# BANCA D'ITALIA

# Temi di discussione
### del Servizio Studi

**The Short-Term Behavior of Interest Rates:
Did the Founding of the Fed Really Matter?**

**by Paolo Angelini**

**Numero 141 - Settembre 1990**

# BANCA D'ITALIA

# Temi di discussione
### del Servizio Studi

**The Short-Term Behavior of Interest Rates:
Did the Founding of the Fed Really Matter?**

**by Paolo Angelini**

**Numero 141 - Settembre 1990**

*The purpose of the «Temi di discussione» series is to promote the circulation of working papers prepared within the Bank of Italy or presented in Bank seminars by outside economists with the aim of stimulating comments and suggestions.*

*The views expressed in the articles are those of the authors and do not involve the responsibility of the Bank.*

# Abstract

The paper addresses the issue of the impact of the foundation of the Federal Reserve System on the behavior of the U.S. short-term interest rates. Empirical evidence is presented showing that no regime change in the process governing the short-term rates took place in the years staddling the foundation of the Fed. Since the behavior of this process after 1920 was different from what it was before 1910, the paper discusses some major institutional changes in the U.S. that may have had an impact on the behavior of short-term interest rates during the period 1908-1920.

# Introduction[1]

The recent literature has seen a revival of interest in the behavior of nominal interest rates prior to and after the decade 1910-20, during which the stochastic process generating short-term rates underwent a structural change.[2] Some authors, in particular Mankiw, Miron and Weil (1987) and Barsky, Mankiw, Miron and Weil (1988) have maintained that the founding of the Fed in 1914 had a key role in this structural change. The data most widely used in the literature investigating the regime change[3] are the series of interest rates on time and call loans recorded on the New York Money Market.

Using data on time loans, the present paper makes an empirical assessment of the result obtained by Mankiw, Miron and Weil (1987) that the founding of the Fed at the end of 1914 was a major factor in determining the regime change in the short-term interest rates behavior. The evidence provided in section III of this paper suggests that this conclusion is not robust. No parameter change took place between the period prior to the creation of the Fed and the one that followed

---

2. Some authors have focused on the behavior of real rates in the U.S.A (Shiller (1980), Barsky, Mankiw, Miron and Weil (1988), and in other countries (Shiller and Seigel (1977), Clark (1986)). Much of the work has been done on nominal rates for the U.S. economy (Miron (1986), Mankiw and Miron (1986), Clark (1986), Mankiw, Miron and Weil (1987), Barsky et al. (1988), Canova (1988)).

3. Among the others Clark (1986), Mankiw and Miron (1986), Barsky et al. (1988), Canova (1988), Miron (1989).

it.

The remainder of the paper discusses two major events that are unrelated to the creation of the Fed but likely to have had an equally if not more important effect on short-term interest rates: a) the passing into law of the Aldrich-Vreeland Act in 1908, which allowed currency creation during emergencies, and b) the imposition of administrative controls on the New York Money Market in September 1917. Failure to take these events into account may be the reason why the previous literature has erroneously attributed the change observed in the behavior of short-term interest rates to the founding of the Fed.

In section one, we give a brief account of the results of Mankiw, Miron and Weil (1987) (MMW henceforth). Section II examines some reasons why further testing of MMW's results should be undertaken. In the third section we perform some sensitivity analysis on the result that a regime change took place around the foundation of the Fed. In section IV we examine the impact of the above-mentioned structural changes in financial markets on the behavior of the interest rates on time and call loans. Some conclusions are drawn in the final section.


I.   **The results of the existing literature**


The Federal Reserve Act was approved on December 23, 1913. The first meeting of the presidents took place in July 1914 and the official inception of the system was on November 16, 1914. The literature has recently examined the impact of the funding of the Fed on financial markets, in particular on the behavior of short-term interest rates. A major contribution in this field was made by a recent article by Mankiw, Miron and Weil, which focuses on the New York Money Market, for which data on interest rates are available from

the early nineteenth century. The analysis is based on the series of three and six-months interest rates on time loans, and it reaches two basic conclusions.

MMW find that the stochastic process generating the short term rate underwent a parameter shift between the period 1890-1910 and the period 1920-1933. Two types of evidence are reported:

1) Autocorrelations computed for the rate on three-month time loans for the subperiods 1890-1910 and 1920-1933 show a marked increase in the second period, indicating that the series followed a much smoother pattern during the post-war years.

2) An AR(1) model is assumed for the three-month rate, and OLS regressions are estimated for the two subperiods, with and without seasonal dummies; the coefficient estimates are .75 and .77 for the first subperiod, and .97 and .98 for the second (the second numbers refer to the regressions including monthly dummies); this shows that the degree of persistence substantially increased in the second subperiod, independently of the changes in the seasonal properties of the series.

MMW then try to pin down the exact time at which the regime change took place. Two statistical procedures are adopted. The first assumes that the switch took place at a certain date at an infinite speed; the second adopts a logistic model to allow the speed of adjustment to vary from infinity to several months. The results indicate that the most likely date for the shift to the new regime to have occurred is between December 1914 and March 1915, and that the change took place in a very short period, less than three

months.[4]

In conclusion, MMW's evidence seems to suggest that there was a significant change in interest rate behavior between the periods before and after the end of 1914. Since the end of 1914 coincides with the start of the Fed's operations, they conclude that its inception had important effects on the short-term behavior of interest rates.

## II. Is further empirical analysis required ?

A few considerations provide grounds for a degree of skepticism regarding the timing of the regime change pinned down by MMW's analysis. First, it appears unlikely that a brand new institution, such as the Fed was at the beginning of 1915, could have so strong an immediate effect on market conditions. A review of the literature confirms that this view was shared by some authors of the period (see e.g. Griffiss (1925)). Second, MMW fail to consider several other factors that affected financial markets in the early part of the century. In particular, the following facts must be noticed:

a) As a consequence of the outbreak of the First World War, the New York Stock Exchange was closed on July 31, 1914. Since time and call loans were made using New York Stock Exchange securities as collateral, these suddenly became highly illiquid. In fact, immediately after the closing of the New York Stock Exchange the number of new loans

---

4.  A third part of MMW's paper seeks to determine the speed at which the expectations formation mechanism adjusted to the regime change. MMW report evidence that the switch took place rapidly between October 1914 and January 1915, in the same period, according to their results, as the change in the stochastic process governing the short-term rate.

dropped to virtually zero; at the same time existing ones could not be dealt with or called, as no market for the collateral existed. As a consequence, time and call loans rates immediately after the closing of the New York Stock Exchange were far from being market rates.[5]

b) In September 1917, as a consequence of World War One, strict administrative controls were imposed on the New York Money Market; the amount of funds available and the level of the interest rate on time and call loans were decided on an administrative basis, or heavily influenced by the authority of the so-called Money Committee.

c) Until the end of the first decade of the century bank panics were not unlikely events, but subsequently their frequency dropped dramatically. The Aldrich-Vreeland Act, enforced after the panic of 1907, is widely recognized as having played a major role in reducing their frequency.[6]

d) The qualitative features of the collateral used for money market loans underwent substantial changes, especially during the war years. These changes concerned the type and quality of the securities accepted as collateral against time and call loans, and are likely to have smoothed the

---

5.  The New York Stock Exchange reopened on December 12, and by the middle of January 1915 the three-month rate on time money was below 3%, the level that had prevailed before the outbreak of the war. On these issues, see Angelini (1989).

6.  For a brief outline of the Aldrich-Vreeland Act, see Section IV.a). See also Dewald (1972), Timberlake (1984), Gorton (1985). Miron (1986) makes the point that the Fed played a key role in the reduction of the frequency of financial panics. However, his argument is based on a model in which the Fed accomplishes this target through a policy of seasonal open market operations that reduce or eliminate seasonal fluctuations from nominal rates. On this point there is evidence provided by Clark (1986) indicating that seasonal movements in U.S. currency and high powered money only began in the latter half of 1917.

pattern of the underlying interest rates.[7]

These are just some of the major economic events in the early part of the century that, quite independently from the foundation of the Fed, had a strong potential for affecting the behavior of the interest rates on call and time loans.

The conclusion is that when analyzing nearly a half a century of data, as MMW do, one should be cautious about attributing a structural change to one single source. An attempt to evaluate the potential impact of the events mentioned in b) and c) is made in section IV.

## III. Results of further empirical tests.

The aim of the analysis in this section is to check whether controlling for the events mentioned at the end of the previous section has any impact on MMW's results. One way of doing this is to test for structural change in the behavior of short-term interest rates while gradually modifying the sample size to take account of the influence of some of the above-mentioned factors, and see whether the results display any sensitivity to the choice of the sample period.

We consider the sample period 1908-1920, which is much smaller than the one used by MMW (1890-1933). This choice serves to isolate the "Fed-effect" more effectively from spurious effects that may be introduced into the analysis if the sample period is extended too far on either side of the event under consideration. Within this smaller sample period we consider two subsamples. The first goes from

---

7. For an extensive examination of this issue, see Angelini (1989).

1908 to the middle of 1914. The last data point included corresponds to July 22 1914, immediately before the outbreak of World War One. The second subsample goes from the last week of July 1914 through 1920.

As mentioned in the data appendix, we used both weekly and monthly data, and ran tests of the null hypothesis of no change in the slope parameter of an AR(1) process between the two subperiods. The results are shown in Tables I through VI.[8]

All the tables have been generated to give a picture of how the results of the "no-change hypothesis" test and the AR(1) slope coefficient change when the subsample periods are modified. The key column in all of the tables is the first, which reports the value of the F-test of the null hypothesis.[9]

---

8. We made no attempt to check the correctness of the specification of the AR(1) model assumed by MMW. Clark (1986) maintains that the series of call and time loans show evidence of non-stationarity, and uses first differences for his analysis. Even if a unit root is present in the stochastic process generating the data, the parameter estimates displayed in Tables I through VI are consistent. Unlike MMW, we did not try to account for seasonal patterns, for two reasons. First, the limited number of years in my sample period would make estimates of the seasonal dummy coefficients hardly reliable. Secondly, MMW's estimates of the AR(1) coefficient (Tables 2, 3, and 4 of their paper) are extremely insensitive to whether the model is specified with or without seasonal dummy variables.

9. Following the suggestion of Toyoda (1974), we checked for heteroscedasticity between the two subsamples that constitute the basis for my analysis. As the tests that we ran were somewhat inconclusive, we ran the tests for structural change using GLS to correct for the possible presence of heteroscedasticity. We also estimated the AR(1) model including dummy variables for the intercept and the slope, and ran a t-test on the coefficient of the slope dummy using the heteroscedasticity-robust White standard error. The resulting tables of test statistics and coefficient estimates were roughly equivalent to the ones obtained with OLS, and therefore are not reported here.

Exercise no.1: A simple replica of MMW's hypothesis testing.

As a first exercise, we verified whether the outbreak of World War One, at the end of July 1914, constituted a breaking point in the interest rate time series. By contrast with MMW, data points prior to 1908 and after 1920 are excluded, but this does not seem to affect the result. In fact, an F-test of change in the AR(1) slope parameter allows the null hypothesis of no parameter change to be rejected at all significance levels (Table I).[10]

Next, we checked whether data from the period when the New York Stock Exchange was closed have any effect on the regime change result. To do this, we dropped consecutive data points from the second subperiod (from 1914.7.5 through 1915.2.4), and each time computed an F-test of the null hypothesis of no slope parameter change between the two subperiods. Table I reports the test statistics and coefficient estimates obtained in this way. The first column shows that the null hypothesis of no parameter change can be rejected at all significance levels. The AR(1) coefficient is smaller for the subperiod before the creation of the Fed, thus indicating higher interest rate volatility in these years. It should also be noted that the value of the test statistic is highest when the observations for the period November-December 1914 are dropped. MMW's conclusion is thus confirmed. It appears that this result holds even when data prior to 1908 and after 1920 are not considered, and that it is not sensitive to the exclusion of data from the New York Stock Exchange shutdown period.

---

10. We also allowed the switching point to vary, one week at a time, into the NYSE shutdown period (without dropping observations as is done in Exercise 1) and obtained the same result. We found somewhat higher F-test values for switching dates between November 1914 and March 1915.

## Exercise no.2: Effects of the Money Market Committee controls.

Next, we checked whether the period of administered rates and quantities which began in September 1917 had an impact on the regime change result obtained by MMW. To do this we estimated an AR(1) regression for each of the 1908-mid 1914 and mid 1914-1920 subperiods, and computed the usual F-test of the null hypothesis of no parameter change between the two subperiods. We then gradually reduced the second subperiod by dropping the last observations until the whole period of administered rates is eliminated. The resulting statistics for each sample period are displayed in Tables II and III for the weekly and monthly data, respectively.

The results clearly show that the data from this period play a major role in generating MMW's result: in Table II the test statistic gradually decreases from a value of 35 to about 7. This is not surprising, since the "stickiness" of interest rates can be expected to increase under administrative controls. The null hypothesis can, however, still be rejected at all significance levels.

Table III displays a somewhat surprising result: the F-tests computed with monthly data generated by sampling out the first week of each month[11] confirm the rejection of the null hypothesis, but the same tests computed with data from the second, third and fourth week of each month become highly insignificant. The pattern of the test statistic this time is thus sensitive to the choice of both the subsample and the data set. Specifically, test statistics obtained with data from the second, third and fourth week of each month seem to contradict the same test statistics generated from the first week of each month. An explanation of this apparent inconsistency may lie in the 1907 bank panic. Visual

---

11. See the Data Appendix.

inspection of the data in Graph I suggests that the first few
observations of 1908 are still influenced by the panic.[12] We
checked the sensitivity of the results in Tables I through
III to the inclusion of these data points. For this purpose,
we dropped the observation relative to the first week of
January 1908. Table IV reports the results of this exercise
for the weekly data series; comparing them with the analogous
statistics from Table I, one can see a dramatic difference.
When the 1908.1.1 data point is excluded from the regression
the AR(1) coefficient for the prewar subperiod jumps to over
.94, and the test statistic drops from a value of 6.85 to
.13. This shows that the inconsistency documented in Table
III is explained by a single data point which is still
influenced by the panic of 1907. The conclusion is that MMW's
result vanishes once the effects of the bank panics and of
the period of administered rates are controlled for.

**Exercise no.3**: Joint effects of bank panics, Money Committee
controls and the New York Stock Exchange
shutdown.

In Tables II, III and IV the switching point for the
regime change is constrained to be the outbreak of World War
One. We made this choice in view of the unreliability of the
data immediately following the beginning of the war and the
shutdown of the New York Stock Exchange. In order to check
the sensitivity of the previous results to this restriction,
in Tables V and VI, generated with weekly and monthly data
respectively, we allowed the switching point to vary by
gradually dropping data points from the New York Stock
Exchange shutdown period from the 1914.7.5-1917.8.4
subsample. The Tables show that the F-test statistics are

---

12. The first four weekly data points reported by the
    Financial Review for January 1908 are 10, 6, 5.375, 4.5
    (midpoint of the range). In February the series
    stabilizes whithin the band 2-4%.

consistently highly insignificant, except for those of the first week; the null hypothesis of no parameter change cannot be rejected, no matter whether the New York Stock Exchange shutdown period is included or not. Tables V and VI also show that the results described in Exercise no. 2 above are insensitive to the inclusion in the sample of data points from the Stock Exchange shutdown.

A peculiar result illustrated in the tables is that the estimates of the AR(1) parameter for the second subperiod are often, although not significantly, smaller than the estimates for the pre-war subperiod. This fact seems to strengthen the conclusion that in the years immediately following the creation of the Fed the stochastic process generating the rate on time loans did not change at all. The conclusion reached by MMW is therefore due to their choice of sample period; in particular, it depends on their inclusion of data prior to 1908 and after 1918, which are influenced by major events that have nothing to do with the creation of the Fed.

## IV.  Why the choice of sample size is so important.

The analysis of the previous section has shown that the choice of sample size is crucial in the analysis of the short-rate regime change. The period 1910-1920 saw several historical events which had major consequences, both worldwide and for the U.S. In what follows we focus on some of the events that in my view are important for a better understanding of the issues under examination and a more appropriate choice of sample period.

### a) The Aldrich-Vreeland Act.

During financial panics the collateral loan market

typically dried up, and reported rates reflected only
sporadic deals. For example, the Commercial and Financial
Chronicle, in its retrospective evaluation of 1907, reports
that when the banking troubles developed call money rates
went as high as 100-125%. By the end of the month of October,
after some measures of relief had been devised, the range for
call loans came down to 6-20%. This situation lasted through
most of December.[13]

Situations like the one just described, in which the
market for time loans virtually stopped working, were common
during banking panics. The Aldrich-Vreeland (A-V) Act was
passed on June 30, 1908, in the aftermath of the panic of
1907. It represented a major step toward the elimination of
financial panics, and can be considered as a first move
toward the creation of the Federal Reserve System.[14] Perhaps
the main goal set out in the Federal Reserve Act by its
founders was to provide the country with a more elastic
currency. In this specific regard, the Fed Act did little but
refine what was already contained in the A-V Act and make it
a permanent law of the country. The A-V Act called for a
group of ten or more national banks to create a "National
Currency Association", which was to issue "emergency
currency" during crises to give the banks greater flexibility
in varying the money supply, thereby greatly increasing its
elasticity during emergencies. Previously, the clearinghouses
had the power to issue additional currency in such cases. The
basic difference introduced by the A-V Act was that the
Secretary of the Treasury was now the authority in charge of
administering and controlling the emergency currency issues.
The effectiveness of the A-V Act in heading off banking
panics was tested in the summer of 1914, at the outbreak of
the war. Since the Fed was not due to start operation until

---

13. See the Commercial and Financial Chronicle, January 4,
    1908, pp. 23-26.

14. See, for example, Miron (1989).

November 1914, the A-V Act, which was due to expire on June 30, 1914, was extended for one year. On that occasion, the emergency currency facility was successfully tested.[15]

Graph I plots interest rates on time loans and commercial paper over the period 1907-1915. During the two periods of crisis (the bank panic of 1907 and the outbreak of the war in 1914) the rates on time loans, normally lower than the rates on commercial paper, rose far above the latter. This suggests once more that during periods of financial stress one should be careful in interpreting rates on time loans as a reliable indicator of the conditions of the credit market.

**b) The Evolution of the New York Stock Exchange.**

The New York Money Market, where time and call loans were made, was an appendix of the New York Stock Exchange. Not only did the collateral on time and call loans consist of securities listed on the New York Stock Exchange, but loans were also physically made on the floor of the Stock Exchange. It is therefore important that major developments of this institution be taken into account in the analysis of the behavior of interest rates on time and call loans. A detailed survey of events is beyond the scope of this paper. However, two main points can be highlighted.

First, the decade 1910-1920 recorded important institutional changes in the regulations of the New York Money Market. Griffiss (1925) distinguishes three periods. The first covers the operation of the money market from its creation up to America's entry into the war, and the formation of the above-mentioned Money Committee, which was a subcommittee of the Liberty Loan Committee. From September

---

15. A detailed account of its efficacy in preventing a disruption of banking activity is given by Dodge (1922).

1917 through January 10, 1919 the New York Money Market was under the supervision of the Money Committee, which exerted considerable restraint on interest rate movements. Griffiss comments on these effects:

> "As the Money Committee had complete control over the demand and supply of money, it is obvious that they were also able to exercise complete control over the rates at which this money was loaned .... Thus all elements of competition for the use of money were eliminated, because this was a period in which money was rationed just as any other commodity might be during war-time .... The rates at which money was loaned were not decided freely by the lender and borrower, but were virtually fixed by the Money Committee through its control over demand and supply".[16]

Another important institutional change that took place during the MC period was the institution of the "money desk". Since the creation of the money market, the activity on the floor of the Exchange had taken place around the "money post", which worked as a normal stock trading post. Loans were thus made between two members of the "money crowd", who agreed between themselves what the rate should be for each individual loan.[17] Consequently, there was no fixed rate, and each loan, with each institution, was a matter of

_____

16.  Griffiss (1925), pp. 42-43. The events that led to the creation of the Money Committee are vividly described in an address by Mr. R.R. Atterbury, member of the Executive Committee of the Stock Clearing Corporation, delivered on October 25, 1928: "This situation was so exaggerated during the Great War that a money committee of five members of the Governing Committee of the Stock Exchange was formed to cooperate with the banks in controlling, not only the rate, but the disposition of funds available for Stock Exchange purposes. This was at the time of the closed money market, during which the committee of five, together with a committee of the banks, were the sole arbiters of all matters pertaining to the loaning and borrowing of money." (Reported by Meeker (1922), pp.622-3).

17.  See e.g. Griffiss, pp.28-9.

personal negotiation, and the rate often varied widely. The money market was without supervision, and subject to violent changes in money rates whenever an unusual demand for or supply of money existed.

In 1917, following the constitution of the MC, the "money desk" was substituted for the old money post. Basically, borrowers and lenders could ask the clerk at the money desk to record the amounts they wished to supply or demand at a given price; the clerk would then match suitable offers. Both sides of the market could therefore use the money desk to get immediate information about supply and demand schedules.[18]

The advantages accompanying the control of the Money Committee naturally led to various suggestions for some form of permanent supervision of the New York Money Market even when normal conditions were restored. The outcome of this debate was to make the money desk a permanent institution, and to create a committee of three members of the Executive Committee of the Stock Clearing Corporation to supervise its activity.[19]

Graph II, plotting the weekly data on time loan interest rates for the period 1914.1.1-1920.12.4, shows the impact of the foregoing institutional changes on the rate series. During the period of the operation of the Money Committee, and for some time thereafter, rates did not rise above 6%, and were kept at this level for relatively long

---

18. Detailed descriptions of the operation of the money desk can be found in Griffiss' book, or in Meeker (1922), chapter XI.

19. This committee was still active at the time Mr. Atterbury's address (see note 16) was delivered, as he goes on to say: " .... I might say that the efforts of the Money Committee in charge of the money market are all centered in keeping a stable money market, and preventing, as far as possible, not only wide fluctuations in the rate, but even the change in the rate whenever it is at all possible ...." (Reported by Meeker (1922), p .624).

periods. The "spikes" that are typical of the data prior to September 1917 seem to disappear afterwards.


## Conclusions


There is a wide literature which holds the view that the work of the Fed had major effects on the New York Money Market. Recently Miron, Mankiw and Weil found that the most likely date for the regime change in the short-term interest rates on time and call loans was between the end of 1914 and the beginning of 1915, which is when the Fed started operating.[20] The tests performed in this paper tend to cast doubts on MMW's interpretation that the founding of the Fed had an impact on the behavior of the short term interest rates. In particular, Tables I through VI show that once the effects of the 1907 panic and of the 1917-1919 period of administered rates are eliminated, no parameter shift can be detected in the period straddling the Fed's foundation. This seems to imply that MMW's result lacks robustness; the foundation of the Fed may have had little to do with the observed change in the short-term interest rate behavior; other institutional changes examined in this paper may have had an important influence on it.

---

20. We made no special attempt to check for the effects of the war, which broke in August 1914, or the symultaneous abandonment of the gold standard. For comments on the likely effects of these events on the time series under examination, see MMW's paper and Barsky, Mankiw, Miron and Weil (1988).

## Data Appendix

The original sources for the data are the Commercial and Financial Chronicle (CFC), a weekly magazine that used to give a brief account of the state of the New York Money Market in its opening pages, and the Financial Review (FR), a yearly publication of the CFC. The data collected in the FR are the same as those published in the CFC apart from occasional corrections of typos and mistakes. Both sources report weekly data. MMW create their monthly series by selecting the first week of each month. For the subperiod 1890-1909, the data are taken from the FR. For the subperiod 1910-1933 the data are taken from the FR as well as the CFC, as publication of the FR was discontinued shortly after 1920. We generated three additional monthly time series for the three month rate by sampling out of the FR data for the second, third and fourth week of each month. We then treated these series as additional realizations of the same stochastic process. The interest rates comprising the data series are the midpoint of the range reported by the FR. We used the first available data point of each month to form the first week series, the second data point for the second week series, and so on. As some months have five data points, we eliminated the fifth observation of the month when constructing the monthly series. These data points are used, however, to generate the weekly tables. MMW' data set as reported in table A1 of their paper differs from ours for obvious reasons, and in the case of six observations that are incorrect. The data points for February, March, April and May 1908, January 1910, October 1911 reported by MMW are in the order 3.5, 3.5, 3.0, 2.375, 4.5, 3.5, whereas the FR for the same dates reports (midpoint of the range) 4.125, 3.75, 3.375, 2.75, 4.625, 3.625.

## Table I

| F-tests | AR(1) | Subsamples | |
|---------|-------|------------|---|
| | | **First** | |
| | .877 | 1908.1.1 | -1914.7.4 |
| .......... | ........ | ........................... | |
| | | **Second** | |
| 37.133 | 0.991 | 1914.8.1 | - 1920.12.4 |
| 38.520 | 0.990 | 1914.8.2 | - " |
| 42.670 | 0.994 | 1914.8.3 | - " |
| 42.930 | 0.992 | 1914.8.4 | - " |
| 42.738 | 0.992 | 1914.9.1 | - " |
| 45.382 | 0.994 | 1914.9.2 | - " |
| 45.264 | 0.994 | 1914.9.3 | - " |
| 45.146 | 0.994 | 1914.9.4 | - " |
| 45.027 | 0.994 | 1914.10.1 | - " |
| 45.818 | 0.995 | 1914.10.2 | - " |
| 45.418 | 0.994 | 1914.10.3 | - " |
| 46.224 | 0.995 | 1914.10.4 | - " |
| 46.450 | 0.996 | 1914.10.5 | - " |
| 46.363 | 0.996 | 1914.11.1 | - " |
| 46.555 | 0.996 | 1914.11.2 | - " |
| 47.276 | 0.996 | 1914.11.3 | - " |
| 47.563 | 0.997 | 1914.11.4 | - " |
| 47.518 | 0.997 | 1914.12.1 | - " |
| 47.520 | 0.996 | 1914.12.2 | - " |
| 47.359 | 0.996 | 1914.12.3 | - " |
| 47.181 | 0.996 | 1914.12.4 | - " |
| 46.985 | 0.996 | 1914.12.5 | - " |
| 46.772 | 0.996 | 1915.1.1 | - " |
| 46.659 | 0.996 | 1915.1.2 | - " |
| 46.275 | 0.995 | 1914.1.2 | - " |
| 45.860 | 0.995 | 1915.1.3 | - " |
| 45.526 | 0.994 | 1915.1.4 | - " |
| 45.359 | 0.994 | 1915.2.1 | - " |
| 45.191 | 0.994 | 1915.2.2 | - " |
| 45.021 | 0.994 | 1915.2.3 | - " |
| 44.851 | 0.994 | 1915.2.4 | - " |

Notes:

First column : F-tests of the null hypothesis of no
parameter change between the first
and the second subsample, weekly
data. Degrees of freedom: (1,676)
for the first test of the table,
(1,675) for the second, ... (1,646)
for the last.

Second column: AR(1) slope coefficient.

## Table II

| F-tests | AR(1) | Subsamples | |
|---|---|---|---|
| | | **First** | |
| | .877 | 1908.1.1 | -1914.7.4 |
| ......... | ........ | ....................... | |
| | | **Second** | |
| 35.324 | 0.991 | 1914.7.5 | - 1920.12.5 |
| 35.550 | 0.993 | " | - 1920.11.3 |
| 35.743 | 0.995 | " | - 1920.10.2 |
| 33.296 | 0.993 | " | - 1920.8.4 |
| 31.719 | 0.992 | " | - 1920.7.3 |
| 29.257 | 0.991 | " | - 1920.6.1 |
| 26.453 | 0.988 | " | - 1920.4.4 |
| 23.475 | 0.983 | " | - 1920.3.2 |
| 22.131 | 0.981 | " | - 1920.1.5 |
| 21.031 | 0.980 | " | - 1919.12.4 |
| 20.294 | 0.979 | " | - 1919.11.2 |
| 19.645 | 0.979 | " | - 1919.10.1 |
| 18.594 | 0.977 | " | - 1919.8.4 |
| 18.146 | 0.977 | " | - 1919.7.2 |
| 17.987 | 0.978 | " | - 1919.5.5 |
| 16.863 | 0.977 | " | - 1919.4.3 |
| 15.562 | 0.975 | " | - 1919.3.1 |
| 14.744 | 0.974 | " | - 1919.1.4 |
| 13.290 | 0.972 | " | - 1918.12.2 |
| 11.440 | 0.967 | " | - 1918.11.1 |
| 10.001 | 0.964 | " | - 1918.9.3 |
| 8.654 | 0.960 | " | - 1918.8.2 |
| 8.641 | 0.960 | " | - 1918.6.4 |
| 8.615 | 0.961 | " | - 1918.5.3 |
| 8.394 | 0.960 | " | - 1918.2.4 |
| 7.890 | 0.958 | " | - 1918.1.2 |
| 7.710 | 0.957 | " | - 1917.11.5 |
| 7.292 | 0.955 | " | - 1917.10.3 |
| 6.850 | 0.953 | " | - 1917.9.1 |

**Notes:**

First column : F tests of the null hypothesis of no parameter change between the first and the second subsample, weekly data. Degrees of freedom: (1,677) for the first test of the table, (1,671) for the second, .... (1,502) for the last.

Second column: AR(1) slope coefficient.

## Table III

**First week**

| F-tests | AR(1) | Subsamples | |
|---|---|---|---|
| | | **First** | |
| | 0.551 | 1908.1.1 | -1914.7 |
| .......... | ........ | ...................... | |
| | | **Second** | |
| 35.333 | 0.956 | 1914.8 | - 1920.12 |
| 35.493 | 0.961 | " | - 1920.10 |
| 36.025 | 0.971 | " | - 1920.8 |
| 32.298 | 0.958 | " | - 1920.6 |
| 29.726 | 0.952 | " | - 1920.4 |
| 27.162 | 0.951 | " | - 1920.2 |
| 22.839 | 0.917 | " | - 1919.12 |
| 21.008 | 0.905 | " | - 1919.10 |
| 20.090 | 0.903 | " | - 1919.8 |
| 18.752 | 0.895 | " | - 1919.6 |
| 17.838 | 0.891 | " | - 1919.4 |
| 16.867 | 0.884 | " | - 1919.2 |
| 16.832 | 0.889 | " | - 1918.12 |
| 15.539 | 0.883 | " | - 1918.10 |
| 13.855 | 0.872 | " | - 1918.8 |
| 12.557 | 0.863 | " | - 1918.6 |
| 10.869 | 0.850 | " | - 1918.4 |
| 8.6220 | 0.825 | " | - 1918.2 |
| 6.9150 | 0.803 | " | - 1917.12 |
| 5.6745 | 0.789 | " | - 1917.10 |
| 4.0461 | 0.752 | " | - 1917.8 |

**Notes:**

First column : F tests of the null hypothesis of no parameter change between the first and second subsample, monthly data sampled out of a weekly series. Degrees of freedom: (1,150) for the first test of the table, (1,148) for the second, .... (1,110) for the last.

Second column: AR(1) slope coefficient.

## Table III (continued)

**Second week**

| F-tests | AR(1) | Subsamples | |
|---------|-------|------------|---|
| | | **First** | |
| | 0.771 | 1908.1.1 | -1914.7 |
| ·········· | ········· | ·················· | ········· |
| | | **Second** | |
| 7.626 | 0.969 | 1914.8 | - 1920.12 |
| 7.809 | 0.973 | " | - 1920.10 |
| 8.558 | 0.986 | " | - 1920.8 |
| 7.181 | 0.972 | " | - 1920.6 |
| 6.636 | 0.970 | " | - 1920.4 |
| 5.967 | 0.966 | " | - 1920.2 |
| 4.271 | 0.936 | " | - 1919.12 |
| 3.676 | 0.926 | " | - 1919.10 |
| 3.507 | 0.924 | " | - 1919.8 |
| 3.117 | 0.917 | " | - 1919.6 |
| 3.003 | 0.917 | " | - 1919.4 |
| 2.660 | 0.909 | " | - 1919.2 |
| 2.847 | 0.916 | " | - 1918.12 |
| 2.593 | 0.912 | " | - 1918.10 |
| 2.169 | 0.903 | " | - 1918.8 |
| 1.822 | 0.894 | " | - 1918.6 |
| 1.570 | 0.889 | " | - 1918.4 |
| 1.017 | 0.869 | " | - 1918.2 |
| 0.659 | 0.853 | " | - 1917.12 |
| 0.363 | 0.834 | " | - 1917.10 |
| 0.074 | 0.800 | " | - 1917.8 |

**Table III** (continued)

**Third week**

| F-tests | AR(1) | Subsamples | |
|---------|-------|------------|---|
| | | First | |
| | 0.749 | 1908.1.1 | −1914.7 |
| . . . . . . . . . . | . . . . . . . . | . . . . . . . . . . . . . . . . . . . . . | |
| | | Second | |
| 5.374 | 0.956 | 1914.8 | − 1920.12 |
| 5.550 | 0.961 | " | − 1920.10 |
| 6.049 | 0.971 | " | − 1920.8 |
| 4.830 | 0.955 | " | − 1920.6 |
| 4.279 | 0.949 | " | − 1920.4 |
| 3.631 | 0.941 | " | − 1920.2 |
| 2.250 | 0.910 | " | − 1919.12 |
| 1.855 | 0.901 | " | − 1919.10 |
| 1.587 | 0.894 | " | − 1919.8 |
| 1.347 | 0.887 | " | − 1919.6 |
| 1.236 | 0.884 | " | − 1919.4 |
| 0.999 | 0.875 | " | − 1919.2 |
| 0.994 | 0.876 | " | − 1918.12 |
| 0.900 | 0.873 | " | − 1918.10 |
| 0.624 | 0.861 | " | − 1918.8 |
| 0.420 | 0.850 | " | − 1918.6 |
| 0.264 | 0.840 | " | − 1918.4 |
| 0.053 | 0.815 | " | − 1918.2 |
| 0.001 | 0.790 | " | − 1917.12 |
| 0.101 | 0.763 | " | − 1917.10 |
| 0.447 | 0.729 | " | − 1917.8 |

## Table III (continued)

**Fourth week**

| F-tests | AR(1) | Subsamples | | |
|---------|-------|------------|---|---|
| | | **First** | | |
| | 0.551 | 1908.1.1 | –1914.7 | |
| · · · · · · · · · | · · · · · · · · | · · · · · · · · · · · · · · · · · · · · · · · · · · | | |
| | | **Second** | | |
| 5.221 | 0.952 | 1914.8 | – | 1920.12 |
| 5.364 | 0.956 | " | – | 1920.10 |
| 5.728 | 0.965 | " | – | 1920.8 |
| 4.833 | 0.952 | " | – | 1920.6 |
| 4.268 | 0.946 | " | – | 1920.4 |
| 3.660 | 0.937 | " | – | 1920.2 |
| 2.206 | 0.901 | " | – | 1919.12 |
| 1.905 | 0.894 | " | – | 1919.10 |
| 1.540 | 0.882 | " | – | 1919.8 |
| 1.379 | 0.878 | " | – | 1919.6 |
| 1.238 | 0.873 | " | – | 1919.4 |
| 1.048 | 0.867 | " | – | 1919.2 |
| 1.002 | 0.865 | " | – | 1918.12 |
| 0.943 | 0.864 | " | – | 1918.10 |
| 0.663 | 0.851 | " | – | 1918.8 |
| 0.422 | 0.837 | " | – | 1918.6 |
| 0.257 | 0.825 | " | – | 1918.4 |
| 0.048 | 0.798 | " | – | 1918.2 |
| 0.003 | 0.771 | " | – | 1917.12 |
| 0.109 | 0.743 | " | – | 1917.10 |
| 0.482 | 0.706 | " | – | 1917.8 |

## Table IV

| F-tests | AR(1) | S u b s a m p l e s |
|---------|-------|---------------------|
| | | **F i r s t** |
| | .953 | 1914.7.5 - 1917.8.4 |
| . . . . . . . . . . | . . . . . . . . . | . . . . . . . . . . . . . . . . . . . . . . . |
| | | **S e c o n d** |
| 6.850 | .877 | 1908.1.1 - 1914.7.4 |
| .135 | .943 | 1908.1.2 - 1914.7.4 |

**Notes:**

First column : F tests of the null hypothesis of no
parameter change between the first
and the second subsample, weekly
data. Degrees of freedom: (1,676)
for the first test of the table,
(1,675) for the second.
Second column: AR(1) slope coefficient.

**Table V**

| F-tests | AR(1) | S u b s a m p l e s | |
|---|---|---|---|
| | | **F i r s t** | |
| | 0.943 | 1908.2 | – 1914.7.4 |
| . . . . . . . . . | . . . . . . . . . | . S e c o n d | . . . . . . . . . . . . . . . . . . . |
| 0.135 | 0.953 | 1914.8.1 | – 1917.8.4 |
| 0.199 | 0.932 | 1914.8.2 | – " |
| 0.243 | 0.955 | 1914.8.3 | – " |
| 0.164 | 0.933 | 1914.8.4 | – " |
| 0.460 | 0.926 | 1914.9.1 | – " |
| 0.000 | 0.943 | 1914.9.2 | – " |
| 0.033 | 0.938 | 1914.9.3 | – " |
| 0.139 | 0.933 | 1914.9.4 | – " |
| 0.348 | 0.926 | 1914.10.1 | – " |
| 0.120 | 0.933 | 1914.10.2 | – " |
| 0.960 | 0.914 | 1914.10.3 | – " |
| 0.539 | 0.920 | 1914.10.4 | – " |
| 0.509 | 0.920 | 1914.10.5 | – " |
| 0.865 | 0.912 | 1914.11.1 | – " |
| 0.819 | 0.911 | 1914.11.2 | – " |
| 0.215 | 0.926 | 1914.11.3 | – " |
| 0.025 | 0.937 | 1914.11.4 | – " |
| 0.003 | 0.941 | 1914.12.1 | – " |
| 0.033 | 0.950 | 1914.12.2 | – " |
| 0.045 | 0.951 | 1914.12.3 | – " |
| 0.058 | 0.952 | 1914.12.4 | – " |
| 0.071 | 0.953 | 1914.12.5 | – " |
| 0.083 | 0.954 | 1915.1.1 | – " |
| 0.082 | 0.954 | 1915.1.2 | – " |
| 0.115 | 0.956 | 1914.1.2 | – " |
| 0.112 | 0.956 | 1915.1.3 | – " |
| 0.100 | 0.955 | 1915.1.4 | – " |
| 0.096 | 0.955 | 1915.2.1 | – " |
| 0.091 | 0.955 | 1915.2.2 | – " |
| 0.087 | 0.955 | 1915.2.3 | – " |
| 0.083 | 0.954 | 1915.2.4 | – " |

**Notes:**

First column : F tests of the null hypothesis of no parameter change between the first and second subsample, weekly data. Degrees of freedom: (1,500) for the first test of the table, (1,499) for the second, ... (1,470) for the last.

Second column: AR(1) slope coefficient.

## Table VI

**First week**

| F-tests | AR(1) | Subsamples | |
|---------|-------|-----------|---|
| | | **First** | |
| | 0.551 | 1908.1 | - 1914.7 |
| ......... | ........ | ........................... | |
| | | **Second** | |
| 4.046 | 0.752 | 1914.8 | - 1917.8 |
| 2.476 | 0.731 | 1914.9 | - " |
| 0.753 | 0.666 | 1914.10 | - " |
| 0.003 | 0.561 | 1914.11 | - " |
| 0.825 | 0.732 | 1914.12 | - " |
| 0.991 | 0.757 | 1915.1 | - " |
| 1.286 | 0.787 | 1915.2 | - " |
| 1.217 | 0.783 | 1915.3 | - " |

**Second week**

| F-tests | AR(1) | Subsamples | |
|---------|-------|-----------|---|
| | | **First** | |
| | 0.771 | 1908.1 | - 1914.7 |
| ......... | ........ | ........................... | |
| | | **Second** | |
| 0.074 | 0.800 | 1914.8 | - 1917.8 |
| 0.202 | 0.723 | 1914.9 | - " |
| 1.961 | 0.604 | 1914.10 | - " |
| 0.869 | 0.634 | 1914.11 | - " |
| 0.074 | 0.726 | 1914.12 | - " |
| 0.006 | 0.758 | 1915.1 | - " |
| 0.006 | 0.758 | 1915.2 | - " |
| 0.010 | 0.754 | 1915.3 | - " |

**Notes:**

First column : F tests of the null hypothesis of no parameter change between the first and second subsample, monthly data sampled out of a weekly series. Degrees of freedom: (1,110) for the first test of each week, (1,109) for the second ... (1,103) for the last.

Second column: AR(1) slope coefficient.

## Table VI (continued)

**Third week**

| F-tests | AR(1) | Subsamples | |
|---------|-------|------------|--|
| | | **First** | |
| | 0.794 | 1908.1 - 1914.7 | |
| .......... | ........ | ..................... | |
| | | **Second** | |
| 0.447 | 0.729 | 1914.8 - 1917.8 | |
| 0.771 | 0.697 | 1914.9 - " | |
| 2.126 | 0.610 | 1914.10 - " | |
| 0.505 | 0.685 | 1914.11 - " | |
| 0.085 | 0.746 | 1914.12 - " | |
| 0.006 | 0.780 | 1915.1 - " | |
| 0.012 | 0.775 | 1915.2 - " | |
| 0.019 | 0.770 | 1915.3 - " | |

**Fourth week**

| F-tests | AR(1) | Subsamples | |
|---------|-------|------------|--|
| | | **First** | |
| | 0.777 | 1908.1 - 1914.7 | |
| .......... | ........ | ..................... | |
| | | **Second** | |
| 0.482 | 0.700 | 1914.8 - 1917.8 | |
| 1.043 | 0.658 | 1914.9 - " | |
| 2.167 | 0.579 | 1914.10 - " | |
| 0.619 | 0.651 | 1914.11 - " | |
| 0.247 | 0.693 | 1914.12 - " | |
| 0.106 | 0.722 | 1915.1 - " | |
| 0.123 | 0.717 | 1915.2 - " | |
| 0.142 | 0.712 | 1915.3 - " | |

INTEREST RATES ON THREE MONTHS TIME LOANS AND COMMERCIAL PAPER
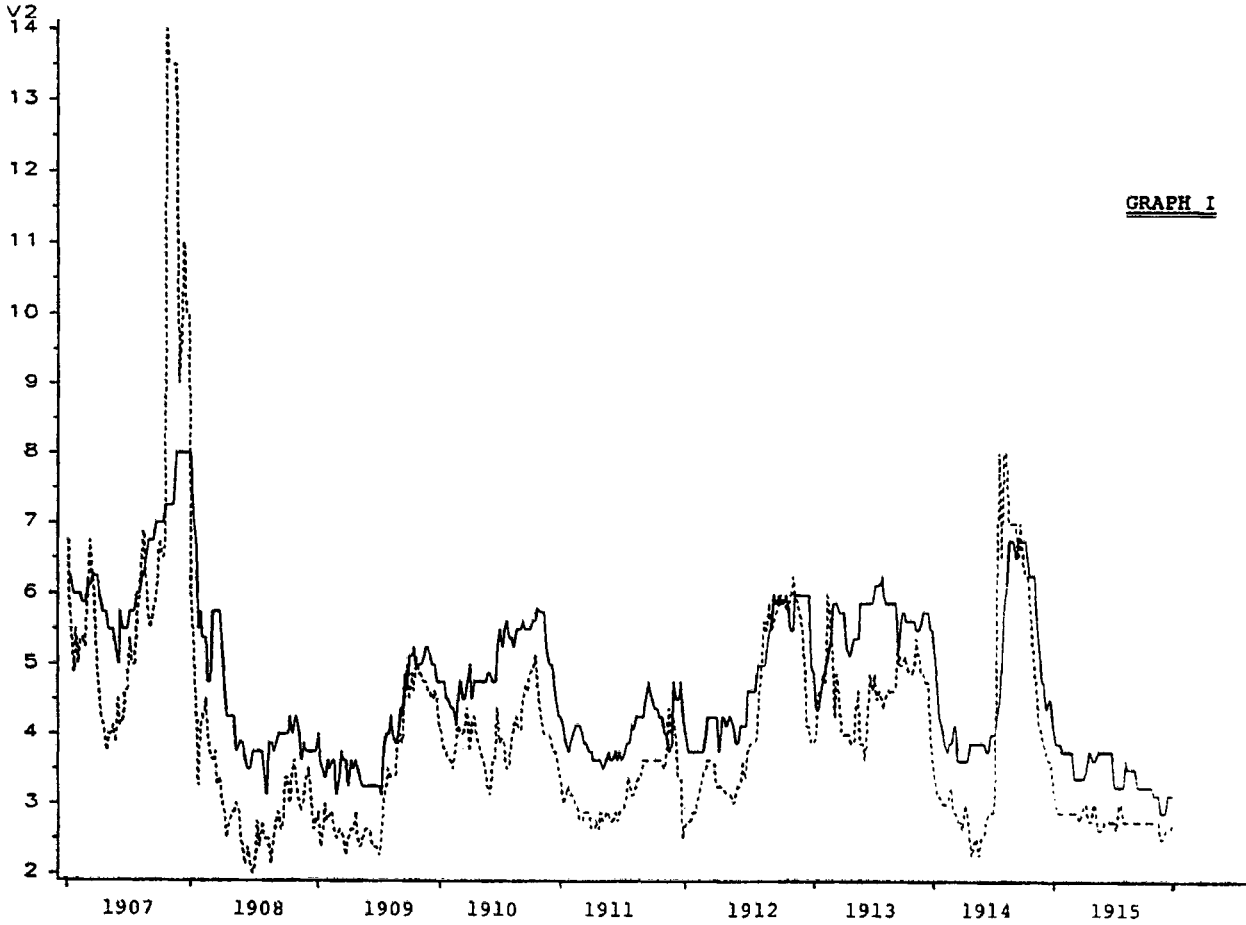


NOTE: Solid line: commercial paper rates.  Dotted line: time loans rates.
In 1907 some observations for both series were missing and required interpolation.

# INTEREST RATES ON THREE MONTHS TIME LOANS
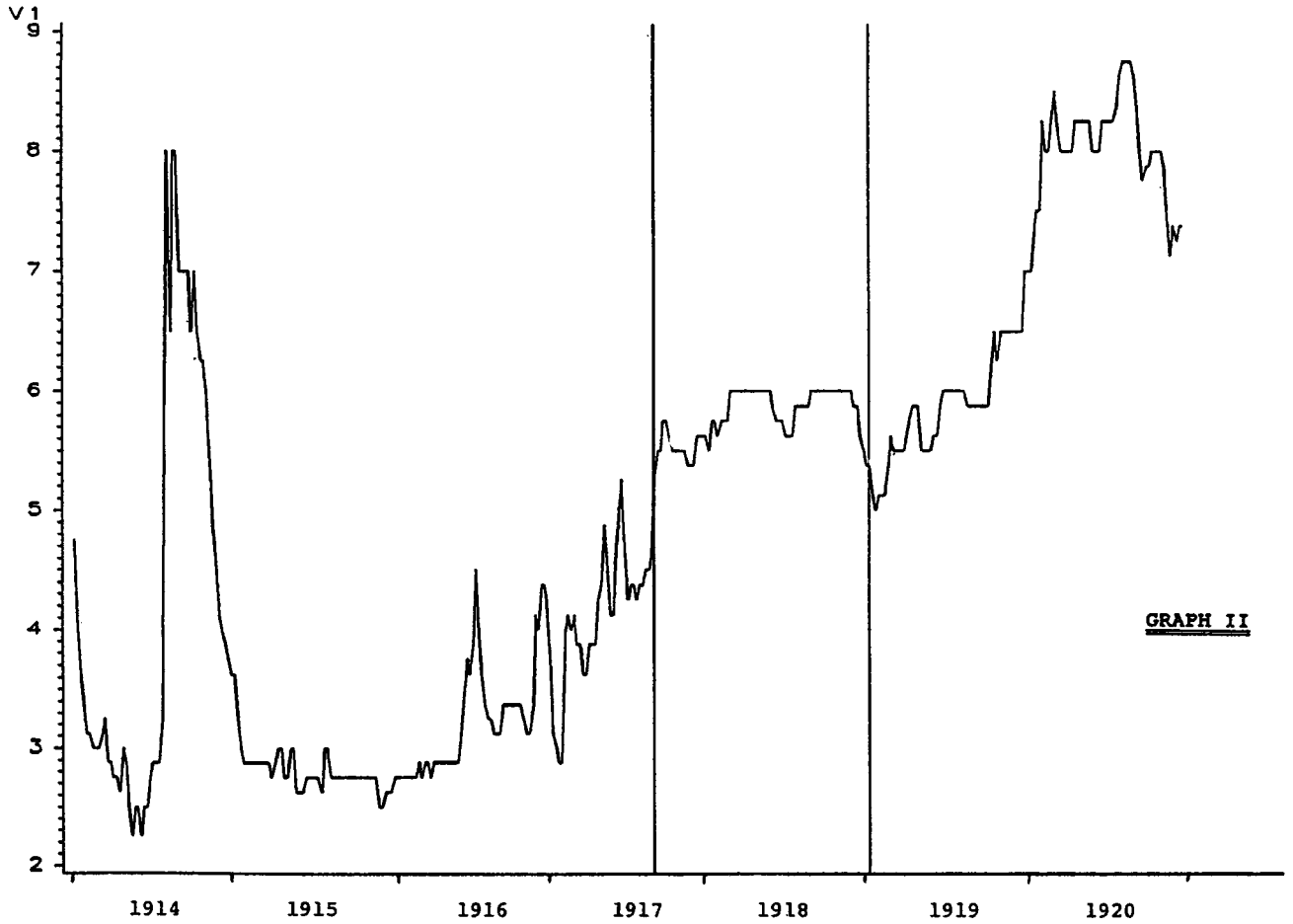


NOTE: The vertical lines mark the beginning and the end of the Money Committee period, September 1, 1917 - January 10, 1919.

**REFERENCES**

ANGELINI, P. (1989), The Behavior of Interest Rates in the Pre-and Post-Fed Eras, mimeo, Brown University.

BARSKY, R.B. - MANKIW, N.G. - MIRON, J.A. - WEIL, D.N. (1988), The Worldwide Change in the Behavior of Interest Rates and Prices in 1914, "European Economic Review", no. 32, pp. 1123-54.

BECKHART, B.H. (1932), The New York Money Market, vol.II, III and IV, New York, Columbia University Press.

BURGESS, W.R. (1927), The Reserve Banks and the Money Market, New York, Harper & Brothers.

CANOVA, F. (1988), An Econometric Analysis of the Disappearance of Interest Rates Seasonals: Real Factors or the Fed?, mimeo, Brown University.

THE COMMERCIAL AND FINANCIAL CHRONICLE, various issues.

DEWALD, W. (1972), The National Monetary Commission: A Look Back, "Journal of Money, Credit and Banking", no. 4 November, pp. 930-56.

DICE, C.D. - EITEMAN, W.J. (1941), The Stock Market, New York, second ed. McGraw-Hill.

DODGE, H.J. (1922), The Aldrich-Vreeland Act Emergency Currency, "The Annals of the American Academy of Political and Social Science", vol. XCIX, no. 188,

pp. 49-55.

THE FINANCIAL REVIEW, various issues.

GORTON, G. (1985), Clearinghouses and the Origin of Central Banking in the U. S., "Journal of Economic History", no. 45.

GRIFFISS, B. (1925), The New York Call Money Market, New York, Ronald Press.

JOHNSTON, J. (1984), Econometric Methods, third edition, New York, McGraw- Hill.

MACAULAY, F.R. (1938), The Movements of Interest Rates, Bond Yields and Stock Prices in the United States Since 1856, New York, National Bureau of Economic Research".

MANKIW, N.G. - MIRON, J.A. (1986) The Changing Behavior of the Term Structure of Interest Rates, "Quarterly Journal of Economics", no. 101, pp. 211-28.

--------- - --------- - WEIL, D.N. (1987), The Adjustment of Expectations to a Change in Regime: A Study of the Founding of the Federal Reserve, "American Economic Review", vol.77, no. 3, June.

MEEKER, E.G. (1922) The Work of the Stock Exchange, fourth ed. and revised ed. (1930), New York, Ronald Press.

MIRON, J.A. (1986), Financial Panics, the Seasonality of the Nominal Interest Rate and the Founding of the Fed, "American Economic Review", vol.76, no. 1, March, pp. 125-40.

----------, (1989), <u>The Founding of the Fed and the Destabilization of the Post-1914 US Economy,</u> in "A European Central Bank ?", edited by M. De Cecco and A. Giovannini, Cambridge, Cambridge University Press, pp. 290-328.

MYERS, M.G. (1931), <u>The New York Money Market</u>, vol.I, New York, Columbia University Press.

RIEFLER, W.W. (1930), <u>Money Market and Money Rates in the United States</u>, New York, Harper & Brothers.

SCHMIDT, P. - SICKLES, R. (1977), <u>Some Further Evidence on the Use of the Chow Test Under Heteroskedasticity</u>, "Econometrica", vol.45, no. 5, July.

SHILLER, R.J. - SIEGEL, J.J. (1977), <u>The Gibson Paradox and Historical Movements in Real Interest Rates</u>, "Journal of Political Economy", vol. 77 no. 85.

TIMBERLAKE, R. (1984), <u>The Central Banking Role of Clearing House Associations</u>, "Journal of Money, Credit and Banking" no. 16 pp. 3-16.

TOYODA, T. (1974), <u>Use of the Chow Test Under Heteroscedasticity</u>, "Econometrica", vol.42, no. 3, May.

WOODWORTH, G.W. (1965), <u>The Money Market and Monetary Management</u>, New York, Harper and Row.

# RECENTLY PUBLISHED «TEMI» (*)

n. 114 — *La tassazione delle rendite finanziarie nella CEE alla luce della liberalizzazione valutaria* (febbraio 1989).

n. 115 — *Il ruolo delle esportazioni nel processo di crescita e di aggiustamento dei PVS*, di L. BINI SMAGHI - D. PORCIANI - L. TORNETTA (marzo 1989).

n. 116 — *LDCs' repayment problems: a probit analysis*, by F. DI MAURO - F. MAZZOLA (maggio 1989).

n. 117 — *Mercato interbancario e gestione degli attivi bancari: tendenze recenti e linee di sviluppo*, by G. FERRI - P. MARULLO REEDTZ (giugno 1989).

n. 118 — *La valutazione dei titoli con opzione di rimborso anticipato: un'applicazione del modello di Cox, Ingersoll e Ross ai CTO*, di E. BARONE - D. CUOCO (giugno 1989).

n. 119 — *Cooperation in managing the dollar (1985-87): interventions in foreign exchange markets and interest rates*, by E. GAIOTTI - P. GIUCCA - S. MICOSSI (giugno 1989).

n. 120 — *The US current account imbalance and the dollar: the issue of the exchange rate pass-through*, by C. MASTROPASQUA - S. VONA (giugno 1989).

n. 121 — *On incentive-compatible sharing contracts*, by D. TERLIZZESE (giugno 1989).

n. 122 — *The adjustment of the US current account imbalance: the role of international policy coordination*, by G. GOMEL - G. MARCHESE - J. C. MARTINEZ OLIVA ((luglio 1989).

n. 123 — *Disoccupazione e dualismo territoriale*, di G. BODO - P. SESTITO (agosto 1989).

n. 124 — *Redditi da lavoro dipendente: un'analisi in termini di capitale umano*, di L. CANNARI G. PELLEGRINI - P. SESTITO (settembre 1989).

n. 125 — *On the estimation of stochastic differential equations: the continuous-time maximum-likelihood approach*, by R. CESARI (settembre 1989).

n. 126 — *La misurazione dell'efficienza nei modelli di "frontiera"*, di M. GRESTI (settembre 1989).

n. 127 — *Do intergenerational transfers offset capital market imperfections? Evidence from a cross-section of Italian households*, by L. GUISO - T. JAPPELLI (settembre 1989).

n. 128 — *La struttura dei rendimenti per scadenza secondo il modello di Cox, Ingersoll e Ross: una verifica empirica*, di E. BARONE - D. CUOCO - E. ZAUTZIK (ottobre 1989).

n. 129 — *Il controllo delle variabili monetarie e creditizie: un'analisi con il modello monetario della Banca d'Italia*, di I. ANGELONI - A. CIVIDINI (novembre 1989).

n. 130 — *L'attività in titoli delle aziende di credito: un'analisi di portafoglio*, di G. FERRI - C. MONTICELLI (dicembre 1989).

n. 131 — *Are asymmetric exchange controls effective?* by F. PAPADIA - S. ROSSI (gennaio 1990).

n. 132 — *Misurazione dell'offerta di lavoro e tasso di disoccupazione*, di P. SESTITO (marzo 1990).

n. 133 — *Progressing towards European Monetary Unification: Selected Issues and Proposals*, by L. BINI SMAGHI (aprile 1990).

n. 134 — *Il valore informativo delle variabili finanziarie: un'analisi con il modello econometrico trimestrale della Banca d'Italia*, di I. ANGELONI - A. CIVIDINI (aprile 1990).

n. 135 — *A Model for Contingent Claims Pricing on EMS Exchange Rates*, by A. ROMA (maggio 1990).

n. 136 — *Le attività finanziarie delle famiglie*, di L. CANNARI - G. D'ALESSIO - G. RAIMONDI - A. I. RINALDI (luglio 1990).

n. 137 — *Sistema pensionistico e distribuzione dei redditi*, di L. CANNARI - D. FRANCO (luglio 1990).

n. 138 — *Time Consistency and Subgame Perfection: the Difference between Promises and Threats*, by L. GUISO - D. TERLIZZESE (luglio 1990).

n. 139 — *Test di integrazione e analisi di cointegrazione: una rassegna della letteratura e un'applicazione*, di G. BODO - G. PARIGI - G. URGA (luglio 1990).

n. 140 — *The Experience with Economic Policy Coordination: the Tripolar and the European Dimensions*, by G. GOMEL - F. SACCOMANNI - S. VONA (luglio 1990).