The Weimar Hyperinflation:

Germany after World War I

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Germany after World War I:
Hyperinflation and Stabilization

Perhaps the most frequently cited episode in monetary economics is the post World War I hyperinflation in Germany. The price inflation of 1922-23 peaked in October of 1923 with a monthly inflation rate over 29,500 percent. Tales are told of Germans trundling wheelbarrows full of *papiermarks* to the grocery store, of walls papered with currency, and of *papiermarks* used as notepaper. People tried to spend their wages as quickly as possible to avoid the higher prices that would be coming quickly, an action that only promoted further inflation and disrupted production. To provide some scale to the problem several examples suffice. At the peak of the hyperinflation a postage stamp cost 5 *billon* paper marks, a U. S. dollar cost 4.2 *trillion* paper marks; and the pre-war *goldmark* rose from one *papiermark* to one *trillion papiermarks*.

The German hyperinflation is often cited as support for the Quantity Theory of Money, the idea that the supply of money is the primary determinant of the price level, and that the rate of growth of the money supply is the primary determinant of the rate of price inflation. The Quantity Theory, around since Richard Cantillion promoted it in the 16th century, was the intellectual foundation for John Law's radical revamping of public finance in early 18th century France, and it is the basis of the modern doctrine of "Monetarism" espoused by Milton Friedman, the Nobel Prize winning economist who famously stated that, "Inflation is everywhere and always the result of money."

Before discussing the hyperinflation and its solution, some background into German history is useful. We conclude with brief remarks on the Quantity Theory.

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Germany Before Hyperinflation

Prior to WWI Germany had two currencies: the *papiermark* and the *goldmark*. The *papiermark*, issued by the Reichsbank, had no commodity backing and could be issued in unlimited quantities; it was simply paper whose value depended solely on what people would exchange for it. The *goldmark* was introduced after the 1871 Franco-Prussian War, when Germany adopted the gold standard (which then spread to other European countries and to the United States). The *goldmark* was convertible into gold at a fixed price of 2,790 *goldmarks* per kilogram of gold: at the average 1921 U. S. gold price ($20.58 per ounce), this amounted to 3.83 *goldmarks* to the dollar.

The gold standard limited the supply of *goldmarks* by setting a gold-reserve requirement: the government had to maintain a stock of gold equivalent to a fixed proportion of *goldmarks* in circulation. Thus, if, say, the gold-reserve requirement was twenty percent, the amount of *goldmarks* in circulation could be no greater than five times the government's gold reserves. Convertibility between the *papiermark* and the *goldmark* ensured that the amount of currency in Germany was limited. But the *goldmark* was eliminated in 1914 when the war began, leaving *papiermarks* as the sole currency and ending limits on the quantity of *papiermarks*.

After the war, Germany had a number of serious economic problems. The Weimar Republic's budget required expenditures of about 25 percent of national income just for war-related reasons, such as services to veterans and service on the war debt. To meet these expenses with a tax levy would require a general income tax of about 25 percent, very high for the time, especially since, as we will see, German production was falling and German citizens were under great financial and psychological stress.

To this deficit was added war reparations amounting to about 10 percent of national output.[1] France was especially punitive, and at its insistence the 1919

[1] These data are cited in Roselli, Alessandro. *Money and Trade Wars in Interwar Europe*, p. XX

Treaty of Versailles levied an interim reparations requirement for 1919-1921 and established a Reparations Commission that would meet in 1921 to determine the future payments Germany would have to make to the allied nations (particularly France). This prompted John Maynard Keynes to write *The Economic Consequences of the Peace*, a tract accurately predicting what was to come.

The 1921 commission set reparations at a total of 132 billion *goldmarks* to be paid over a period of 100 years.[2] The German obligation was structured in three types of bonds, cleverly called A, B, and C bonds. Each class of bonds carried a 5 percent interest rate, payable in the *goldmark* equivalent, and a payment schedule was attached. There was an important exception: C bonds, totaling 82 billion gold marks, were a political fiction requiring no payments; this fiction was designed to make the punitive French public feel that they had more severely punished Germany. Thus, the actual required reparations were 50 billion *goldmarks*, the equivalent of 634.3 million ounces of gold, or 135 billion dollars. Payments could be made in territory, hard currencies and gold, exported goods, or other acceptable means.

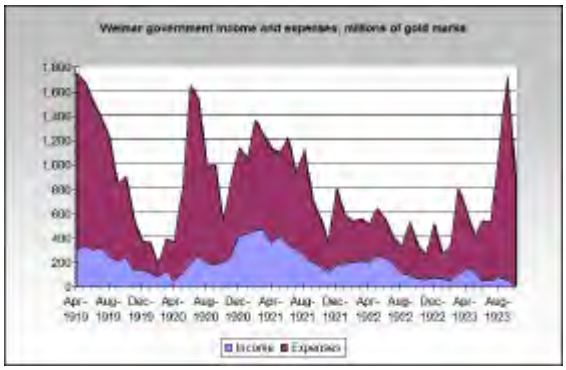
Between 1919 and 1921 Germany paid the equivalent of 9 billion *goldmarks*, leaving 41 billion to be paid under the 1921 reparations agreement. In each year, Germany was required to pay an estimated of 2 billion *goldmarks*. A significant component of the annual reparation payment to France was in coal produced in Germany's Ruhr region. This was a particularly important commodity—it was the basis of residential and industrial heat and power, and it was essential to production of steel.

The 2-billion *goldmark* annual reparations payments were equivalent to a large tax on Germany's national income, amounting; as noted above, according to Roselli (2014), total annual reparations were roughly 10 percent of national output. Germany's gold reserves had been reduced (but not depleted) during the war (and by futile postwar efforts to maintain the foreign exchange value of the *papiermark*), so the primary mode of payment was through exporting more goods (some of it the

[2] True, the goldmark didn't exist as a tangible medium of exchange. But it was still used as a unit of account in which to measure "real" values in gold equivalents.

mandated coal exports from the Ruhr) and importing less, thus creating an current account surplus that brought hard currencies (dollars, pounds).

As shown below, the Weimar Republic's deficit in August of 1923 exceeded the previous peak deficit just after the war, in part because of the decline in tax revenues associated with the breakdown of the economy.



Getting Germany's fiscal house in order was essential, but the 35 percent tax on national output needed to pay for normal and war-related expenses could not be levied. To do so would create an existential problem for the population, which was also suffering from lack of basic fuel, large spending requirements to attempt to reduce the hardship for the population, and continued payment of Ruhr coal miner wages. Faced with this, Germany defaulted in 1922 by refusing to ship coal from the Ruhr to France. In 1923 the French retaliated by occupying the Ruhr and forcing Germany to transfer its coal (while, of course, requiring Weimar to pay the Ruhr coal miners).

With no access to credit markets because of inflation—few would lend to the Weimar Republic knowing that the value of the loan was uncertain because of credit default risk and depreciation—the government financed its deficits by issuing *papiermarks* through the Reichsbank.[3] The result was explosion in the quantity of

[3] The government did not directly print and issue new *papiermarks*. The mechanism for money creation was that the government issued short-term notes that were bought by the Reichsbank. The Reichsbank paid for those notes by giving the government credits denominated in papiermarks. The credits could be used to pay for goods and services, thus adding to the currency and bank deposits in circulation. This is essentially the way the money supply is created today.

papiermarks and accelerating inflation. In effect, it created an inflation tax on money by beating the public to the punch—issuing money to buy resources before the public could also spend it and drive inflation up further. Of course, at some point the public caught on and began anticipating increases in future inflation to avoid the inflation tax by spending first.

This "solution" to the fiscal problem resulted in rapid depreciation of the *papiermark* both domestically in terms of the *papiermark*'s purchasing power, and in foreign exchange markets (in terms of hard currencies that a *papiermark* would buy). As the *papiermark* depreciated in foreign currencies, the rate of inflation was pushed up by even higher prices of imported goods. As inflation accelerated, the papiermark depreciated faster than the inflation rate and the real exchange rate rose; this increased foreign demand for Germany's exports and dramatically increased the cost of its imports.

The very high and accelerating inflation resulted in even less access to foreign credit and imposed high costs on the German population: the real cost of imports rose, the distribution of wealth shifted dramatically against those who had saved in the past and in favor of those who had not; creditors were wiped out while debtors gained; pensions were wiped out; chaos in production of goods was created as workers focused their energies on spending wages as rapidly as possible; producers and workers resorted to barter their products rather than accept cash.[4]

The state of production and employment in the hyperinflation is suggested below. Note the plunge in national real income, and the associated jump in trade union employment, in the fall of 1923. It was during this crisis period that a solution to the problem was developed.

[4] During this period German wages were generally indexed to inflation, so the hyperinflation was immediately transmitted to wages; in the fall of 1923 many companies recontracted wages daily to keep the *papiermark* wage up with inflation on a day-by-day basis, but even so worker's wages fell behind on the trip from the workplace to the grocery store.

INDEX OF AGGREGATE REAL INCOME OF GERMAN INDUSTRIAL POPULATION, 1920-1923[73]

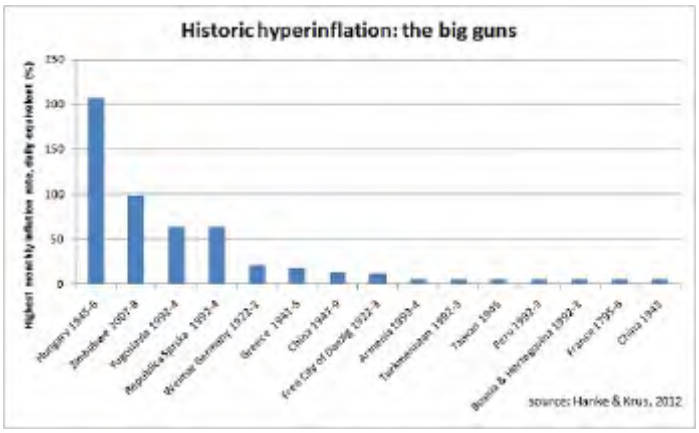
YEAR		APPROXIMATE INDEX NUMBER (1913-1914 = 100)
Yearly average	1920	60-85
" "	1921	75-105
" "	1922	70-90
Jan. to August	1923	58-76
November	1923	36-47

TABLE XL

UNEMPLOYMENT AMONG TRADE UNION MEMBERS, BY MONTHS: 1922–1923[74]

DATE		PERCENTAGE WHOLLY UNEMPLOYED	PERCENTAGE PARTIALLY UNEMPLOYED
1921: yearly average		2.8	5.4
1922	Jan.	3.3	1.6
	April	0.9	0.6
	July	0.6	0.8
	Oct.	1.4	4.7
1923	Jan.	4.2	12.6
	Feb.	5.2	14.9
	Mar.	5.6	23.6
	April	7.0	28.5
	May	6.2	21.7
	June	4.1	15.3
	July	3.5	14.5
	Aug.	6.3	26.0
	Sept.	9.9	39.7
	Oct.	19.1	47.3
	Nov.	23.4	47.3
	Dec.	28.2	42.0

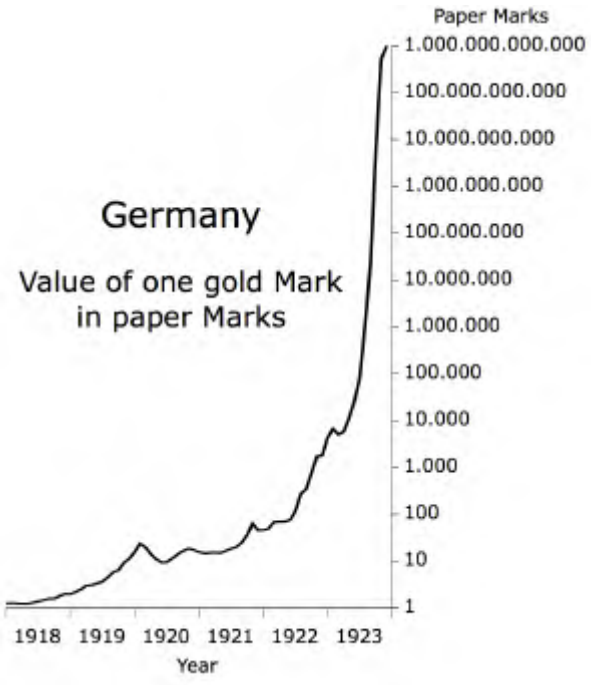
The Quantity Theory predicts that as the paper money supply exploded, the rate of inflation would soar; and so it did. By mid-1923 rapid inflation had turned into uncontrollable hyperinflation. Surprisingly, this was not the granddaddy of all hyperinflations: it is "only" the fifth highest in the Hanke-Krus list of fifteen hyperinflations shown below. The chart below shows the highest *daily* inflation rates in the top fifteen hyperinflations. The peak daily rate (wholesale prices) in the Weimar Republic was 20.9 percent, occurring in October 1923. At this rate it took 3.7 days for prices to double, and if maintained for the full month the October inflation rate would have been 29,500 percent.


Historic hyperinflation: the big guns
Highest monthly inflation rate, daily equivalent (%)
250
200
150
100
50
0
Hungary 1945-6
Zimbabwe 2007-8
Yugoslavia 1992-4
Republika Srpska 1992-4
Weimar Germany 1922-3
Greece 1941-5
China 1947-9
Free City of Danzig 1922-3
Armenia 1993-4
Turkmenistan 1992-3
Taiwan 1945
Peru 1990-1
Bosnia & Herzegovina 1992-3
France 1795-6
China 1949
sources: Hanke & Krus, 2012

The German Hyperinflation

The chart below shows the course of German inflation in 1918-23. As noted above, the *goldmark* didn't exist in a tangible form during this period: it had been abandoned in 1914 with the beginning of the war because Germany's gold reserves were insufficient to maintain *goldmarks* as a convertible medium of exchange. However, it did serve as a unit of account, that is, as a way of measuring value: the *goldmark* was defined as 2,790 *goldmarks* per kilogram of gold, or about 475 goldmarks per ounce of gold, one *goldmark* was equivalent to .0126 ounces of gold. Thus, the goldmark had a "real" value for accounting purposes—used to measure prices in terms of gold—but it was not a tangible currency.

The chart below shows the *papiermark* price of one *goldmark* in the 1918-1923 periods.



From 1918 through 1919 the *papiermark* value of a *goldmark* increased about 50-fold, a 600+ percent annual rate of inflation. By the end of 1921 it had roughly doubled from its year-end 1919 level, a "mild" 40+ percent annual inflation rate. During 1922 the price of a goldmark increased another 50-fold, over 600+ percent annually. During 1923 the price of a goldmark increased one *billion*-fold. At the end of 1923 it took 1 *trillion papiermark*s to equal one *goldmark.*

It was clear that something needed to be done, and good minds were bent on finding the solution. Of course, the fundamental problem was fiscal, not monetary—the deficit *had* to be financed by nonmonetary debt but without confidence that loans would retain their value the only mode of finance was issuing *papiermarks*. Attention focused on actions that might restore Germany's access to foreign credit markets. To do this, the inflation rate had to be brought down to a normal level.

One proposal was to replace the *papiermark* with a commodity-based currency. A new currency based on rye, a rye-mark or *roggenmark*, was sent up the flagpole, but it was not saluted because the price of rye fluctuated too much relative to other prices: rye served poorly to mimic the average price of goods. The final choice was to introduce an indexed currency that would maintain a constant value in terms of gold, like the *goldmark*, but would not be directly convertible into gold. In October 1923, the Weimar Republic created a new financial institution and two new financial instruments.

The financial institution was the *rentenbank,* and the two financial instruments were the *rentenmark* and the *rentenbriefe.* The *rentenbank* was a private bank capitalized with 3.2 billion *goldmarks* in mortgage bonds (earning 5 percent) on industrial and agricultural land; half of its capital was provided by the agricultural sector, half from industry. The bank allocated 2.4 billion *goldmarks* as capital, keeping the remaining 800,000 *goldmarks* in a reserve account. The mortgage loans had principal and interest indexed to the price of gold, so they were "real" assets. Note that they were not directly convertible into gold, but that their principal and interest was payable in gold-equivalents.

The bank made loans to the government (loans to government were capped at 2 billion *goldmarks*) and to the private sector, paying for those loans in

*rentenmark*s. It could issue *rentenmarks* up to its initial capital of 2.4 billion *goldmarks*. Because *rentenmarks* could be converted into shares of the underlying mortgage bonds (called *rentenbriefes*), the *rentenmark* was a "real" asset to its holder and a "real" liability of the bank; it was "real" currency

To complete the transition to a "real" currency, the "real" nature of the *rentenmark* was transferred to the *papiermark* by fixing the exchange rate at 1 trillion *papiermarks* per *rentenmark*—one could exchange an unlimited amount of between *rentenmarks* and *papiermarks* at this ratio; this convertibility made *papiermarks* and *rentenmarks* equivalent. The *rentenmark* was also convertible into U. S. dollars at 4.2 *rentenmarks* per dollar.

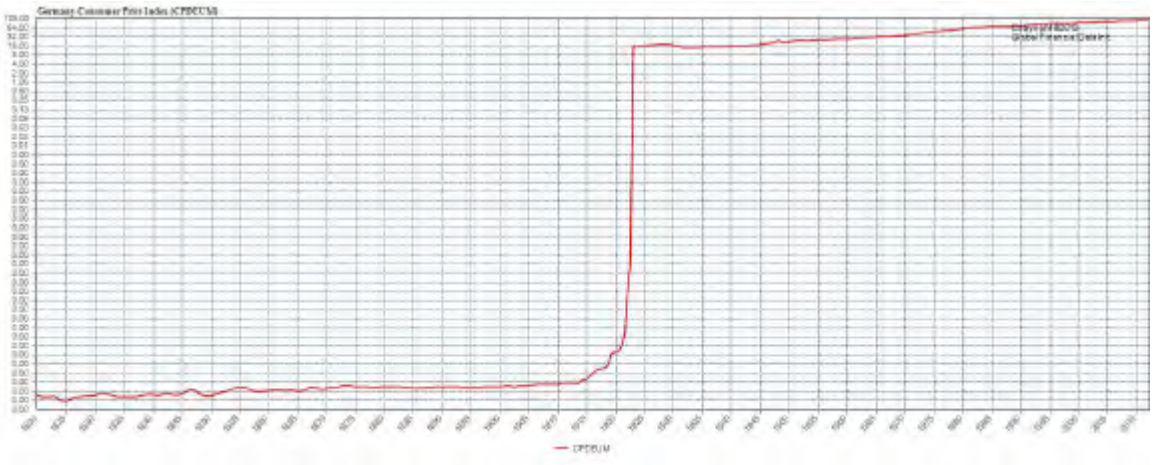
The effect of all this was to re-establish something very similar to the pre-war *goldmark*: it was convertible into (something like) gold, as well as into dollars, and *papiermarks* were convertible into the new currency. Yet, creatively, no gold was needed. Today we would call this "creative accounting," but back then it was just creative.

Of course, the method could have failed in a number of ways. For example, the Reichsbank might have continued issuing *papiermarks* hand-over-fist until the public, seeking a store of value, wanted to convert more *papiermarks* to *rentenmarks* than the quantity of *rentenmarks* would allow. This would leave an overhang of unsatisfied *papiermark* holders who wanted to convert and the *papiermark* price of a *rentenmark* would rise. In that case *rentenmarks* would be used only as a store of value, and *papiermarks* would be the sole medium of exchange with no fixed link to the *rentenmark*.

Second, the public could have converted *rentenmarks* into *rentenbriefs* until the *rentenbank*'s primary asset (and with it the bank's capital) slipped so low that convertibility was threatened and the *rentenmark* disappeared from circulation; this would restore the status quo ante of a *papiermark*-only economy.

Fortunately, neither of these or other scenarios occurred. The reason is that the public's confidence in the *papiermark* was restored by its convertibility into something "real" (the *rentenmark*). The flight from the *papiermark* into foreign currencies and domestic goods ended. As shown below, German inflation abruptly

stopped in late 1923, and with this foreign investors again became willing to lend to both the public and private sectors in Germany. Government credit was restored, and the Weimar Republic was able to finance its deficits with foreign and domestic credit rather than money creation.



Why did the *rentenmark* experiment stop Germany's hyperinflation? Many economists have treated it as a gimmick that worked solely through psychology—the *rentenmark* increased the public's confidence that the inflation would end, or, said alternatively, it reduced the rate of inflation that Germans *expected* to prevail in the future, thus making them behave as if the inflation had ended and thereby ending it. It was a self-fulfilling prophecy but no gimmick—it derived from a correct understanding that psychology is the essence of inflation.

There certainly was an important psychological element to the plan, but how was this transmitted to reality on the ground? First, by thinking that inflation would end, Germans could feel more comfortable returning to their habit of saving for the future rather than spending for the present. Second, producers and workers could stop devoting energy to beating inflation and return to their primary jobs as producers and workers in a credit-based economy. Third, the efforts to beat inflation through barter and other inefficient methods could be abandoned. Fourth—and perhaps most importantly—both domestic and foreign banks and other institutions could begin to lend to Germany again with some confidence that

the rapid depreciation of the mark was over. The net result was that the public finance in Germany was restored—the Republic could finance its deficits by borrowing both domestically and from abroad rather than issuing paper money. In essence, self-fulfilling expectations corrected the problem.

The *rentenmark* was intended as an interim monetary reform to be adopted while a long-term solution to the currency situation was explored. If the interim solution worked to end hyperinflation and to restore Germany's access to credit markets, a new stable and permanent institutional structure could be adopted. That long-term solution was of a more traditional form.

In August 1924 the *rentenmark* was replaced by the *Reichsmark*, a paper currency with a required gold reserve of 30 percent that limited *Reichsmarks to* 3½ times the gold held by the Reichsbank. The old *papiermarks* could be converted into *Reichsmarks* at a trillion-to-one ratio. Twelve zeros were knocked off of all prices so that, for example, the 4.2 trillion *papiermark* price of a dollar became 4.2 *Reichsmarks* to the dollar. The *rentenmark* became equivalent to one *Reichsmark* and the *rentenmark* was retired, leaving the *Reichsmark* as the sole currency.

Of course, this required confidence that the Republic and the Reichsbank not return to their evil ways. The appointment of Hjalmar Schacht as President of the Reichsbank in November 1923 was salutary. Noted for his "strong money" posture, his appointment enhanced confidence that the Reichsbank's wayward behavior was behind it.

Perhaps of more substantive value was the fiscal reforms associated with the Dawes Plan in September of 1924 (succeeded in 1929 by the Young Plan) to address the "German problem." Among other actions, the Dawes plan re-established the Ruhr as a German territory, restoring to Germany the coal that had been scheduled to be sent to France; it renegotiated the reparations level to one billion *Reichsmarks* annually for five years, rising thereafter to 2.5 billion *Reichsmarks*; it established an $800 million U. S. loan to Germany that restored Weimar's international reserves; and it required an increase in Germany's indirect taxes to meet the new reparations requirements.

In 1924 the government had a surplus. Though deficits returned in later years, they never amounted to those experienced during the inflation and hyperinflation of 1919 – 1923.

The Quantity Theory of Money Revisited

The Quantity Theory (actually, it is more a *description* of inflation than a true *theory*) has often been misinterpreted as the view that the rate of inflation always matches the rate of growth of money. In fact, this is not true, and evidence from the most significant historical example supporting the theory—the Weimar inflation—shows this.

The Quantity Theory is usually represented by an accounting identity called the *equation of exchange*: MV = PT, where M is the money supply, V is the velocity of money (the number of times a "dollar" turns over in a period, P is the price level, and T is the number of transactions in which money is used to buy goods. The quantity theory prediction that the inflation rate equals the money growth rate assumes that the *velocity of money* is constant (the velocity of money is PT/M, a measure of the spending done by an average unit of money).

MV = PT can be rewritten to describe the price level: P = MV/T. If, for example, the number of transactions in an economy is constant, the rate of inflation will equal the rate of growth of money plus the rate of change of velocity, that is (using g_x to denote the percentage rate of change in a variable, x)

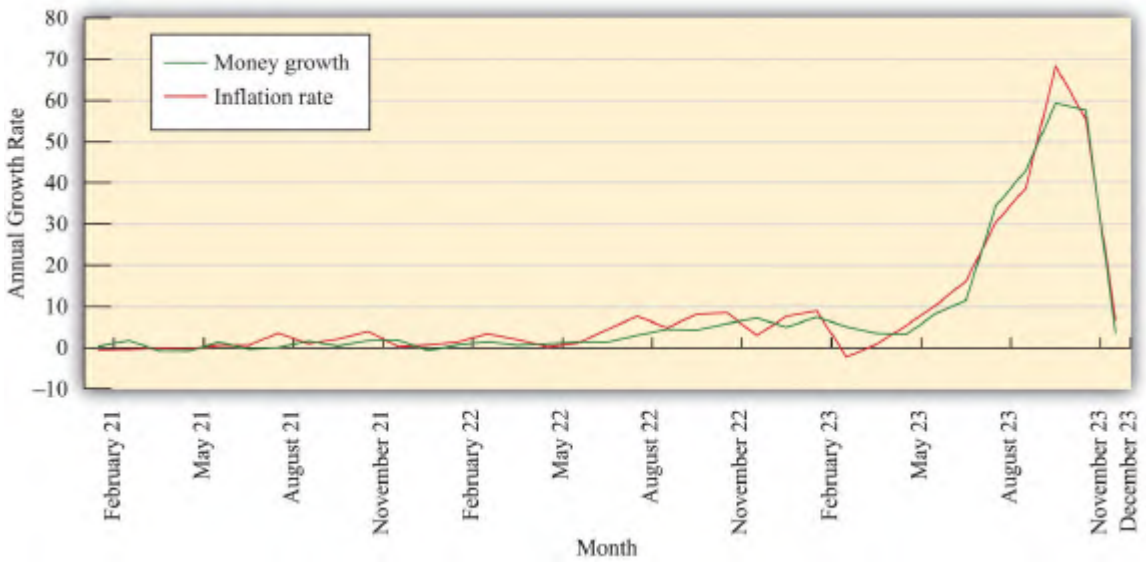
$$g_P = g_M + g_V$$

Thus, the inflation rate (g_P) is the sum of the money growth rate (g_M) and the growth rate of velocity (g_V). The key to a discrepancy between inflation and money growth is the behavior of velocity: if velocity is rising, inflation exceeds money growth; if velocity is falling inflation is below money growth. Now, an established behavior is that when inflation is high, people want to spend money more rapidly and the velocity of money rises, creating inflation in excess of money growth.

The reason is, of course, that the public wants to limit the losses in money's real value due to its depreciation—money becomes a hot potato to be gotten rid of

quickly. The opposite is true when inflation falls—velocity declines as money is more acceptable for longer-term holding.

The chart below shows the inflation rate and the *papiermark* growth rate in the Weimar Republic. Note that in the peak of the inflation episode in October, 1923, the inflation rate was well above the money growth rate, and in early 1923 inflation was well below money growth. Clearly, the money growth and inflation were highly correlated, the lockstep connection of money growth and inflation didn't hold.



Does this refute the Quantity Theory? The answer is a resounding "No." As the chart below show,

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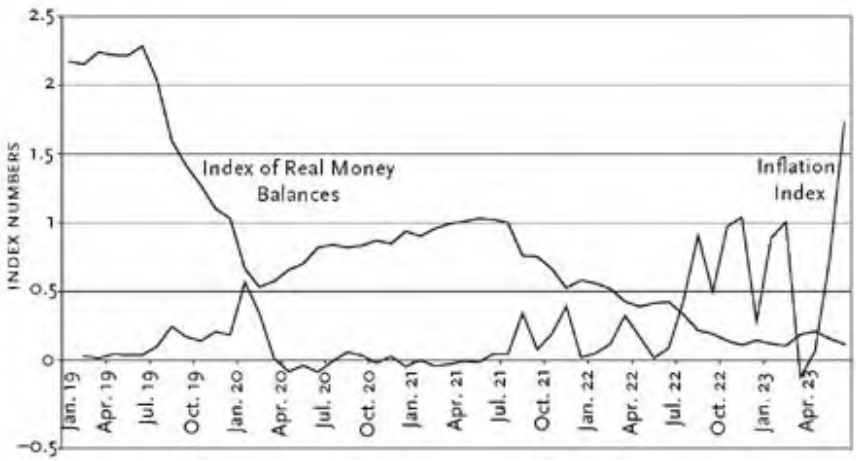
quickly. The opposite is true when inflation falls—velocity declines as money is more acceptable for longer-term holding.

This behavior is shown in the chart below.

The velocity of money rose almost consistently beginning in 1919, but in the fall of 1923 it skyrocketed as the German public worked hard to convert *papiermarks* into goods. Thus, What the chart first and second charts reveal is not evidence against the Quantity Theory but additional support for it.

As inflation exceeded money growth, that is, as velocity rose, the amount of real money balances (in the sense of purchasing power of the money stock) held by Germans fell. The chart below shows this clearly.



When inflation rose during 1919, real balances fell as Germans tried to shed money; from 1920 to mid-1921 inflation was very low and real money balances rose; from mid-1921 early 1923 inflation rose and real balances declined, and with the hyperinflation in late 1923 money balances fell a bit, though by a surprisingly small amount.[5]

[5] Possibly by late 1923 real balances had fallen to a minimal level for transactions in Germany, or, perhaps, anticipations of a successful monetary reform reduced expected inflation and brought velocity down.

Summary

Inflation is primarily a monetary phenomenon, though the inflation rate and the money growth rate are not inextricably in lock step. But, though inflation is "too much money chasing too few goods," the underlying cause of inflation is typically a fiscal problem: the government cannot finance its "needs" with taxes and debt because the tax burden is too high and/or lenders are scarce. In this event, governments resort to money issuance as a means of finance.

The consequence is a high inflation rate and, in many historical episodes, a hyperinflation. An often-cited example is the hyperinflation that emerged in Germany's Weimar Republic after World War I. This episode has often been cited as the poster child for Milton Friedman's dictum that, "Inflation is everywhere and always a symptom of money growth." Friedman, who was a stalwart proponent of the Quantity Theory of Money that underlies this wisdom, never could convincingly explain the Quantity Theory, but it certainly holds true in high-inflation periods.

The Weimar Republic's hyperinflation ended abruptly in late 1923 with a creative financial reform that returned Germany to something like a gold standard. It is possible that this reform would have broken down had it not worked so quickly, but it restored Weimar's public finances and ended the excessive growth in money supply. The fact that it worked temporarily set a background for more permanent reform.

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