

11. INFLATION IN THE INDUSTRIALIZED WORLD

Money as an Institution

Money, the use of tokens that carry value, is an institution of great value to any society. To see this consider the demand curve for money under conditions of inflation. With a fiat (paper or token) money the marginal cost of production of money is essentially 0. The cost of holding a certain stock of money for the public is the nominal interest rate. The nominal interest rate i will be given by

$$i = r + \pi$$

where r is the real interest rate (typically in the modern world around 3%) and π is the inflation rate. The cost of holding a certain amount of currency is the interest you forego by not investing the money in an interest bearing form. Thus if I hold a balance of \$100 in my wallet in cash, and the interest rate is 8%, the annual cost of this is \$8. This cost will lead me to economize on how large a cash balance I hold. As the inflation rate gets higher the cost of holding money as cash gets larger and so the amount people holds should get smaller.

If the government maintains an inflation rate of π then the issue of fiat money generates a revenue for the government per year of

$$i \cdot M = (r + \pi) \cdot M$$

where M is the real (constant value) stock of money people hold. rM is what it would cost per year in real values for the government to borrow an amount M . But when $\pi > 0$, the public has to constantly acquire πM units of new money from the government each year to maintain the real value of their cash balances.

However the generation of this revenue through the **inflation tax** reduces the usefulness of money. It thus causes the loss of consumer surplus shown in figure 1, the **deadweight loss**.

Note that the total value of money as an institution to society is shown by the total area under the curve.¹ We shall see below that evidence from various hyperinflation episodes suggests that this value is great.

¹One implication of figure 1 is that for the most efficient use of money there should instead be a deflation of $r\%$ per year so that the total cost of holding money is truly 0.

Figure 1: The Social Costs of Inflation

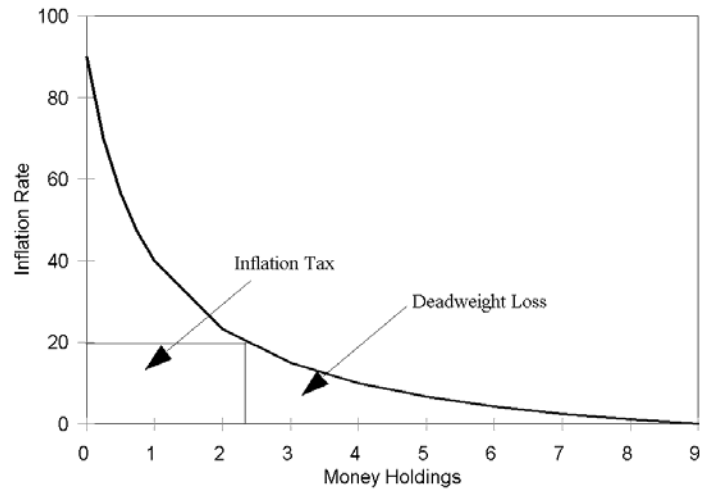
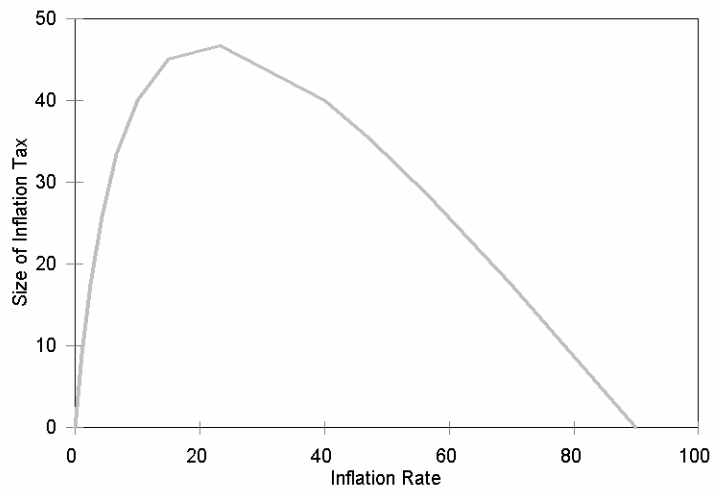


Figure 2: The size of the Inflation Tax and the level of Inflation



The demand curve for money in figure 1 implies that there will be a rise in the revenue the government can collect by increasing the inflation rate from 0, but that eventually the inflation tax revenue will begin to fall as the inflation rate rises further. As the inflation rate rises the costs to consumers for each dollar of the inflation tax raised also rises until eventually for each \$ being raised many times as many dollars in costs are being imposed.

This implies that if a government wants to maximize social welfare it will maintain a stable value currency. It also implies that no rational government, however indifferent it is to the interests of the public, or however constrained it is in raising tax revenue, would ever want to print enough money to drive the rate of inflation above that which generates the peak of the curve in figure 2. Hyperinflations should not occur.

In the modern USA there is a note issue by the Federal Reserve corresponding to about \$1,000 per person. Most of this is not held by US citizens, but is held in other countries which have depreciating, or potentially depreciating local currencies – Argentina, Russia, Ukraine for example. Thus a state that can provide a stable monetary medium can profit from *seigneurage*, the interest free loan that the holders of such currency make to the issuer.

The first known coins were introduced in Lydia, in Asia Minor, circa 640 BC, made out of an amalgam of gold and silver. Thereafter many states produced metallic monies. These monies were partially backed by the value of the gold, silver or copper content of the coins. Thus they are a relatively inefficient way of providing money since there is a significant resource cost to providing this metal content.

But weak governments could debase the value of the coinage below that of the metal content of the coin only to a limited extent. If they debased the coinage too much then the citizenry in a place like Europe would simply use the monies of other states. This competition between monies existed as far back as the time of the Greek city-states.

Thus in most of the pre-industrial world inflation was not a major problem. Table 1, for example, shows the average rate of price inflation in England by century from 1200 to 2000 – though it should be noted that pre-industrial England was known for the sound management of its currency. As can be seen for the 800 years from 1200 to 1900 inflation was generally at very modest rates. Even in the 16th century, the period known as the Price Revolution, the average rate of inflation was less than is the norm in the 1990s in the US and other industrialized countries. Only in the twentieth century have most economies witnessed significant rates of inflation.

Table 1: Average Annual Rate of Price Inflation, England

Period	Average Inflation Rate (%)
1200-1299	0.0
1300-1399	0.1
1400-1499	-0.1
1500-1599	1.4
1600-1699	0.1
1700-1799	0.7
1800-1899	-0.4
1900-1950	-
1950-2000	6.3

There were some countries that did experiment with paper monies. Thus the Chinese emperor first introduced paper money c. 810 AD. The Chinese for the next 500 years had various forms of paper currency, including private note issues by banks. But this paper currency was associated with inflation, and had to be periodically reissued to restore its value. By 1448 the Ming Dynasty note that was nominally worth 1,000 *cash* (a small denomination copper coin) had a market value of only 3. By 1455 in response to these problems China abandoned paper money.

With industrialization in the nineteenth century came also the ability of governments to issue **fiat** money - money backed only by the taxing power of the government. And along with fiat money have come much more frequent episodes of inflation. In Britain, for example, the stress of the Napoleonic War, the First World War, and the Second World War all led to rapid inflations. In the First World War, for example, prices in Britain roughly tripled between 1914 and 1920, an inflation rate of 19%. But there have also been significant peacetime inflations. Thus all across Europe and North America the 1970s and 1980s were a very inflationary decade. The average inflation rate in Britain from 1971 to 1980, for example, was 13.8%. There have also been episodes of hyperinflation.

Latin American countries have been particularly prone to inflation. Thus in 1983 Argentina's prices rose 434%. That was the third year in a row that Argentina had the highest inflation rate in the world.

HYPERINFLATIONS

The German hyperinflation of 1922-3 is the world's most famous, but there were hyperinflations in the 1920s also in Austria, Hungary, Poland and Russia. There was similarly a hyperinflation in Hungary in 1945-6 after the end of World War II. From August 1922 to November 1923 prices in Germany rose by $10^{10.2}$.² By August 1922 the rate of price increases was about 100% per month. At the peak of prices in November 1923 a kilogram of bread cost 428,000,000,000 marks. By November 20, 1923 one dollar was the equivalent of 11.7 trillion marks.

In any economy by definition

$$MV = PY$$

where M is the money stock, V is the velocity of money, P is the price level and Y is real income. As the inflation rate gets greater the real stock of money in the economy (M/P) falls, since holding money becomes very expensive. Thus since

$$M/P = Y/V$$

the velocity of money has to correspondingly increase. The way this happens is that people rush to spend their wages and earnings the very day they get them, and stores rush to turn into goods immediately also. At the height of the hyperinflation in Germany the velocity of money increased to 100 times its normal level, so that relative to real income the real stock of money was only one hundredth of its normal level. We shall see that this decline in the real stock of money makes it very easy, in one sense, to end a hyperinflation.

Once the economy had entered the hyperinflation period it became very hard for people to know what the level of prices was since it was changing day by day. Businesses operated by setting prices according to the exchange rate of the mark with the \$ or the £. By the end of the inflation prices were changing twice a day. The stores would close for lunch to set the afternoon prices.

Interestingly while we think of inflation as being caused by the government printing too much money, peoples experience in Germany at the height of the inflation was of a persistent shortage of money. Because prices were being set with reference to the foreign exchange rate in local areas the price level could get ahead of the supply of currency. The perception of the scarcity of money was greatest in the summer of 1923. A bank clerk in Hamburg, for example, noted in August 1923 that "There is still an alarming shortage of money." Banks would have to ration check cashing after rapid exchange rate depreciation or suspend payments. Private parties would then refuse to accept checks in payment. A printers strike in August 1923 in particular caused great fear of a money shortage.

² This is not the world's record hyperinflation. In Hungary in 1945-6 prices rose 4×10^{27} .

In 1922 local municipalities and private firms stepped in to print up local and private monies. This emergency money was called “Notgeld” = “need money”. The city treasurer in Frankfort in charge of issuing emergency money noted, for example, that “I have printed the lot, everything – I print anything people demand.” While most of this emergency money was denominated in the rapidly inflating mark, some of it was denominated in stable units such as **rye** or **matches**. The Reichsbank, similarly, devoted its energies entirely to the task of printing up enough money. Thus the daily report of the bank on October 23, 1923, near the height of the inflation expresses the regret of the bank at its inability that day to get out paper money as rapidly as was being demanded, and its determination to do better. Bank employees rose from 13,000 to 23,000 in 1923. 132 private companies were hired to assist in printing money. Notes were despatched to banks daily as opposed to monthly.

The hyperinflation caused dramatic reallocations of income within the German economy. By 1920 the German government owed a debt in bonds denominated in nominal terms of 60 b. marks. This was reduced to a value of a few cents by late 1923. The German middle classes were held to be the great losers in this process, but some of them also gained substantially. Thus in 1913 mortgage debts were 40 billion marks, and constituted about one sixth of total wealth holdings in the economy. By 1923 all this mortgage debt was worth 1 cent. There was after stabilization of the currency in November 1923 some revaluation of these debts, however. Apartment rents in these years were fixed by rent control. By 1923 rents had fallen to be only 0.5% of average household expenditure.

Since we saw above that it is not in even the governments own interest to allow inflation to rise beyond a certain level the questions the German hyperinflation raises are:

1. What lead the government into the hyperinflation?
2. Did it indeed have great costs for the economy?
3. How did the government end the inflation?

THE CAUSE OF THE INFLATION

The Monetary Theory

The standard theory of what went wrong in Germany in 1922 is that the weak post war Government was unable to raise enough revenue to finance its expenditures. Thus it was running a budget deficit. But the lack of credit worthiness of the government meant that it had to cover the deficit by printing money. There is a limit, however, to the size of a deficit than can be covered by printing money at a stable inflation rate. The German government simply tried to run to large a deficit through the inflation tax.

Germany had financed World War I largely through **debt**, not taxes. The Germans had expected a short war as in the Franco-Prussian War of 1870 followed by victory and reparations payments from the French. But of course the Germans lost the war after a long and bitter struggle. The London Ultimatum of 1921 fixed reparations payments by Germany at 132 billion gold marks, with interest on any unpaid balance of 5%. Since the GNP of postwar Germany was only about 40 billion gold marks this was a huge sum. The allies set the annual reparations bill to be paid by Germany at 4 billion gold marks, which was 10% of GNP. Thus the German government was expected to raise 10% of GNP for reparations above all other government expenses. Because of the internal economic turmoil the annual reparations payments in the years 1920-3 actually averaged 1.7 billion gold marks only, but this was still an extra cost of 4% of GNP.

At the end of the war the German government had heavy internal expenses to meet. Large numbers of soldiers were demobilized and promised aid to return to civilian life. Germany had also to meet the costs of the Allied forces occupying areas such as the Ruhr. And the government had to maintain large police forces internally because of the threats to law and order from right wing and left wing groups. But the political weakness of the Weimer regime made raising taxes extremely difficult. Thus the record of Revenue and Expenditures for the central government in the years 1919-1923 is as is shown in table 2.

Table 2: Government Receipts and Expenses, 1919-23

Fiscal Year (April – March)	Revenue (b. gold marks)	Expenditure (b. gold marks)	Deficit (b. gold marks)
1919	2.6	8.6	6.0
1920	3.2	9.3	6.1
1921	2.9	6.7	3.8
1922	1.5	4.0	2.5
1923 (7)	0.5	5.3	4.8
1923 (all)	2.6	9.0	6.4
1924	7.8	7.2	-0.6

The deficit in 1919-20 was thus about 15% of GNP. But the central government was collecting in taxes only a meager 5% of GNP. The monetary theory is that this was just too big a deficit to be financed by printing money. But the post war government was politically so weak that it was unable to raise much finance by selling long term fixed interest debt. As the government printed money to cover this deficit it created an ever increasing rate of inflation. By 1921 the government began cutting back its expenditures, but the inflation rate was so rapid by 1922 that the size of the deficit that could be covered by printing money was correspondingly smaller. Also with very rapid inflation it became hard to collect any tax revenue. Since taxes are typically paid with a lag they were largely worthless by the time the government received them.

In the period between the second quarter of 1920 and the second quarter of 1921 the inflation rate was actually close to zero, despite the huge government deficit. The government was able to finance most of the deficit in this period by selling fixed interest securities. But after the London Ultimatum of May 1921 fixed a very heavy reparations obligation on the government it was unable to finance itself except by printing money, and there simply was not enough finance available at a stable inflation rate.

The German Theory

The theory popular in Germany at the time was that the cause of the hyperinflation was the excessive reparations fixed by the Allies. The payment of reparations caused Germany to have persistent Balance of Payments problems in the years 1919 to 1923. This led to a decline in the exchange value of the mark. The rise in the price of foreign goods this created induced, argued some German economists, an upwards push of wages in an attempt to protect living standards. The government was forced to print more money given these wage increases to avoid unemployment. The reparations bill created a need for a substantial decline of real living standards in Germany which workers resisted, forcing the government to resort to inflation to maintain employment levels.

There is, however, little sign of any unemployment in Germany until the very end of the hyperinflation. Thus the unemployment rate by year was:

1920	3.8%
1921	2.8%
1922	1.5%
1923	9.6%

Thus it does not look like this was a “wage push” inflation as the Germans claimed.

Deliberate Mismanagement

A theory more popular with the French was that the hyperinflation was deliberately created by the German government as a way of escaping their reparations obligations. The inflation rate began to increase rapidly only in May of 1921 when the London Ultimatum fixed a very large sum for the reparations bill. Up to this point the Reichsbank had been opposing the monetization of the German government deficit. But it now argued that the government budget could be balanced and the printing presses stopped only when the reparations bill was reduced.

By allowing the hyperinflation Germany was trying to prove to the allies that their reparations demands were simply unworkable. Certainly the German government seemed amazingly inept in this period in collecting revenue. Taxes were collected with a lag of 2 weeks in the case of wages taxes, and 1 month in the case of sales taxes. This sharply reduced their real value by the time the government received them. By November 1923 taxes were only about 1% of expenditure. The prices for government services such as the Post Office and the State Railways were allowed to lag dramatically behind in real terms. By 1922 real rail prices were 5% of their 1913 level, real postal rates were between 6 and 21% of the 1913 level. This meant that subsidies to support the rail system ended up being a very large share of government expenditure. In 1921 they accounted for 10% of the budget, but by 1923 fully 27% of the German budget was devoted to subsidizing rail fares. This led to widespread rail travel within Germany for leisure purposes in the hyperinflation years, and the diversion of foreign freight through Germany to take advantage of the ludicrously cheap transport costs.

The Reichsbank itself accepted bills from private industry at an annual 5% discount rate until mid 1922 by which time the inflation rate was 100% a month. Thereafter it did raise the discount rate, but never to anything approaching the inflation rate. Thus the Reichsbank discount rate was raised to 90% per year by September 1923, but the inflation rate was more than 10 times this figure by then. The Reichsbank policy implied that German industry was effectively being handed free money by the bank, and swelling the nominal money stock further.

Overall it seemed the inflation was created by a combination of forces. The government was running a significant deficit, a deficit it was unable to close with taxes because of its political unpopularity and also its incompetence in managing its affairs.

THE COSTS OF THE INFLATION

What was the cost of the hyperinflation to the German economy. One book about this episode is entitled “When Money Died?” Is this the correct description of what went on?

The economic costs in terms of lost production were actually rather small until the final couple of months. Prior to that there was very little unemployment. There were great random reallocations of wealth within the economy. Holders of nominal debts were all wiped out completely (though there was some revaluation of debts after the hyperinflation ended). Those on fixed nominal incomes also suffered. But each of these losses represented a gain to someone else.

The one great loss that did occur was the loss in usefulness of money to ease ordinary transactions. People were having to turn their wages immediately into goods. Wives would meet husbands on pay days to rush off to the stores with them to spend the money immediately. People going on weekend trips could find themselves stranded without enough money to get home if the inflation rate unexpectedly spiked upwards.

By measuring the area under the money demand curve in figure 1 we should be able to measure the costs to people of this loss of the usefulness of money. If at a 500% inflation rate people still hold significant stocks of money then it implies that money has great social value.

NOTE – THIS PART WILL BE DONE IN CLASS

ENDING THE HYPERINFLATION

The government in Germany tried twice to end the hyperinflation, but only the second attempt was successful. The first attempt was in February to April of 1923. Since everyone used the exchange rate to learn about the price level the government, the price stabilization was achieved by pegging the exchange rate and then defending the rate using the Reichsbank's gold reserves. By February 1923 these gold reserves of 1 billion gold marks were large compared to the value of the outstanding currency, so the bank was able to hold the exchange rate for 12 weeks. But eventually the reserves were exhausted and the inflation resumed with ferocity.

The government was unable to effectively end the inflation in part because the French occupied the Ruhr region to force the resumption of reparation payments. This both reduced the government revenue sources (the Ruhr being the major industrial region in Germany) and led to greater government expenditures to subsidize the passive resistance the government called for in resistance to the French occupation.

The second successful attempt to end the inflation came on November 20, 1923. The government again fixed the exchange rate to fix prices. But it also took strong measures to control the government deficit. And it introduced a new currency the **Rentenmark**.

The key realization that made the second stabilization successful was that since the inflation had reduced real money holdings in the economy to one hundredth of their normal level, there was a potentially huge source of revenue available in restocking the economy with money. In October 1923 real cash holdings were only 0.1% of GNP, compared with a normal holding of 10% of GNP. Thus if people could be convinced that the inflation had really ended they would want to purchase currency from the government of a value of 10% of GNP, which would allow the government to finance itself without raising any taxes for several years. But the problem was to convince people that the inflation was over. Without that conviction no-one would increase their money holdings, and the problem of the government deficit would continue. In the ten days prior to November 13, 1923 government expenses had exceeded revenue by 1,000 times.

This was where the Rentenmark played a crucial role. The Rentenmark was introduced as a gold backed money, whose value was to be guaranteed by a land tax. The Rentenbank which issued the notes was to be backed by claims on real estate. But the Rentenmark was really just a psychological means of achieving confidence in the currency. The printing presses were still running printing money, except that now the notes effectively had "good as gold" printed on them. But if people accepted that this really was a stable value currency then there would be tremendous demand for it, and the government finances would immediately improve, allowing it to also stabilize the regular mark.

Thus while we believe that the inflation was caused by too much money being printed, the period at the end of the inflation saw the

government greatly expand the amount of money in circulation. The total stock of currency was thus:

Nov 16, 1923	93×10^{18} marks
Nov 30, 1923	400×10^{18} marks
July 31, 1924	$1,211 \times 10^{18}$ marks

There were 13 times as many notes in circulation six months after the end of the inflation! But this was achieved without any inflation because people were stocking up on money again.

The extra money printed tided over the government while it eliminated its budget deficit. Thus revenues and expenditures by month were, in millions of gold marks,

	Taxes	Expenditure
Nov 1923	63	-
Dec 1923	312	669
Jan 1924	504	397

With the end of the inflation tax revenue became much greater in real terms. And in January the government cut its labor force by 10%.