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Claude Diebolt, Antoine Parent & Jamel Trabelsi [*]

Abstract: *»Eine erneuerte Lektüre der Krise von 1929: War die Fed Vor-Keynesianisch? Neue Erkenntnisse aus der Vergangenheit«*. This article is organized as follows: in section 1, we discuss the Bordo et al. (2002) monetarist counterfactual analysis. Section 2 presents data. In section 3, we address the following question: referring to Keynes' definition of liquidity trap, we ask ourselves whether there were episodes of liquidity trap over the pre and post 1929 crisis period and whether the Fed modified its reaction function in consequence? Following this, in section 4 and using a SVAR approach, we simulate how US economic activity would have reacted following an expansionary monetary policy after the 1929 crisis. In conclusion, we suggest a renewed monetary lesson from the past.

Keywords: 1929, crisis, Fed, Pre-Keynesian, cliometrics.

Introduction

A much debated hypothesis about the Great Depression of the thirties is Friedman and Schwartz's (1963) contention that a severe but not unusual recession turned into the greatest contraction of all times because the Federal Reserve (Fed) failed to undertake expansionary open-market operations. They could have offset a drastic decline in the stock of money attributable to a series of banking panics.

Bordo, Choudhri and Schwartz (2002) implemented a counterfactual analysis in order to test Friedman and Schwartz's proposition. They give evidence,

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in a monetarist framework, that nothing prevented the US, the largest country in the world with massive gold reserves, from using expansionary policy to offset banking panics, deflation and declining economic activity. Simulations, based on a monetarist model of a large open economy, indicate that expansionary open market operations by the Fed at two critical junctures – Oct. 1930 to Feb. 1931 and Sept. 1931 to Jan. 1932 – would have been successful in averting the banking panic that occurred. Had expansionary open market purchases been conducted in the 1930s, the contraction would not have led to the international crises that followed.

Nonetheless, the outcomes of Bordo et al. (2002) depend on the monetarist framework used. One could argue that their picture forgets that the Great Depression may have been characterized by a situation of liquidity trap (Keynes 1936) which would have annihilated the positive impact of expansionary monetary policy on economic growth at that time. The purpose of our article is to attempt to clarify the supposed lessons of the Great Depression. The issue – the absolute relevance of expansionary monetary policy even in a context of liquidity trap – needs to be considered and tested in order to appreciate any possible errors in the lessons drawn from the past, as well as in monetary policy responses.

Our article is organized as follows: in section 1, we discuss the Bordo et al. (2002) monetarist counterfactual analysis. Section 2 presents data. In section 3, we address the following question: referring to Keynes' definition of liquidity trap, we ask ourselves whether there were episodes of liquidity trap over the pre and post 1929 crisis period and whether the Fed modified its reaction function in consequence? We give empirical evidence of episodes of liquidity trap in 1929. In the aftermath of 1929, we highlight that the Fed adopted a new policy rule "avoiding the trap" as early as 1930 which lasted until 1933. This point contrasts with the existing literature. Following this, in section 4 and using a SVAR approach, we simulate how US economic activity would have reacted following an expansionary monetary policy after the 1929 crisis. We give empirical evidence that expansionary monetary policy would not have been the path towards economic recovery in the USA. In conclusion, we suggest a renewed monetary lesson from the past.

1. Monetarist Counterfactual Approach of the 1929 Crisis by Bordo et al.

Counterfactual analysis is one of the cornerstones of the cliometric methodology (Costa, Diebolt and Demeulemeester 2007; Carlos 2010; Demeulemeester and Diebolt 2007; Fogel 1964; Williamson 1974). It is used to measure the deviation between what actually happened and what could have happened under different circumstances. This methodological principle is based on the measurement of the influence of a given factor upon a development by using the difference between the development actually observed and the hypothetical development that would have been observed if the factor in question had not existed.

The monetarist model developed by Bordo, Choudhri and Schwartz (2002) is a two-country model to determine US gold flows and to simulate the US gold reserves under alternative monetary policies.

The authors assume that the US demand for money in period t is given by:

$$m_t\text{-}p_t=\alpha_o+\alpha_1 y_t+\alpha_2 i_t+v_t,\ \alpha_1>0,\ \alpha_2<0 \qquad (1)$$

where, m_t, p_t, y_t represent logs of money stock, price level and real income, i_t, denotes the interest rate and v_t is the error term. The determinants of m_t are expressed by the two following identities:

$$m_t \equiv \mu_t+\log(H_t) \qquad (2)$$

$$H_t=G_t+D_t \qquad (3)$$

where μ_t is the log of the money multiplier while, H_t, G_t, D_t represent high-powered money, gold reserves and domestic credit.

Using (1)-(3) and considering,

$$\underline{H}_t=(H_t+H_{t-1})\,/\,2$$

It comes in first differences (Δ) that:

$$\Delta G_t/\underline{H}_t=-\Delta D_t/_t-\Delta\mu_t+\Delta p_t+\alpha_1\Delta y_t+\alpha_2\Delta i_t+\Delta v_t \qquad (4)$$

Equation (4) can be utilized to examine the effect of an expansion in domestic credit on gold flows. Although the direct effect of ΔD_t on ΔG_t equals -1 in (4), ΔD_t could also exert an indirect effect through other variables on the right hand side of (4). Over a very short period, (1 month), the authors assume that $\Delta\mu_t$, Δp_t, Δy_t, Δv_t are exogenous to ΔD_t and Δi_t is the only potential channel for the indirect effect. The authors model the monetary relations in the rest of the world to explore this channel. Assuming that the money demand function in the rest of the world is of the same form as (1), representing the determinants of money stocks by identities similar to (2) et (3), we obtain:

$$\Delta G_t^*/\underline{H}_t^* \equiv -\Delta D_t^*/\underline{H}_t^* - \Delta\mu_t^* + \Delta p_t^* + \alpha_1^*\Delta y_t^* + \alpha_2^*\Delta i_t^* + \Delta v_t^* \qquad (5)$$

where these variables are expressed in foreign-currency units. Assuming that the world stock of gold is fixed and the US price of gold is constant over time, this implies that gold flows in the US and in the rest of the world are linked as follows:

$$\Delta G_t=-\Delta(e_t G_t^*) \qquad (6)$$

where e_t denotes the exchange rate in representing the price of foreign currency in US dollars. The relationship between interest rates in the US and abroad is expressed as follows:

$$i_t = i_t^* + x_t + \varepsilon_t \qquad (7)$$

where x_t denotes the expected rate of US dollar depreciation and ε_t represents departures from perfect capital mobility (or uncovered parity) caused by factors such as risk premiums, transaction costs, information gaps and capital controls. If the gold standard had operated smoothly, no changes in gold parities would have been expected and x_t=0. In this case, the Fed would still have been able to affect the interest rate differential i_t-i_t^*, if departures from perfect capital mobility allowed it to systematically influence ε_t. However, even if the Fed was unable to affect the interest rate differential, the size of the US would have enabled it to influence the world interest rate and hence follow an independent monetary policy under the gold standard.

Using (4), (5), (6) and the first-difference form of (7), one obtains:

$$\Delta G_t/\underline{H}_t = \theta_t[-\Delta D_t/\underline{H}_t - \Delta\mu_t + \Delta p_t + \alpha_1 \Delta y_t + \alpha_2(\Delta x_t + \Delta\varepsilon_t) + \Delta v_t]$$
$$+(\theta_t \alpha_2/\alpha_2^*)\left(\Delta D_t^*/\underline{H}_t^* + \Delta\mu_t^* - \Delta p_t^* - \alpha_1 \Delta y_t^* - \Delta v_t^* + \gamma_t\right)$$

where $\theta_t \equiv \alpha_2^* e_t \underline{H}_t / (\alpha_2 \underline{H}_t + \alpha_2^* e_t \underline{H}_t^*)$,

and $\gamma_t \equiv \Delta e_t G_{t-1}^* / e_t \underline{H}_t^*$, which represents an adjustment for changes in the foreign price of gold (in periods when this price is constant, it is equal to zero).

Equation (8) can be used to examine the offset coefficient which is the proportion of an increase in US domestic credit offset by gold outflows in the short run. In the special case in which no changes in gold parities are expected and thus x_t=0, and there is either perfect capital mobility so that ε_t=0 or near-perfect capital mobility in the sense that $\Delta\varepsilon_t$ is independent of ΔD_t, then (8) implies that the offset coefficient equals $-\theta_t$. As the US stock of high powered money represented a substantial portion of the world stock during the Great Depression, θ_t was significantly less than 1.

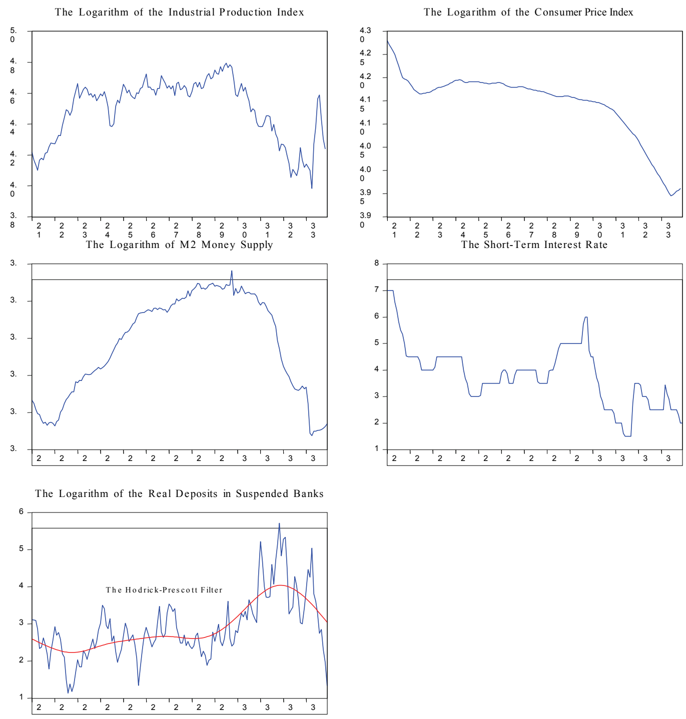
The conclusion of the authors is that even given perfect or near-perfect capital mobility, gold flows would not have severely constrained the Fed's ability to determine the high-powered stock of money in the short run. The Fed would have been even less constrained under imperfect mobility in which case the absolute value of the offset coefficient would be smaller than θ_t. American monetary authorities would have had more room for manoeuvre.

This monetary model, which assumes a permanent, direct effect of the money stock on output and prices, by definition, rejects the possibility of a liquidity trap existing.

2. Data

Our data are monthly and cover the 1922:1-1933:12 time periods for five variables: the real industrial production index, *y* (considered as a proxy of the real economic activity), the consumer price index, *p*, the M2 money supply, *m*, the short-term interest rate[1], *r*, and the real deposits in suspended bank[2], *s* (which is considered as a measure of the importance of bank failure).

Figure 1



With the exception of the interest rate, all variables are expressed in logarithms. The nominal M2 money supply is converted into a real variable by dividing it

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1 Balke and Gordon (1986), Friedman and Schwartz (1963).

2 Federal Reserve Bulletin, Sept. 1937 <http://fraser.stlouisfed.org/publications/FRB/1937/>; McCallum (1990). It is also used by Bernanke (1983) as a proxy for the non-monetary influence of banking failure on economic activity.

by the consumer price index. Finally, the inflation rates are computed as growth rates of the consumer price index.

As shown in Figure 1, the log of real industrial production began to decline from April 1929 to the cyclical trough in 1933:1. This sharp and most prolonged decline was followed by a brief recovery at the beginning of 1933. The Consumer Price Index (CPI) plot illustrates the most severe deflation in US history. Indeed, it declined by 23 percent from 1929 to 1933. In the same way as real industrial production, the log of the M2 money supply fell by more than 10% from October 1929 to March 1933. The short-term interest rate was clearly on the decrease over the period. The sharp increase of the log of real deposits in suspended banks between 1930 and 1933 reflects to a large extent, the fall in the money supply multiplier observed during this period. Friedman and Schwartz (1963) explained this decline in the money supply by the series of banking panics which reduced the money supply and real activity through the money supply multiplier channel. The Hodrick-Prescott trend plot of real deposits in suspended banks consolidates this finding since the outbreak of banking panic precedes the decline in the money supply.

Prior to investigating whether quicker reactivity of monetary policy in the thirties would have been the appropriate tool to fight the Great Depression, we need to provide an answer to a preliminary question: is it possible to identify episodes of liquidity trap over the period 1921-1933?

3. Is it Possible to Identify Episodes of Liquidity Trap over the Period 1921-1933 and did the Fed Modify its Monetary Policy Rule Accordingly?

According to Keynes (1936), a liquidity trap situation is characterized as an episode when the interest rate is insensitive to a move in the money supply. Below, we present several quotes taken from the General Theory (1936) which clearly identify the correct meaning of trap according to Keynes:

> Liquidity preference is defined as the relationship between the rate of interest and the quantity of money … The speculative motive is particularly important in transmitting the effects of a change in the quantity of money … Let the amount of cash held to satisfy the transaction and precautionary-motives be M1 and the amount held to satisfy the speculative-motive be M2 … Finally, is the question of the relation between M2 and r (Keynes 1973, 173, 196, 199, 201).

In this article, we will strictly refer to Keynes' definition. We shall test, over the period 1921-1933, the occurrence of situations in which the interest rate is insensitive to a move in M2.

Using appropriate methodology (a State Space specification of the Fed reaction function) we set out in this section to test the existence of liquidity traps in accordance with the definition stated above. For the state space model, we estimate the Fed reaction function by assuming that all the regression coefficients are time-variant. By estimating this model, the periods of liquidity trap which correspond to the near-zero parameter of the money supply can be detected, i.e. when the interest rate does not react to variations in the money supply. Ultimately, we are led to question whether the Fed modified its monetary policy rule accordingly.

3.1. The Kalman Filter Estimation

In order to test the existence of a liquidity trap (in the sense of an insensitivity of the interest rate to a move in the money supply), we model the interest rate process as:

$$r_t = c_1 + \alpha_{1t} y_t + \alpha_{2t} p_t + \alpha_{3t} m_t + \alpha_{4t} s_t + \varepsilon \qquad \varepsilon_t \approx N(0, \sigma_\varepsilon^2) \qquad (10)$$

$$\alpha_t = \alpha_{t-1} + c_2 + v_t \qquad v_t \approx N(0, \sigma_v^2) \qquad (11)$$

where $\alpha_t = (\alpha_{1t}, \alpha_{2t}, \alpha_{3t}, \alpha_{4t})$.

We assume that the dynamic of the interest rate, r is given by a time-varying parameters model and the coefficients α_t are driven by an Auto-Regressive process (AR(1)). Equations (10) and (11) represent respectively the measurement and transition equations. Since the liquidity trap is defined as an episode when the interest rate is insensitive to a move in the money supply, this corresponds to the case where $\alpha_{3t}=0$.

The estimation of all the parameters by the Kalman filter allows us to determine the temporal receptivity of the interest rates to the different variables. The Maximum Likelihood estimates of the parameters of the models are reported in Table 1. The results indicate that all parameters α_{it} for $i = 1,\ldots 4$ are statistically significant.

Figure 2 shows the dynamic degree of interest rate receptivity to the variations in output, price levels, money supply and suspended deposits. Over the period 1921-1933, the Fed was receptive to variations in all the variables with the exception of the real suspended bank deposits whose coefficient remains equal to zero over the entire period. Clearly the Fed never acted before and after the 1929 crisis as a lender-of-last-resort to support the banking system.

Very interestingly, Figure 2 shows that the money supply coefficient reached a zero value between 1928:7 and 1929:9. This near zero money supply coefficient illustrates the case of liquidity trap since the interest rate is insensitive to a move in the money supply. At the end of 1929, the money supply coefficient begins with a downward trend for few months then it stabilized for the rest of the period at a level previously reached between 1925 and 1927: the so-called “roaring twenties”. Immediately after the 1929 crisis the Fed restored its sensitivity to the money aggregate (M2) at the level which prevailed before the triggering of the crisis. This strongly suggests that in the aftermath of the

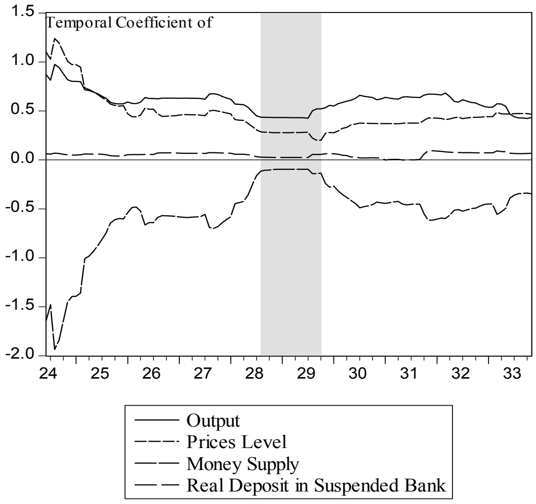
1929 crisis the Fed's reaction function moved towards preventing the liquidity trap situation.

Table 1: Maximum Likelihood Estimation Results of the Model (Equations (10) and (11))

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-2.6129	1.3239	-1.9736	0.0484
C(2)	0.9454	0.0231	40.8219	0.0000
	Final State	Root MSE	z-Statistic	Prob.
α_1	0.4311	0.1863	2.3138	0.0207
α_2	0.4657	0.1449	3.2135	0.0013
α_3	-0.3447	0.1526	-2.2580	0.0225
α_3	0.0664	0.0290	2.2834	0.0224
Log likelihood	-42.0924	Akaike info criterion	0.5856	
Parameters	3	Schwartz criterion	0.6447	
Diffuse priors	4	Hannan-Quinn criterion	0.6096	

This new strategy adopted by the Fed just after the triggering of the 1929 crisis illustrates that the Fed acted through the interest rate channel to avert the risk of liquidity trap. This point is neglected in the literature which insists on the passive attitude of the Fed and its refusal to intervene by any means.

Figure 2: Time-Varying Fed Reaction Function



4. How Would US Economic Activity Have Reacted Following an Expansionary Monetary Policy After the 1929 Crisis: Lessons from a SVAR Approach

In the previous section, using an empirical reaction function, we highlighted that there was a change in the monetary policy rules of the Fed as early as 1930. With this in mind, the following section is devoted to this question: how would the US economy have reacted consequent to an expansionist monetary policy?

4.1. Methodology

We develop a SVAR model which should allow for a simultaneous examination of the reaction of real economic activity to an expansionist monetary policy shock, had it been implemented after 1929:10. In order to build the dynamic structure of our SVAR approach, we use economic theory and econometric considerations with various types of restrictions on the structural parameters.

The unit root test results, given in Table 2, show that all the series appear to be integrated of order one I(1). Table 3 shows the results of tests for the orders of co-integration. Both Trace and Eigenvalue statistics indicate that the order of co-integration is 3.

Table 2: Integration Tests

	y	*p*	*m*	*r*	*s*
ADF test	-2.06	-0.76	-1.02	-2.74	-2.82
KPSS test	0.32	1.12	0.44	0.74	0.89

The table shows the Augmented Dickey-Fuller and Kwiatkowski et al. tests for stationarity of each time series.

Table 3: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value
None*	0.4262	154.93	60.0614	83.3232	30.4396
At most 1*	0.2674	71.60	40.1749	46.6785	24.1592
At most 2*	0.1151	24.92	24.2759	18.3506	17.7973
At most 3	0.0281	6.57	12.3209	4.28050	11.2248
At most 4	0.0151	2.29	4.12990	2.29732	4.12990

*Denotes rejection of the hypothesis at the 0.05 level.

In light of the existence of co-integration relations among variables and since our primary focus is on the short-run dynamics of the system including all the variables, we present and estimate our Structural VAR in levels (Faust and Leeper, 1997).

The basic approach is derived from the studies of Blanchard and Quah (1989), Shapiro and Watson (1988), Blanchard (1989) and others on structural modelling. Indeed, many SVAR model identification processes define either short run (Kim and Roubini 2000) or long run (Blanchard and Quah 1989) restrictions.

In this paper we adopt a short-term restrictions approach within the framework of an open economy. Our purpose in this section is to identify the propagation mechanisms in the case of the Fed's expansionist monetary policy after the 1929 crisis and to analyze the contribution of this monetary shock to the US economic recovery. To determine the transmission mechanism shocks, we briefly summarize the SVAR modelling process[3].

In the first step we estimate the VAR reduced-form:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_p y_{t-p} + \varepsilon_t \qquad E(\varepsilon_t \varepsilon_t^{'}) = \Omega \tag{12}$$

Where A_i are (nxn) coefficients matrix and y is a covariance stationary vector process. The vector $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t}, \ldots, \varepsilon_{nt})$ is n-dimensional.

The structural form of (1) can be written as:

$$Ay_t = A_1^* y_{t-1} + A_2^* y_{t-2} + \ldots + A^*_p y_{t-p} + Bu_t \tag{13}$$

where $E(u_t)=0$ and $E(u_t u_t) = I_n$

The relation between reduced and structural shocks is simply obtained by multiplying the relation (13) by A^{-1}:

$$\varepsilon_t = A^{-1} B u_t \tag{14}$$

Equation (14) illustrates the relation between the reduced-form (disturbances) and the structural-form (innovations).

The connection between these two forms is given by:

$$A_j = A_j^{-1} A_j^{-1} \tag{15}$$

Matrix A enables the instantaneous relations to be modelled, whilst B is a structural form parameter matrix. Identifying the structural vector autoregression requires the introduction of additional constraints since, following (14), the number of non-redundant elements of $\Omega\,(n(n+1)/2)$ is less than the overall number of elements in matrix A and B $(2n^2)$. The identification structure is therefore achieved by imposing $2n^2 - n(n+1)/2$ restrictions, taken from economic theory and intended to represent meaningful short term relationships between the variables and the structural shocks.

Our system includes five endogenous variables: y is the real industrial production index, p the consumer price index, m the M2 money supply, r the inter-

[3] For a complete mathematical presentation, see Hamilton, 1994.

est rate, and s the real value of deposits in suspended banks. With the exception of the interest rate, all variables are expressed in logarithms. We take the log of the deposits in suspended banks, s, as proxy of banking panic.

The architecture of our short term restrictions is characterized by the following structure:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & 0 & a_{53} & 0 & 1 \end{bmatrix} \begin{bmatrix} y_t \\ p_t \\ m_t \\ r_t \\ s_t \end{bmatrix} = A_1^* y_{t-1} + \ldots + A_P^* y_{t-p} +$$

$$\begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 \\ 0 & 0 & 0 & 0 & b_{55} \end{bmatrix} \begin{pmatrix} u_{yt} \\ u_{pt} \\ u_{mt} \\ u_{rt} \\ u_{st} \end{pmatrix} \tag{16}$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & 0 & a_{53} & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{pt} \\ \varepsilon_{mt} \\ \varepsilon_{rt} \\ \varepsilon_{st} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 \\ 0 & 0 & 0 & 0 & b_{55} \end{bmatrix} \begin{pmatrix} u_{yt} \\ u_{pt} \\ u_{mt} \\ u_{rt} \\ u_{st} \end{pmatrix} \tag{17}$$

$\varepsilon = [\varepsilon_y, \varepsilon_p, \varepsilon_m, \varepsilon_r, \varepsilon_s]$ corresponds to the errors of the reduced VAR form, while the structural disturbances u_y, u_p, u_m, u_r, u_s are, by definition (IS/LM models originated by Hicks, 1937 and their extensions, see especially Gali, 1992), aggregate supply shocks, aggregate demand shocks, supply monetary shocks, demand monetary shocks, and banking shocks:

$$\begin{gathered} \varepsilon_{yt} = b_{11} u_{yt} \\ \alpha_{21} \varepsilon_{yt} + \varepsilon_{pt} = b_{22} u_{pt} \\ \alpha_{31} \varepsilon_{yt} + \alpha_{32} \varepsilon_{pt} + \varepsilon_{mt} + \alpha_{34} \varepsilon_{rt} + \alpha_{35} \varepsilon_{st} = b_{33} u_{mt} \\ \alpha_{43} \varepsilon_{yt} + \alpha_{42} \varepsilon_{pt} + \alpha_{43} \varepsilon_{mt} + \varepsilon_{rt} = b_{44} u_{rt} \\ \alpha_{51} \varepsilon_{yt} + \alpha_{53} \varepsilon_{mt} + \varepsilon_{st} = b_{55} u_{st} \end{gathered} \tag{18}$$

This model is exactly-identified because we impose 35 restrictions which correspond to the case of five endogenous variables.

The first row of the system (16):

$$y_t=A_1^{*(1,1)}y_{t-1}+\ldots+A_p^{*(1,1)}y_{t-p}+b_{11}u_{yt} \quad (19)$$

specifies that, except for aggregate supply shock, all the others affect real activity with a lag (Sims and Zha, 2006). Such a restriction can be justified by the inter-temporal IS equation, by which interest-sensitive expenditure is predetermined (Rotemberg and Woodford, 1999).

The relation given by the second row:

$$p_t=-\alpha_{22}y_t+A_1^{*(2,.)}y_{t-1}+\ldots+A_p^{*(2,.)}y_{t-p}+b_{22}u_{pt} \quad (20)$$

is consistent with the specification by which the inflation rate reacts contemporaneously to output shocks (Woodford, 2003). Indeed, based on Calvo (1983), Rotemberg (2003), Rotemberg and Woodford (1999), we assume that effects on price changes on the remaining variables occur with a delay (except for real economic activity).

The third row:

$$m_t=-\alpha_{31}y_t-\alpha_{32}p_t-\alpha_{34}r_t-\alpha_{35}s_t+A_1^{*(3,.)}y_{t-1}+\ldots+A_p^{*(3,.)}y_{t-p}+b_{33}u_{mt} \quad (21)$$

corresponds to global liquidity aggregate dynamics, which is assumed to react contemporaneously to real income, demand aggregate, the short-term interest rate shock, and bank failure shocks.

The fourth equation:

$$r_t=-\alpha_{41}y_t-\alpha_{42}p_t-\alpha_{43}m_t+A_1^{*(4,.)}y_{t-1}+\ldots+A_p^{*(4,.)}y_{t-p}+b_{44}u_{rt} \quad (22)$$

represents the central bank reaction function by which the Fed reacts contemporaneously to movements in output, prices level and money supply.

The last equation:

$$s_t=-\alpha_{51}y_t-\alpha_{53}m_t+A_1^{*(5,.)}y_{t-1}+\ldots+A_p^{*(5,.)}y_{t-p}+b_{55}u_{st} \quad (23)$$

represents the banking shocks dynamics relevant to bank suspensions and failures.

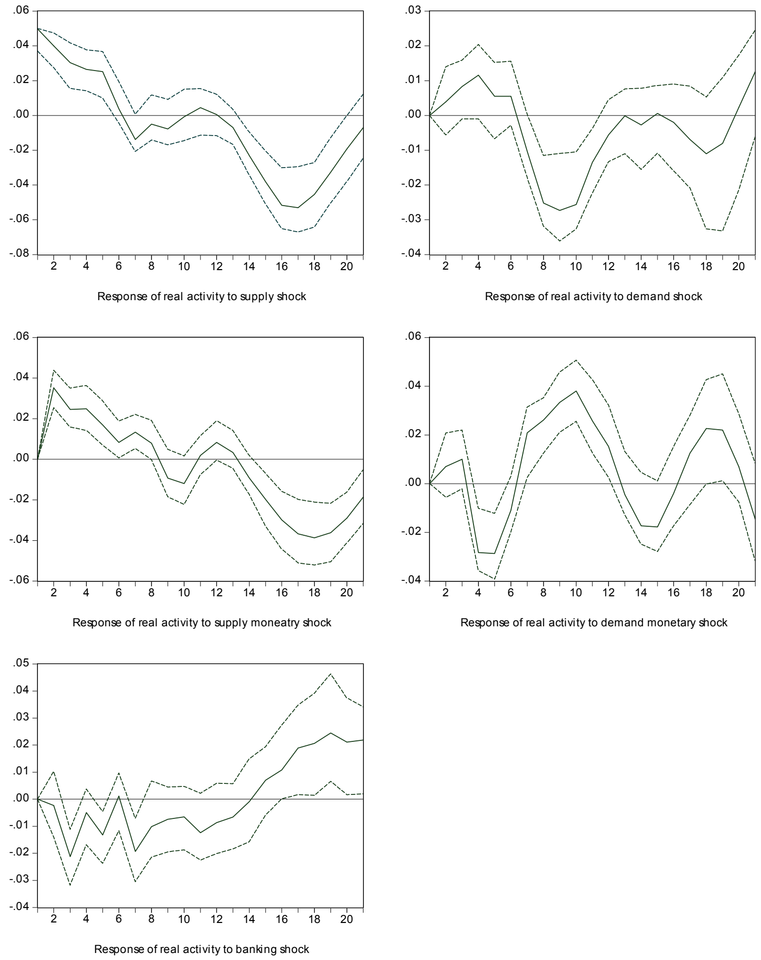
The introduction of such shock mechanisms in our specification is prompted by the contribution of a series of banking panics from 1930 to 1933 to explain the severe decline of the money supply through the money supply multiplier.

Indeed, as explained by Friedman and Schwartz (1963), the banking failure generated by the absence of Fed lender-of-last-resort action, altered the public's confidence, leading to a massive decline in the deposit-currency ratio. This naturally forced the banks to reduce in turn their loans, causing a sharp fall in the deposit reserve ratio. Bernanke (1983) also highlights the important role played by bank failures in affecting the financial intermediation process and hence reducing the level of real output.

4.2. Empirical Results

4.2.1 Impulse Response Functions Analysis

Figure 3: IRF



We now develop our impulse/response function (IRF) analysis of the reaction of real economic activity to various shocks. We follow the calculation procedure presented in Hamilton (1994).

In the figure above, we display the real economic activity, estimated by impulse response functions with 95% confidence intervals. The response of real economic activity to an unexpected aggregate supply shock is in line with the literature, but only in the short term. Indeed, after only 6 months, real activity becomes significantly negative and remains so for the rest of the period. This result illustrates how difficult it is to undertake structural or cyclical policies in an unstable economic environment.

The response of real activity to demand shock reflects the incidence of increasing prices on output. This channel is ineffective: indeed, after 6 months, a shock on price negatively affects output for the rest of the period. An increase in prices has no effect on economic activity. In the light of these results it seems difficult to defend the view that a break in the expectations of deflation and their replacement by expectations of inflation would help to reduce real interest rates and trigger economic growth[4].

Apart from this, three main results emerge from our analysis:

- Firstly, *expansionist monetary policy would not have had significant effects on US economic growth*: real output increases in the short term in response to an unexpected money supply shock but after 8 months it begins to die off. Indeed, real economic activity decreases by -4% after 18 months. This minors the role of the monetary channel as a solution to the financial crisis. The 1929's great contraction would certainly have been attenuated (in the very short term) but not offset by expansionist monetary policy, as Friedman and Schwartz (1963), Bordo et al. (2002) argued. Thus, our results tend to minor the role of the monetary channel as a solution to the financial crisis of 1929.
- Secondly, *the banking variable appears as a significant transmission channel of the financial crisis*. The effects we observe are in line with the stylized facts: indeed, banking panics significantly contributed to the emergence of the Great Contraction of 1929 (Bernanke 1983). Would this Great Contraction have been attenuated, had the Fed decided to fund the banks? This issue is more controversial. We find that banking failures have immediate adverse effects on economic growth: real activity decreases sharply in the first 14 months after a banking shock. But, amongst all the variables, it is the only one (along with the interest rate, see below) to exert positive medium term effects (after 14 months). Do these medium-term positive effects reflect the indirect incidence of expansionist monetary policy used to fight bank failures? A renewed intermediation is supposedly a condition for enhancing economic growth. But since the Fed never acted over this period as a lender of last resort, more plausibly this medium term positive effect may directly reveal a kind of "survival of the fittest" syndrome. Eliminating "bad banks" (and not funding them) acts as a "purge" to restore confidence in the banking system and improve medium term economic recovery.

[4] C. Romer (2009).

- Thirdly, *the incidence of increasing the interest rate suggests that "Avoiding the Trap" was a good policy to enhance medium term economic growth.* After 6 months, the impact of raising the interest rate on economic growth is almost continuously positive (except for an episode of 2 months around the 15th month). This corroborates the underlying situation of liquidity trap at the very beginning of the period: expecting an increase in the interest rate, economic agents prefer to hoard money. This has no impact on economic growth over the six first months. After that, the recession is better contained and less persistent. Thus, an increase in the interest rate may help break the speculative demand for money and restore confidence in economic recovery[5].

4.2.2. Variance Decomposition Analysis (VDA)

Table 4: Variance Decomposition

Months	Aggregate supply shocks (u_y)	Aggregate demand shocks (u_p)	Monetary supply shocks (u_m)	Monetary demand shocks (u_r)	Banking shocks (u_s)
2	0.75	0.02	0.13	0.08	0.02
6	0.49	0.07	0.09	0.31	0.04
12	0.38	0.12	0.07	0.24	0.19
20	0.39	0.11	0.05	0.33	0.12

Table 4 displays the historical decompositions of the real economic activity from 1929:10 to 1933:12. Columns 1 to 5 contain the portion of the real activity that can be respectively explained by aggregate supply shocks (u_y), aggregate demand shocks (u_p), monetary supply shocks (u_m), monetary demand shocks (u_r) and banking shocks (u_s).

The VDA results corroborate the IRF analysis:

- The liquidity trap constraint almost annihilates the efficiency of expansionist monetary policy: the contribution of the monetary supply shock is the weakest of all after twenty months (5%). This result calls into question the monetarist claim for an increase in the money supply as a solution to the financial crisis.
- The liquidity trap constraint explains why the contribution of the interest rate channel is so important with 33% (ranking second behind the aggregate supply shock with 39%).

[5] This finding echoes Ariccia-Blanchard-Mauro's suggestion to increase the interest rate in the current crisis situation. See "Rethinking Macroeconomic Policy", IMF note, 2010: "To prick asset bubbles before they grow dangerously large relies on raising interest rate"; "It would have been good to start (the current crisis) with a higher nominal rate".

- We verify the contribution of the banking shocks (12%) as another relevant transmission channel for explaining real variations in US output. Nevertheless, this smaller than expected level highlights that in a liquidity trap context the banking system cannot fully play its role of intermediation.

5. Conclusion

In this article, we have given empirical evidence that a situation of liquidity trap prevailed in the US in 1929 which in turn encouraged the Fed to adopt a new policy rule during the 1930-1933 period. We have called this new policy rule "avoiding the trap". This innovative result which is in contrast to the existing literature on the 1929 crisis is corroborated by the simulations undertaken in a SVAR framework. The liquidity trap context explains why expansionist monetary policy would have had a limited effect on real economic activity and only in the very short term. The monetarist lessons from the 1929 crisis (Friedman and Schwartz 1963; Bordo et al. 2002) should then be balanced out. In no way, could a miracle in terms of economic growth be expected simply by means of an expansionist monetary policy.

Another key finding is that the channel of run deposits ("Bernanke effect") was obviously linked to a liquidity trap context. Our simulations indicate that the Great Depression would have been better contained and less persistent following an increase in interest rates that break the speculative money demand and restore confidence in economic recovery, rather than increasing the money supply.

We consider that the lessons from the Great Depression have been partially misunderstood. Our diagnosis of the 1929 crisis is that the banking channel was obviously combined with a liquidity trap context. We highlighted in a SVAR framework that faced with this double constraint, two policy tools were required:

- Expansionist monetary policy proved to be inefficient in restoring economic growth; then, the quantitative side of monetary policy ought to be devoted to combat banking panics which does not mean funding "bad banks";
- An adequate interest rate policy means an interest rate that endeavors to avoid the liquidity trap. Indeed, we found that "avoiding the trap" would have been a decisive manner in which to foster economic growth in the thirties.

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