

Are prices and wages sticky downwards?

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In this article,⁽¹⁾ Anthony Yates examines the theoretical and empirical evidence for prices being sticky downwards—in other words, for the existence of downward nominal rigidities. This evidence has most commonly been cited in the context of wages—if downward nominal rigidities exist and prevent wages from adjusting fully to a shock to demand or supply, then such a shock may affect levels of employment. He concludes that the theoretical and empirical cases are both at best unproven.

Introduction

From time to time, economists have argued that there may be barriers to prices adjusting fully. If prices do not adjust, then more of the effects of a shock—a shift in demand or supply—will be felt in quantities. This paper examines the evidence for one possible source of rigidity: that the money (or nominal) price of goods or labour may be sticky—and in particular sticky *downwards*.

The argument is most commonly made in connection with wages, and it is usually put in these terms: when the demand for labour falls, the real wage (that is, the amount of goods the wages will buy) has to fall to minimise the effect on employment. But if for some reason the money wage will not fall, then the real wage can only fall if the amount of goods these money wages can buy also falls—in other words, if the price level rises.⁽²⁾ This simple example gives us our definition of downward nominal rigidity: wages are downwardly rigid if the responsiveness of the money wage to a shock to labour demand is greater when the shock is positive than when it is negative. In this kind of world, if monetary policy holds the price level constant, the real wage cannot fall sufficiently, and the shock to the demand for labour will bring about a fall in employment.

The second section of this article evaluates the theoretical case for downward nominal rigidity in wages and in prices; the third section considers the empirical evidence. The final section draws together the theoretical and empirical evidence, and concludes that the empirical case for downward nominal rigidities is at best 'not proven'.

Theories of downward nominal rigidity

1 Wages

There are two broad classes of argument for the existence of downward nominal rigidities in wages, relating to (i) relative wage effects and (ii) money-illusion.

(i) Relative wage effects

One argument—asccribed by some to Keynes—for the existence of downward nominal rigidities is that individuals will not be prepared to concede nominal wage cuts because they are concerned about relative wages. In fact, a concern about relative wages is not enough to generate downward nominal rigidity. Suppose, for example, that I am offered a 10% cut in nominal wages by my employer. If I am concerned about what my peers are earning in a neighbouring factory, and uncertain as to whether they are going to be made a similar offer, I might resist the cut, investing time and energy in strikes, or quitting and searching for another job. Next, suppose that in a different situation, I am offered a 10% nominal wage increase by my employer. If I am concerned about relativities, I should still be worried that I might lose out by accepting the offer: my peers in the neighbouring factory may be offered 20%. So I ought to devote just as much effort towards increasing the money wage offer as I did when I was offered a 10% cut. In each case, there is a kind of co-ordination failure: no one party wants to be the first to take what might be a disadvantageous wage offer. In each scenario, real wage cuts could be implemented across the economy by a change in the general price level, but this is just as true for when nominal wages are rising as when they are falling.

The following section argues that for concern about relative wages to result in an argument for the existence of downward nominal rigidities, additional—and quite possibly unrealistic—assumptions are needed about the determination of wages.

● Union cartels

One possibility is that wage-bargainers are part of a cartel. If the labour force were members of competing trade unions, and unions wanted to maintain 'market share' in worker-membership and were concerned about real wages, the unions could collude by fixing nominal wages (or at least nominal wage bids); and they would do this only if

(1) This article summarises some of the analysis in 'Downward nominal rigidities and monetary policy', Bank of England *Working Paper*, No 82, forthcoming.

(2) For the sake of simplicity, it is assumed that there is no productivity growth. With productivity growth, then even if the price level is constant, the real product wage can fall if nominal wages are constant.

they did *not* have access to cheap means of continuous wage indexation. In this situation, under certain informational assumptions, individual unions would be reluctant to concede nominal wage cuts in the face of an adverse shock to aggregate demand, in case other unions would interpret this as beginning a ‘price war’ over membership, which would eventually result in no change in market share and lower nominal (and real) wages. They would feel more inclined to accept nominal wage increases, since other unions would know that by doing so they risked pricing themselves out of the market for worker-members.

However, note the auxiliary assumptions made here: competing trade unions cannot properly infer each others’ preferences and so cannot interpret each others’ wage bids, and worker-members are transferable across trade unions and jobs.⁽¹⁾

- *Staggered wages and no information about outside wage changes*

Another possibility is that wage contracts are staggered and, as before, not indexed to the price level; individual workers or unions have no information about outsiders’ future wage settlements, and always assume that others’ nominal wages are going to remain unchanged when they come up for renegotiation. In this situation, workers will be happier with a 10% nominal wage increase—which, according to their information, will give them a real relative increase of 10%—than with a 10% cut.

- *Staggered wages and a dislike of ‘going first’*

Yet another possibility is that wage contracts are staggered and non-indexed, and renegotiation of wages outside the (say annual) wage round is impossible or very costly for workers and firms alike. In these circumstances, workers faced with a 10% nominal wage cut may be reluctant to go first, even if they know that others will follow, because they will lose out in the meantime. But workers will be happy to go first if they are offered a 10% nominal wage increase, because for a short period they will gain. Of course, we also need to rule out the possibility that workers will value the option to ‘catch up’ in the next period’s negotiations, or to assume that they discount this option so heavily that downward nominal rigidity still results.

The argument that downward nominal rigidities exist thus rests on a series of assumptions: the existence of union cartels; the non-indexation of wage contracts; and no knowledge about outside wages, or the aversion to falling behind others when wage contracts are staggered. All possibilities rely on an additional assumption that workers can extract some rent from employers and not be substituted costlessly for a member of the jobless queues. These rents

may derive from the monopoly power of trade unions, or search costs, or hiring and firing costs. If they cannot extract these rents, then firms will simply pay workers their real marginal product, whatever that implies in nominal terms.

Relativities reconsidered

Leaving aside these theoretical assumptions, can we find evidence that wage relativities, or ‘fairness’, are indeed important concerns in the real world? There is a considerable amount of survey, experimental and empirical evidence that fairness is important.⁽²⁾ But there are serious problems in interpreting this evidence. It could be that workers are concerned about the differential between themselves and the highest earners, but it could also be that individuals are simply happier with higher levels of income. In some cases, the two behaviours are observationally equivalent.

Moreover, it is difficult to distinguish between workers who are genuinely concerned about fairness, and workers who are simply monitoring wages relative to their own outside options. If workers are aware of their outside opportunities and are simply weighing up the costs and benefits of staying with their current firm, then this is perfectly consistent with competitive (full-information) behaviour in labour markets. For example, if there is a fall in the demand for x ’s type of labour across the whole economy, x will see that the outside wage has also fallen and will probably accept a cut in his or her own money (and therefore real) wage. If the outside wage has not fallen, this will send a signal to x that there is something amiss with x ’s firm, and will lead x to decide whether or not to stay put, taking into account the chances of getting a job elsewhere. In short, what in empirical studies looks like a concern for ‘fairness’ could be nothing of the sort, and may not lead to downward nominal rigidity in wages.

But there is an interesting contradiction here: many of the studies of fairness demonstrate the phenomenon that an individual’s happiness or own wage is a function of the outside wage. This comes close to violating one of the assumptions needed to link fairness to downward nominal rigidity—that workers have little or no knowledge of outsiders’ wages and assume that a 10% nominal wage cut means that they will lose out by 10%.

Moreover, the discussion so far has taken it as given that concern about relativities reflects *selfish* behaviour: that, for example, x feels unhappy if he or she earns less than y . It is common in the literature on experimental game theory to observe the opposite. For example, laboratory experiments

(1) We might ask at this point why we could not think of individuals competing for work forming a cartel, rather than a collection of trade unions. The reasons are these. First, the assumption that individuals cannot interpret others’ wage negotiations accurately is less plausible when the others work in the same firm. Second, labour demand is typically ‘lumpy’ (because of technology and hiring and firing costs) and so competition over ‘market share’, which in the individuals’ case means hours worked, is likely to be limited and of second-order importance.

(2) For example, a recent paper by Clark and Oswald (1996) studies 5,000 workers surveyed in the first wave of the British Household Panel Study. They find evidence of respondents reporting themselves as being ‘happier’ when their wages are higher relative to a benchmark comparison. Cappelli and Sherer (1988) report on a survey of around 600 airline employees in the United States, and also find that ‘satisfaction with pay’ rises significantly as the wage rises relative to a measure of outside market wages. Katz (1986) found that firms are concerned with the ‘fairness and consistency’ of their wage structures, which could indicate that workers themselves consider fairness to be important. Di Tella *et al* (1996) find a weak correlation across countries between income inequality (measured by the Gini coefficient) and total reported levels of ‘happiness’ in country surveys. They also find that happiness rises as individuals move up the income distribution within countries.

with people playing competitive games often show that participants will throw away income if this leads to a fairer distribution of the winnings.⁽¹⁾ This could mean that certain groups within a company might turn down a money wage increase, or even accept a money wage decrease that leads to a fairer distribution of earnings. This is not to say that this form of fairness is an important economic phenomenon, but it does illustrate that concern about wage relativities does not give us *a priori* grounds for believing that there is downward nominal rigidity in wages.

(ii) *Wage bargainers suffer from money-illusion*

Another argument for the existence of downward nominal rigidities is based on the assumption that workers suffer from money-illusion, and so will resist nominal wage cuts as they assume they amount to real wage cuts.

But money-illusion itself is not enough to create downward nominal rigidities. First, if there is no real-wage rigidity—if wage-bargainers are simply price-takers and are paid their marginal products—then a negative shock to the demand for labour will not create any excess supply: workers' money-illusion will not come into the determination of the labour market equilibrium. Second, for downward nominal rigidities to operate, wage earners' happiness must suffer more when 5% of their money wage is taken away than it improves by having an extra 5% given to them. In other words, workers must also display what is known as *loss aversion*. This may amount to nothing more than the observation that individuals find themselves at a point where the marginal utility of real income falls as income rises. Or it could be that consumption is lumpy. A fall in real income may mean that an individual can no longer service the mortgages on a house of size x , and has to trade down to one of $x - \delta$ and incur transactions costs. Yet a rise in real income of the same size may not be sufficient to warrant paying the transactions costs associated with trading up to a house of size $x + \delta$.

So is there evidence that money-illusion and loss aversion are pervasive? Keynes (1936) himself wrote of 'the psychological encouragement likely to be felt from a moderate tendency for money-wages to rise' (page 271). On the other hand, Tobin (1972) once wrote that 'economic theorists can commit no greater crime than to assume money illusion' (page 3); but perhaps the evidence persuades us to think differently.

For example, Kahneman, Knetsch and Thaler (1986) report the results of a survey where 78% of respondents said that they would prefer a 7% money wage increase when inflation was 12% to a 5% money wage cut when prices were stable. This is money-illusion: real wages fall by (about) 5% in both examples, but respondents gained satisfaction from having increases in the money wage itself. Shiller (1996) also reports survey evidence of people's dislike of inflation: he says that 'the largest concern with

inflation appears to be that it lowers people's standard of living. Non-economists often appear to believe in a sort of sticky-wage model, by which wages do not respond to inflationary shocks' (page 2). No one would dispute the fact that some money wages will not respond to inflationary shocks, nor that over significant time periods, inflation does lower people's standard of living.⁽²⁾ But Shiller's observation still sounds very much like a form of money-illusion, not least since in industrialised economies, the *real* wage has risen pretty much in line with productivity. Shiller asked respondents a more direct question about money-illusion—he asked whether they agreed with the statement: 'I think that if my pay went up I would feel more satisfaction in my job, more sense of fulfilment, even if prices went up just as much'. Only 41% of all respondents disagreed with this. (Worryingly, only 90% of economists disagreed.)

However, perhaps we ought not to place too much weight on this kind of information. It relies on individuals' perceptions of *hypothetical* events, rather than reveals their preferences by showing how they respond to *actual* events.

Turning to loss aversion, Dunn (1996) finds evidence of this in wage data from the United States. His observation confirms the earlier work of Thaler (1980), Knetsch and Sinden (1984), and Kahneman, Knetsch and Thaler (1990), which found that in experimental games, people required more money to give up an object than they were willing to pay to acquire it. There are instances of this kind of behaviour elsewhere in the economy. For example, a substantial literature has grown up around the idea that managers of joint-stock companies set their dividend policies to minimise the chance of ever having to cut dividends. This is presumably because they fear that markets will react more adversely to a cut in dividends than they do positively when dividends increase. This is borne out by survey evidence, for example Lintner (1956), or empirical tests, such as the work by Fama and Babiak (1968).

Nonetheless, it ought to be evident by now that the task of finding a good explanation for money wages being sticky downwards is very demanding. To summarise, we need either:

- (i) a concern for fairness, real wage-stickiness plus *either*
 - (a) union cartels;
 - (b) no information about outside wage settlements;*or*
 - (c) extreme dislike of 'going first' in the wage round;
- or
- (ii) money-illusion, loss aversion *and* real-wage stickiness.

There are many examples of practitioners who believe that downward nominal rigidity is a genuine phenomenon.

(1) See, for example, Guth *et al* (1982), Bolton (1991) and Smith (1994).
 (2) See Briault (1995) for a discussion of the costs of inflation.

Bewley and Brainard (1993) surveyed employers in Connecticut and wrote: *'The psychological factors are the reaction of employees to the loss of income resulting from a pay cut or short-time. A loss of income hurts morale . . . Employers claimed that employees saved little so that their living standards fall as soon as their pay is cut . . . the reduction in living standards put them in a bad mood . . . a pay cut may also be interpreted as a slap in the face, even if the pay of all employees is cut'* (page 3). If this is true, Connecticut would seem to be subject to money-illusion, loss aversion and fairness considerations all at the same time: perhaps proof of the old joke that economists are those who take something that works in practice and prove that it does not work in theory!

2 Prices

Are there similar possibilities that prices are sticky downwards in product markets? Of course, if firms are price-setters in product markets, and they operate in labour markets with some or all of the features identified already, then there may be a visible downward stickiness in product prices. But are there features of the goods market, *independent* of the determinants of money wages, that mean that prices will not fall as readily as they should?

(i) Price cuts would confuse customers who have money-illusion

Just as money-illusion could influence the determination of the price of labour, it could also affect product prices. One argument is that when aggregate inflation is positive, and price cuts are therefore rare, producers may be reluctant to cut prices for fear that such cuts would confuse their customers, who are not used to them. Whatever we may think about the theory, we can probably throw out this possibility simply because anyone who has shopped will know that price cuts, though perhaps rarer than price rises, are still common. Some prices (for example the prices of calculators, videos and computers) have fallen almost continuously, even leaving aside the improvements in the quality of these goods. In January last year, around 20% of prices in the UK RPI had fallen during the previous twelve months.

(ii) Price cuts signal quality cuts

A second argument why firms might be inhibited from making price cuts is that they fear that customers might interpret this as a fall in quality. One possibility is that customers cannot perfectly observe the quality of the good they are to purchase before they buy it; if they assume that firms price at or according to marginal cost, then they might assume that a fall in the price constitutes a reduction in the quality of the (marginal) inputs used to produce it. And if the relationship between the expected quality of the good and utility derived from buying it is discontinuous (below a certain quality threshold the good is useless), then the firm could experience disproportionate falls in demand if the

price is reduced. This idea was first suggested by Stiglitz (1987), and presumes that customers have only limited information about the quality of the range of goods from which they are choosing. What little evidence there is suggests that this type of behaviour is rare.⁽¹⁾ But another possibility is that consumers derive utility from high prices themselves—from the prestige of consuming an expensive product, for example.

(iii) Prices are sticky downwards because of strategic behaviour between firms

Another barrier to price cuts may be strategic interaction between firms. The argument here is very similar to the discussion of union cartels. Imagine the following set of circumstances. Costs are falling over time (because of process innovation) in an industry with a few large competing firms. Selling prices are set by implicit agreement above the competitive (marginal cost) price, and because cartels cannot costlessly index the agreement, the agreement is made in nominal terms. But in order to stop new firms from entering, prices have to fall in line with the downward trend in costs. If firms cannot easily monitor whether a firm is cutting prices to gain market share or to preserve price/marginal cost margins, then prices may not fall at all, because no firm wants to be first to break the agreement and risk a price war. There is a small theoretical literature on this subject,⁽²⁾ and some survey evidence in support of this idea.⁽³⁾

'Outcome'-based evidence of downward nominal rigidity

So far, it has been argued that some typical arguments for the existence of downward nominal rigidities—based on either fairness concerns, or on money-illusion—are not watertight. We have also considered some evidence that sheds light on whether the behaviours embodied in a fuller theory of downward rigidity (money-illusion, loss aversion, cartel behaviour, quality signalling) are detectable. We turn now to look at empirical evidence on wage and price outcomes to see if the economy behaves in a way that is *consistent with* there being some downward nominal rigidity—even if, as we shall explore later, such evidence cannot *prove* that there is downward nominal rigidity.

How frequent are wage and price cuts?

This is perhaps the most obvious question to ask. Surely, if price and wage cuts are common, we cannot claim that the economy behaves as though there is downward nominal rigidity. Chart 1 shows that cuts in the aggregate money wage were far more common in previous centuries; Chart 2 makes the same point, but for the aggregate price level.

Nevertheless, movements in the *aggregate* price level conceal considerable variation in *individual* prices. Table A

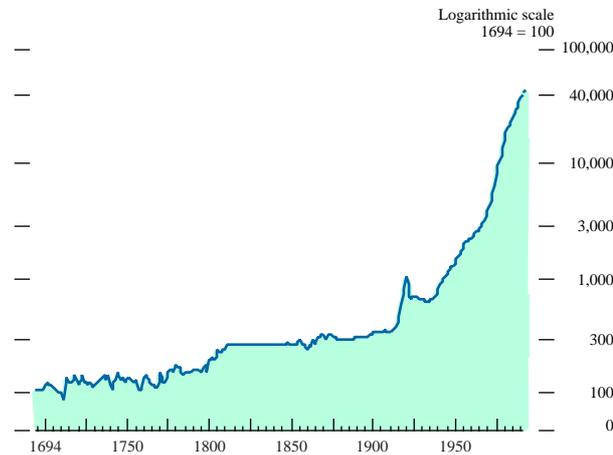
(1) See, for example, Blinder (1995) and Hall *et al* (1996).

(2) Granero (1996); Hansen *et al* (1996) and Kovenoch and Widdows (1991) all present models that generate nominal price asymmetries due to strategic interaction.

(3) See Hall *et al* (1996) and Small and Yates (1998).

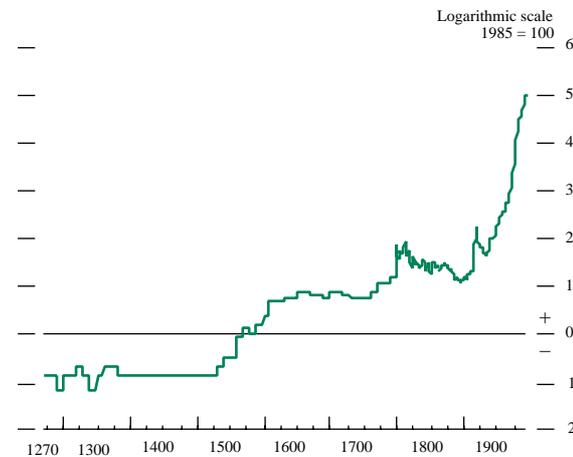
offers snapshots of the distribution of (annual) price changes at two-year intervals from 1976–96, and Chart 3 plots the proportions of prices within the aggregate index that are falling (year on year), from 1975–96. It is clear that at any one time significant proportions of retail prices are falling in the economy.

Chart 1
The money wage since 1694



Source: Data compiled at the Bank of England, combining ONS sources and data from Phelps Brown and Hopkins (1956).

Chart 2
The aggregate price level since 1270



Source: McFarlane and Mortimer-Lee (1995).

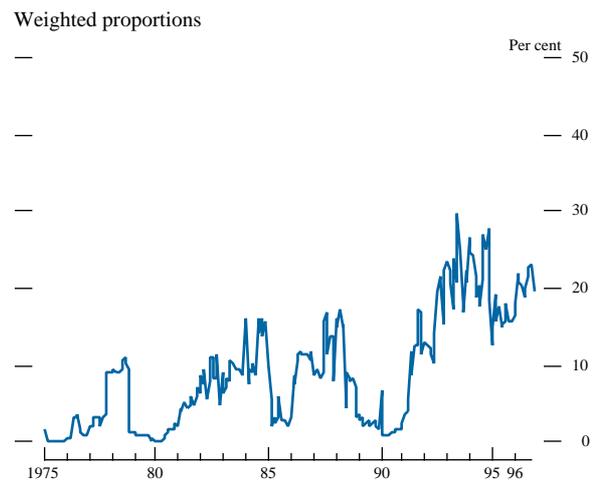
Table A
The distribution of price changes in the RPI

Per cent	<-10	-10 ≤ x < -5	-5 ≤ x < 0	0	0 < x ≤ 5	5 < x ≤ 10	>10
Jan. 1976	0.3	0.0	0.3	0.0	5.6	4.2	89.6
Jan. 1978	1.2	0.0	8.0	0.0	5.3	6.9	78.6
Jan. 1980	0.0	0.0	0.0	0.0	5.0	8.3	86.8
Jan. 1982	0.0	0.0	8.9	0.0	16.1	32.5	42.6
Jan. 1984	0.0	0.0	16.1	1.4	39.7	40.6	2.3
Jan. 1986	0.3	0.0	2.9	0.0	46.9	44.4	5.6
Jan. 1988	0.0	0.3	15.7	3.0	40.0	38.0	3.0
Jan. 1990	0.0	0.0	6.6	0.4	26.5	50.5	15.9
Jan. 1992	7.7	0.5	4.7	0.0	18.2	38.2	30.7
Jan. 1994	0.7	8.1	15.7	3.0	42.7	23.9	5.8
Jan. 1996	0.0	3.6	14.5	1.1	48.2	32.1	0.5

Note: Weighted proportions of the index falling into particular inflation ranges, calculated as annual percentage changes; distribution observed across around 65 components of the RPI.

Similarly, we can look at the distribution of money wages. Table B shows data compiled by the Bank from various organisations that collect data on wage settlements.

Chart 3
Price cuts in the RPI



Negative settlements are indeed rare: in 1993, when 63% of employees were receiving settlements in the range 0.1%–2.4%, 3% were receiving pay freezes and only 0.2% of employees took pay cuts. In no other years were there any recorded negative settlements. Carruth and Oswald (1989) also find that there are very few negative settlements in the United Kingdom. Ingram (1991) uses manufacturing settlements data collected by the Confederation of British Industry and arrives at the same conclusion: negative settlements are extremely rare.

Table B
The distribution of wage settlements in the United Kingdom

Employees in each pay band as a percentage of the total

	Cuts	Freezes	0.1–2.4	2.5–4.9	5.0–7.4	7.5–9.9	10.0+
1992	0.0	5.8	0.8	78.1	15.2	0.0	0.2
1993	0.2	3.0	63.2	33.3	0.3	0.0	0.0
1994	0.0	0.6	47.7	50.9	0.7	0.0	0.0
1995	0.0	0.7	5.7	92.6	0.8	0.1	0.0
1996	0.0	0.7	11.3	86.1	1.8	0.0	0.1
1997	0.0	0.2	3.6	87.5	8.1	0.1	0.5
1998 (a)	0.0	0.1	0.4	85.3	12.8	1.3	0.1

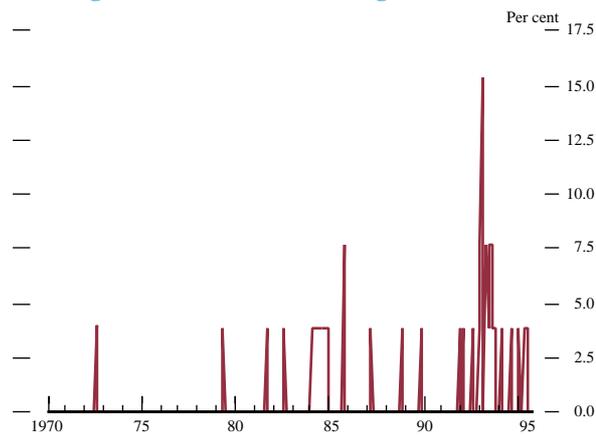
Source: Bank wage settlements database, compiled from IDS, LRD, IRS publications.

(a) Provisional data.

Of course, negotiated settlements may leave scope for employers to cut nominal earnings by other means. Chart 4, which shows the (unweighted) proportion of industries where average earnings fell over a twelve-month period, reveals that there are rather fewer earnings cuts than price cuts (Chart 3) in the United Kingdom. But we would expect this, because money wages rise not only with inflation but also with productivity.

Smith (1998) examines changes in the self-reported, ‘usual’ gross pay of respondents in the British Household Panel Study (BHPS): she finds that nominal pay cuts are common. Each year between 1991 and 1995, between 26%–30% of respondents (who did not change jobs) saw their nominal pay fall. Even this figure may conceal some flexibility, since employers could no doubt bring about deviations from ‘usual’ pay, for example, by varying overtime.

Chart 4
Earnings cuts in the United Kingdom



Source: ONS.

Table C summarises the evidence on the frequency of wage cuts, including studies on US data, which reveal a fair degree of controversy about exactly how frequent nominal wage cuts are.

What does the distribution of wage and price changes tell us about downward rigidities?

It is difficult to know what to conclude from these data on the frequency of wage and price cuts, because we do not know the counterfactual. For example, just because we observe some wages and prices falling, this does not allow us to rule out the possibility that these wages and prices would have fallen by even more in the absence of some downward rigidity. To detect downward nominal rigidity, we need to know more about the distribution of wage and price changes: in this way we can get a grip on the counterfactual.

First, if there is downward nominal rigidity, then we would expect wage and price changes to cluster at zero and so to exhibit positive skewness. Of course, there may be other factors causing a cluster at zero—for example, productivity shocks could cluster such that the bargained wage change comes out at zero—but this is unlikely.

Do the UK distributions of wage and price changes show some signs of skewness? The settlements data are clearly truncated at zero—see Table B. Table A also shows some evidence of a cluster at zero and positive skewness in retail prices. But Charts 5 to 7 show that average skewness does not seem to be positive, and in fact varies a great deal.

There is also useful information in changes in the distribution over time. Skewness should fall as inflation rises: the higher the rate of aggregate inflation, the fewer workers and firms there are who would ideally like to cut wages/prices, and the fewer recorded wage changes there

Table C
Evidence on nominal wage rigidity: the frequency of wage cuts

Source	Nature of data	Summary
Akerlof <i>et al</i> (1996), Bureau of Labor Statistics	Changes in wages by employers (ie settlements) 1959–78 (US)	Negligible fractions of both union and non-union employers making negative changes
Akerlof <i>et al</i> (1996), Authors' survey of Washington area	Phone survey of respondents' wage changes in previous year, 1995 (US), excluding overtime and bonuses	1.7% negative pay changes and no change in job characteristics; additional 1% with changes in job characteristics
Akerlof <i>et al</i> (1996), Bureau of Labor Statistics	Contract settlements involving more than 1,000 workers (US)	2.3% of contracts with negative changes in first year, average 1970–94
Various studies using the Panel Study of Income Dynamics (PSID)	Wage and salary changes (including bonuses and overtime) (US)	10.6% of wage-earners and 24.3% of salary-earners with pay cuts
Carruth and Oswald (1989)	UK settlements data	Nominal wage cuts rare
Crawford and Harrison (1997)	Canadian SLID data, 1993	10% had hourly wage cuts
Crawford and Harrison (1997)	Sobeco Ernst and Young Survey of wage changes, including bonuses	9%–20% had wage cuts
Crawford and Harrison (1997)	Canadian union wage settlements data units of >500 employees	Negligible number of negative settlements
Pierre Fortin (personal communication with Akerlof <i>et al</i>)	Canadian labour contracts without COLAs	0.25% with wage cuts during 1986–88; 5.7% with cuts and 47.2% with wage freezes during 1992–94
Holzer (1996) four-city study	Changes in wages of new employees (excluding bonuses etc) reported by firms hiring non-college graduates (US)	4.84% of new employees with wage cuts
Ingram (1991)	UK manufacturing settlements data	Nominal wage cuts rare; wage freezes common in recession
O'Brien (1989), Hanes (1993), and others	Historical data (US)	Considerable wage rigidity in pre-war recessions
Smith (1998)	United Kingdom, gross pay from the BHPS, 1991–95	30% of job-stayers (per year) had nominal pay cuts
Yates (1998)	UK settlements data 1992–97	Very few recorded nominal wage cuts

ought to be clustered around zero. In other words, downward nominal rigidity should mean that there is a negative correlation between the mean and skewness of inflation in prices and wages. We cannot rule out the possibility that there might be other reasons why there is a zero-spike, or that this spike should correlate with the inflation rate. But in the absence of any obvious candidates, it would seem reasonable to interpret any correlation as revealing downward nominal rigidity.⁽¹⁾

We can test this straightforwardly by examining the correlation coefficients between different moments of price and wage changes for the United Kingdom. (The data used run from 1965–95 for wages; from 1975–95 for retail prices; and from 1980–95 for producer prices.)⁽²⁾ These coefficients show that there is no strong negative correlation

(1) Hall and Yates (1998) point out that a negative relation between mean and skewness could also indicate *upward* nominal rigidity; in which case, we need to use theory to decide whether a negative correlation is indicative of downward or upward rigidity. Kashyap (1995) is the only reference to the possibility that prices might be sticky upwards, pointing out that firms may be reluctant to push prices above certain nominal thresholds (eg £2.99 or £3.99) if they expect that demand would fall disproportionately. Hall *et al* (1996) found that 34% of firms (and 69% of retailers) thought that threshold pricing was important for their pricing. This argument is of course less relevant for wages. Other studies of the skewness in wage and price distributions include McLaughlin (1994), Lebow, Stockton and Wascher (1995) and Kahn (1997).

(2) The evidence on wages is an update of Yates (1995); the evidence on prices cited here draws from Hall and Yates (1998).

Chart 5
Skewness in retail prices

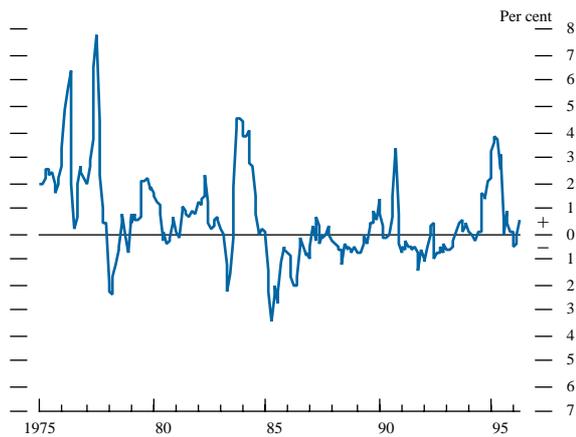


Chart 6
Skewness in producer prices

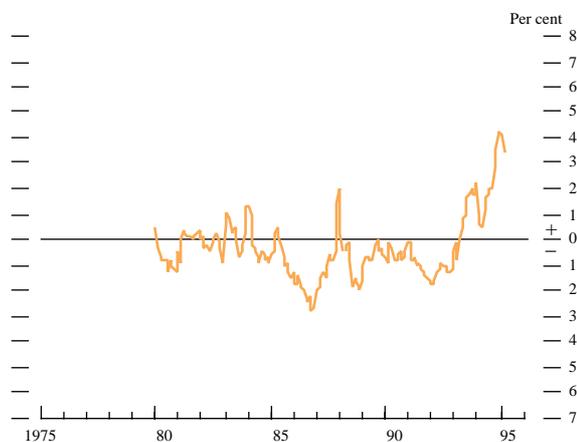
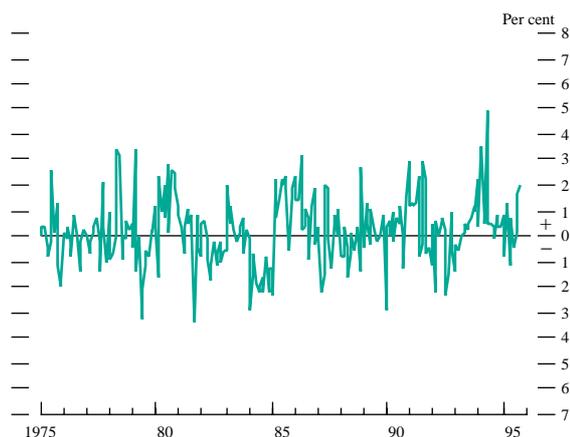


Chart 7
Skewness in wages



Note: All data come from the ONS; distributions are of the annual change in prices or wages, so these are the units of 'skewness'; retail price distribution consists of 65 sub-components; the producer price distribution is a disaggregation of the Producer Price Index, made up of around 300 sub-components; the earnings distribution is of SIC two-digit industries.

between the mean and skewness of inflation in retail, producer prices or wage inflation.

Hall and Yates (1998) go on to test more formally for a relationship between the mean and skewness of price changes, using the concept of Granger causality. These

results, together with new results for UK earnings data, are reproduced in the Annex on page 243. If downward nominal rigidity is a significant phenomenon, then not only should there be a significant negative causality, but this causality should run from mean inflation to skewness and not the other way round. In fact, the results show no evidence of this. In no case, for either retail/producer prices or wages, is there any significant negative causality running from mean inflation to skewness. Formally, the hypothesis that the coefficients on mean inflation are insignificant in a regression of the skewness (or kurtosis) of inflation on its own lags can be accepted with a level of confidence greater than 80%. The closest to a result consistent with downward nominal rigidity is that there is evidence of negative causality running from the skewness to the mean of (i) the level and change in wages, and (ii) the change in retail prices. But the causality goes the wrong way for this to be evidence of downward nominal rigidity. Hall and Yates (1998) report experiments testing for the impact of the level of aggregation used in the calculation of the moments of these distributions, the weighting procedures used to construct the inflation aggregates, and the sample period. They conclude that this central result is relatively robust.

But other studies that use more disaggregated data have tended to find evidence of downward nominal rigidity, for example, Card and Hyslop (1995), using US data on individual earnings from the Panel Study of Income Dynamics (PSID). But Card and Hyslop noted that the data source that they used excluded low-performing job-movers, and perhaps biased the results towards finding evidence of downward nominal rigidity. Using the same PSID data, Kahn (1997) notes that while the spike in the distribution of wage-earners (paid more often than monthly) gets larger as inflation falls, this is not the case for salary-earners (paid monthly): regressions of the asymmetry in the wage distribution on the median wage change in Lebow *et al* (1995) confirm this dichotomy.

Brown *et al* (1996) confirm these findings, using CBI manufacturing settlements data for the United Kingdom. They measure wages at the level of the bargaining group, and so include all individuals, low-performing or otherwise (although there may be other selection biases induced by studying only firms who are CBI members). However, the drawback of settlements data, as we have already noted, is that firms can, in practice, achieve nominal earnings flexibility by varying hours worked, or overtime rates, or holiday, or other benefits, or any number of variables that are not measured by Brown *et al*. So an apparent downward rigidity in settlements may not imply that total earnings are rigid downwards. Smith's (1998) study of the BHPS reveals that between 6%–7.5% of those who did not change jobs had constant nominal wages (year on year) between 1991–95. The figure falls somewhat when she adjusts for those who report changes in hours worked, and the 'spike' is likewise smaller for 'job-changers'.

Table D summarises the evidence on how inflation affects the distribution of wages and prices.

Table D
Evidence on nominal rigidity: the effect of inflation on the distribution of wages and prices

Source	Nature of data	Summary
Lebow <i>et al</i> (1992)	US retail prices	No negative correlation between skewness and mean inflation
Rae (1993)	New Zealand retail prices	No negative correlation between skewness and mean inflation
Crawford and Dupasquier (1994)	Canadian retail prices	No negative correlation between skewness and mean inflation
Card and Hyslop (1995)	Panel Study of Income Dynamics (PSID) data (including earnings)	Inflation reduces the asymmetry between the upper and lower parts of the wage-change distribution
Lebow <i>et al</i> (1995)	As above—PSID	Correlation between asymmetry and inflation for wage-earners but not salary-earners
Brown <i>et al</i> (1996)	UK settlements data, manufacturing	Inflation reduces the asymmetry between the upper and lower parts of the settlements distribution
Crawford and Harrison (1997)	Canadian wage settlements data	Some evidence that the predicted number of settlement freezes is less than the actual number, at zero inflation. But depends on settlement definition
Groschen and Schweitzer (1997)	Federal Reserve Bank of Cleveland Community Salary Survey	Inflation reduces the standard deviation of wage changes across occupations and employers
Hall and Yates (1998) and Yates (1998)	United Kingdom: retail, producer price and average earnings distributions	No negative correlation between skewness and mean inflation
Yates (1998)	Japan: earnings and wholesale prices	No significant negative correlation between the skewness and mean of wage or price inflation
Smith (1998)	United Kingdom: gross pay of job-stayers in BHPS	No significant correlation between asymmetry and inflation

So there is no unanimity on the question of downward nominal rigidities, and there are clearly problems in interpreting correlations between the moments of a distribution in the way that these studies do. On the face of it, the evidence for downward nominal rigidity remains unpersuasive.

Asymmetries in the response to shocks

One final broad type of evidence that can shed light on whether there are downward nominal rigidities or not is whether the economy as a whole, individual industries, or even individual firms respond in the same way to upward demand or supply shocks as to downward shocks. Small and Yates (1998) use the responses to the Hall *et al* (1996) survey to analyse asymmetries in price responses to cost and demand shocks. They find that output prices are downwardly rigid in the face of cost shocks, but upwardly rigid in the face of demand shocks. Arden *et al* (1997) find, using UK manufacturing prices, that prices are quicker to respond to upward than downward shocks. Buckle and Carlson (1998) use survey data on New Zealand

firms and find that (at high rates of inflation) prices are more likely to respond to demand/cost increases than decreases.

Blinder's (1995) survey also offers very mixed support for theories of downward nominal rigidity. He found that firms take longer to change prices in response to falls in demand and costs than they do to respond to increases in demand and costs. But he also reports that 4.5% of firms prefer to increase prices (rather than production) in response to a rise in demand, while 27% of firms prefer to cut prices in response to a fall in demand.

Another literature that has emerged over the last ten years or so looks at whether output responds symmetrically to upward and downward shocks to money or prices. If there is downward nominal rigidity in wages, for example, then a downward shock to prices will reduce the demand for labour (because the real wage will rise), and output will fall; an upward shock will have no (or at least a smaller) effect on employment or output. But though some of the results reported are consistent with there being downward nominal rigidity, they are not proof of it: De Long and Summers' work (which spawned the literature) was actually designed to test the 'credit channel' view of monetary policy. If this is what explains the asymmetry, then there are no implications for the existence of downward nominal rigidities.

Yet another approach has been to estimate the sacrifice ratio—the amount of unemployment generated by (or output lost in) a disinflation of a given size—and to see whether this is higher at lower rates of inflation.⁽¹⁾ If there are downward nominal rigidities, then it could be that inducing a disinflation will lead to more firms coming up against the downward floor to money wages when inflation is lower, and therefore that the (temporary) cost in terms of unemployment is higher. Ball, Mankiw and Romer (1998), Ball (1993), and Yates and Chapple (1996) all find that the output-inflation trade-off is higher in countries (or during episodes) with lower rates of inflation. Once again, these results are consistent with, but not proof of, there being downward nominal rigidity. (These particular pieces of work were actually designed to test 'menu cost' theories of price-setting, which predict that the trade-off will increase at lower rates of inflation, because firms change prices less frequently.)

The Ball, Ball *et al* and Yates and Chapple papers look at the correlation between the sacrifice ratio and inflation for a cross-section of countries. Another literature has sought to uncover evidence of non-linearities in the Phillips curve by estimating time-series relationships between inflation and growth, or inflation and unemployment. Certain types of non-linearity in these relationships might be consistent with downward nominal rigidity. For example, Clark *et al* posit that negative output gaps reduce inflation by less than positive output gaps increase it. That could be because negative output gaps do not have the same impact on

(1) Note that the conventional view is that in the long run there will be no impact on output or unemployment, so here we are really talking about whether the downward nominal rigidity increases the short-run cost of disinflation.

nominal wages, because of a floor to nominal wages, as positive output gaps do. Alternatively, one could invert the Phillips curve so that the output gap was on the left-hand side, and posit that negative changes in inflation are more likely to push desired wage changes against the zero constraint and therefore imply larger shifts in the output gap.

The evidence for non-linearity in the Phillips curve is decidedly mixed, as Table E shows. The findings differ according to the countries covered, the frequency and length of time-series covered and the method used to measure the output or unemployment gap. Such evidence as there is points to such effects being weaker in the United Kingdom than elsewhere.⁽¹⁾ Some (eg Clark *et al* (1996)) have argued

that tests have been biased towards finding that the Phillips curve is linear: policy may have acted to counter the potentially non-linear response of inflation to demand shocks, for example. But even if there were a non-linearity in the Phillips curve, hidden or otherwise, such a finding would only be consistent with, not proof of, there being downward nominal rigidities in an economy. Other explanations abound. For example, Debelle and Laxton (1996) motivate their non-linear Phillips curve by arguing that ‘as the unemployment rate falls below the NAIRU, bottlenecks start to develop which result in further increases in demand having even larger inflationary consequences’ (page 8): the idea being that, in the very short run, capacity is fixed, or at least prohibitively costly to expand.

Table E
Evidence on non-linearities in the Phillips curve

Authors	Country, time period, data frequency	Method	Measures of output gap and expectations	Conclusion
Evans (1992)	United States, 1953–91, quarterly	SVAR with time-varying parameters	Output gap and inflation expectations system-determined	Trade-off higher at low rates of inflation
Clark <i>et al</i> (1996)	United States, 1964 Q1-1990 Q4, quarterly	Kinked functional form	Moving average output gap, survey inflation expectations	Significant non-linearity
Laxton <i>et al</i> (1995)	Pooled sampled major seven OECD countries, 1967–91, annual	Cubic, quadratic, fractional functional forms, pooled estimation	HP-filtered output gap; proxy of inflation expectations based on lagged values of inflation and other variables	Linear model rejected by the data
Turner (1995)	OECD, early 1960s to 1994 approximately, annual	Kinked functional form	HP-filtered output gap, lagged inflation used instead of expectations	Linear model preferred for the United Kingdom; Phillips curve is non-linear in the United States, Japan and Canada
Bean (1996)	OECD, sample period varies from 1951/1983–92, annual	Pooled estimation, no correction for convexity in measurement of output gap; quadratic and exponential functional forms	Transform of capacity utilisation measure of output gap, lagged inflation proxy for inflation expectations	Mild non-linearity, but not significant at 10% level
Debelle and Laxton (1996)	United States, Canada, United Kingdom, 1971 Q2-1995 Q2, quarterly	Fractional functional form	Unemployment gap, bond market inflation expectations	No nested test, but argue that non-linear model fits data better under certain restrictions on the volatility of the NAIRU
Gordon (1996)	United States, 1955–96, quarterly	Kinked functional form	Lagged inflation proxy for inflation expectations; time-varying NAIRU estimated jointly with Phillips curve	No significant non-linearity
Eisner (1997)	United States, 1956–94, quarterly	Kinked functional form	Moving average of unemployment; lagged inflation proxy for expectations	Phillips curve is non-linear, but the curvature is opposite to that suggested by other papers, ie concave, not convex
Fisher <i>et al</i> (1996)	United Kingdom, 1977 Q1-1995 Q1, quarterly	Exponential functional form	Production function output gap, survey inflation expectations	Asymmetric Phillips curve fits the data better, but no nested test
Fillion and Leonard (1997)	Canada, 1968 Q4-1994 Q4, quarterly	Not known	Not known	Significant but imprecise asymmetry
Dupasquier and Ricketts (1997)	Canada, United States, 1963–95, quarterly	(i) correlation of errors from linear model with the output gaps (ii) correlation of trade-off with Maskeov inflation states	Multivariate filters/SVAR output gaps; lagged inflation and Kalmar Filter inflation expectations	Method (i) linear for Canada, non-linear for United States Method (ii) opposite to (i) above
Kimura and Ueda (1997)	Japan, 1976–95, quarterly	Kinked functional form for each industry	Actual unemployment, inflation proxy for expectations	No downward nominal rigidity in wages
Laxton <i>et al</i> (1997)	United States, 1968 Q1-1997 Q1, quarterly	Fractional functional form, Kalmar Filter; and estimation of Phillips curve and NAIRU	Michigan Survey expectations	Mild asymmetry fits the data better
Yates (1998)	United Kingdom, 1966 Q1-1994 Q4, quarterly	Kinked and quadratic functional form, model consistent output gap	Moving average output and unemployment gaps, filters, bond market expectations	No significant non-linearity
Yates (1998)	United Kingdom, United States, Sweden, France, Italy, Denmark, sample varies from 1800–1938, annual	Kinked functional form, SURE estimation	Moving average output gap	No significant non-linearity

(1) See *Working Paper* for further details, including test results.

Problems with the empirical evidence

What should we make of all this evidence on downward nominal rigidities? The majority of the evidence seems to point to there being no downward nominal rigidities, although there are clearly studies that suggest the opposite. There are two points we need to bear in mind for interpreting this evidence. First, some have argued that the likelihood of finding evidence of downward nominal rigidities is reduced by using data collected in an era of positive inflation, when the nominal wage or price floors do not bite. For example, if inflation is high enough, the whole of the wage distribution is above the zero floor, and we will not observe a spike. The only way of addressing this criticism is to look at evidence collected for countries or time periods when inflation was either zero or at least very low. Yates (1998) looks at this question by performing tests on the correlation between the mean and skewness of the wage and price distributions in Japan, concluding that there is no evidence of downward nominal rigidity. He also looks to see whether the Phillips curve is sloped differently when the aggregate price level is falling, where the Phillips curve is estimated over the period 1800–1938 and for the United States, United Kingdom, Italy, Sweden, Denmark and France. He detects no extra convexity in the Phillips curve during times of falling prices.

Another argument is that what little evidence there is of downward nominal rigidities is in fact *exaggerated*, not diminished, by it being collected in an era of positive inflation. For example, Ball and Mankiw (1995) present a model in which at zero inflation, firms respond symmetrically to shocks to desired prices in either direction; but when inflation is positive, firms have an incentive to allow downward shocks to prices to be achieved by the effect of inflation eroding the real price, rather than incurring a ‘menu cost’ associated with making a nominal price change. So though it is true that the historical inflation regime may affect our inference about whether or not there are downward nominal rigidities, it is not clear which way the evidence is biased.

Summary

This article has reviewed the theoretical and empirical evidence for the existence of downward nominal rigidities. It has argued that, contrary to the reasoning implicit in studies by others, a concern about fairness is not sufficient to generate downward nominal rigidities in wages. Other assumptions are also needed: that there are union

cartels; or that individuals/unions have no knowledge of outside wages; or that individuals/unions are highly averse to falling behind when wage contracts are staggered. A second possibility raised in the literature is that individuals might suffer from money-illusion. But they must also display loss aversion for this to be an explanation of downward nominal rigidities.

Three arguments have been advanced to support the existence of downward nominal rigidities in product markets. Price cuts may confuse customers used to positive inflation (a form of money-illusion); may be interpreted as quality cuts (and buyers are subject to money-illusion); and may be inhibited by strategic behaviour between firm cartels.

Four types of empirical evidence have been examined:

- (i) *the frequency of wage and price cuts*, which is not particularly illuminating, since it is unknown how frequent wage and price cuts would be in a frictionless world running at a given inflation rate;
- (ii) *the skewness of the distribution of wage and price changes*, which should be negatively related to the mean if downward nominal rigidities were operating. This was generally found not to be the case for either wages or prices in the United Kingdom;
- (iii) *survey evidence* (in particular from the Bank) on how firms set prices, which shows that prices are downwardly rigid in response to some phenomena, but upwardly so in response to others; and
- (iv) *evidence on the UK Phillips curve*, which it has been argued is not significantly convex.

Much of the empirical evidence is only consistent with and not proof of downward nominal rigidities, and tests have not revealed the existence of downward nominal rigidities in countries or time periods in which prices were falling. Moreover, there are theoretical models that predict that at positive rates of inflation, we are more rather than less likely to detect empirical relationships that reveal an apparent downward nominal rigidity.

In short, the theoretical arguments for downward nominal rigidities are more complex than much of the literature would have us believe. The empirical evidence leaves the case for downward nominal rigidities at best unproven.

Annex

Granger-causality test results:

(i) Wages

Dependent variable	Independent variable	P	Sign of sum of coefficients on independent variable
skew	mean	0.62	+
mean	skew	0.06	-
kurt	mean	0.66	+
mean	kurt	0.12	+

(ii) Producer prices

Dependent variable	Independent variable	P	Sign of sum of coefficients on independent variable
skew	mean	0.91	+
mean	skew	0.66	-
kurt	mean	0.59	+
mean	kurt	0.92	+

(iii) Retail prices

Dependent variable	Independent variable	P	Sign of sum of coefficients on independent variable
skew	mean	0.24	+
mean	skew	0.10	-
kurt	mean	0.44	+
mean	kurt	0.29	-

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