing in this way a well-defined log-likelihood function. For more details, see Psaradakis and Sola (2017).

In the two-state case $P_{11}(Q'_{t-1}\,\varphi_{11}) + P_{12}(Q'_{t-1}\,\varphi_{12}) = 1$, $P_{22}(Q'_{t-1}\,\varphi_{22}) + P_{21}(Q'_{t-1}\,\varphi_{21}) = 1$, and the transition matrix is adjusted accordingly.

It reads as $$\begin{bmatrix} P_{11}(Q'_{t-1}\,\varphi_{11}) & 1 - P_{22}(Q'_{t-1}\,\varphi_{22}) \\ 1 - P_{11}(Q'_{t-1}\,\varphi_{11}) & P_{22}(Q'_{t-1}\,\varphi_{22}) \end{bmatrix} \quad (12)$$

The full log-likelihood is a normal mixture

$$l(\omega, \varphi) = \sum_{t=1}^{T} log\left[\sum_{s=1}^{2} \frac{1}{\sigma_s} h\left(\frac{e_{\Delta es_t t}}{\sigma_s}\right) . P_s(Q_{t-1}, \varphi)\right] \quad (13)$$

4. Exchange Rate Dynamics Estimation

4.1 The Data Sources

Our weekly data span the 3 June 1920 – 24 March 1927 time interval.

The origin of the time series of the data set reads as follows.

FF/GBP and USD/GBP exchange rates. (The latter being essentially used as a control variable). Daily closing rates are retrieved from the financial page of The Times. Weekly observations correspond to the Tuedsay price of each week.

Banque Nationale du Crédit stock prices. Daily observatons are retrieved from the financial page of Le Petit Parisien (Gallica, Le Petit Parisien, various issues). Weekly observations correspond to the Tuesday rate of each week.

Banque de France discount rate. Annuaire Statistique, National Bureau of Economic Research, [M13014FRM156NNBR], retrieved from FRED, Federal Reserve Bank of St.Louis.

Security yields index for France. (Percent, not seasonally adjusted), National Bureau of Economic Research, [M13027FRM156NNBR], retrieved from FRED, Federal Reserve Bank of St. Louis.[11]

French stock price index. (1913=100, monthly, not seasonally adjusted.) ,National Bureau of Economic Research, [M11024FRM324NNBR], retrieved from FRED, Federal Reserve Bank of St. Louis.[12]

[11] According to the 1928 Journal De La Societe De Statistique, reported in the Fred Database, in 1913 the average net yield was 3.78%. Starting from this yield and using the monthly index of security prices and earnings on the base 1913=100, the net yield for each month of the period was computed. For more details, see the Fred Macrohistory Database, Interest Rates.

[12] For a comprehensive list of the assets entering the index, see the Fred Macrohistory Database.

Wholesale price index, All Commodities for France. Retrieved from various issues of the financial page of The Times. This time series can also be retrieved from the Fred Macrohistory Database, [M04057FRM360NNBR].

Wholesale price index, All Commodities for Great Britain. Retrieved from various issues of the financial page of The Times.

Summary statistics are set forth in Table 1.

Table 1. Preliminary Statistical Analysis
Weekly Data

03/06/1920 – 24/03/1927											
$m=2$	Mean	St.Dev.	Sk.	Kurt.	BDS(2)	AR(1)	AR(2)	ARCH(1)	ARCH(2)	ADF(0,c)	JB
$\Delta f_t - \Delta e_{FF/GBPt-m}$	0.009	0.372	-0.15	7.587	14.547 [0.00]	43.907 [0.00]	56.326 [0.00]	63.362 [0.00]	73.820 [0.00]	-13.144 [0.00]	155.266 [0.00]
$\Delta e_{FF/GBPt}$	0.002	0.029	-1.81	16.150	8.947 [0.00]	18.148 [0.00]	22.731 [0.00]	29.985 [0.00]	33.192 [0.00]	-14.922 [0.00]	3087.4 [0.00]
Δr_t^{Fd}	0.002	0.083	0.244	13.099	-3.367 [0.00]	0.000 [0.99]	0.000 [1.00]	2.279 [0.13]	4.578 [0.10]	-18.84 [0.00]	1492.8 [0.00]
r_t^F	-0.001	0.125	3.750	75.665	-0.839 [0.40]	0.000 [0.99]	0.000 [1.00]	0.065 [0.79]	0.131 [0.94[	-18.81 [0.00]	78159 [0.00]

Notes. m : fundamentalists' reaction lag; Sk.: skewness; Kurt.: kurtosis; Probability values in square brackets; AR(k): Ljung-Box test statistic for k-th order serial correlation of the time series; ARCH(k): Ljung-Box test statistic for k-th order serial correlation of the squared time series; ADF(n, c): Augmented Dickey Fuller unit root test statistic, with a constant term and n^{th} order autoregressive component; BDS(k): test statistic, with embedding dimension k, of the null that the time series, filtered for a first order autoregressive structure, is independently and identically distributed; JB: Jarque Bera test statistic for normality of the data distribution.[13]

Foreign exchange market efficiency is rejected, because of the relevant serial correlation of the time series. As expected volatility clustering is extremely large between 1923 and 1924 and in 1926 for both the nominal and real FF/GBP rates. The distributions of the returns are always significantly skewed and leptokurtic, the departure from normality being confirmed by the size of the Jarque Bera (JB) test statistics. The presence of nonlinearities explains the significance of the BDS test statistics of Brock et al. (1987) for three of the four time series.

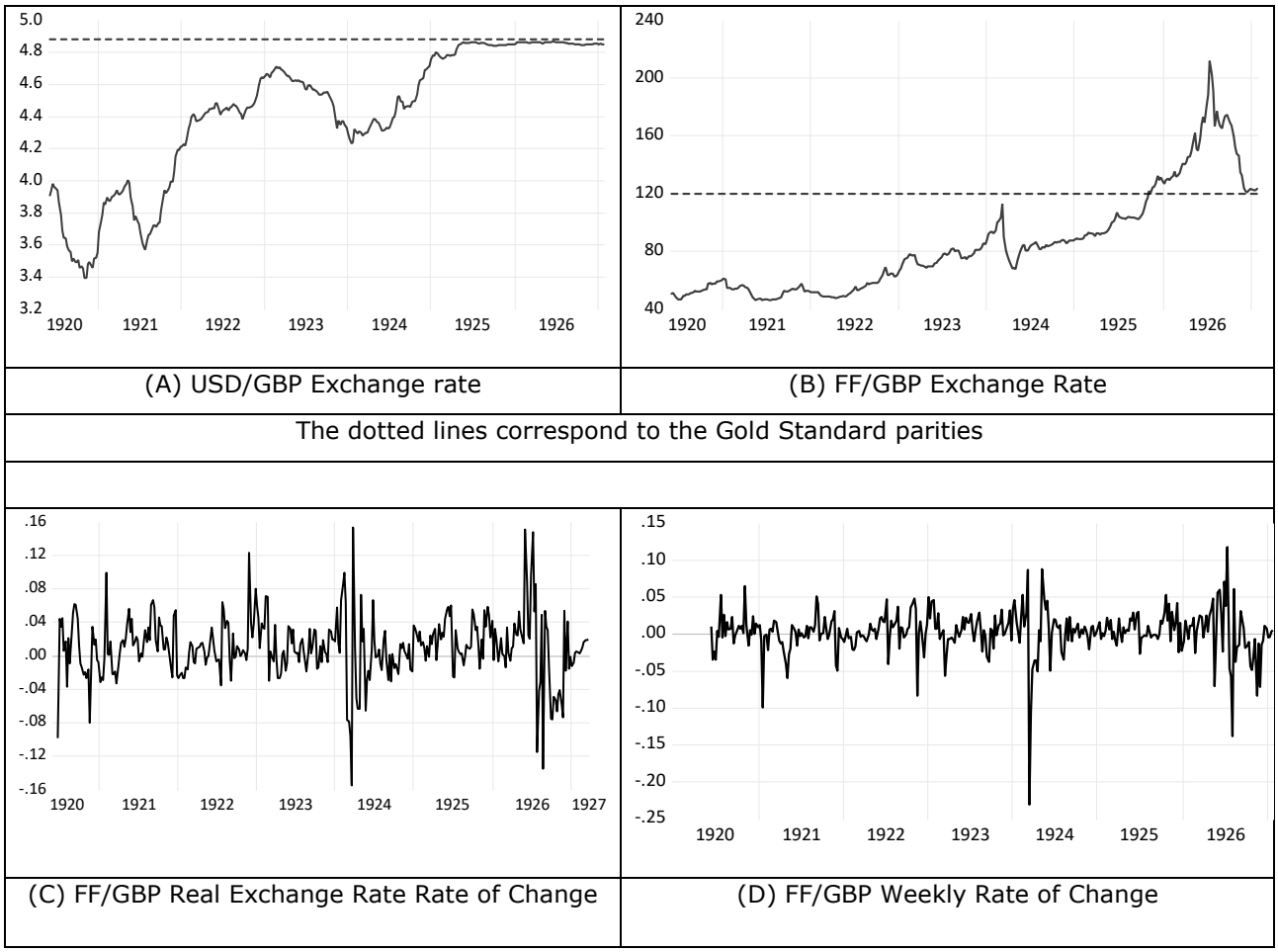
The USD/GBP exchange rate, set out in Figure 1.(A), underwent large fluctuations, heavily influenced by the British political and diplomatic events mentioned in section 1. The 1924 conservative electoral success, by increasing the prospect of a return to the Gold Standard, brought about a GBP revaluation.

The dynamics of the FF/GBP exchange rate are even more volatile in the time-period under investigation as they react to large shocks of political, diplomatic and financial nature. The

[13] Analogous results are obtained for unfiltered returns, with embedding dimensions varying from 2 to 6.

consequences of the festering reparation issues, from the French invasion of the Ruhr (and the subsequent collapse of the German Papiermark) to the Dawes plan, the generalized mistrust of

Figure 1. Weekly Exchange Rates: Levels and Rates of Change



(A) USD/GBP Exchange rate | (B) FF/GBP Exchange Rate

The dotted lines correspond to the Gold Standard parities

(C) FF/GBP Real Exchange Rate Rate of Change | (D) FF/GBP Weekly Rate of Change

the Cartel des Gauches governments from June 1924 to July 1926 and the subsequent regime shift brought about by the prestige of the Poincaré Government are clearly identified. The dynamics of the real exchange rate rate of change (i.e. of the deviations from the corresponding relative purchasing power parity) identify the turbulence due to the exchange rate crises mentioned above. The nominal exchange rate shifts more than compensated the excess of the French over the British inflation rates. The currency dynamics were influenced more by financial than by real drivers since, as pointed out in the the O*f*CE 2012 report, each currency crisis was associated with a sharp increase in French competitiveness.

4.2 Markov-Switching Model Estimates

The FF/GBP estimates of equations (8″) and (9/12) are set out in Table 2, where the reaction delay lag m is set to two weeks (m=2).[14]

The quality of the estimates is satisfactory: the LR tests of row 16

Table 2. Markov-Switching Constant and Time-Varying Transition Probabilities Estimates

03/06/1920 – 24/03/1927

$$\Delta e_t = \theta_{0s_t} + \theta_{1s_t}(\Delta f_{t-1} - \Delta e_{t-m-1}) + \theta_{2s_t}\Delta e_{t-1} + \theta_{3s_t} r^F_{t-1} + \theta_{4s_t}\Delta r^{Fd}_{t-1} + \varepsilon_{es_t} \quad (8'') \qquad \begin{bmatrix} P_{11}(Q'_{t-1}\,\varphi_{11}) & P_{21}(Q'_{t-1}\,\varphi_{21}) \\ P_{12}(Q'_{t-1}\,\varphi_{12}) & P_{22}(Q'_{t-1}\,\varphi_{22}) \end{bmatrix} \quad (12)$$

	CTP						TVTP					
m=2	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**	**L**	**H**
Δe_t	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
$P_{s_t,not\ s_t}$	0.11	0.24	0.11	0.25	0.10	0.26	0.15	0.28	0.16	0.30	0.16	0.32
Exp.Durat.	9.44	4.08	9.28	3.94	9.69	3.81	21.03	3.62	22.77	3.36	16.97	3.21
θ_{0s_t}	0.00 (3.72)	-0.01 (-1.41)	0.00 (3.91)	-0.01 (-1.23)	0.00 (4.24)	-0.01 (-1.64)	0.00 (3.87)	-0.01 (-1.39)	0.00 (3.99)	-0.00 (-1.19)	0.00 (4.20)	-0.01 (-1.54)
θ_{1s_t}	0.11 (2.62)	0.38 (3.94)	0.10 (2.92)	0.34 (3.44)	0.11 (2.90)	0.33 (.3.36)	0.12 (3.04)	0.37 (3.89)	0.10 (3.01)	0.33 (3.50)	0.10 (3.00)	0.33 (3.43)
θ_{2s_t}	0.12 (1.75)	0.07 (0.70)	0.16 (2.66)	0.05 (0.51)	0.12 (1.94)	0.12 (1.09)	0.14 (2.20)	0.07 (0.67)	0.16 (2.70)	0.06 (0.55)	0.14 (2.47)	0.11 (1.07)
θ_{3s_t}			-0.02 (-2.25)	-0.14 (-2.28)	-0.03 (-2.55)	-0.12 (-2.06)			-0.02 (-2.16)	-0.14 (-2.34)	-0.03 (-2.57)	-0.14 (-2.23)
θ_{4s_t}					0.02 (2.49)	0.07 (2.29)					0.01 (1.76)	0.06 (2.36)
$log\sigma^2_t$	-4.44 (-51.63)	-3.10 (-35.87)	-4.48 (-63.2)	-3.13 (-38.3)	-4.43 (-54.6)	-3.13 (-35.2)	-4.53 (-62.6)	-3.12 (-39.4)	-4.54 (-63.7)	-3.15 (39.6)	-4.49 (-61.5)	-3.16 (-38.6)
φ_{11c}	2.35 (5.90)		2.11 (6.38)		2.16 (6.37)		2.26 (6.81)		2.23 (6.79)		2.15 (6.46)	
$\varphi_{11\Delta p^{FF}_t}$							-29.69 (-2.34)		-31.73 (-2.75)		-27.13 (-2.33)	
φ_{21c}	-0.2 (0.49)		-1.08 (-2.66)		-1.03 (-2.54)		-0.96 (-2.63)		-0.86 (-2.45)		-0.79 (-2.16)	
$\varphi_{21\Delta p^{FF}_t}$							2.53 (0.41)		3.75 (0.69)		3.93 (0.70)	
Function value	858.3459		863.3476		868.9704		905.9052		866.6638		871.2987	
$LR_{\sigma^2_{1t}=\sigma^2_{2t}}$	19.68 [0.00]		21,17 [0.00]		24.29 [0.00]		114.014 [0.00]		26.12 [0.00]		27.178 [0.00]	
$LR_{CTP/TVTP}$							107.97 [0.00]		6.63 [0.03]		4.66 [0.09]	
AR(1)	0.05 [0.82]		0.17 [0.68]		0.42 [0.52]		010 [0.75]		0.00 [0.99]		0.04 [0.84]	
AR(2)	0.05 [0.98]		0.17 [0.92]		0.44 [0.80]		0.14 [0.93]		0.03 [0.98]		0.18 [0.92]	
ARCH(1)	11.33 [0.00]		8.80 [0.00]		9.72 [0.00]		5.72 [0.02]		4.33 [0.04]		4.36 [0.04]	
ARCH(2)	11.42 [0.00]		9.51 [0.01]		10.48 [0.01]		5.84 [0.05]		4.83 [0.09]		4.81 [0.09]	
JB	2136.31 [0.00]		767.84 [0.00]		890.45 [0.00]		2433.93 [0.00]		775.56 [0.00]		789.78 [0.00]	

Notes. $LR_{CTP/TVTP}$: *LR* test of the null hypothesis that $\varphi_{11\Delta p^{FF}_t} = \varphi_{21\Delta p^{FF}_t} = 0$, distributed as a chi-square with 2 degrees of freedom; $LR_{\sigma^2_{1t}=\sigma^2_{2t}}$: LR test of the null hypothesis $\sigma^2_{1t} = \sigma^2_{2t}$

[14] The estimation was repeated with differing values of the reaction delay lag m, with qualitatively similar results.

($LR_{\sigma_{1t}^2=\sigma_{2t}^2}$) strongly corroborate the hypothesis of a variance Markov regime shift. The standardized residuals are serially uncorrelated and conditional heteroscedasticity is mostly accounted for. In the same way, the Jarque Bera tests statistics of the estimate residuals detect a significant reduction of the non-normality of the original exchange rate time series.

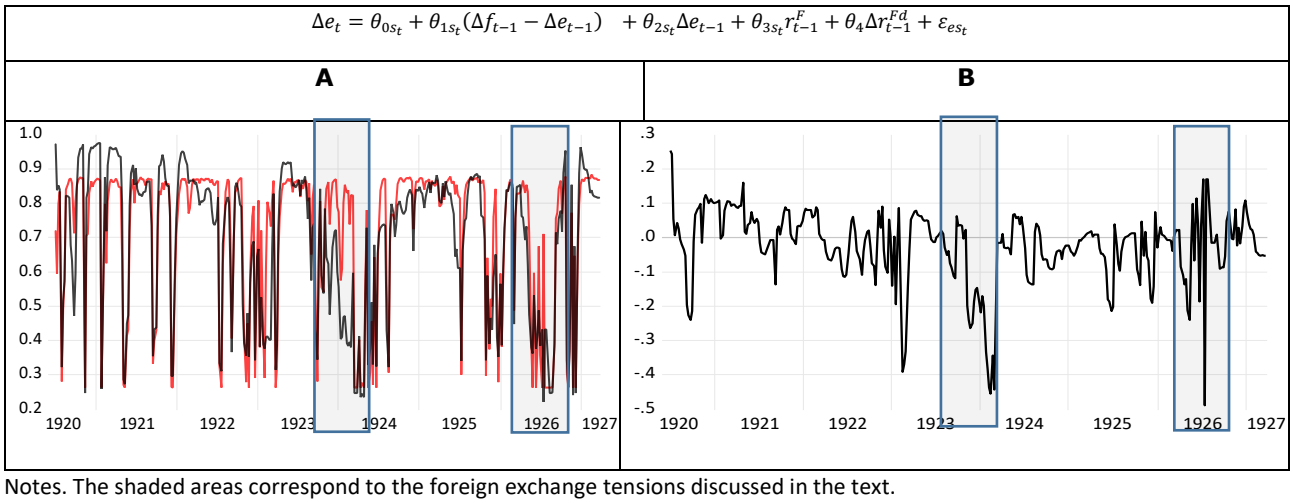
Constant Transition Probability Estimates are set forth in the first and second columns of the table. The low volatility regime 1 reflects the success of the French stabilization policies. Speculators play their expected roles. The coefficient estimates of θ_{11} and θ_{21} are significant and positive, trend followers destabilize the exchange rate whilst fundamentalists tend to stabilize it, by preventing excessive deviations from the purchasing power parity. During crises, in the high volatility regime 2, the stabilizing role of speculators is reinforced: the destabilizing pressure of trend followers is no longer statistically significant while fundamentalists' reaction to deviations from PPP rises. The θ_{22} coefficient estimate is significant and twice as large as θ_{21}. These rather unorthodox findings seem to corroborate Eichengreen's (1982) results as to the stabilizing role of speculation during crises and contradict the traditional interpretation of Nurske (1944). The significance and negative sign of the θ_{31_t} coefficient does not support the 'psychological' interpretation of exchange rate determination of Aftalion (1926). A negative shift in the yield of French securities (i.e. an increase in the correnponding stock prices) r_t^F is followed by a depreciation of the FF with respect to the GBP, and vice versa, as investors transfer home their funds and reduce their investment in foreign (mostly British) assets. In the high volatility regime 2 the absolute value of this linkage rises, in line with the fears of risk averse French savers about foreign exchange risk.[15] The significance and positive signs of the θ_{4s_t} coefficients reflects the cost of borrowing policies of the Banque de France. An increse in the rate of discount raises the cost of borrowing, depresses the stock exchange and discourages domestic financial investment by French savers. This is reflected, ceteribus paribus, in an outfolw of capital to Anglo-Saxon financial centres and an increase of the FF price of a GBP. This reaction seems to be more relevant in the high variability regimes.

[15] We have repeated the estimation replacing the change in the stock exchange yield by the rates of change of the overall stock exchange price index and of the Banque Nationale du Crédit stock prices and have obtained qualitatively similar results.

A peculiar characteristic of the French economy during this period is the relevant inflation rate, a by-product of the monetary/exchange rate policies of the Banque de France. Our estimates are adjusted accordingly. In the last six columns of the table are set forth the Time Varying Transition Probability estimates of equation (8") and (12). The LR tests of row 17 ($LR_{CTP/TVTP}$) reject the null of a Constant Transition Probability and support the alternative of a relevant impact of past domestic inflation. The negative and significant estimates of $\varphi_{11\Delta p_t^{FF}}$ suggest that an increase in French inflation decreses the probability of switching from the low volatility regime 1 to the low volatility regime 1 (i.e. raises the probability of switching from the low to the high volatility regime 2).[16]

A rapid inspection to the one step ahead regime 1 (low volatility) probabilities of figure 2 shows that the Markov-switching approach captures reasonably well the timing of the turmoil of the FF/GBP rate of return. The major crises identified in the text coincide with the reduction in the one-step ahead regime 1 (low variability) probability. As expected, an increase in inflation reduces the expected one period ahead probability of entering the (low exchange rate variability) regime 1, which suggests that French speculators were sensitive to the past inflation rate.[17]

Figure 2. A: Markov-Switching One-Step Ahead Predicted Regime 1 (low volatility) Probabilities Obtained with Constant (red) and Time-Varying (black) Transition Probabilities Estimates. B: Differences between the One-Step Ahead Predicted Regime 1 (low volatility) Probabilities obtained with TVT and CT Probabilities Estimates



Notes. The shaded areas correspond to the foreign exchange tensions discussed in the text.

[16] It should be noticed that we find no direct impact of the inflation rate on the exchange rate rate of change. The latter seems to be driven mostly by speculators' expectations.

[17] The divergence between the constant and time-varying transition probabilities estimates is due to the improved accuracy of the latter and to the subsequent greater reaction of its one-step ahead volatility regime predictions

5. Conclusion

The dynamics of the FF/GBP exchange rate have been extensively investigated, a relevant role being attributed to speculation. No clearcut result on the stabilizing vs. destabilizing role of the latter was reached.

In this essay we use standard Markov-switching analysis of a HAM reduced form to show that speculation was indeed stabilizing. French political and social turmoil did play a relevant role in triggering capital outflows, but fundamentalist speculators basing their analysis on the relative purchasing power principle, tended to stabilize the exchange rate. The economic and financial consequences were relevant. The assumption of a destabilizing role, generally attributed to the Banque de France policies of the subsequent years and assumed to be one of the major causes of the demise of the Gold Exchange Standard (see Batchelder and Glasner, 2013, among many others), has to be revisited. Foreign investors flocked to purchase French assets because they had perceived the sound way in which the Gold Standard parity of the franc had been determined.[18] The latter contrasted with the less sophisticated behavior of the Bank of England. As pointed out by Friedman, an inappropriate parity selection was the original sin which undermined Britain's return to Gold.[19]

Bibliography

Aftalion, A., (1926), L'Histoire du Change en France de 1915 à 1926 et la Théorie Psychologique du Change, Revue d'Economie Politique, 40, 945-986.

Aftalion, A., (1927), Monnaie, Prix et Change, Tenin Ed., Paris.

Batchelder, R.W., Glasner, D., (2013), Pre-Keynesian Monetary Theories of the Great Depression: What Ever Happened to Hawtrey and Cassel?, Available at SSRN https://ssrn.com/abstract=2029813 or http://dx.doi.org/10.2139/ssrn.2029813

Blancheton, B., Maveyraud, S., (2009), French Exchange Rate Management in the 1920s, Financial History Review, 16, 183-201.

[18] Which explains the persistence with which the French financial and political authorities adhered to the Gold Standard paradigm, well into the Great Depression. As pointed out by Eichengreen and Temin (1997), the first calls for a devaluation were due to Reynaud in 1934, when the franc was hopelessly overvalued.

[19] In his foreword to the English translation of Moreau's memoirs, Friedman pointed out that "Britain went back to gold in 1925 at a price of gold in terms of the pound that was… 5 or 10 percent too low, and France…at a price of gold in terms of francs that was 5 or 10 percent too high. This difference meant the difference between the French being at the mercy of the British and the British being at the mercy of the French.", Friedman (1991, page 2).

Brock W.A., Dechert, W.D., Scheinkman, J.A., (1987), A Test for Independence Based on the Correlation Dimension, Department of Economics, University of Winsconsin-Madison, SSRI Working Paper n. 8702.

Dal-Pont Legrand, M., Torre, D., (2014), Pierre Quesnay (1895-1937) From the League of Nations to the Franc Poincaré: Financial Discipline and Monetary Pragmatism, GREDEG Working Papers Series, n. 2014-43.

Debeir, J-C., (1980), Inflation et Stabilisation en France (1919-1928), Revue Économique, 31, 622-647.

Diebold, F.X., Lee, J.-H., Weinbach, G.C., (1994), Regime Switching and Endogenous Transition Probailities, in Non-stationary Time Series Analysis, ed. Hargreaves, C., Oxford University Press, Oxford.

Dimsdale, N.H., (1981), British Monetary Policy and the Exchange Rate 1920-1938, Oxford Economic Papers, 33, Supplement: The Money Supply and the Exchange Rate, 306-349.

Dornbusch, R., (1976), Expectations and Exchange Rate Dynamics, Journal of Political Economy, 84, 1161-1176.

Eichengreen, B.J., (1982), Did Speculation Destabilize the French Franc in the 1920s?, Explorations in Economic History, 19, 71-100.

Eichengreen, B.J., Temin, P. (1997), The Gold Standard and the Great Depression, NBER Working Paper Series, n. 6060.

Filardo, A.J., (1994), Business Cycles and Their Transitional Dynamics, Journal of Business & Economic Statistics, 12, 299-308.

Frenkel, J.A., (1978), Purchasing Power Parity, Doctrinal Perspectives and Evidence from the 1920s, Journal of International Economics, 8, 169-191.

Frenkel, J.A., (1980), Exchange Rates, Prices and Money: Lessons from the 1920's, NBER Working Paper Series, n. 452.

Friedman, M. (1991), 'Foreword' in 'The Golden Franc, Memoirs of a Governor of the Bank of France: The Stabilization of the Franc (1926-1928)', by Emile Moreau, Boulder Colorado, Westview Press.

Gaston-Breton, T., Garnier, P., (2014), 1928, Le Dilemme du Franc Poincaré, Les Echos, 10 Aôut.

Gerlach, S., Kugler, P., (2015), Back to Gold Sterling in 1925, CFS Working Paper Series, n. 515.

Gregory, T.E., (1926), The First Year of the Gold Standard, Benn, London.

Hamilton, J.D., (1989), A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle, Econometrica, 57, 357-384.

Hommes, C., (2005), Heterogeneous Agents Models in Economics and Finance, TI 2005-056/I , Tinbergen Institute Discussion Papers, CeNDEF, Department of Quantitative Economics, University of Amsterdam.

Keynes, J.M. (1931), The Economic Consequences of Mr Churchill, in Essays in Persuasion, vol 9, MacMillan, London, 1971.

Lacout, G., (1926), Le Retour à l'Étalon-Or. La Politique Monétaire de l'Angleterre (1914-1926), Payot, Paris.

Lothian, J.R., (2016), Purchasing power parity and the behaviour of prices and the nominal exchange rates across exchange rate regimes, Journal of International Money and Finance, 69, 5-21.

Moggridge, D.E., (1969), The Return to Gold, 1925, Cambridge University Press, Cambridge.

Moreau, E., (1954), Mémoires d'un Gouverneur de la Banque de France, M.-Th. Génin, Paris.

Morgan, E.V., (1952), Studies in British Financial Policy 1914-1925, MacMillan, London.

Mouré, K., (1996), Undervaluing the Franc Poincaré, Economic History Review, 49, 137-153.

Nurske, R., (1944), International Currency Experience: Lessons from the Interwar Experience, League of Nations, Geneva.

O*f*CE, (2012), Monnaie et Méchanismes Monétaires en France de 1878 à 1939, Revue de l'O*f*CE, 24, 147-203.

Officer, L.H., (1982), Purchasing Power Parity and Exchange Rates: Theory, Evidence and Relevance, Greenwich, Connecticut: JAI Press.

Pigou, A.C., (1936), Economics in Practice, MacMillan & co, London.

Psaradakis, Z., Sola, M., (2017), Markov-Switching Models with State-Dependent Time-Varying Transition Probabilities, BWPEF 1702, Birbeck College, London.

Rueff, P., (1954), Préface, à E. Moreau: Mémoires d'un Gouverneur de la Banque de France, M.-Th. Génin, Paris.

Rueff, P., (1959), Sur un Point d'Histoire: le Niveau de la Stabilisation Poincaré, Revue d'Economie Politique, 69, 168-178.

Sarno, L., Taylor, M.P., (2002). International Purchasing Power Parity and the Real Exchange Rate, IMF Staff Papers, 49, n.1.

Stolper, W.F., (1948), Purchasing Power Parity and the Pound Sterling from 1919-1925, Kyklos, 3, 240-269.

Taylor, M.P., (1992), Dollar Sterling Exchange Rate in the 1920s: Purchasing Power Parity and the Norman Conquest of $4.86, Applied Economics, 24, 803-811.