



Money growth and inflation: Policy lessons from a comparison of the US since 2008 with hyperinflation Germany in the 1920s



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HIGHLIGHTS

- Comparing inflation in post-Lehman US and in hyperinflation Germany for identical base expansion.
- Inflation many folds higher in Germany which appears to be puzzling for quantity theory of money.
- A resolution in terms of the quantity theory.
- Other background institutional and political factors.
- Implications for monetary policy

ARTICLE INFO

Article history:

Received 16 September 2016

Received in revised form

21 February 2017

Accepted 26 February 2017

Available online 28 February 2017

JEL classification:

E3

E4

E5

E6

Keywords:

Inflation

Money

US deflation

German hyperinflation

ABSTRACT

The quantity theory of money implies that sustained inflation requires a sustained increase in the money supply. It does not, however, imply that all increases in the money supply are inflationary. This letter explores and illustrates this issue by comparing the inflationary consequences of the same base expansion in the US following the collapse of Lehman Brothers with Germany's hyperinflation experience after WWI. A key factor explaining the vastly different inflation experiences between those two episodes is how the monetary expansion translated into demand. The Fed's base expansion did not translate into demand for goods and services since most of it was absorbed by a huge increase in demand for liquidity by financial institutions. By contrast, the German monetary expansion was immediately translated into demand for goods and services since it was motivated by government's hunger for seigniorage revenues.

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The famous (Friedman, 1963) dictum “Inflation is always and everywhere a monetary phenomenon”, by Milton Friedman succinctly summarizes a basic implication of the quantity theory of money for the relation between money and prices. It has been an empirical beacon for generations of students of inflation as well as for central bankers. Translated into more precise terms, it implies that a necessary condition for sustained inflation is a sustained increase in the quantity of money. But it does not imply that all persistent increases in the quantity of money are necessarily inflationary. In particular, when increases in money supply are matched by increases in money demand even the simple quantity theory implies that the price level should not change. More gen-

erally whether persistent monetary expansion induces persistent inflation depends on a number of additional economic and institutional factors that transcend the run of the mill quantity theory of money.¹

This letter illustrates and discusses those issues, first by documenting the dramatic difference between US inflation since Lehman's collapse and inflation during the first half of the post-WWI German hyperinflation for identical rates of expansion of high-powered money, and second, by analyzing the reasons for this difference.

¹ More sophisticated versions of the quantity theory accommodate some but not all of those factors. An early example is Cagan (1956) who explicitly recognizes the effects of changing expectations on velocity and the dynamics of inflation.

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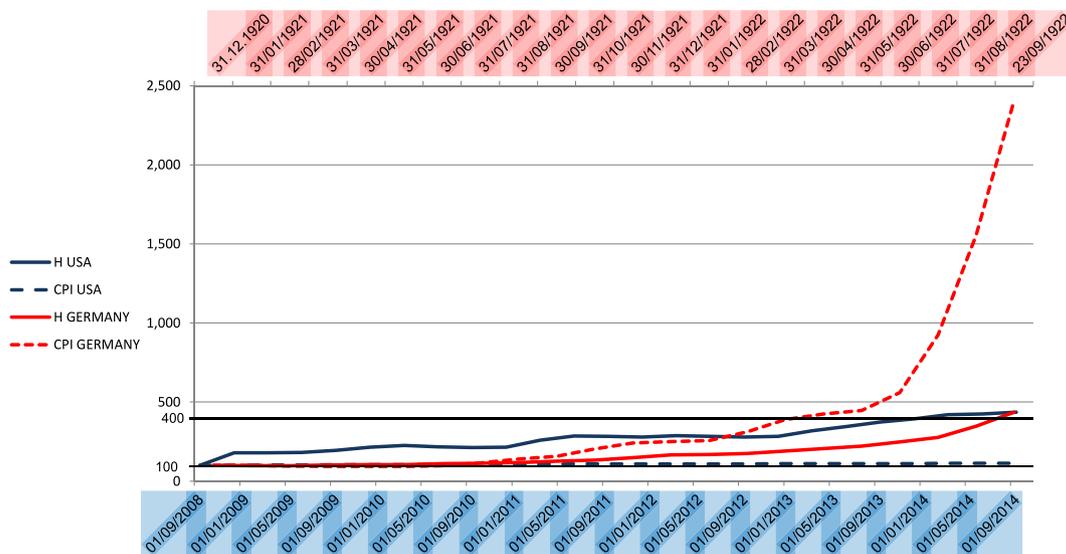


Fig. 1. The behavior of the monetary base and the price level in the US since Lehman's collapse and during the German Hyperinflation: A comparison.² Source: (i) *H* and CPI for USA: Federal Reserve Bank of St. Data Base (ii) *H* and CPI for Germany: Calculated from data in Table 1 of Cukierman (1988).

1. Inflationary consequences of the same money base expansion: hyperinflation Germany versus the US in the aftermath of Lehman's collapse

Fig. 1 displays the evolution of high-powered money and inflation in the US starting in September 2008 till September 2014 and in Germany starting from December 1920.³ The values of the monetary bases and of the price levels in both the US and Germany are normalized to 100 at the beginning of each of those two periods in order to provide a common comparative scale for the two episodes.⁴ For the same reason, the initial periods of the two episodes are located at the same extreme left-hand sides of the horizontal axis, where the chronological dates for the US are displayed on the lower horizontal axis and those for Germany on the upper horizontal axis.

Between September 2008 and September 2014 base money in the US increased by a factor of 4.35 (435%). In order to compare the inflationary consequences of the same base money expansion in today's US with those of the German hyperinflation 90 years ago; the German data is truncated when the cumulative rate of base money expansion equals that of the US between September 2008 and September 2014. This occurs in September 1922, which is about 15 months prior to the end of the hyperinflation. The figure essentially replaces chronological time with time units anchored on identical rates of base money expansion. The blue and red lines in Fig. 1 refer to the US and Germany respectively. The solid lines stand for the evolutions of the base money stocks and the dashed lines for the evolution of the price levels, all in comparison to their respective base periods. Consequently a point on any of the curves shows by how much high powered money or the price level have increased in comparison to their common base period.

For Germany the figures show that, following a period of about seven months during which the price level increased less than high-powered money, there was a persistent acceleration of

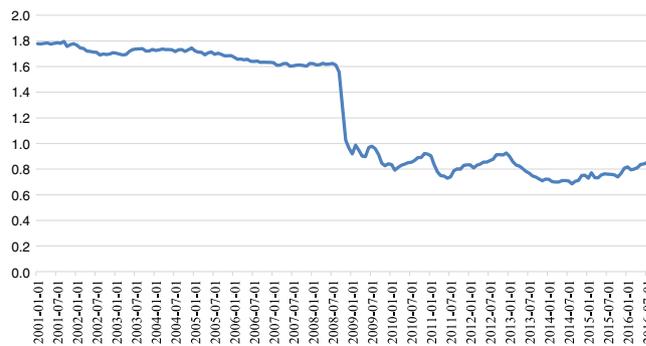


Fig. 2. Behavior of the US monetary multiplier (January 2001–September 2016). Source: Calculated from data on the monetary base and M1 from the Federal Reserve Bank of St Louis monetary data base.

inflation much beyond the rate of base money expansion. As a result, the German price level in September 1922 was 24 times higher than in December 1920. During the same period, base money increased only by a factor of 4.35. By contrast, in the US the cumulative rate of increase in the price level is consistently much lower than the cumulative rate of base expansion. The cumulative CPI increase between Lehman's collapse and September 2014 is 12.4%. This is obviously miniscule in comparison to the 435% increase in the monetary base.

What are the reasons for this dramatic difference in inflation outcomes? The most important economic reason is that, in post Lehman's US, expansion of the base was hardly translated into higher demands for goods and services, while in Germany during the twenties practically all the expansion in high-powered money was used from the start by Government to finance the state budget.⁵ In the US since September 2008 about three quarters of the huge monetary base expansion took the form of an increase in bank reserves at the Fed without any appreciable impact on credit growth. As a consequence, higher order monetary stocks in the public's portfolio and (relatedly) the transmission to the demand for goods and services was much weaker than suggested at first

² The values of the monetary bases and of the price levels US and Germany are all normalized to 100 beginning of each of two periods (Sept 2008 for the US and December 1920 for Germany).

³ Cagan (1956) estimates the semi elasticity of the demand for money during the German hyperinflation using data between September 1920 and July 1923 (Table 3 in Cagan op. cit.).

⁴ Hence, by construction all four graphs start from a common base of 100.

⁵ In Cukierman (1988, 47), I calculate that during 1921, 1922, and 1923, seigniorage financed 56%, 64%, and 89% of the German Government budget, respectively.

blush by the figures on base expansion.⁶ The upshot is that the Fed's base expansion did not translate into demand for goods and services whereas the German monetary expansion was motivated from the start by a strong hunger on the part of government for seigniorage revenues.

2. Comparison of the two episodes using the quantity theory equation of exchange

The difference between the two episodes can be illustrated within the following run of the mill formalization of the quantity theory of money

$$MV = PY$$

where M , V , P and Y are the quantity of money, the velocity of circulation of money, the price level and real output respectively. In its simplest form this "equation of exchange" implies that, for relatively immobile values of velocity and output, aggregate inflation is determined mainly by the rate of growth of the money supply. However, this formulation is silent about the empirical counterpart of the money supply, M . Is it the monetary base, H , narrow money, $M1$, or perhaps, as Friedman advocated, $M2$ which also includes longer term deposits? Most economists believe that the rate of growth of $M1$ is the most relevant for inflation. On this view M in the equation of exchange should be replaced by $M1$.

Since the comparison in Fig. 1 is in terms of H rather than in terms of $M1$ it is necessary to provide a link between $M1$ and H . As is well known the relation between those two stocks is affected by the level of banking credit and by the public's demand for cash. A reduced form formulation of the relation between the endogenous $M1$ and the monetary base, H , is given by the money multiplier. The money multiplier is defined as the ratio between $M1$ and the monetary base, H . Under the assumption that banks' desired reserve ratio between reserves and deposits, r , and the cash to deposit ratio, ρ , are constant the money multiplier, κ , is also constant and is given by⁷

$$\kappa \equiv \frac{1 + \rho}{r + \rho}.$$

Fig. 2 shows the behavior of the US multiplier prior to and following Lehman's collapse. Up to Lehman's collapse the relative fixity of the money multiplier is supported by the data. But, in parallel with the start of large scale quantitative easing operations (QE0) following this collapse, the money multiplier undergoes a dramatic fifty percent drop (from 1.6 to about 0.8). The bulk of this decrease is due to the reluctance of banks to use the huge increase in banks' reserves (due to QE0) to expand credit in the aftermath of the post-Lehman financial panic.⁸ Using the monetary multiplier to express $M1$ in terms of H and substituting into the equation of exchange yields

$$\kappa HV = \frac{1 + \rho}{r + \rho} HV = PY.$$

Since, following Lehman's collapse, real income and the price level in the US did not change much PY was relatively immobile in spite of the huge increase in the monetary base, H . Velocity also did not change much. The formal "explanation" in terms of the equation of exchange is that the relative immobility of nominal

income was mainly due to a large, post-Lehman, decrease in the money multiplier that partially offset the huge increase in H .⁹

By contrast during the German hyperinflation increases in the monetary base were quickly transformed into money by a government that was using monetary base expansion to finance large chunks of its budgetary expenditures. Essentially the German government was using the printing press to finance its expenditures—a process currently dubbed "helicopter money" and recently advocated by some economists as a device for reviving the economy.¹⁰

It is of some interest to compare the behavior of the $M1$ money multipliers in the US and in Germany during the periods covered in Fig. 1. Unfortunately, due to lack of detailed data on German $M1$ between 1920 and 1922, this is not feasible. But existing annual data makes it possible to compare the behavior of the $M2$ German multiplier between the end of 1920 and the end of 1922 with the behavior of the US $M2$ multiplier between September 2008 and September 2014. The $M2$ multipliers went down in both cases; in the US from 8.4 in September 2008 to 2.8 in September 2014, and in Germany from 2.2 at the end of 1920 to 1.2 at the end of 1922.¹¹ The decrease in the post 2008 US $M2$ multiplier reflects the fact that the growth of $M2$ did not keep up with the expansion of the monetary base due to credit arrest and flight to the safety of US government treasury bills. The decrease in this multiplier in Germany between 1920 and 1922 is mainly due to flight away from nominal $M2$ assets in the face of mounting inflationary expectations.

3. Differences in background institutional and political factors

Lurking behind this are important differences in monetary institutions. The Fed is largely independent from political authorities and committed to a low rate of inflation. By contrast, the Reichsbank (the German central bank during the hyperinflation) was largely under the control of German political authorities.¹² For political reasons – related to the structure of war reparations imposed on Germany, in conjunction with a post-war damaged tax collection apparatus – German political authorities had a major incentive to heavily rely on the printing press.¹³ This difference is critical for

⁹ This is reminiscent of the decrease in the money multiplier (and of its consequences) during the great depression documented in Friedman and Schwartz (1963). However there is an important difference. During the great depression the multiplier decreased mainly due to an increase in the cash to deposit ratio, ρ , and banking failures against the background of a passive monetary policy. During the great recession the existence of deposit insurance neutralized the incentive for traditional runs on the banks. In this case the decrease in the multiplier was due to banks' reluctance to lend in spite of a policy induced deluge of reserves. In terms of the money multiplier formalism this took the form of an increase in the reserve ratio, r .

¹⁰ See for example Caballero (2010).

¹¹ The multipliers for the US are obtained by dividing figures for $M2$ by the monetary base, both from the Federal Reserve Bank of St-Louis data set. The multipliers for Germany are obtained by dividing the sum of columns 13 through 19 from Table 10 in Holtfrerich (1986) by the monetary base (column 12) from the same table.

¹² Holtfrerich (1986, p. 168) mentions that, at the insistence of the allies, an Autonomy Law meant to strengthen the position of the Reichsbank vis-à-vis Government was passed in May 1922. But the Bank did not use its newly granted legal powers. It continued to discount treasury bills in larger amounts and even started to discount commercial bills as well. Those actions support the view that the actual independence of the Reichsbank was substantially lower than its legal independence. A discussion and implementation of this distinction in the context of the Bank of Israel appears in Cukierman (2007).

¹³ A detailed discussion appears in section 7 of Cukierman (1988).

⁶ Details appear in Fig. 2 and 10A of Cukierman (2016).

⁷ A fuller discussion of this textbook multiplier appears on pages 269–271 of Carlin and Soskice (2006).

⁸ Section 4 in Cukierman (2016) provides a detailed discussion of the reasons for this reluctance.

the anchoring of inflationary expectations. As highlighted by the New-Keynesian literature, the behavior of those expectations has a first order effect on price adjustments in the economy, and therefore on the rate of inflation.¹⁴

In addition, when inflationary expectations go up, the speed of price adjustment by firms in the economy goes up as well after a while. This mechanism further reinforces the acceleration in the rate of inflation.¹⁵ This process reached its full impact on inflation in Germany during the second half of the hyperinflation. During the German hyperinflation central bank actions reinforced a trend of increase in the velocity of circulation of money (Cagan, 1956). By contrast, in the US since Lehman's Collapse, the low interest policy of the Fed reduced the velocity of circulation. As previously explained those differences are traceable to differences in the origins of the original shocks along with different institutional setups.

During the German inflation there was no anchor for expectations. As a consequence, as inflation picked up, those expectations ultimately adjusted upward which raised inflation further. By contrast, in today's US, expectations are tightly anchored by the following two institutional devices:

- Only the Fed decides on monetary policy and the Fed is committed to an explicit inflation targeting regime; and,
- Relatedly, the US Government is prohibited from relying on seigniorage to finance deficits.

Admittedly the Fed has to turn the profits that accrue to it as a result of its independent monetary operations to government every week. But government cannot influence the size of those profits in order to tailor them to its fiscal needs. Those two factors contribute a lot to the current credibility of monetary policy in the US and through it to the anchoring of inflationary expectations.

Last but not least, following WWI, the German government had little or no access to international capital markets.¹⁶ As a consequence, the main (if not only) way to finance deficits was via monetary expansion. By contrast the US enjoys unparalleled access to both home and international capital markets as well as the privilege to borrow in its own currency.¹⁷ Thus, US fiscal authorities have no reason to rely on seigniorage revenues even in the face of substantial deficits. Consequently, the credibility of low US inflation is backed not only by the law that prohibits government from directly borrowing from the Fed but, more fundamentally, by the US Government's easy access to financial markets.

¹⁴ Standard references on New-Keynesian models are (Woodford, 2003; Gali, 2008).

¹⁵ In terms of the New-Keynesian model this means that the Calvo coefficient changes with the customary level of inflationary expectations and so does the degree of indexation. Evidence from Israel, whose rate of inflation fluctuated widely over the past sixty years, shows that the degree of indexation and the pass-through coefficient from the exchange rate to domestic prices are both positively related to average inflation (Cukierman and Melnick, 2015, sections 7 and 8).

¹⁶ But until summer 1922 the private German sector benefitted from short term capital inflows mainly from foreign investors who speculated on a recovery of the depreciated German Mark (Holtfrerich, 1986, pp. 76–79). Nonetheless there is little doubt that the post 2008 access of the US government to international capital markets is substantially higher than that of the German government between 1921 and 1923 including in particular the subperiod ending in summer 1922.

¹⁷ Valéry Giscard d'Estaing, de Gaulle's finance minister during the sixties, referred to this privilege as "exorbitant" (Eichengreen, 2011). This highlights the fact that not many countries possess the ability to borrow in their own currencies.

4. Implication for current monetary policy choices

The inflationary experience of the post-WWI German hyperinflation contributed a lot to monetary policymakers' belief that large liquidity injections by central banks invariably endanger price stability.¹⁸ As a matter of fact, during the first several years following the outbreak of the Global Crisis, some practically oriented central bankers worried that the large liquidity levels created by the Fed will ignite the fires of inflation. An outspoken example of this view is (Issing, 2012). An important lesson from the comparison between German inflation some 93 years ago with recent inflation in the US is that, due to profound differences in economic circumstances and institutions, such fears are grossly exaggerated.

Acknowledgments

The letter benefitted from the suggestions of an anonymous referee and of Carl-Ludwig Holtfrerich on previous versions. Gabi Gordon provided efficient research assistance. The usual disclaimer applies.

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¹⁸ Based on extensive data for this period (Bresciani-Turroni, 1937) argues that the main driver of the German hyperinflation was the persistently high rate of monetary expansion.