Toulouse School of Economics, 2014-2015
Macroeconomics L3 Semester 1 – Franck Portier

Problem set 7: Hyperinflation
Version 1.0 - 01/11/2014

This problem set is due on December 12.

Problem I – An Aggregate Demand -Aggregate Supply Model

This problem reviews the Aggregate Demand-Aggregate Supply model studied in L2

Let us consider an economy with three agents (a firm, a household and a government) and four goods (consumption and investment good Y, labor L, money M and bonds B). We assume that the firm self-finance its investment, so that the only bonds are public bonds. All constants are positive. It is assumed that expected inflation is null.

The production function is given by

$$Y = AL^{\alpha}$$

and we asssume that the firm maximizes its nominal profit $PY - WL$, where W is the nominal wage and P the general price level. Investment is given by

$$I = \overline{I} - \gamma i$$

where i is the nominal interest rate.

The household's consumption is

$$C = c\mathcal{Y} + \overline{C},$$

where disposible income $\mathcal{Y}$ is

$$\mathcal{Y} = (1-\tau)Y - T$$

(T is a lump sum transfert). We assume that labor supply is inelastic at level $L^s = \overline{L}$, and that household's money demand is :

$$M^d = P(\alpha Y - \beta i)$$

The government demands G on the good market and receives tax revenues $\tau Y + T$. It supplies an amount of money $M^s = \overline{M}$, and issues a level B of debt.

$\star$

We first construct the Aggregate Supply curve, assuming that prices and wages are fully flexible.

1 – Compute labour demand.

2 – Draw labor demand and labor supply. Show the determination of the equilibrium real wage. Compute the equilibrium levels of real wage, labor, output.

3 – Draw the AS curve Y^S in the (Y, P) space.

$\star$

Let us now construct the Aggregate Demand curve as the solution of the IS-LM model for a given level of prices P.

4 – Define and give the equation of the IS curve.

5 – Define and give the equation of the LM curve.

6 – Compute the equilibrium income of the IS-LM model, which is the AD curve Y^D.

$\star$

Let us compute now the equilibrium of the whole model.

7 – Write down the budget constraint of the government. Which policies are available? Are all policy instruments independent?

8 – Draw the AD and AS curves. Compute the equilibrium level of output Y and the value of the government expenditures multiplier $\frac{dY}{dG}$ and of the monetary policy one.

$\star$

Assume now that the nominal wage is rigid at level $\overline{W}$.

9 – Find the price $\overline{P}$ for which the labor market clears..

10 – Compute the labor demand as a function of P and consider the two regimes $P < \overline{P}$ and $P > \overline{P}$.

11 – Draw labor demand and supply in the space (L, P).

12 – Give the expressions of AD and AS and draw them.

13 – Discuss of the multipliers values along the AD locus (ie in IS-LM) and at the AD-AS equilibrium.

Problem II – Cagan's model

WARNING: notations are not the same than in the course slides.

In 1956, P. Cagan published a study of hyper inflation episodes, episodes in which expectations seem to be crucial. This problem is inspired from Cagan's model, but modifies the way expectations are modeled. We assume that real variables (output, interest rate) are constant, and we study the interactions between the general price level and the money supply, using a money demand equation.

$\star$

1 – The Cagan's money demand equation is specified as follows::

$$\log(M_t/P_t) = \alpha_0 + \alpha_1 \log y_t + \alpha_2 R_t + u_t$$

where M is the monetary aggregate, P the price level, R the nominal interest rate and u_t an *iid* random shock with zero mean. Comment this equation. What are a priori the signs of the coefficients?

2 – Given the relation $R_t = r_t + \pi_t$, where r is the real interest rate and π the expected inflation, and under the assumption (admissible in the very short run) $y_t = y, r_t = r \ \ \forall t$, show that the money demand can be written

$$m_t - p_t = \gamma + \alpha\pi_t + u_t \tag{1}$$

where m et p are the natural logarithms of M and P, and γ, α some constants to define.

Table 1: Cagan's data (1956)

Country	Period	Average inflation rate (% per month)	Real balances (minimum/initial)
Austria	Oct 1921–Aug 1922	47.1	.35
Germany	Aug 1922–Nov 1923	322	.030
Greece	Nov 1943–Nov 1944	365	.007
Hungary	March 1923–Feb 1924	46.0	.39
Hungary	Aug 1945–June 1946	19800	.0003
Poland	Jan 1923–Jan 1924	81.1	.34
Russia	Dec 1921–Jan 1924	57.0	.27

3 – In table 1 are gathered Cagan's observations concerning hyper inflation episodes. The last column presents the minimum level of real balances M/P over the period, as a % of the initial level of real balances. Comment this table. Are these observations compatible with the money demand equation?

$\star$

4 – Why can't we estimate directly equation 1 using available data?

5 – Working under the supervision of Friedman, Cagan assumed that expectations were adaptative:

$$\pi_t - \pi_{t-1} = \lambda(\Delta p_t - \pi_{t-1})$$

with $\Delta p_t = p_t - p_{t-1}$ and $\pi_t = p^a_{t+1} - p_t$, where p^a_{t+1} is the expectation of the price level in $t+1$. Comment this expectation equation.

6 – Show that expected inflation π_t can be written as a weighted sum of past inflation rates Δp_{t-i}. What is the meaning of the λ parameter?

7 – Using the expectation formula given in 5), solve the model to get $m_t - p_t$ as a function of observable variables Δp_t, $m_{t-1} - p_{t-1}$, u_t and u_{t-1}.

Table 2: Cagan's estimates

Episode	α	λ	R^2
Austria	-8.55	.05	.978
Germany	-5.46	.20	.984
Greece	-4.09	.015	.960
Hungary	-8.7	.10	.857
Hungary	-3.63	.15	.996
Poland	-2.3	.3	.945
Russia	-3.06	.35	.942

8 – Table 2 shows Cagan's results from estimating α and λ. Comment.

$\star$

9 – Assume that money supply is exogenous. Rewrite the model's solution as $p_t = f(p_{t-1}, m_t, m_{t-1}, u_t, u_{t-1})$. We further assume that $m_t = m$ et $u_t = 0 \ \ \forall t$. Under which condition is the model stable (ie converging to a finite limit)?

10 – Cagan's estimations lead to the results given in table 3. Are there countries in which hyper inflation can occur without any explosion of the money supply. why?

Table 3: Cagan's estimates

Episode	$\alpha\lambda + 1 - \lambda$	$1 + \alpha\lambda$	$\frac{\alpha\lambda+1-\lambda}{1+\alpha\lambda}$
Austria	.516	.556	.928
Germany	-.292	-.092	3.17
Greece	.236	.386	.611
Hungary	.03	.13	.23
Hungary	.305	.455	.67
Poland	.01	.31	.032
Russia	-.421	-.07	5.92

Problem III – Hyperinflation in Germany and Zimbabwe

We consider hyperinflation in two different historical cases : Germany in 1923 and Zimbabwe today. Using documents I to VI, answer in each case answer the following questions:

1 – What caused the hyperinflation?

2 – What were the consequences of the hyperinflation? (consider both economic and political consequences)

3 – How would you advise policy makers to reduce the country's inflation?

4 – Does the Quantity Theory of Money apply in these cases? Explain.

5 – Did monetary neutrality hold or did money matter in these two cases (i.e., did money impact real variables?) Explain

Problem IV – The Billion Prices Project @ MIT

The Billion Prices Project is an academic initiative that uses prices collected from hundreds of online retailers around the world on a daily basis to conduct economic research. You must visit the website of the project at http://bpp.mit.edu/ and read documents VI to X to answer the questions.

1 – What is the method used by the Bureau of Labor Statistics to construct the Consumer Price Index? What are the problems with this method?

2 – Describe the way the Billion Prices Project (BPP) construct its inflation index.

3 – What is the specific problem with the weights of different goods?

4 – What are the problems with the BPP index?

5 – What are the results that the BPP obtain for Brazil, Chile, Columbia and Venezuela?

6 – What are the results for Argentina

7 – For which reasons would the Argentinian government manipulate the inflation measure?

8 – Why is the Economist using the PriceStats inflation measure? Go to the PriceStats website and find who is inspiring the method to construct the inflation measure in Argentina.

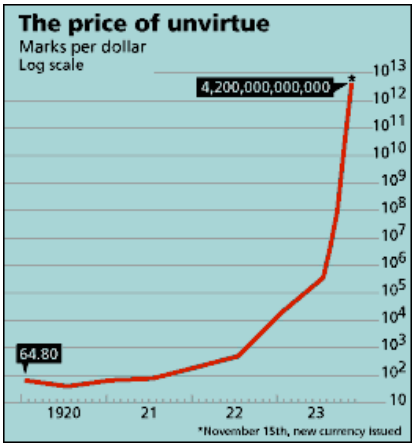
Document I – Loads of money, Dec 23rd 1999, From The Economist print edition

"For these ten marks I sold my virtue," were the words a Berliner noticed written on a banknote in 1923. He was buying a box of matches, all the note was worth by then. That was in the early days. By November 5th, a loaf of bread cost 140 billion marks. Workers were paid twice a day, and given half-hour breaks to rush to the shops with their satchels, suitcases or wheelbarrow, to buy something, anything, before their paper money halved in value yet again. By mid-November, when a new currency was issued, prices had added twelve noughts since the first world war began in 1914.

Currencies have collapsed, and inflation turned hyper-, in other places: in Shanghai awaiting Maoist takeover in 1949, in Argentina in 1989, when, in July alone, prices rose 197%. But Germany's was the most spectacular bout of inflation ever to hit an advanced economy; and none has had more awful results. It was not the main reason for Hitler's rise, but it was as the leader of a failed mini-coup during the crisis that most Germans first heard of him. And the anger of those who had lost their all fed Nazism's growth.

The origins of the hyperinflation lay in the war, and the readiness of Germany's legislature to let the authorities suspend the individual's right to convert banknotes into gold. The central bank was also authorised to use government and commercial paper as part of the reserves it was required to hold against newly issued notes. This freed the government to finance the war by running the printing presses, with the usual effect: prices rose. By the end of 1918 the mark had fallen more than 50% against the dollar.

The government continued to run a huge deficit. From 1919 to 1923, taxes never exceeded 35% of expenditure. The gap was covered by heroic money-printing. The public finances, bad enough anyway, were worsened by the Allies' demands for reparations, enough not just to compensate for damage done but to pay the pensions of Allied combatants. Even ignoring the part due to be paid in some bonds of dubious worth, the total was $12.5 billion-a huge amount for the time, about half Britain's GDP. How could it be found? The Allies did not want to see German exports boom, nor were they united in encouraging payment in labour to rebuild Europe. So-roll the presses. Notes in circulation increased from 29.2 billion marks in November 1918 to 497 quintillion (497 plus 18 noughts) five years later. As early as 1919, when the peace treaty was signed, Keynes had warned that the settlement imposed on Germany would ruin it. By early 1922, even the Times, much given to berating Germany for allegedly failing to meet its promises to disarm, was warning that the Allied demands would lead to further production of paper marks on a massive scale. In the present state of German finances, that would mean a big step on the way to Moscow.To Auschwitz, in the event, but the analysis of money-printing was sound enough. In vain: the victorious powers shut their ears.



Later that year, the German government defaulted on its reparations payments. In response, in January 1923 French and Belgian troops occupied the Ruhr, Germany's industrial heartland. The direct economic cost was huge; the Ruhr provided 85% of Germany's coal. But, besides that, the government backed a campaign of passive resistance- in effect, a general strike. To pay the 2m workers involved, it printed more money. This was enough to tip the economy over the edge. Prices roared up. So did unemployment, modest as 1923 began. As October ended, 19% of metal-workers were officially out of work, and half of those left were on short time. Feeble attempts had been made to stabilise prices. Some German states had issued their own would-be stable currency: Baden's was secured on the revenue of state forests, Hanover's convertible into a given quantity of rye. The central authorities issued what became known as "gold loan" notes, payable in 1935. Then, on November 15th, came the Rentenmark, worth 1,000 billion paper marks, or just under 24 American cents, like the gold mark of 1914.

Prices quite soon stabilised, but the damage was done. Millions had seen their life savings evaporate, and were ready later to believe that Germany had been stabbed in the back by a conspiracy of Jews, international financiers and local appeasers. Elias Canetti, a German writer, likened the Nazis' treatment of Jews to the great inflation: depreciation to the point where they could be "destroyed with impunity by the million". He strained the analogy. But he was right that a debauched currency was one reason why a whole country could lose its virtue.

German Monetary History in the First Half of the Twentieth Century

Robert L. Hetzel

At the end of 1998, the German Bundesbank turned over the administration of monetary policy to the European Central Bank (ECB). In the years between World War I and 1998, the Bundesbank had come to embody the modern central bank. What history did Germany traverse to make possible the creation of such an institution? And how does that history help us define a modern central bank?

Today, a central bank chooses one of two objectives. It may target either the exchange rate or domestic economic conditions, including the inflation rate. In either case, the central bank is the unique institution charged with controlling the chosen objective. Such control relies exclusively on the central bank's management of its own balance sheet. In particular, the central bank controls its liabilities (the monetary base) through its asset acquisition.[1]

Conversely, a country with a modern central bank does not rely on government intervention in specific markets to achieve either price-level or exchange-rate objectives. If the central bank targets the exchange rate, the country does not rely on exchange controls, multiple exchange rates, tariffs, quotas, or other

This history will be continued in a related article, to appear in a future issue of the *Economic Quarterly.* It will consider how Germany came to define stability of the mark in terms of its internal value (price level) rather than external value (exchange rate). It will also explain the reasons for the creation of the European Monetary System and its successor, the European Monetary Union, and review the political process that led to the creation of the ECB. The author gratefully acknowledges helpful comments from Michael Dotsey, Martin M. Fase, Andreas Hornstein, Thomas Humphrey, Jeffrey Lacker, Joachim Scheide, and Alexander Wolman. The views expressed in this article are those of the author and should not be attributed to the Federal Reserve Bank of Richmond or to the Federal Reserve System.

[1] Central banks exercise this control indirectly through use of an overnight bank rate as a policy variable. This rate is a market rate. The need to control money creation imposed by the need to control inflation disciplines the central bank to respect the role the interest rate plays as a price in the price system.

administrative measures. If the central bank targets the inflation rate, the country does not rely on wage and price controls, guideposts, antitrust actions, or special intervention into the wage and price-setting decisions of firms. A modern central bank does not in general allocate credit either through subsidized lending at the discount window or quotas on the credit that individual banks can extend.

This article reviews German monetary history in the first half of the twentieth century, employing the theme that the evolution of the concept of a modern central bank required popular support for a free market.[2] It summarizes three episodes: hyperinflation in the twenties, deflation in the early thirties, and the currency reform of 1948. Inflation and deflation accompanied the economic instability of the first and second episodes, respectively. In each case, free enterprise lost public support. The third episode inaugurated a period of economic and monetary stability, during which free enterprise again became acceptable.

1. HYPERINFLATION IN THE WEIMAR REPUBLIC

In 1913, total currency in Germany amounted to just 6 billion marks. In November 1923 in Berlin, a loaf of bread cost 428 billion marks and a kilogram of butter almost 6,000 billion marks. From the end of World War I until 1924, the price level rose almost one trillionfold.[3] The economic cause of this hyperinflation was the monetization of public and private debt by Germany's central bank, the Reichsbank.[4] The political cause lay in the inability of a fragile democracy to impose the taxes necessary to pay war reparations.[5]

Reparations and Budget Deficits

Germany entered World War I believing that the war would be like the Franco-Prussian War of 1870–1871 and that the government would be able to finance a short war by issuing bonds, which a defeated France would redeem in gold (Marsh 1992, 77). In fact, the combatants devoted half of their economic output to the fighting. The central government in Germany, which did not impose income taxes, financed the war almost completely by issuing debt.

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[2] An intellectually kindred exercise is Humphrey (1998). He traces the historical relationship between proponents of the quantity theory and free markets on one hand and anti-quantity theorists and mercantilists on the other. The quantity theory explains how governments can control the price level or trade balance without direct intervention in markets.

[3] The figures are from Webb (1989, 3) and Bresciani-Turroni (1937, 25).

[4] Among others, Bresciani-Turoni (1937), Keynes (1923), Cagan (1956), and Webb (1989) present this quantity theory view.

[5] Among others, Holtfrerich (1986) and Webb (1989) present this view. The earliest criticism of the punitive character of the Versailles treaty by an economist is Keynes (1919).

With the deficits that followed the end of the war, the Reich's debt amounted to half of national wealth. Interest on the debt amounted to four times the Reich's 1913 revenues.[6]

At Versailles, the victorious Allies imposed a punitive settlement on Germany. They stripped Germany of its colonies and Alsace-Lorraine. The Versailles treaty required that Germany pay for the damages caused by the war without stipulating an upper limit. France in particular demanded heavy reparations, embittered by the appalling human cost of retaking Alsace-Lorraine.

In May 1921, in the London Ultimatum, the Allies set an aggregate amount for reparations of 132 billion gold marks. However, the Ultimatum allowed the Reparations Commission to demand interest on the unpaid amount when it judged that German finances had recovered. Uncertainty about the total reparations payments and the disincentive to run fiscal surpluses that uncertainty created for Germany probably weighed even more heavily than the huge magnitude of the total. Foreign lenders then found it difficult to assess Germany's credit worthiness (Holtfrerich 1986, 143, 145, 154).

Because of differing valuations placed on payments in kind, it is difficult to measure the reparations Germany actually paid. Holtfrerich (1986, 151) compares various estimates and concludes that for the years 1919 through 1922, Germany paid 10 percent of its national income in reparations. Webb (1989, 106) arrives at a similar number, which amounted to 80 percent of Germany's exports. Holtfrerich (1986, 153) points out that, as a fraction of national income, reparations equalled the amount of government expenditure at all levels in the prewar period.

Holtfrerich (1986, 153) argues that Germany could not have raised through direct taxation the amounts necessary "to effect a foreign transfer regarded from the outset as beyond fulfillment, unjust and indeed morally reprehensible by almost the entire population." He explains the resort to an inflation tax by quoting Friedrich Bendixen, a Hamburg bank director:

> Only in taxation do people discern the arbitrary incursions of the state; the movement of prices, on the other hand, seems to them sometimes the outcome of traders' sordid machinations, more often a dispensation which, like frost and hail, mankind must simply accept. The statesman's opportunity lies in appreciating this mental disposition. (153)

Unable to cover its expenditures through explicit taxes, the German government ran deficits exceeding 50 percent of its expenditures from 1919 through 1923 (Holtfrerich 1986, 173). Reichsbank purchases of government debt made the printing press the ultimate source for funding these deficits.[7]

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[6] These figures are from Holtfrerich (1986, 102, 109, 126).

[7] Keynes (1923, Chapter 2) explains inflation as a tax.

Holtfrerich (1986, 152) reproduces figures of Arnd Jessen showing that, as a proportion of government expenditures, the yield of the inflation tax also amounted to about 50 percent. In the years 1919, 1920, 1921, and 1922, revenue from the inflation tax respectively amounted to 62, 53, 43, and 43 percent of government revenue.

A Chronology of Inflation

Although money creation ultimately caused German inflation, expectations about the ability of the government to achieve ultimate fiscal balance determined inflation's timing (Webb 1989). The foreign and domestic public willingly purchased new debt issues when it believed that the government could run future surpluses to offset contemporaneous deficits. When it did not, the debt presented to the Reichsbank rose. Foreign speculative capital inflows ceased, the exchange rate depreciated, and inflation rose.

Inflation exacerbated the government deficit by reducing tax revenue. Because the government levied taxes in nominal terms, the elapsed time between assessment and collection destroyed their real value (Bresciani-Turroni 1937, 66; Sargent 1993, 69). Figure 1 reveals the pattern of an inflation driven by fiscal fears. It shows the wholesale price index with the periods demarcated as by Webb (1989, 5).

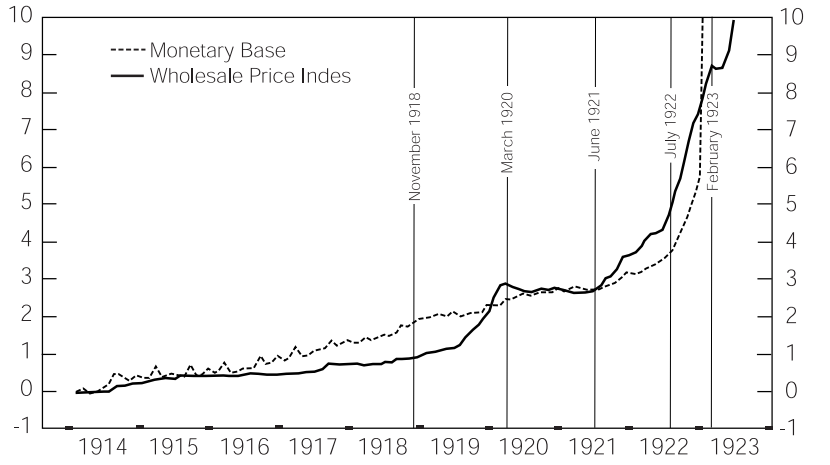
At the end of the war, the fiscal situation was gloomy. In November 1918, a worker revolution overthrew the Kaisertum. Widespread, paralyzing strikes occurred. The new government issued debt to obtain the food supplies and funds for demobilization that were necessary to limit social unrest (Marsh 1992, 79). The government subsidized food, coal, and employment in the railway and postal systems to prevent a second worker revolt.

The new government's concern was valid, for it was indeed possible that fiscal restraint would raise unemployment and set off a Bolshevik revolution (Ferguson and Granville 2000, 1063–65; James 1999, 18). The price level rose from the end of the war until early 1920. By February 1920, the wholesale price level had risen to 17 times its 1913 level. According to Webb (1989, 52), this rise reduced the real value of the nominal government debt outstanding in October 1919 (172 billion marks) to a value consistent with future budget balance. The political situation stabilized in March 1920 with the failure of the Kapp Putsch.

The price level steadied after March 1920.[8] Minister of Finance Matthias Erzberger implemented tax reforms that brought Germany close to achieving future budget balance. Although the budget remained in deficit, tax revenues

[8] Regarding this paragraph and the next, see Webb (1989, 54–60) and Holtfrerich (1986, 301–11).

Figure 1 Monetary Base and Wholesale Price Index



Notes: Data normalized with 1913 equal to 1. Observations are the natural logarithm. The figure uses the data in Diagram 4 in Holtfrerich (1986). The monetary base is cash in circulation plus commercial bank deposits at the Reichsbank.

were rising steadily. Given stable real expenditures, growth in the economy would have increased revenues and balanced the budget. These calculations depended upon maintenance of the current level of reparations, which amounted to 2.24 billion marks in the 12-month period ending 21 June 1920.

However, in the London Schedule of May 1921, the Allies threatened to occupy the Ruhr unless Germany transferred 4 billion marks annually and made additional payments as its economy grew. The Reichstag refused to impose additional taxes, and inflation rose when the prospect of ultimate budget balance receded. As inflation rose, collection lags in the tax system reduced real revenues. In October 1921, the Allies further weakened the political standing of the German government by annexing Upper Silesia to Poland.

Only the United States was in a position to broker a compromise, for it could have forgiven war debts owed it by France and Britain in return for moderation of their reparations demands. But the United States retreated into isolationism. Contradictorily, Allied governments made it hard for Germany to run the surplus on its external trade account that was necessary to pay reparations by imposing high duties on its exports. Many Germans adopted the fatalistic attitude that German economic ruin would be necessary to demonstrate the injustice of reparations. They contended that only when the Allies

scaled back demands for reparations could Germany bring order to its domestic finances.

To support their case, they argued that the reparations caused inflation: The purchase of foreign exchange to make reparations payments depreciated the mark.[9] In turn, the depreciation of the mark raised internal prices. An end to the monetization of government debt without a settlement of the reparations issue would leave unchecked both the depreciation of the mark and domestic inflation. Because the government would still have to maintain subsidies, it would become bankrupt. Rudolf von Havenstein, the head of the Reichsbank, said, "So long as the reparations burden remains, there is no other means to procure the necessary means for the Reich than the discounting of Reich Treasury notes at the Reichsbank" (Feldman 1997, 445).[10]

Inflation became hyperinflation with the assassination of foreign minister Walther Rathenau in July 1922 by right-wing reactionaries. Capital flight spurred mark depreciation, which exacerbated domestic price increases. The resulting fall in the purchasing power of the mark created a liquidity crisis. To deal with this crisis, industrialists argued for the rediscounting of bills of exchange at the Reichsbank. Georg Bernhard, an influential newspaper editor and member of the Reich Economic Council, argued that "There is only one source of money in Germany left, the Reichsbank. . . . It is thus absolutely correct that we create commercial bills; then the Reichsbank can issue money" (Feldman 1927, 450). In the second half of 1922, the Reichsbank began to discount significant numbers of private bills (Webb 1989, 28).

Karl Helfferich, finance minister during World War I, said that if the Reichsbank ceased "the printing of notes. . . all national and economic life would be stopped."[11] Hjalmar Schacht (1927), later the Reichsbank president, wrote:

> In 1923 there were engaged on the production of notes for the Reichsbank. . . 1,783 machines. . . . [E]ven with assistance on so vast a scale the

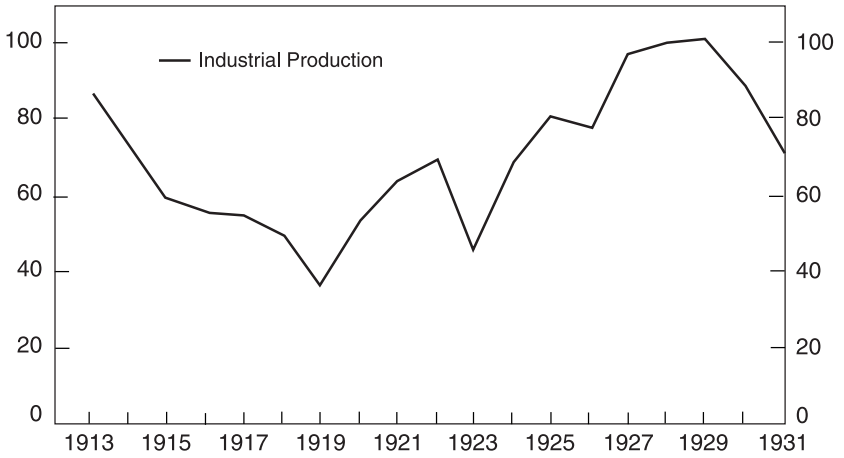
[9] See references in Bresciani-Turroni (1937, Chapter II), especially pages 77 to 82.

[10] The argument is a mixture of economic fallacy and political insight. As a matter of positive economics, a depreciation of the mark on the foreign exchanges could not in and of itself produce a significant rise in the domestic price level. A rise in the price level would have reduced the real money holdings of the German public. The attempt by the German public to restore its monetary purchasing power through a reduction in expenditure would have reversed the rise in the domestic price level (apart perhaps from an amount relecting a reduction in desired real money holdings as a consequence of feeling poorer due to the mark depreciation).

From a political perspective, however, without an end to the reparations, the problems of achieving fiscal balance were, if not insupurable, at least extremely difficult. If the Reichsbank had not monetized debt, the outstanding debt would have grown more rapidly. The effective default on existing debt that came through inflation might then have occurred sooner and explicitly through an actual default. In this sense, the reparations forced the Reichsbank into a situation where inflationary finance appeared to be the only politically feasible option.

[11] Cited in Bresciani-Turroni (1937, 81).

Figure 2 Industrial Production



Notes: Data normalized with 1928 equal to 100. Observations are the natural logarithm. The figure reproduces Diagram 4 in Holtfrerich (1986).

> Bank was not in a position to supply the business world with a sufficiency of notes. (105)

In fact, the high rate of inflation made holding money extraordinarily costly. German moneyholders responded rationally by reducing the real amount of marks they held.[12] The minimal real purchasing power of marks made money appear scarce. That scarcity rationalized the demands of the industrial class for the Reichsbank to continue discounting its commercial paper at a discount rate of 6 percent. In this way, industrialists obtained costlessly the revenues from the taxing powers (seigniorage) that money creation granted to a central bank.

France never confronted the inherent contradictions in its policy toward Germany. It wanted a weak German economy incapable of supporting remilitarization, and it wanted the payment of reparations, which required a strong German economy. On 11 January 1923, France occupied the Ruhr when Germany failed to make in kind deliveries of coal. Germany responded with a policy of passive resistance. With government support, workers in the Ruhr went on strike to prevent France from obtaining the region's coal and steel.

[12] They achieved the reduction in the purchasing power of the mark by increasing the price level in excess of the amount of paper marks issued.

Without coal, German railroads could not run, and without railroads the German economy could not run. Figure 2 shows the decline in output precipitated by the Ruhr occupation. Germany had to import coal. The government also had to pay striking workers, in part, it believed, to prevent them from joining the Communist movement and starting a Bolshevik revolution. As the government deficit widened to 22 percent of net national product, the money stock soared (Ferguson and Granville 2000, 1068).[13] By year-end 1922, the mark-dollar exchange rate had fallen from its prewar level of 4.2 to 1 to 1,500 to 1. By the end of November 1923, it had fallen to 4,200,000,000,000 to 1.

End of the Hyperinflation

On 20 November 1923, Germany ended inflation by pegging the mark's foreign exchange value at its prevailing value of 4,200 billion marks to the dollar.[14] What made monetary reform credible to the German public?

As background, note a characteristic of twentieth-century monetary reforms that ended hyperinflations (for example, in Argentina in 1991).[15] At the time of a reform, the economy in question is using a stable currency as the standard of value, often the dollar, rather than the domestic currency. In hyperinflations, individuals set prices in dollars and then use the dollar exchange rate to convert prices to domestic currency equivalents. The domestic money serves only as a token currency for small transactions. One prerequisite for a successful monetary reform is to make credible the maintenance of a fixed dollar exchange rate, which will reestablish individuals' faith in the purchasing power of domestic currency.

In 1923, "German society was moving massively to disown the paper mark" (Feldman 1997, 691). The German economy largely indexed ("valorized") transactions to maintain their real value. One example was a bank proposed by Hans Luther and Rudolf Hilferding (Food and Finance Ministers, respectively) that would issue a "rye" mark, that is, a deposit redeemable in rye. The bank came into existence on 15 November 1923 as the Rentenbank, but with a rentenmark deposit convertible to gold at the prewar value. The

[13] Webb (1989, Chapters 2 and 3) provides a careful account of the interaction between the fiscal system and inflation. Inflation reduced the revenue that government raised because it vitiated the real value of taxes, which the government set in nominal terms but collected with a delay. If Germany had had a period of price stability or if it had indexed its tax system, it could have balanced its budget. (The wealthy opposed indexing because it would have prevented inflation from reducing the real value of their tax liability.) In the absence of inflation, the tax reforms the government passed might have raised sufficient revenue to cover domestic expenditure and reparations payments. However, the government faced an incessant set of domestic and external pressures (such as French demands to pay immediate cash reparations). As a result, it never had an interval of time during which it could have stopped inflation by meeting its expenditures without printing money (Webb 1989, 42–43).

[14] For a brief account of the November 1923 monetary reform, see Humphrey (1980).

[15] For other examples, see Bruno et al. (1988).

new bank had strict limits on the credit it could extend to the private sector and to the government and met with "astounding success" (Holtfrerich 1986, 316).

The actual breakdown of German economic life came about because of interventions by the German government to maintain the paper mark as the medium of exchange. Holtfrerich (1986, 313) writes of hyperinflation Germany, "The economy had already largely turned over to a foreign, hard-currency standard. . . . The crisis arose out of the reluctance of the Reich to permit business to employ foreign means of payment in domestic transactions as desired; indeed the Reich could not permit the practice. . . as long as inflation remained as a 'tax' source."

Although the government ignored the price setting of the large industrial cartels, it imposed price controls on professionals and the retail trades to prevent "profiteering." Rent control destroyed the wealth of small property owners. Because farmers could not borrow using an indexed value of land as collateral, they could not obtain fertilizer (Feldman 1997, 681–84). "Because the farmers were already refusing to accept the currency. . . Germany faced the imminent danger of hunger revolts" (Feldman 1997, 693).

Bresciani-Turroni offers two observations helpful for understanding the German reform. First, "At the beginning of the inflation. . . the public still did not understand the phenomenon of monetary depreciation" (Bresciani-Turroni 1937, 430). However, by the end, the public associated inflation with the money issues of the Reichsbank. Everyone knew at that point that an end to inflation would require the Reichsbank to limit monetary emission to whatever was needed to maintain the new mark-dollar exchange rate. Second, hyperinflation threatened imminent economic and social collapse. Holtfrerich (1986, 312), citing Schacht, writes "Plundering and riots were a daily occurrence," and Bresciani-Turroni (1937, 336) cites Luther, "The effective starving of the towns and the impossibility of continuing economic activities on the basis of the paper mark was so obvious in the days preceding November 16th that a dissolution of the social order must have been expected almost from hour to hour."

The 1923 reform worked because there was political consensus that it had to work. The economic disruption produced by the combination of hyperinflation and government attempts to force continued use of the mark had pushed Germany to the edge of social disintegration. Revolts, including Hitler's beer-hall Putsch and attempted March on Berlin on 9 November 1923, challenged the survival of the government. A social and political consensus emerged that the Reichsbank had to maintain the dollar-mark exchange rate. Faced with chaos, Germany took steps to restore order.

In this changed environment, the Reichsbank ceased monetizing government debt. The amount of treasury bills held by the Reichsbank went from

190,000,000 trillion marks in mid-November to zero by year-end (Marsh 1992, 83). Finance minister Hans Luther balanced the budget through emergency tax decrees and budget cuts. Germany declared an end to the policy of passive resistance opposing the Ruhr occupation and ceased payments to striking workers in the Ruhr. Negotiations between Germany and the Allies began that led to the 1924 Dawes Plan rescheduling of reparations (Ferguson and Granville 2000, 1078; Yeager 1981, 57).

The final test that established the credibility of the Reichsbank occurred in April 1924. When the dollar value of the mark weakened, the Reichsbank drastically restricted credit. S. Parker Gilbert, Agent General for Reparations Payments, later cabled George Harrison, governor of the Federal Reserve Bank of New York:[16]

> [The Reichsbank's] policy resulted in [a] check to [the] increase of Reichsbank credit and circulation, development of excess of exports over imports, liquidation of heavy commodity stocks accumulated during inflation, decline in commodity prices, and large failures of many firms established during inflation. Rates for month[ly] money rose from 30 to 80 percent but later declined rapidly.

Discrediting Capitalism

Ferguson and Granville (2000, 1084) write, "By discrediting free markets, the rule of law, parliamentary institutions, and international economic openness, the Weimar inflation proved the perfect seedbed for national(ist) socialism." The Weimar inflation produced arbitrary redistributions of income that discredited the market economy. As a class, the wealthy were the main losers because they held most of the mark-denominated financial wealth. Pensioners, bondholders, and rentiers lost everything. Laws against indexation and profiteering hurt merchants. Workers who were protected by labor unions preserved their real wages.[17]

Keynes has described how inflation destroys the social foundation of a market economy:

> By a continuing process of inflation, governments can confiscate, secretly and unobserved, an important part of the wealth of their citizens. By this method they not only confiscate, but they confiscate arbitrarily; and,

[16] S. Parker Gilbert memo to George Harrison, "Reichsbank Credit Policy," 22 July 1931, Harrison Papers. The Harrison Papers are at the Federal Reserve Bank of New York and Columbia University. Gilbert refers to the description of the episode on page 162 of Schacht's book, *Stabilization of the Mark*.

[17] These generalizations come from Holtfrerich (1986, Chapter 8) and Webb (1989, Chapter 5).

> while the process impoverishes many, it actually enriches some. . . . Those to whom the system brings windfalls. . . become profiteers. (1919, 148–49)
>
> To convert the business man into a profiteer is to strike a blow at capitalism, because it destroys the psychological equilibrium which permits the perpetuance of unequal rewards. (1923, 24)
>
> Lenin was certainly right. There is no subtler, no surer means of overturning the existing basis of society than to debauch the currency. The process engages all the hidden forces of economic law on the side of destruction, and does it in a manner which not one man in a million is able to diagnose. . . . By combining a popular hatred of the class of entrepreneurs with the blow already given to social security by the violent and arbitrary disturbance of contract. . . governments are fast rendering impossible a continuance of the social and economic order of the nineteenth century. (1919, 149–50)

Popular resentment concentrated on speculators. When Germans sold their family heirlooms to survive, they blamed the middlemen who organized the sales. A fictional character called Raffke, created by cabaret songwriter Kart Tucholsky, embodied the culturally ignorant person made rich from profiteering (Feldman 1997, 553). Bresciani-Turroni (1937, 328) would later write of "the poverty of certain German classes during the inflation which contrasted with the foolish extravagance and provocative ostentation of inflation profiteers."

Nationalist resentment targeted all foreigners but most especially the minority within reach—Jews. Hitler railed against the "Jewification of the economy" (Feldman 1997, 780, 575). On 5 November 1923, the government raised the price of bread to 140 billion marks, and in response, crowds plundered stores and attacked Jews. In July 1922, the British Consul in Frankfurt wrote:

> [T]he educated classes, deprived, in a great majority of cases, of the right to live and bring up their families in decency, are becoming more and more hostile to the Republic and open in their adhesion to the forces of reaction. Coupled with this movement, a strong and virulent growth of anti-Semitism is manifest. (Feldman 1997, 449)

Germans wanted a world where wealth resulted from hard work, not financial transactions. According to Feldman (1997), Germans desired a return to a world where

> the public good should take precedence over private gain. . . . It was not only Hitler who appealed to these sentiments. . . . [I]nflation. . . caused the Republic to be identified with. . . violations of law, equity and good faith. . . . No less offensive. . . was the sense that there had been a misappropriation of spiritual values. (657–58)

Robert Mugabe is wrecking Zimbabwe. But if voters reject his party at the elections, there is hope

There should have been military bands, synchronised gymnastics and lashings of cold Zambezi beer. But celebrations to mark the 20th anniversary of Zimbabwe's independence, which fell on April 18th, were cancelled. The official reason was that the government thought it better to spend the money on the victims of the cyclone that drowned much of south-western Zimbabwe in February. A more likely explanation is that President Robert Mugabe is afraid to address a large crowd.

Rather than taking his usual podium at a packed football stadium, the president therefore spoke to the nation from the safety of a television studio. It was a wise move. Zimbabweans are increasingly sceptical of Mr Mugabe's excuses for why the country is in such a mess. He blames the IMF, white racists, and a nebulous homosexual conspiracy led by Britain's prime minister, Tony Blair. Zimbabweans reply: "IMF!"-It's Mugabe's Fault.

How times change. Twenty years ago, Mr Mugabe was a hero, praised in rebel songs for his courage. Zimbabweans hailed him as their liberator from the misery of colonial rule: from what Chenjerai Hove, a poet, described as

> the rat-hole
> where husband, wife, child, pot, fire, mealie-meal
> share the same mat,
> and only mother's empty nipple
> soothes the starved gums
> of children who lie like discarded biltong



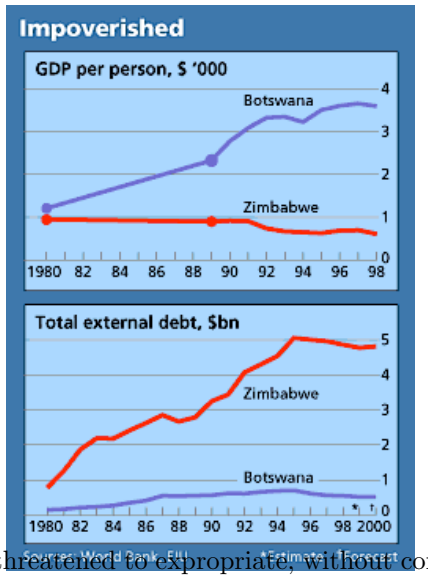
Now that Mr Mugabe has been in charge of Zimbabwe for two decades, his people harmonise to new lyrics. Thomas Mapfumo, a pop star once jailed by the old white regime and honoured by Mr Mugabe for his chimurenga (struggle) songs, now sings protest ballads about "the beautiful country that Mugabe has turned into hell". The Zimbabwe Congress of Trade Unions (ZCTU), once an obedient puppy of the ruling party, is now the core of a strident opposition with a real chance of winning power. The rump of white Zimbabweans who stayed on after independence, once a quiet and apolitical minority, now openly march with the opposition Movement for Democratic Change (MDC). The violence unleashed on some MDC supporters-their farms invaded, their faces pulped with bricks, a few murdered-suggests the desperation of a despot who fears his time is up.

Why is Mr Mugabe so much less popular than he used to be? Zimbabweans have many reasons to resent him. Members of the minority Ndebele tribe cannot forget the massacre of perhaps 20,000 of their kinsfolk by Mr Mugabe's troops in the early 1980s. White Zimbabweans do not like the way Mr Mugabe describes them as "the enemy of the state", and Zimbabwean homosexuals are not exactly thrilled when he calls them "worse than dogs and pigs".

The president calculates that baiting minorities gains him more votes than it loses. He is probably wrong. Few Zimbabweans still blame whites for their problems; there are, after all, more elephants (75,000) than whites (70,000) in Zimbabwe. And Mr Mugabe loses support by the cityful for his wretched handling of the economy. In 1980, when he came to power, average income per person in Zimbabwe was $950, and a "Zim" dollar was worth more than an American one. Now the average Zimbabwean is one-third poorer, with GDP per person a wretched $600. It takes 38 Zim dollars to buy a greenback at the official exchange rate, and Zimbabweans find it all but impossible to lay their hands on hard currency. Fuel is scarce, and sporadic power cuts make homes gloomy and roads hazardous by night. Half the workforce is unemployed. The only ill that is not Mr Mugabe's fault is HIV, the virus that causes AIDS, which afflicts a quarter of the adult population.



From peacemaker to parasite



Strange to recall, Mr Mugabe started well. The first two years after independence saw impressive economic growth of 28%. The civil war was over, sanctions had been lifted, Mr Mugabe preached racial reconciliation, the rains were good and the national mood was optimistic. It did not last.

Mr Mugabe's grasp of economics is shaky, his spending habits profligate. During the 1980s he ran up large budget deficits-partly for hospitals and schools, but partly for weapons-and saddled the economy with a plethora of controls. In 1990 he turned to the IMF for assistance and attempted half-heartedly to liberalise. Droughts, together with Mr Mugabe's inability to rein in expenditure, derailed reform. After several policy flip-flops, the ruling party no longer stands for a coherent ideology. Instead, it is Mr Mugabe's patronage machine.

Government finances, never frugal, went haywire in the mid-1990s. Mr Mugabe, caught between dwindling aid flows and rising anger at continuing poverty, tried to buy popularity. In 1997, he awarded hefty, unbudgeted pensions to veterans of the liberation war that brought him to power. He also threatened to expropriate, without compensation, land belonging to white commercial farmers, a prospect that scared off investors. The Zim dollar plunged.

In 1998, Mr Mugabe sent 6,000 troops to Congo, a country in which Zimbabwe had no strategic interest, to defend the feeble Congolese government against rebels. The Zimbabwean force has since expanded to 11,000 and has cost an estimated $500m, equivalent to one-third of Zimbabwe's total budget for 1999. The war gives Zimbabwean generals a chance to loot Congo's diamond mines, but brings no benefit to Zimbabwe. During February's floods, there were few helicopters to rescue stranded families because they were in Congo.

This year, Mr Mugabe handed out pay rises of 60-90% to the civil service and the army. He himself received an even bigger rise and, by a remarkable coincidence, won a lottery organised by the state-owned Zimbank. The annual budget deficit is now at least 10% of GDP. Inflation peaked at 70% in October, and is expected to average over 50% this year. Buy a basket of groceries in Harare, and the change comes in ominously crisp, newly printed banknotes. A failure to tighten fiscal and monetary policy in the second half of this year could result in hyperinflation, according to Tony Hawkins, an economist at the University of Zimbabwe. The achievements of Mr Mugabe's early years-better education and health care for poor Zimbabweans-have been eroded by his economic incompetence.

Trouble on the farm

In February, Mr Mugabe held a referendum on the adoption of a new constitution that would have given him greater powers. Zimbabweans saw it as a vote of confidence in the government, and rejected it. It was Mr Mugabe's first electoral defeat, and raised the possibility that his party, ZANU-PF, might lose the parliamentary election that was then scheduled for April. Within days, groups claiming to be veterans of the civil war of the 1970s (though many were in their teens) started to occupy white-owned commercial farms.



Mr Mugabe denies ordering the farm invasions, but the invaders arrive in ZANU-PF vehicles and are given food, money and instructions by officials with mobile telephones. About 1,000 farms, almost a quarter of the total, have been occupied. Veterans have beaten farmers and their employees with whips and golf clubs, sometimes binding them first with wire. Farmers known to support the MDC are singled out. At least six people have been killed. Mr Mugabe refuses to condemn the murders, though he used the word "regrettably" in his speech on independence day. The courts have ruled the farm invasions illegal and have ordered the invaders to leave. Mr Mugabe has told the police not to intervene.

The president promises to return to black Zimbabweans the land that was stolen from their forefathers by British colonialists. It is an emotive issue. White farmers own about 70% of the most fertile farmland in Zimbabwe. They employ 350,000 (mainly black) workers who, in turn, support about 1.6m family

members, according to the Commercial Farmers' Union (CFU). The rest of the rural population is crammed on to marginal plots or shares communal pastures. Mr Mugabe hopes that the land-hungry will vote for ZANU-PF in the expectation of free land. Some, doubtless, trust him. But Mr Mugabe has been promising redistribution for 20 years, without delivering much.

He blames Britain for not bankrolling his programme. But Britain forked out £44m ($102m) for land reform after independence. Some 70,000 poor families were resettled on land bought at market rates. Free at last to work for themselves, many enjoyed a rapid rise in incomes. Donor funds dried up only when it appeared that much of the land-270 farms in a single year, by a recent report-had been given or leased at trifling rents to Mr Mugabe's cronies.

The land invasions are not merely a lousy way of tackling rural poverty. They also hurt the rest of the economy. Agriculture, obviously, is suffering. Fear of invasion makes farmers hesitate to plant new crops, let alone invest in new machinery. They cannot get credit, either. No bank will accept as collateral land that may be overrun or seized without compensation. Tobacco farmers, who earn a third of Zimbabwe's export revenues, are reluctant to sell this year's crop until the currency is devalued. Commercial banks, which have yielded to government pressure since January last year to freeze the exchange rate, say they will soon unfreeze it. But will Mr Mugabe, who does not want a devaluation just before an election, allow this to happen?

A few white farmers have signed over their property to the invaders and fled to Harare. But most are sitting tight, praying for a change of government and swapping grim jokes. What's the worst way to abuse your children? Leave them your farm in your will.

The deterrent effect

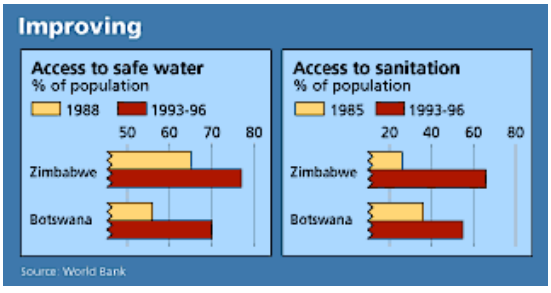
Every other sector of the economy has been damaged, too. Manufacturing output is at its lowest level for 15 years, according to a report published by Standard Chartered, a British bank. Workers arrive late because their buses have no fuel. Firms employ full-time staff to queue for petrol. Lack of foreign currency makes it hard to import capital goods and spare parts. Taxes are punitive, and corruption adds to the burden. A businessman in Bulawayo laments: "The people in government are just thieves. If they see you have something, they try to take it. I drive a battered second-hand car in the hope that they won't notice me."

Surgimed, a maker and distributor of medical equipment in Harare, used to supply public hospitals, but Danny Meyer, its managing director, grew frustrated with crooked tendering procedures and late payments. "We delivered 15 anaesthetic machines at about £15,000 [$24,000] each. The government took a year and a half to pay us. With interest rates at 70%, this nearly sank us. From then on, we stopped dealing with the government."

Zimbabwe has sizeable deposits of gold, coal and base metals. But Mr Mugabe's unpredictability deters mining firms from sinking the necessary long-term investments into the Zimbabwean rock. In hard-currency terms, mining output has declined by a third over the past five years. Last year, BHP, an Australian mining group, pulled the plug on the largest single private investment in Zimbabwe since independence, the $585m Hartley platinum mine. The mine made huge losses, partly because BHP misjudged the local geology, but also because of obstruction by the government, which would not, for example, allow the firm to hire enough technically skilled expatriates. BHP's withdrawal meant the loss of 3,500 jobs.

Mr Mugabe frightens tourists, too. Television pictures of elderly demonstrators drenched in blood deter all but the hardiest of travellers. In fact, the country's main attractions, such as Victoria Falls, have not seen political violence. Tourists are probably safe, so long as they do not visit farms or attend political rallies. But many are choosing to visit Botswana or Kenya instead.

The spark of enterprise



The damage that Mr Mugabe has inflicted on Zimbabwe is grave, but it is not irreparable. Zimbabwe has excellent farmland, a well-educated workforce, an independent judiciary and the most diversified sub-Saharan economy outside South Africa. Despite the government, many Zimbabwean businesses manage somehow to survive or even thrive. When petrol queues lengthen, traders sell hot coffee to frustrated motorists. The dreadful state telephone monopoly has created opportunities for mobile telephone companies. Econet, the market leader, was recently named by Salomon

Smith Barney, an American investment bank, as one of the most attractive shares in Africa. For years, the government tried to deny Econet a licence because its founder, Strive Masiyiwa, would not give a share of the business to Mr Mugabe's nephew. Despite death threats, Mr Masiyiwa fought his way to the highest court and won. Imagine how such entrepreneurs could thrive under a better government.

For the first time since independence, a change of government now looks plausible. Until recently, most Zimbabweans had not heard of the MDC. Now they have, mainly because Mr Mugabe devotes long televised speeches to denouncing it. The party was founded last year by a trade-union boss, Morgan Tsvangirai. Mr Tsvangirai rose to prominence in the late 1990s, leading strikes to protest against excessive taxation, inflation and corruption. The MDC was the principal campaigner for the No vote in the referendum, and the main organiser of a peaceful demonstration that was broken up by ZANU-PF thugs on April 1st. The ruling party recognises the threat that the MDC poses. The state media accuse Mr Tsvangirai of conspiring with white South Africans to impose apartheid on Zimbabwe. His driver was murdered with a petrol bomb on April 15th, and there has been at least one attempt on his own life.

The MDC's manifesto is sensible. If he wins control of parliament, Mr Tsvangirai promises to impose a 100-day, IMF-style stabilisation programme. The civil service will be purged of crooks, the army pulled out of Congo, the central bank given autonomy, and all state-owned companies privatised within two years. The MDC also promises a complete restructuring of government.

Since the party has no record in office, it is impossible to know whether Mr Tsvangirai can do all this. Mr Mugabe does not face re-election as executive president until 2002, and can be relied upon to obstruct reform. Neighbouring Zambia, too, provides a cautionary precedent. There, a popular trade-union leader, Frederick Chiluba, defeated an ageing autocrat, Kenneth Kaunda, in 1991; but Mr Chiluba's government is now generally acknowledged to be as corrupt as Mr Kaunda's was, and Zambia is no better off.

By law, Zimbabwe must hold an election within the next three months. Can the MDC win it? Mr Mugabe's heroic image has not wholly faded. An opinion poll in February found that he enjoys the solid support of about one-third of the voters, mainly in rural areas. Almost two-thirds of Zimbabweans want a new government, but only one-fifth say that they support Mr Tsvangirai. The rest are undecided, or favour minor politicians. The election will hang on the don't-knows, as well as on how effectively Mr Mugabe rigs the poll.

He holds several levers. ZANU-PF receives state funds and the adulation of the state-owned media. The ruling party mans the polling booths, too. During the referendum, campaigners for a No vote found that they did better in constituencies where they were able to sleep with the ballot box to prevent it being stuffed. The electoral roll is so old that about a quarter of the registered voters are dead. Since the dead are conservative, voting without exception for the ruling party, it will be a disaster for the opposition if their names are not removed. The register is being updated, but will probably not be accurate in time for the election.

Constituencies are also gerrymandered to favour Mr Mugabe's own Shona group, and the president directly appoints a fifth of the 150 seats in parliament. If, despite all these advantages, Mr Mugabe still fears that his party will lose, he can declare a state of emergency and postpone the election.

If the election is held, and ZANU-PF wins, it will be a calamity for Zimbabwe. If the MDC wins, relations between the executive president and the legislature will be stormy. The veterans have threatened a civil war if ZANU-PF loses. They probably could not wage one, but what of the army?

Several generals owe their crooked fortunes to Mr Mugabe's patronage, and might not stand by if he lost control. But there are signs that many within the ruling party are fed up with him. A few have asked when he will retire. Some ministers have called for an end to farm invasions, only to be overruled.

Given the state to which Mr Mugabe has reduced the country, a palace coup is possible. That would be an awful outcome. But if Mr Mugabe goes peacefully, there will be a surge of international goodwill and aid. Zimbabwe has terrific potential. The country only needs a better leader to unleash it.

Document IV – Hyperinflation in Zimbabwe: Bags of bricks Zimbabweans get new money-for what it's worth, Aug 24th 2006, From The Economist print edition

Almost unusual shopping spree has just taken place in Zimbabwe. At the end of July the central bank devalued the Zimbabwean dollar (Z$) by more than half and then announced that the currency would also lose three zeros. This is the bank's latest idea to fight hyperinflation hovering around 1,000% a year-the highest in the world-and to attract cash into the banking system. Zimbabweans had until August 21st to get rid of the old bearer cheques used as banknotes. Whatever they could not exchange for the new currency, they spent. Gideon Gono, the governor of the central bank, suggested that the change be called "from zero to hero".

Banks were swamped with customers trying to hand in their cash before the deadline. Anyone willing to deposit more than Z$100m ($400) a week-Z$5 billion for businesses-had to explain where the money came from or risk having it forcibly converted into one-year bonds or confiscated. New bearer cheques could be withdrawn against what had been deposited, subject to strict ceilings. The police searched people for large amounts of cash at roadblocks. Those stuck with extra money had to spend it before it became worthless. Shoppers frantically filled trolleys before the deadline.



In June it could buy a loaf of bread. Now it is worthless.

Spiralling inflation has forced Zimbabweans to use bags to carry cash: wallets are a distant memory. It takes time for cash machines to spit out the daily maximum of Z$250m-or Z$250,000 in new money-that people are allowed to withdraw, so queues have become common. Zimbabweans have become used to dealing in "bricks", as piles of banknotes worth Z$10m are known. Businesses send their money by trucks to banks' special bulk-cash facilities. Computer and accounting systems have been close to collapse, struggling to cope with sums in the trillions.

It is hard to see how scrapping three zeros and forcing people to bank their cash will stop prices spiralling. The central bank is calling for stringent monetary and fiscal policy, but has no power to force the government to tighten the purse strings. It partly blames inflation on speculation in the property and parallel foreign-exchange markets, but it has shown little restraint in printing money. Zimbabwe, the region's breadbasket before the government launched a disastrous land reform in 2000, is now hobbled by shortages of food, petrol, other basic commodities and hard currency. The economy has been contracting fast, and unemployment is estimated at over 70%. Many Zimbabweans rely on support from the 3m relatives or friends thought to have left the country.

Zimbabwe's woes cast serious doubt over the integration plans of the 14-country Southern African Development Community, which held a summit in Lesotho last week. Those attending voiced concern over Zimbabwe, which used to be the region's second-largest economy after South Africa. But it ended with the usual promises to speed up integration, create a free-trade zone within two years and establish a common currency by 2018. A common market, let alone a monetary union, looks like a distant dream. Probably not for the central bank's Mr Gono though: he expects Zimbabwe to have single-digit inflation by the end of 2008.

Document V – Banish the thought of inflation, Jul 31st 2003, From The Economist print edition

Robert Mugabe cannot even print money competently

Bad governments, when they run out of money, print more. But Zimbabwe's government has run out of the ink and special paper needed to print enough notes to keep pace with inflation, currently 365% and rising. Armed police have been deployed to calm the crowds outside banks, where people queue all day to withdraw money. Typically, they are allowed only Z$5,000 ($1.43) at a time.

Because it is so hard to get money out of the bank, no one wants to put it there in the first place. Shops and businesses keep their takings in safes, to have a chance of paying their workers and suppliers. The government blames such "hoarders" for the cash crisis. This week, it unveiled a plan to outwit them.

Within 60 days, said the finance minister, the highest denomination note, the Z$500 bill (worth 14 cents), will cease to be legal tender. Hoarders must deposit their stashes in banks. A new Z$500 bill will be issued, and perhaps even a Z$1,000 bill. Bankers say there is no chance that enough new notes will be ready in time, but the regime does not want to print higher denominations because it thinks this will cause inflation.

Document VI – The price is right – How a new online tool can help measure inflation as accurately as - and more quickly than - traditional methods, Peter Dizikes, MIT News, January 14th 2011

Inflation is a crucial economic indicator, since rising prices can hurt consumers and trigger political discontent. It is also hard to measure. In the United States, Bureau of Labor Statistics employees track over 20,000 prices in person or via phone, which are then aggregated into the Consumer Price Index, a monthly gauge of price levels. But what if the Internet could help measure inflation, and in real time? That is the aim of an ambitious new enterprise, the Billion Prices Project, launched by Roberto Rigobon and Alberto Cavallo, two professors at the MIT Sloan School of Management.

By refining a program that culls prices from the Web, the Billion Prices Project now tracks more than 5 million consumer items every day, sampled from more than 70 countries. The project began collecting price data in 2007 and became publicly available in November.

"We thought it would be great to capture price information on a daily basis and generate a real-time inflation statistic," says Cavallo.

Rigobon and Cavallo began by collecting data from the price lists of supermarkets. "Food and goods sold at supermarkets are an essential element of people's consumption, and prices are readily available online, even in developing countries," explains Cavallo. The project's focus then broadened to consumer electronics, clothing and furniture, and real estate. In each case, the project's software scans the code of Web pages for prices and, to ensure consistency, collects detailed product descriptions, to account for factors that influence costs, like size and brand.

The results have very closely matched the government statistics in the United States over the last three years, which gives the researchers confidence the project is working.

"The temptation is to say this is going to be a replacement for the Consumer Price Index," says Cavallo. "But we like to think of it as a complementary approach." The United States, he says, does an "excellent job" monitoring inflation, but the Billion Prices Project could reveal inflation trends more quickly, add detail to our knowledge of prices by expanding the sample of prices used, and make the results more readily available to economists.

Policing the numbers

Globally, the Billion Prices Project could even affect countries suspected, unlike the U.S., of releasing dubious inflation information. Part of the impetus for the project came from Cavallo's concern, in 2007, that the government in his native Argentina was changing its statistical methods to make inflation seem less severe. "People went to the supermarket and would realize inflation was much higher than the government was saying," says Cavallo. "I thought there had to be a better way to do this."

Argentine officials have denied releasing inaccurate information. Still, if the Billion Prices Project becomes a widely accepted inflation indicator, the existence of real-time public numbers could pre-empt the ability of governments to fudge inflation data.

In any case, economists think the project's approach will help their research. "One of the huge benefits a project like this offers is that you can capture a lot of higher-frequency dynamics that might be masked in the monthly data," says Brent Neiman, an assistant professor of economics at the University of Chicago Booth School of Business, adding that the initiative applies to the research on prices generally and not just inflation. The Billion Prices Project could let economists study how price changes at one firm influence competing firms. Daily price data could also help economists examine the relationship of exchange rates and prices: In a highly globalized economy, how much do the daily shifts in exchange rates affect the prices of imported goods?

Using only monthly data, notes Neiman, "You could be very far off in what the actual change in an exchange rate was that influenced prices." In this way, he says, the project "is a really creative idea to try to get information."

Work in progress

To be sure, the MIT researchers do not regard the Billion Prices Project as a finished product; they would like the project to involve as many economic sectors as possible. At present it is easier to find online price data for tangible goods rather than services, the sector of the economy that deals with the performance of work for others.

"Some services, like transportation, are easier for us to get," says Cavallo. "But health care is quite complicated, because few countries post any health-care costs online. We are already collecting the costs of prescription drugs, but in general health-care costs are very disaggregated. Getting a price for health-care services is going to be more difficult."

Neiman suggests that the cost of labor, or wages, would also be a valuable addition, but a difficult one to make, since "payment to labor is a complicated amalgam of many things besides the actual salary, and this methodology has to confront more challenges before it can be used in that field."

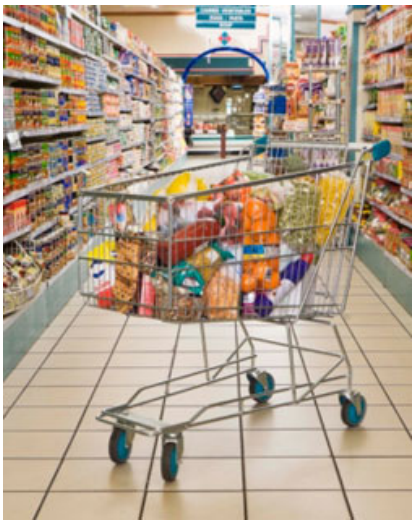
Still, Rigobon and Cavallo are confident that online inflation indices will gain widespread use among the government economists responsible for producing official numbers. "Right now we're on the cutting edge," says Cavallo. "But eventually the statistical offices of governments will incorporate it to complement the traditional methods." The Billion Prices Project is a singular experiment at the moment, but the true sign of its success may come when it is no longer unique.

Document VII – Economists are creating new methods for tracking prices, Annie Lowrey, Slate.com, December 20; 2010

Economists are creating new methods for tracking prices

A shopping cart full of goods that help determine the Consumer Price Index. At some 23,000 retailers and businesses in 90 U.S. cities, hundreds of government workers find and mark down prices on very precise products. And I'm not kidding when I say "very precise."

Say the relevant worker is finding the price for a motel room. She might write a report like this: Occupancy-two adults; Type of accommodation-deluxe room; Room classification/location-ocean view, room 306; Time of stay-weekend; Length of stay-one night; Bathroom facilities-one full bathroom; Kitchen facilities-none; Television-one, includes free movie channel; Telephone-one telephone, free local calls; Air-conditioned-yes; Meals included-breakfast; Parking-free self parking; Transportation-Transportation to airport, no charge; Recreation facilities-an indoor and an outdoor pool, a private beach, three tennis courts, and an exercise room. This mind-numbingly tedious process goes on for a dizzying panoply of items: wine, takeaway meals, bedroom furniture, surgical procedures, pet dogs, college tuition, cigarettes, haircuts, funerals. When all of the prices are marked down, the workers submit forms that are collated, checked, and input into massive spreadsheets. Then the government boils all those numbers down to one. It weights certain prices, taking into account that consumers spend more on rent than cereal, for instance. It considers product improvements and changes in spending habits. Then it comes up with a master number showing how much a customer's spending needed to increase to buy the same goods, month-on-month. That number is the Consumer Price Index, the government's main gauge of inflation.



A shopping cart full of goods that help determine the Consumer Price Index

Each month, the Bureau of Labor Statistics goes through all that hassle because knowing the rate of inflation is such an important measure of economic health-and it's important to the government's own budget. High inflation? Savers panic, watching the spending power of their accounts erode. Deflation? Everyone saves, awaiting cheaper prices in a few months. And wildly changing inflation makes it difficult for businesses and consumers to make economic decisions. Moreover, the government needs to know the rate of inflation to index certain payments, like Social Security benefits or interest payments on TIPS bonds. But just because the government expends so much energy determining the rate of inflation does not mean it is tallying it in the smartest or most accurate way. The reigning methodology is, well, clunky. It costs Washington around $234 million a year to get all those people to go and bear witness to a $1.57 price increase in a packet of tube socks and then to massage those individual data points down to one number. Moreover, there is a weekslong lag between the checkers tallying up the numbers and the government announcing the changes: The inflation measure comes out only 12 times a year, though prices change, sometimes dramatically, all the time. Plus, the methodology is archaic, given that we live in the Internet age. Prices are easily available online and a lot of shopping happens on the Web rather than in stores.

But there might be a better way. In the last few months, economists have come up with new methods for calculating inflation at Internet speed-nimbler, cheaper, faster, and perhaps even more accurate than Washington's. The first comes from the Massachusetts Institute of Technology. In 2007, economists Roberto Rigobon and Alberto Cavallo started tracking prices online and inputting them into a massive database. Then, last month, they unveiled the Billion Prices Project, an inflation measure based on 5 million items sold by 300 online retailers in 70 countries. (For the United States, the BPP collects about 500,000 prices.) The BPP's inflation measure is markedly different from the government's. The economists just average all the prices culled online, meaning the basket of goods is whatever you can buy on the Web. (Some things, like books, are most often bought online. Some items, like cats, are not.) Plus, the researchers do not weight certain items' prices, even if they tend to make up a bigger proportion of household spending.

Still, thus far, the BPP has tracked the CPI closely. And the online-based measure has additional advantages. It comes out daily, giving a better sense of inflation's direction. It also lets researchers examine minute, day-to-day price changes. For instance, this month Rigobon and Cavallo noted that Black Friday discounts "had a smaller effect on average prices in 2010 than in 2009," contrary to reports of deeper discounting this year. And it has already produced some academic insights. For instance, Cavallo found that retailers change prices less often, but more, percentage-wise, than economists previously thought. A second inflation measure comes from Web behemoth Google and is a pet project of the company's chief economist, Hal Varian. As reported by the Financial Times, earlier this year, Varian decided to use Google's vast database of Web prices to construct the "Google Price Index," a constantly updated measure of price changes and inflation. (The idea came to him when he was searching for a pepper grinder online.) Google has not yet decided whether it will publish the price index, and has not released its methodology. But Varian said that his preliminary index tracked CPI closely, though it did show periods of deflation-the worrisome incidence of prices actually falling-where the CPI did not. The new indices lead to the big question of whether the government needs to update its methods to account for changes in the economy-taking new pricing trends into consideration, rejiggering its formula, updating more frequently. The answer might be yes. (Economists have reformed CPI before.) But the CPI and its Stone Age method of calculation boasts one huge benefit: It's a stable, tested measure, consistent over time, since its methodology doesn't change much. Moreover, and somewhat remarkably, the Google and Billion Prices Project indices actually seem to confirm the accuracy of the old-fashioned CPI, tracking it closely rather than showing it to be off-base.

Ultimately, there is a good argument for more inflation measures, not just better or newer ones. The government already calculates a number of rates of inflation to give a fuller picture of price changes, the value of money, and the economy. Most notably, the BLS publishes a "core inflation" number, a measure of inflation outside volatile food and energy prices. There are dozens of other measures, as well. The new Web-based yardsticks provide even more alternatives and opportunities to examine the accuracy of the CPI-and to make new findings. That means, for now, those detective-like government rubes painstakingly checking prices on clipboards get to stay in work.

Document VIII – A billion price now, J. Surowiecki, The New Yorker, May 30, 2011

Between official government statistics, industry surveys, and Wall Street forecasts, it often seems like we're drowning in data, often of uncertain value. But consider the alternative. In the early years of the Great Depression, it was clear that things were awful, but the government had few good figures to go on; there was no official G.D.P. number, and no solid information about unemployment. As a result, policymakers persistently underestimated the severity of the crisis. In June of 1930, relying on some anecdotal evidence of an upturn, Herbert Hoover announced, "The Depression is over." And in his State of the Union address that December he said that two and a half million Americans were unemployed. But, as Hoover acknowledged, that number was eight months old. At the time of the speech, five million people were out of work, and a hundred thousand more were losing their jobs every week. Washington was making policy in the dark.



The government learned from experience, though. In 1934, a team of economists came up with the first measurement of national income, which developed into what we now know as G.D.P. The late thirties saw a more rigorous and systematic collection of unemployment data. And in the years after the Second World War-which accelerated the trend toward quantifying things-the amount of economic information available to policymakers grew exponentially. Today, our picture of the economy is more detailed and sophisticated than ever, and that makes it easier for businesses and the government to react quickly to changes in the economy.

And yet our picture of what's going on is far from perfect. The government continues to track inflation, for instance, by gathering price data much as it did in the nineteen-fifties: it surveys consumers by phone to see where they buy, surveys businesses to see how much they charge, checks out shopping malls to price goods. This leaves out consumers who have only cell phones, and it probably overstates inflation by not fully accounting for things like the impact of big-box stores. The larger problem, though, is the time it takes: the Consumer Price Index's figures don't come out until a month after the fact. In turbulent times, that's too slow.

A new venture called the Billion Prices Project may help change that. The B.P.P., which was designed by the M.I.T. economists Alberto Cavallo and Roberto Rigobon, gathers price data not via survey but, rather, by continuously scouring the Web for prices of online goods around the world. (In the U.S., it collects more than half a million prices

daily-five times the number that the government looks at.) Using this information, Cavallo and Rigobon have succeeded in building what amounts to the first real-time inflation index. The B.P.P. tells us what's happening now, not what was happening a month ago. For instance, after Lehman Brothers went under, in September, 2008, the project's data showed that businesses started cutting prices almost immediately, which suggested that demand had collapsed. The government's numbers, by contrast, didn't show this deflationary pressure until that November. This year, there's been a mild uptick in annual inflation, and again the B.P.P. detected the new trend before the Consumer Price Index did. That kind of early heads-up could help governments make more timely decisions.

The B.P.P. can also help keep governments honest. In much of the world, as a 2010 study of developing countries found, governments regularly manipulate economic data-downplaying inflation, overstating job growth, and the like. The B.P.P. makes that more difficult by providing an independent check on the official numbers. And, while there's no evidence that this kind of thing happens in the U.S., if you're a conspiracy theorist you can now look to the B.P.P. rather than to the regular inflation number to see what's happening.



"That will be all, Mrs. Bernstein. During the break, we reached a verbal agreement."

The B.P.P. doesn't offer a complete picture. In particular, it doesn't cover most services. But, even if it's unlikely to replace the C.P.I. anytime soon, it will almost certainly make the C.P.I. better. Indeed, it wouldn't be surprising if the Bureau of Labor Statistics, which has already said that some of its methods are out of date, begins to move toward a real-time model. The B.P.P., in its rough-and-ready way, is part of a data revolution. Cheap computing power and the Internet have made it possible for companies to do what previously only the government could. The Case-Shiller Index of home resale prices, for instance, has become the benchmark for U.S. house prices. The most concrete result of all this is that policymakers will be better informed than ever before. It also means that they'll have fewer excuses when they mess up.

That's the catch, of course. Giving policymakers more information doesn't mean that they'll believe it or act on it. In the years leading up to the financial crisis of 2008, after all, there was a lot that people didn't know, but the fundamental problems were obvious: housing prices were rising too fast and banks were flinging loans at unqualified borrowers with reckless abandon. Yet the Federal Reserve and banking regulators failed to take any action to try to pierce the bubble before it brought the economy crashing down. These days, all the available numbers, including the C.P.I. and the Billion Prices Project, suggest that inflation is under control. Still, politicians and some Fed members are fretting that a huge price spike may be imminent, and are pushing to make monetary policy tighter, even in the face of unacceptably high unemployment. An enormous amount has been done lately to make sure that policymakers have the numbers they need. The question is whether they'll use them.

Imagine a world without statistics. Governments would fumble in the dark, investors would waste money and electorates would struggle to hold their political leaders to account. This is why The Economist publishes more than 1,000 figures each week, on matters such as output, prices and jobs, from a host of countries. We cannot be sure that all these figures are trustworthy. Statistical offices vary in their technical sophistication and ability to resist political pressure. China's numbers, for example, can be dodgy; Greece underreported its deficit, with disastrous consequences. But on the whole government statisticians arrive at their figures in good faith.

What's in a number



There is one glaring exception. Since 2007 Argentina's government has published inflation figures that almost nobody believes. These show prices as having risen by between 5% and 11% a year. Independent economists, provincial statistical offices and surveys of inflation expectations have all put the rate at more than double the official number (see article). The government has often granted unions pay rises of that order.

What seems to have started as a desire to avoid bad headlines in a country with a history of hyperinflation has led to the debasement of INDEC, once one of Latin America's best statistical offices. Its premises are now plastered with posters supporting the president, Cristina Fernández de Kirchner. Independent-minded staff were replaced by self-described "Cristinistas". In an extraordinary abuse of power by a democratic government, independent economists have been forced to stop publishing their own estimates of inflation by fines and threats of prosecution. Misreported prices have cheated holders of inflation-linked bonds out of billions of dollars. We see no prospect of a speedy return to credible numbers. The trade secretary, Guillermo Moreno, who led the assault on INDEC, is still one of the president's closest advisers. The IMF has "noted" that Argentina is failing in its obligation to provide it with reliable figures-, and made recommendations and set deadlines for it to improve. However, when Argentina ignores it, the fund merely wrings its hands, laments the "absence of progress"-and feebly sets a new deadline. In 2010 we added a precautionary footnote to our statistical tables. From this week, we have decided to drop INDEC's figures entirely. We are tired of being an unwilling party to what appears to be a deliberate attempt to deceive voters and swindle investors. For Argentine consumer-price data we will look instead to PriceStats, an inflation specialist, which produces figures for 19 countries that are published by State Street, a financial services firm. Had we switched to one of the provincial statistical offices still generating reliable figures, we fear it would have come under government pressure. One of the country's best independent analysts made us a generous-and brave-offer of its data against legal advice and on condition that we conceal the source and lightly disguise the numbers. That might have generated confusion.

PriceStats is based in the United States, beyond the Argentine government's reach. The oodles of online prices on which its index is based are tamper-proof. Argentina will no doubt say that it measures consumption by the rich rather than the poor, who may not shop online. But PriceStats' methods are based on solid, peer-reviewed research and have proved an impressive match for (dependable) official figures in countries such as Brazil and Venezuela.

We hope that we can soon revert to an official consumer-price index for Argentina. That would require INDEC to be run by independent statisticians working unhindered. Until then, readers are better served by a credible unofficial figure than a bogus official one.

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Online and official price indexes: Measuring Argentina's inflation

Alberto Cavallo*

Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Ave E62-512, Cambridge, MA 02139, USA

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ABSTRACT

Prices collected from online retailers can be used to construct daily price indexes that complement official statistics. This paper studies their ability to match official inflation estimates in five Latin American countries, with a focus on Argentina, where official statistics have been heavily criticized in recent years. The data were collected between October 2007 and March 2011 from the largest supermarket in each country. In Brazil, Chile, Colombia, and Venezuela, online price indexes approximate both the level and main dynamics of official inflation. By contrast, Argentina's online inflation rate is nearly three times higher than the official estimate.

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1. Introduction

The availability of online prices represents a unique opportunity for the construction of price indexes and the measurement of inflation around the world. An unprecedented amount of micro-level price data can now be collected using special software that finds and aggregates detailed product information available in online retailers across the web. This type of data can be collected remotely, at much higher frequencies, and a tiny fraction of the cost of traditional price-collection methods.

Among its many potential uses, price indexes constructed with online data can be used to obtain alternative inflation estimates in countries where official estimates have lost their credibility. In particular, this paper uses online prices to evaluate the widespread claim that the Argentine government has been manipulating the official inflation indexes since 2007.[1] Online price indexes are first shown to be able to approximate both the level and dynamic behavior of inflation trends in four Latin American countries: Brazil, Chile, Colombia, and Venezuela. In Argentina, by contrast, there is a large unexplained difference in the level of online and official inflation rates. A series of robustness tests show that there is no simple data or methodological explanation that can account for this large discrepancy between online and official data.[2]

The data were collected between October 2007 to March 2011 by the Billion Prices Project (BPP) at MIT. Every day a software scanned the websites of the largest supermarkets in each of these countries, collecting product-level data and storing it in a database. Over time, a panel dataset was constructed with detailed information on each product, including prices, product IDs, and a category indicator. Data from six supermarkets are analyzed in this paper, two for Argentina and one for each of the other countries. On average, there are 20,752 individual products per retailer.

A combination of online prices, standard CPI methodologies and official category weights, is used to build an "online price index" in each country. Each online index is then compared to an equivalent official supermarket index, constructed

* Tel.: +1 617 715 4837.
E-mail address: acavallo@mit.edu
URL: http://acavallo.mit.edu.

[1] See Barrionuevo (2011), Berumen and Beker (2011), Economist (2011).

[2] More tests and details are provided in an Appendix available at http://acavallo.mit.edu.

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as a weighted average of the official CPI components of food, beverages, and household products (the same categories available in the online data).

In Brazil, Chile, Colombia, and Venezuela, the online indexes are able to approximate both the level and main dynamics of official inflation. The matching is best in Chile, with an average annual inflation of 3.00% online and 3.19% offline, and a correlation of 0.97 in the annual inflation series. The match is also close in Colombia, both for the level and dynamics of annual inflation, which dropped in both online and official series from about 8% in late 2008 to about 3% in late 2009. In Brazil and Venezuela, the online index is able to match the main inflation trend of the official index, but the annual inflation series is less synchronized over time. Not surprisingly, the degree of matching appears to driven by the representativeness of the data. The supermarket in Chile has a market share of 27%, and Santiago, the city where the online prices are collected, represents 55% of the national CPI weights. By contrast, the supermarket in Brazil has just a 15% market share, and online prices are collected in Rio, which represents only 17.3% of the national CPI weights.

The results for Argentina are remarkably different. There is a large discrepancy between online and official price indexes that is persistent over time. For over three and a half years, online prices had an annual inflation rate that was consistently two to three times higher than in official statistics, with an average rate of 20.14% for the sample period compared to just 8.38% in official data. During that time the online index grew more than 100% while the official index increased just 35%. Surprisingly, although the *level* of inflation is higher, the dynamic behavior of online inflation matches the official data quite well, both at the annual and monthly frequencies. In particular, both the online and official series show a decrease in annual inflation rates during 2009, when the economy was going through a recession. Compared to the other countries, the results in Argentina are puzzling because there are reasons to expect the online data to be even more representative in this case. The Argentine supermarket has a large market share and targets consumers with a broad range of income levels. Furthermore, the online prices come from Buenos Aires, which is also the only location where official data collection takes place.

Alternative methodologies and subsets of the data provide similar results. First, an online index is built with data from a second supermarket in Argentina with different characteristics: a small, online-only retailer that targets high-income people in Buenos Aires. Second, an index is constructed only with goods that had price controls. Finally, a simple "Subsistence Food" Index, with only 45 goods that are carefully matched to the official data, is compared to the official "Canasta Básica de Alimentos" (CBA) index used to calculate the level of extreme poverty in the country. In all cases there are large unexplained differences with the equivalent official series.

The only way to approximate the official price index in Argentina is to use one-third of the inflation rate observed online. This supports the widespread suspicion that the government has been manipulating the CPI since January 2007, when it intervened the National Statistics Institute (INDEC). The implications for other statistics are significant. For example, using an online-adjusted cost for the subsistence-level CBA basket, the share of the population in extreme poverty during the first quarter of 2011 rises from 2.5% in official estimates to 6.69%. Similarly, poverty estimates are 9.9% in official data, but rise to 25.9% with adjusted price series. The implications for real GDP are equally impressive. If the GDP deflator had behaved like the online index since 2007, the real GDP annual growth rate would have been just 0.5% by March 2011, much lower than the 10% officially reported.

2. The data

The data were collected by the Billion Prices Project at MIT using a technique called "web scraping" to record the price for all goods sold online, between October 2007 and March 2011, in the largest supermarket in Argentina, Brazil, Chile, Colombia, and Venezuela.

The technology to scrape prices is conceptually simple. Most webpages are built using a structured coding language called HyperText Markup Language (HTML). This code has simple "tags", such as `<center>` and `<bold>`, that determine the style and placement of text in a page. These tags tend to remain constant over time, as they provide a distinctive "look and feel" to each page. By contrast, the information *within* these tags, such as a product's price, changes all the time. The scraping software can be taught to use the HTML tags to locate relevant information about a product and store it in a database. Repeating the process every day produces a panel database with a one record per product per day. In addition, the web address or "URL" of the page where each product is located can used to classify products into standardized categories.[3]

Table 1 describes the six databases included in this paper: two for Argentina, and one for each of the other countries. Argentina's Retailer #1 is the largest supermarket chain in the country. It is used for the main online price index, in Section 3, because it has the largest market share and detailed category indicators. Retailer #2, used for robustness in Section 5.3.2, is a smaller supermarket that sells exclusively through the web. The supermarkets in Brazil, Chile, and Colombia are market leaders, with websites that target the cities of Rio de Janeiro, Santiago, and Bogotá. The supermarket in Venezuela is a smaller retailer that sells in Caracas.

In all cases, the online data contains a combination food, beverages, and household products. Categories range from "Eggs" to "Appliances", with about a third of them corresponding to household products (including cleaning materials, health and beauty products, furniture, appliances, and books). These categories account for between 28.44% (Colombia) and 48.51% (Argentina) of CPI weights in these countries, as shown in Table 1.[4]

[3] See Cavallo (2010) for a more detailed description of Scraped Data.

[4] Detailed official category weights, for the products available in each supermarket, are shown in the Appendix.

Table 1
Online data description.

	Argentina Retailer #1	Argentina Retailer #2[a]	Brazil	Chile	Colombia	Venezuela
Starts	10/7/2007	23/7/2007	10/10/2007	10/24/2007	11/13/2007	04/16/2008
Ends	3/24/2011	03/20/2011	03/01/2010	03/20/2011	03/24/2011	03/01/2010
Prices P/day (mean)	11,560	4790	11,000	12,000	5000	9256
Total products	26,333	10,929	21,804	35,432	9166	20,847
Price changes	204,449	136,781	25,9875	12,0112	76,979	94,808
Category indicator	Yes	No	Yes	Yes	Yes	No
CPI weights covered	48.51%	–	27.93%	31.00%	28.44%	–
Retailer market share[b]	28%	n/a	15%	27%	30%	n/a

[a] Argentina's Retailer #2 is used only in the robustness results discussed in Section 5.3.2 and Fig. 4.
[b] Market shares are based on the information posted on the corporate webpages of each supermarket.

3. Online price indexes

The online price indexes use a combination of online data and official category weights. The methodology follows the way CPI statistics are constructed in these countries as closely as possible, but there are some differences in the treatment of the data.

First, daily data are used to construct the online price indexes. Such high-frequency is useful to observe short-term patterns in the data that help validate the online information, as discussed in Section 5.3.3, although similar results can be obtained with monthly data.

Second, the online indexes are built using prices for all products available for purchase at each retailer. This implies that the basket of goods changes dynamically over time as products appear or disappear from the online stores, and that the number of prices for product varieties tends to be much larger than in official statistics. Section 5.3.3 finds similar results when a fixed basket or alternative sub-samples of goods are used.

Third, there are no forced product substitutions or adjustment for quality changes. All goods are treated independently, so products that are discontinued on a given date stop affecting the index from that day forward. Similarly, new goods only impact the index on their second day in the sample, when their first price change can be observed. This has no impact in the results that follow because these substitutions and quality adjustments are not common in official statistics for the categories of goods analyzed in this paper.

Finally, short gaps in individual price series (caused by failures in the scraping method or by products that are temporarily out of stock) are filled by carrying forward the last available price for each product. All results are robust to the use of cell-relative adjustments, the method used by the Bureau of Labor Statistics to fill price gaps in the US CPI.[5]

3.1. Index computation

To build the index, price changes are calculated at the product level, then averaged inside categories using unweighted geometric means, and finally aggregated across categories with a weighted arithmetic mean. In particular, the first step is to obtain the unweighted geometric average of price changes in category j for each day t:

$$R^j_{t,t-1} = \prod_i \left(\frac{p^i_t}{p^i_{t-1}} \right)^{1/n_{j,t}} \tag{1}$$

where p^i_t is the price of good i at time t, and $n_{j,t}$ is the number of products in category j that are present in the sample that day.

The second step is to compute the category-level index at t

$$I^j_t = R^j_{1,0} \cdot R^j_{2,1} \ldots R^j_{t,t-1} \tag{2}$$

Finally, the Supermarket Index is the weighted arithmetic average of all category indexes

$$S_t = \sum_j \frac{w^j}{W} I^j_t \tag{3}$$

where w^j is the official CPI weight for that category and W is the sum of all the weights included in the sample.

The classification of products and weighing of categories is one of the most complex parts of this process. In the original data, each product is linked to a web address (URL) that corresponds to the webpage where the product is located. These URLs group similar items together, into various levels of aggregation chosen by each supermarket. The number of URLs ranges from about 300–1000 in these retailers. The advantage of having URLs is that thousands of items can be easily

[5] See the Appendix for details.

classified into a set of standardized official categories, so that their corresponding official weights w^j can be used to obtain the aggregate index.[6]

Daily estimates for the monthly and annual inflation rates are also obtained. At any point in time, the monthly inflation rate computes the percentage change in the average index of the last 30 days with respect to the average of the previous 30 days. For example, on November 30, 2010, it is the percentage change between the average of the daily index from November 1st to November 30, 2010, and the average of the daily index from October 2nd to October 31, 2010. Similarly, the annual inflation rate is the percentage change in the average index of the last 30 days with respect to the average of the same period a year ago.[7]

Compared to CPI statistics, these online indexes have an advantage in terms of frequency and the number of items sampled within each category. For example, in Argentina alone, there are prices for 781 different product varieties in the "Milk" category alone (this includes different brands and package sizes). A main disadvantage is that these online prices come from a single retailer in only one city. As discussed below, this can limit the ability of online indexes to match the short-term inflation dynamics. However, this problem is minimized in this case because these Latin American supermarkets have huge market shares, shown in Table 1, and are located in cities that concentrate a large percentage of each country's population and CPI weights.[8]

4. Four Latin American countries

This section studies the performance of online price indexes in Brazil, Chile, Colombia, and Venezuela. These countries have similar online markets and CPI methodologies as Argentina, which is studied in detail in the next section.[9] All indexes are weighted using official CPI weights, with the exception of Venezuela, where the online data could not be classified into the standard official categories. In that case, an un-weighted index is constructed with a simple geometric average of all price changes observed each day.[10]

4.1. Online and official data

The online and official supermarket indexes are shown in Figs. 1 and 2. Table 2 shows the summary statistics in each country. The official supermarket index is a weighted average of the "Food and Beverages" and "Household Products" official indexes. These are the sub-component of the CPI that are directly comparable to the online price indexes built in this paper. Using the CPI as the basis for comparison would not change the results, because the supermarket index is closely related to the CPI in these countries, as shown in Table 2.[11]

The graphs in Fig. 1 show a remarkable ability of online indexes to track the main inflation trends over long periods of time. Although there are periods when online inflation is rising faster (or slower) than official estimates, over time both indexes follow a common trend. Indeed, Table 2 shows that the average annual inflation rates for the period are nearly identical for all countries. This happens both in a low-inflation country like Chile, where the annual rate is 3% online and 3.19% in official series, and also in a high-inflation country like Venezuela, where the annual rate is 27.43% online and 29.38% in official data.

In the annual inflation series shown in Fig. 2, Chile and Colombia stand out for the close match in both the level and dynamics of annual rates. In Chile, the online and official estimates are nearly identical over time, with online inflation peaking in April 2009 at 8.7%, falling to −1.3% in February 2010, and climbing back to 3.5% in March 2011. In Colombia, online and official annual inflation series also have very similar patterns over time, with inflation dropping from about 8% in late 2008 to about 3% in late 2009, and remaining relatively stable ever since. In Brazil and Venezuela, the online data can also approximate the average level of annual inflation, but the dynamics of annual inflation are less synchronized. This is evident in both the graphs and the low correlations of annual series shown in Table 2. For Brazil, online and official inflation alternate periods of higher inflation (the correlation improves after June 2010). In Venezuela, the online index puts annual inflation in the 25%–35% range during this period, consistent with official numbers, but it peaks in December 2009, six months before the official index. This may be reflecting a delay of price adjustments in "public" supermarkets owned by the government, which were 25% of the CPI sample in 2008.

[6] The Appendix has a detailed list of categories and weights used. Official weights in each country are available in BCC (2010), IBGE (2007), INDEC (2001), INE (2008), DANE (2009), and INE (2009).

[7] The annual inflation rate is not equal to the sum of the monthly inflation rates because it is not computed as the difference in logged values of the index across periods. Instead, it is the difference in index levels between periods. This is consistent to the way the Argentine Statistical Office (INDEC) computes both monthly and annual inflation rates every month. See the Appendix for details.

[8] Santiago has 55%, Buenos Aires 32%, Caracas and Bogota 22%, and Rio de Janeiro 8% of the total population in each country.

[9] The 2009 World Development Indicators (World Bank) estimate an Internet user penetration of 30.4% in Argentina, 39.2% in Brazil, 33.9% in Chile, 45.5% in Colombia, and 31.2% in Venezuela.

[10] The unweighted index implicitly weighs products by the number of items within each sub-category. For example, milk comes in many forms and product sizes, so when all individual products are included in the index, "milk" will receive a relatively large weight in the supermarket index. Unweighted indexes can provide a good approximation if there is a link between the variety of products and the share of expenditure that a category represents. Consistent with this idea, Simester and Anderson (2011) find a strong correlation between the number of SKUs and purchase volume in a large US retailer. The results of this paper hold if unweighted indexes are used in all countries, as shown in the Appendix.

[11] See the Appendix for more comparisons between the all-items CPI and the official supermarket index.

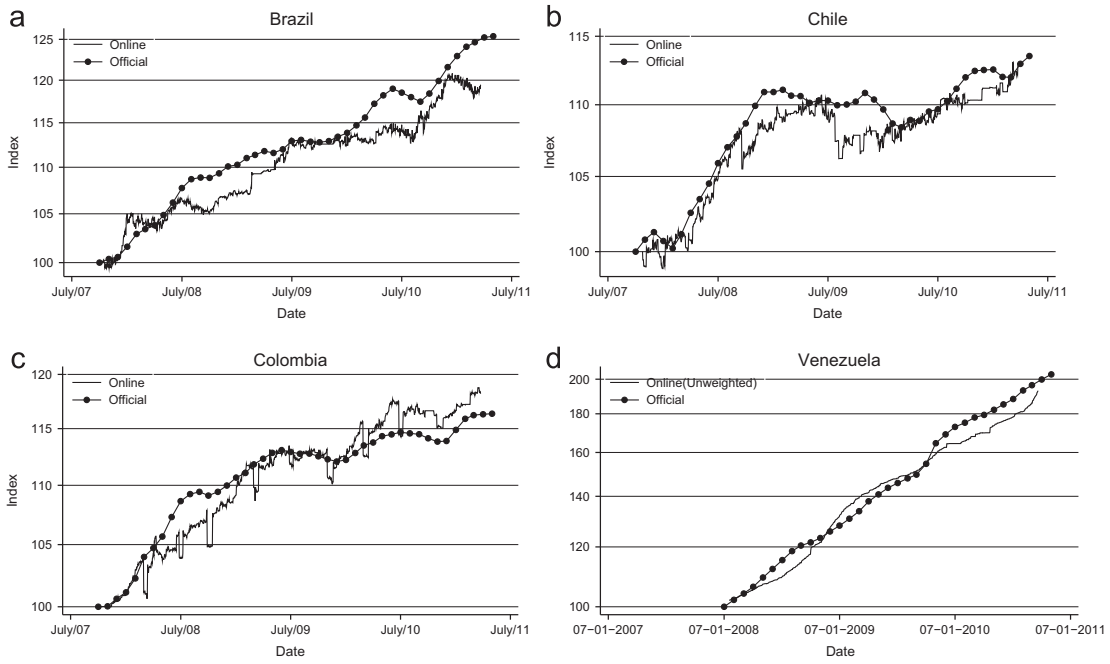


Fig. 1. Online and official price indexes in four Latin American countries. *Notes*: The daily online supermarket index is constructed with an online prices and official CPI category weights. In Venezuela, the online data has no category information and therefore the online index is built as a geometric average of all price changes observed each day. The official supermarket index is an equivalent indicator constructed as a weighted average of the "Food and Beverages" and "Household Products" official price indexes in each country.

4.2. Explaining the differences

The differences in the online-official matching across countries appears to be linked to the representativeness of the retailer used in online data, shown in Table 1. In Chile, for example, the supermarket sampled has a relatively large market share of 27%, compared to only 15% for the Brazilian retailer. At the same time, the city of Santiago (where the products priced online are delivered) represents 55% of the national CPI (it was 100% until 2009), while Rio de Janeiro is only 17.3% of the CPI sample in Brazil.

In all countries, as we move from annual to monthly rates, the matching between online and official series becomes weaker. The correlation between series shown in Table 2 tends to be lowest for the monthly rates. This is caused by the use of data from a single retailer in each country, which in the short run can adjust its prices slower or faster than the economy as a whole. Indeed, many of the temporary deviations from the official index in Fig. 1 appear to be driven by idiosyncratic characteristics of these retailers. For example, the retailer in Brazil tends to increase a large number of prices every few months rather than continually over time, while the supermarket in Colombia has store-wide sales every quarter, causing the online index to drop temporarily for about a week each time. Still, these deviations with official data tend to be corrected after a few months, improving the matching at the annual frequency.

In short, these results show that online price indexes – even when constructed with data from a single retailer – are able to match both the average level of annual inflation and the long-run inflation trends in these countries. Their ability to match high-frequency inflation dynamics appears to depend greatly on the representativeness of the retailer (market share) and the importance of the city where the online products are collected.

5. Argentina

This section focuses on Argentina, where the official estimates of inflation have become widely discredited in recent years. It first documents large differences between official inflation estimates and those obtained independently with online data. It then provides several alternative indexes to evaluate the robustness of these findings, and concludes that the best approximation to the official numbers is simply to use one-third of the actual inflation rate observed online.

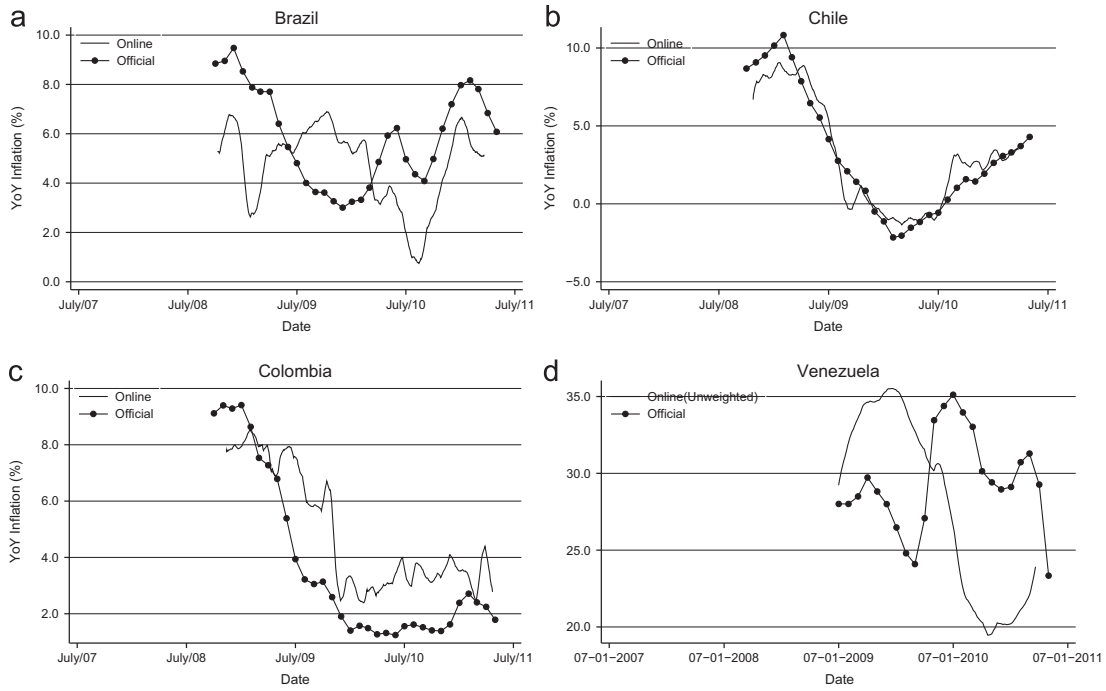


Fig. 2. Online and official annual inflation rates. *Notes*: The annual online inflation rate is a daily time series computed as the percentage change in the average of the index during the previous 30 days with respect to the average of the index in the same period a year before. The annual official inflation rate is a monthly time series computed as the percentage change in the index in the previous 12 months.

Table 2
Online vs. official series.

	Argentina	Brazil	Chile	Colombia	Venezuela
Mean annual inflation (%)					
Official CPI index	8.53	5.28	2.44	3.79	27.37
Official supermarket index	8.38	5.91	3.19	3.73	29.38
Online supermarket index	20.14	4.72	3	4.88	27.43
Correlations between online and official supermarket series					
Price index	0.98	0.96	0.97	0.95	0.92
Annual inflation	0.84	0.09	0.97	0.89	−0.08
Monthly inflation	0.6	0.5	0.38	0.43	0.18
Regression – official supermarket on online monthly inflation rates (12 lags)					
Constant	0.84	−0.54	0.14	0.03	−1.96
Constant *p*-value	0.000	0.19	0.17	0.86	0.23
R2	0.9	0.55	0.66	0.59	0.66
Monthly inflation rate volatility (standard deviation)					
Official supermarket index	0.57	0.51	0.58	0.48	0.98
Online supermarket index	1.11	0.73	0.62	0.76	0.86

Note: The top panel shows that Argentina is the only country where online data does not approximate the average official annual inflation rates. However, the second panel shows that the correlation between the monthly inflation rates is higher in Argentina than in any of the other countries. The discrepancy is therefore in the level of inflation reported, not its dynamic behavior over time. The third panel reinforces this idea with a simple OLS regression of the official monthly rate and 12 lags of the online monthly rate. The R2 is highest in Argentina, which is also the only country where the constant is statistically significant. The fourth panel shows that the official monthly inflation rate is surprisingly stable in Argentina compared to both the online index and the volatility observed in a high-inflation country like Venezuela.

5.1. Government intervention in the statistical office

Since 2003, Argentina's inflation grew steadily as a result of an expansionary monetary policy designed to stimulate consumption and avoid an appreciation of the currency. Inflation became a politically sensitive issue in 2006, when the

annual inflation rate increased above 12%. A combination of subsidies and price controls failed to contain prices, so in January 2007 the government took a drastic decision: to reform the National Statistics and Census Institute (INDEC) and fire the people responsible for computing and publishing the CPI. Since then, official statistics have become widely discredited in the media and academic circles.[12]

During 2007, official estimates of annual inflation remained below 9.7%, while surveys of inflation expectations reached 30% by the end of the year. Gradually, economists and private institutions started to monitor the prices for small baskets of products and reporting inflation rates that were significantly higher than official estimates.[13] Provincial governments also computed regional inflation estimates inconsistent with INDEC's estimates. The government has repeatedly claimed that these metrics are flawed because the samples are small and not representative. Over time, it has increased its pressure on economists and institutions publishing alternative inflation estimates. In February 2011, most of them received official letters imposing large fines and threatening with legal action if they continued to publish their own inflation results.

In the current context, online data provides a unique opportunity to measure alternative inflation rates in Argentina. The government cannot interfere with the data collection and the sample size is several order of magnitude larger than in other estimates. More importantly, the previous section shows that the same online data and methodologies provide close approximations to official inflation rates in similar countries.

5.2. Large differences with official data

In Argentina's case, the online price index follows a completely different trend than the official index, as shown in Figure 3. The accumulated difference with official data has continued to grow steadily over time. Between October 2007 and March 2011, the online index increased over 100%, while the official index grew only 35%.

The annual inflation series in Fig. 2(b) presents two main results. First, online inflation has been consistently between 2 and 3 times higher than official inflation. Second, the online and official estimates share a surprisingly similar pattern over time: inflation fell in early 2009, increased in early 2010, and fell slightly in early 2011. In fact, as seen in Table 2, the correlation in annual inflation rates is high in Argentina, just like in Chile and Colombia.

The monthly inflation rates tell a similar story. The online rate has been consistently above the official rate for the whole period. A simple OLS regression between monthly online and official rates, shown in Table 2, suggests that the official index is missing an average of 84 basis points every month compared to the online inflation. In fact, Argentina is the only country where this regression yield a statistically significant constant. Table 2 also shows how the official monthly inflation rate is far more stable in Argentina than in any of the other country (relative to the observed online volatility).

These results are puzzling because they are exactly the opposite to those in the other countries. Online data cannot match the official *level* of inflation in Argentina, which on average is 20.14% compared to the official 8.38%, but it does an excellent job in matching even the short-run dynamic behavior of inflation rates. Indeed, the contemporaneous correlation in the monthly inflation series is higher in Argentina than in any other country. If the data from this single retailer were not representative, then we would expect the short-term dynamics to be affected first, as it appears to happen in Brazil.

5.3. Robustness

This section considers several robustness tests to find alternative explanations for the differences in Argentina's online and official inflation estimates. I consider three alternatives: using data from a different online supermarket, using only the prices of goods that were under price controls, and using a fixed-basket methodology to construct a basic food index.

5.3.1. Alternative supermarket

The fact that online data can match official inflation rates so well in other countries, but so poorly in Argentina, suggests that the differences are not caused by general characteristics of online data. Still, there may be concerns that the online data used in Argentina are not as good or representative as the data used in other countries. One possibility is that online prices behave differently than offline prices in this particular retailer. However, in Cavallo (2010) I directly compared the online and offline prices of a small sample of goods in this supermarket, and found that online and offline prices had similar levels of inflation. Furthermore, it seems highly unlikely that online and offline prices can behave so differently for such a long period of time. In fact, assuming that online and offline prices were the same in October 2010, by March 2011 online consumers would have been paying over 60% more than offline buyers in the same supermarket.

Another possibility is that this particular retailer is not representative of the country as a whole. To test this, I constructed an online price index using data from Retailer #2, a supermarket with widely different characteristics: a small,

[12] See Berumen and Beker (2011), Barrionuevo (2011), Economist (2011), and Jueguen (2009).

[13] In March 2008 I created a website that published daily inflation statistics (www.inflacionverdadera.com). The CBA Index shown in Fig. 5 was part of that effort.

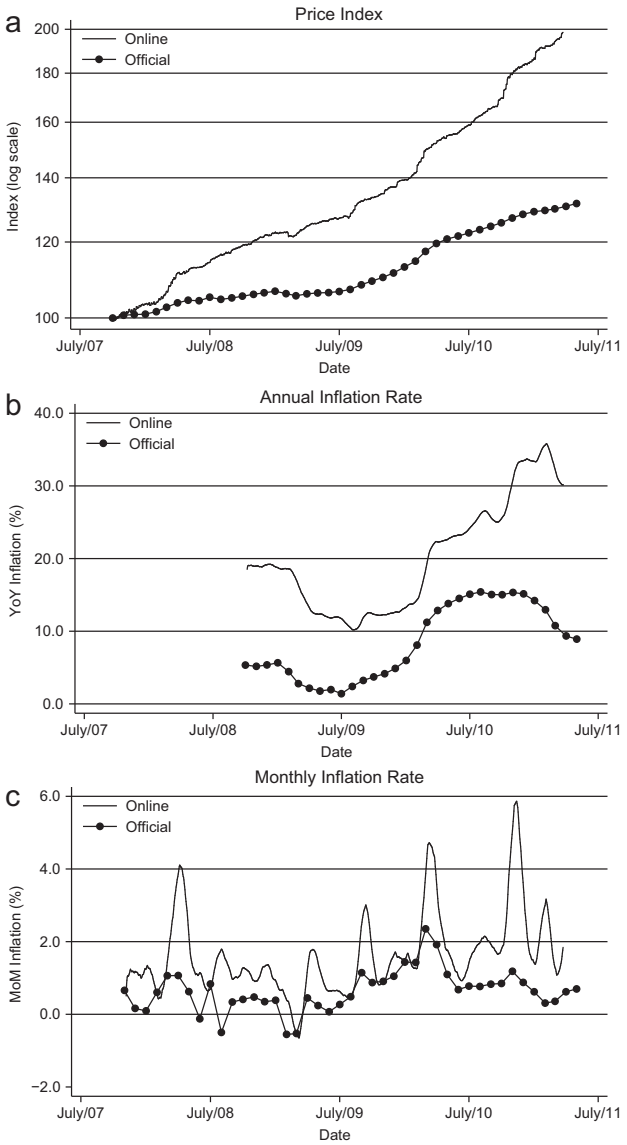


Fig. 3. Online supermarket index in Argentina. *Notes*: The monthly online inflation rate is a daily time series computed as the percentage change in the average of the index in the last 30 days with respect to the average of the index in the same period a month before. The monthly official inflation rate is a monthly time series computed as the percentage change in the index over the previous month.

online-only supermarket that targets high-income people. There is no category information for products in this retailer, so the index is built using a simple geometric average of daily price changes among all products in the retailer each day. This is the same methodology used for Venezuela, where it is able to match official inflation.

The online indexes for both retailers are shown in Fig. 4. No matter what online retailer is used, the online inflation rate is significantly higher than the one reported in official data.

5.3.2. Alternative data: price controls

Another explanation for the differences with official data may be that INDEC uses prices for goods with price controls. These goods can be identified online because retailers place special images next to the product when there is a "Government Agreed Price".

During this period, the government periodically imposed price controls on a set of goods after reaching "agreements" with the major supermarket chains in the country. Although the details were never made public, the scraped data reveal that 597 products where under a price control at some point in time in Retailer #1, with restrictions lasting a few weeks each time.

Fig. 4 shows a price index that includes only price-controlled goods. The inflation rate is far more volatile than when we use all goods in the supermarkets. This volatility rises naturally from the fact that each price control lasted only a few weeks, and retailers tended to increase prices much faster when the controls ended, probably to compensate for any delayed price-adjustments. Once again, the average inflation rate is similar to the other online price indexes, and significantly higher than the official estimates.

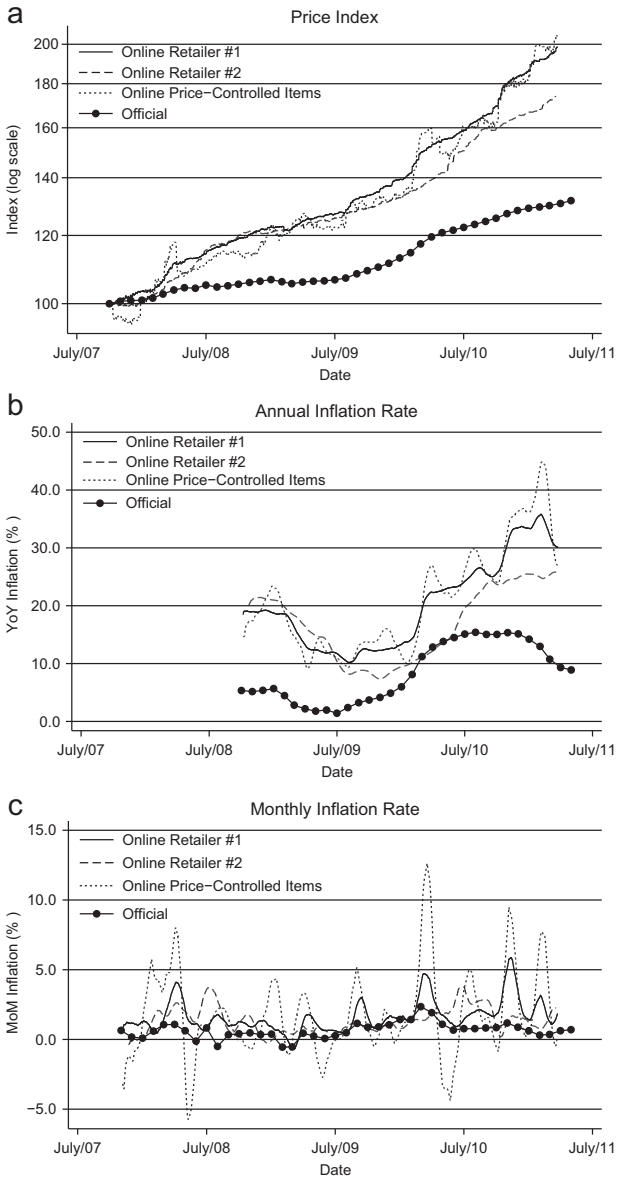


Fig. 4. Different supermarkets and price controls in Argentina. *Notes*: Argentina's Retailer #1 is the largest supermarket chain in the country. Retailer #2 is a smaller supermarket that sells exclusively online to a higher-income population. The index for Retailer #2 is an un-weighted index because the data lacks information on product categories. The Price-Controlled Index uses data from 597 products that were under price controls imposed by the government at some point in time during the sample period.

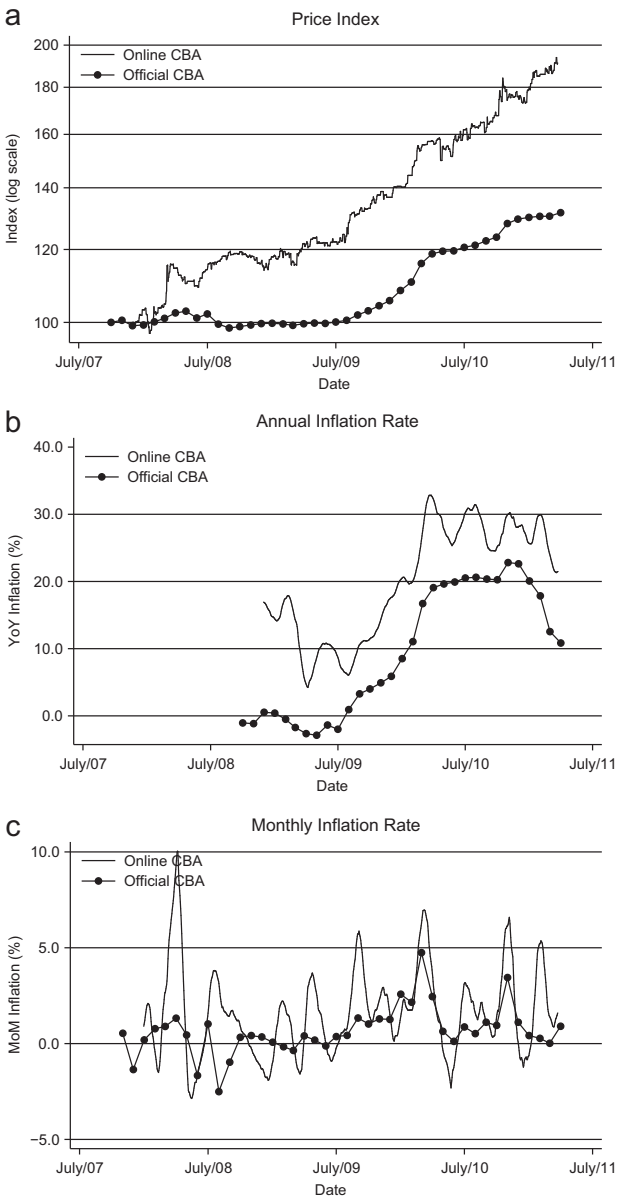


Fig. 5. Subsistence food (CBA) index in Argentina. *Notes*: The "Canasta Basica de Alimentos" (CBA) index is a subsistence food indicator used to measure the level of extreme poverty in the country. It uses 45 carefully selected goods, with official weights and one price from each one of the two retailers available in the country's dataset. Construction details are provided in the Appendix.

5.3.3. Alternative method: the basic food (CBA) index

Beyond the data, it can be argued that the methodology of the supermarket index, which works in other countries, is somehow incompatible with official CPI statistics in Argentina. So, instead of constructing a supermarket index, I now focus my comparisons on a much simpler indicator: the "Canasta Básica de Alimentos" (CBA). This is a Basic Food Index used to measure the level of extreme poverty in the country. Its methodology is well documented, with details of the exact weighing and characteristics of the products that underlie its construction, so I can replicate the exact same basket of goods.[14]

[14] Details for the basket and weights are provided in the Appendix.

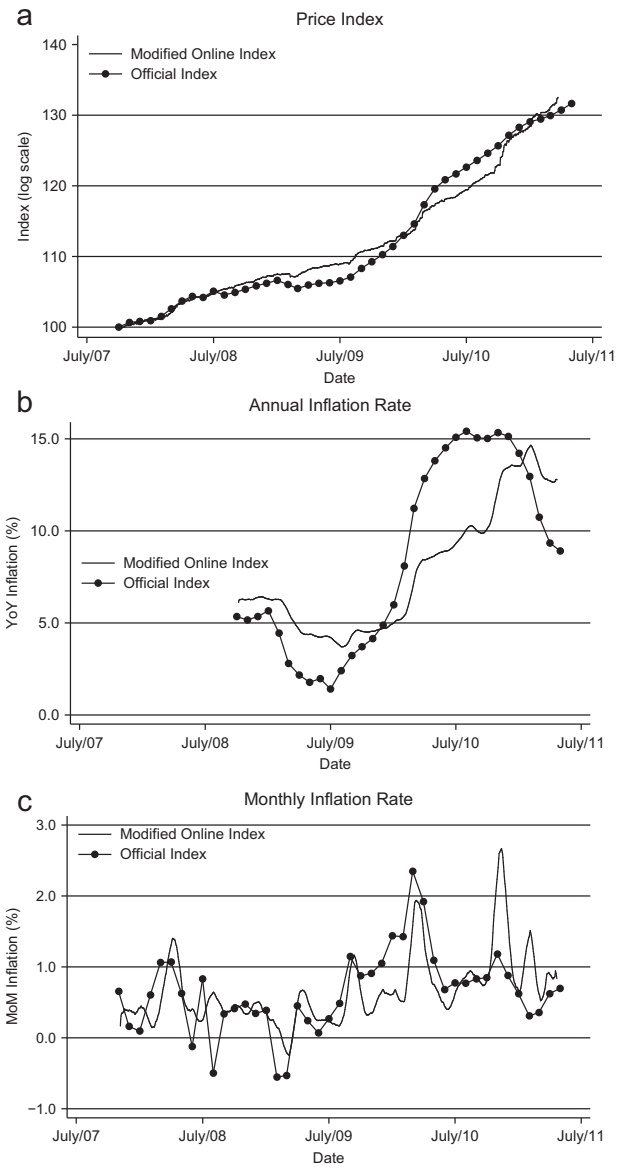


Fig. 6. Best approximation to the official data in Argentina one-third of the online inflation rate. *Notes*: The *modified* online index is a simulation that uses just a third of the daily inflation observed with online data. It provides a surprisingly good approximation to the official price index.

Fig. 5(a) compares the online and official CBA indexes. Once again, the differences are huge and persistent over time: by March 2011, the online CBA index had an accumulated inflation of 91%, while the official INDEC CBA had increased by only 31%. Interestingly, there is a spike in online prices during March 2008 which coincides with the timing of the massive "Farm Strike" that took place in the country. This was a strike of farmers in response to the attempt to introduce a variable-scale export tax regime on several key crops, which in practice meant an increasing the tax rate to 45% for soybeans (Argentina's main agricultural export). Farmers organized road blocks from March to June and caused severe shortages of basic food products for several weeks. The online CBA index shows that the most dramatic price increases occurred during the first strike, which started on March 13, 2008 and lasted until April 3, 2008. The effects were mostly temporary, with the online index going back to its original trend by June 2008. By contrast, the official CBA index was surprisingly unaffected by these events.[15]

[15] The online supermarket index also had a sharp increase in March 2008 and the effects were permanent in that index. It is possible that supermarkets used this shock as an opportunity to justify increase in the aggregate index that had been delayed for some time. In fact,

5.4. Best approximation: one-third of the observed inflation rate

The results so far strongly suggest that the INDEC is manipulating the official inflation estimates. How this is done is an open question, but the series in Fig. 3 suggest a simple answer: the government is reporting just a fraction of the real inflation rate, usually between a third or one-half of the actual numbers. In fact, a simple OLS regression of the official and the online annual inflation series yields a coefficient of 0.36. To test this hypothesis, we can run a simple simulation: an index built using only a third of the inflation rate observed each day.

This simple approach yields an index with a remarkable resemblance to the official data, as seen in Fig. 6. This suggests that the way the data is being altered is far simpler than commonly assumed. INDEC is a large organization, with many employees involved with the data collection and construction of the price indexes. Instead of changing the prices at the item level, it is probably easier for the government to change the aggregate numbers, which are seen by just a handful of people at the end of the CPI calculation process.[16]

5.5. Implications for other statistics

The bias in inflation estimates also affects other statistics, such as the poverty and real GDP estimates. For example, the differences with the CBA index shown in Section 5.3.3 have a direct implication for poverty estimates. Every quarter INDEC uses the cost of the CBA basket to see how many individuals are in extreme poverty conditions. Taking the cost of the official basket in the first quarter of 2008, and adjusting it with the CBA inflation rate observed online, the basket in July 2011 would have a cost of $259.5 Argentine pesos. Using INDEC's income survey, this implies that 6.69% of the population was under extreme poverty at the time, compared to only 2.5% reported in official statistics. Similarly, after adjusting the CBA to obtain the broader "Canasta Basica Total" (CBT), which adds non-food items to the basket, the level of poverty becomes 25.9% compared to the 9.9% officially reported.[17]

To estimate the impact on real GDP, we start by looking at how the CPI and the GDP deflator have behaved in the past decade. Fig. 7 plots both series from 1994 to 2011. The data from 1994 and 2006 show that both series were closely correlated, which is the expected behavior under normal conditions.[18] However, since 2007, the GDP deflator has increased significantly faster than the CPI. This means that government has recognized higher inflation in the GDP deflator. This is not surprising. If the deflator had increased as little as the CPI, the growth rate of real GDP would have been over 10% for several years, which would be impossible for the government to justify. On the other hand, allowing for a higher GDP deflator has little political cost, as it is rarely followed by the media or the general public as a metric for inflation.

Still, the GDP deflator has increased considerably less than the online index since 2007. To get a lower bound for the real growth rate, an "Adjusted Real GDP" can be calculated using the online index to deflate the official nominal GDP. The results, shown in Fig. 7, provide GDP growth rates of -4% in June 2009 (right before the government lost the parliamentary elections), 5% in June 2010, and only 0.5% in March 2011.

6. Conclusions

Online price indexes, constructed using a combination of online data and official methods, are capable of matching both the level and main dynamics of official inflation in Brazil, Chile, Colombia, and Venezuela. The matching is best at annual frequencies and improves when the data come from supermarkets with large market shares and cities that are more representative of the country as a whole.

The results for Argentina, by contrast, confirm the suspicion that the government is manipulating the official inflation series. It is the only country where online inflation deviates significantly from official estimates over time. Two things are surprising: the magnitude of the difference, and its persistence. Indeed, online inflation has been consistently between two and three times larger than in official estimates for over 3 years. On average, the online index had an annual inflation rate of 20.14%, compared to just 8.38% in official data. The accumulated difference was 65% by March 2011. Surprisingly, the difference lies exclusively in the *level* of inflation reported every period, not the dynamic behavior of inflation rates over time.

(*footnote continued*)
the year before the strikes the government was very aggressive with the implementation of price controls and boycotts against supermarkets that raised prices.

[16] The Appendix contains several other alternative approaches that try to replicate the official numbers. Some are methodological, such as using the cell-relative imputation of missing prices or the use of unweighted indexes, and others use special subsets of the data, such as including only the lowest inflation goods in each sub-category. None of them is able to match the low inflation estimates in the official data.

[17] The CBA cost is multiplied by 2.16 to obtain the CBT cost. This coefficient, published by the INDEC for the last quarter of 2010, is the inverse of the share of food over all basic household expenditures.

[18] There are reasons to expect small and temporary differences between the GDP deflator and the CPI. The CPI includes only consumer prices, while the GDP deflator includes the prices of goods purchased by the government and firms. In addition, the CPI includes prices of both imports and exports, while the GDP deflator focuses exclusively on domestically produced goods. These reasons, however, do not seem able to justify the persistent differences observed since 2006.

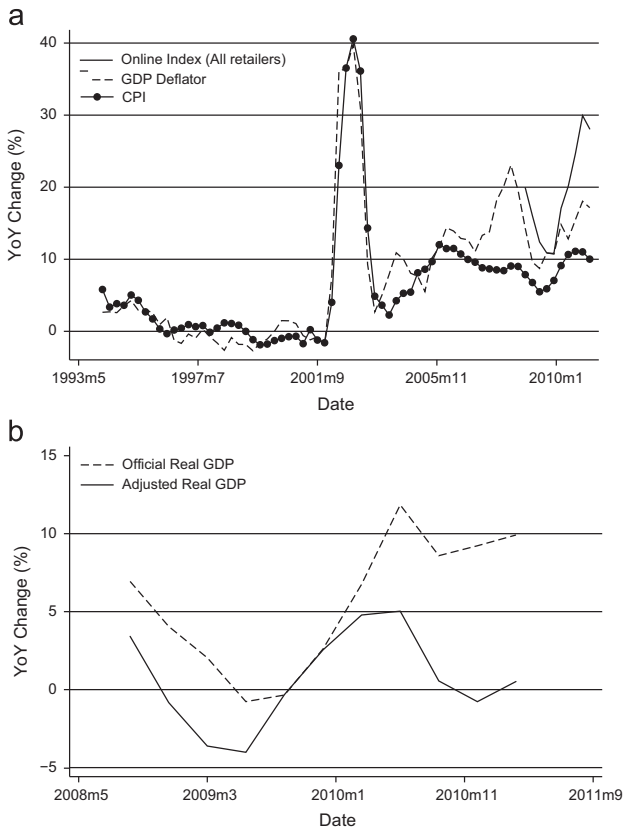


Fig. 7. Implications for real GDP growth: (a) GDP deflator, CPI, and online index – annual change and (b) Real GDP – annual growth rate. *Notes*: The GDP deflator and CPI series in (a) co-moved closely together from 1994 to 2006, but started to deviate from 2007 onwards. Although higher than the CPI, the GDP deflator still has less inflation than the online index in the past 3 years. Assuming the deflator had increased at the same rate as the online index, then we can compute an "Adjusted Real GDP" with a growth rate that is significantly lower than in official estimates.

Several robustness exercises were considered, but none is able to account for the large discrepancies with official data. The best approximation to the official series is to simply divide the online inflation rate by three.

There is no obvious reason for why the government continues to manipulate the official price indexes. Some economists point to lower interest payments for inflation-linked bonds, while others highlight the fact that, by using artificially low inflation estimates in the budget, the government can avoid distributing any excess tax income to the provinces. However, these short-term resources are negligible next to the negative effects and uncertainty the manipulation has introduced in the economy. It is possible that in 2007 the government was simply trying to hide what it though was a temporary rise in inflation, and as time went by it became increasingly harder to recognize it was lying. In any case, the government is not backing down, but quite the contrary. A collaboration with the IMF announced in 2010 to construct a new price index continues to be delayed and appears to have been just a way to avoid sanctions. Independent economists have continued to be threatened with fines and legal action if they publish their own estimates. Most of them have been forced to comply. Provincial governments, which depend greatly on tax resources sent by the federal government, are also under increasing pressure. Seven provinces have recently announced that they are no longer going to publish their own estimates. Meanwhile, in both 2011 and 2012 the government increased the minimum-wage by approximately 25%, consistent with the inflation estimates in this paper. Sooner or later, the official inflation series will have to become accurate. In the meantime, online price indexes can provide a good approximation to the real inflation rate in the country.

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