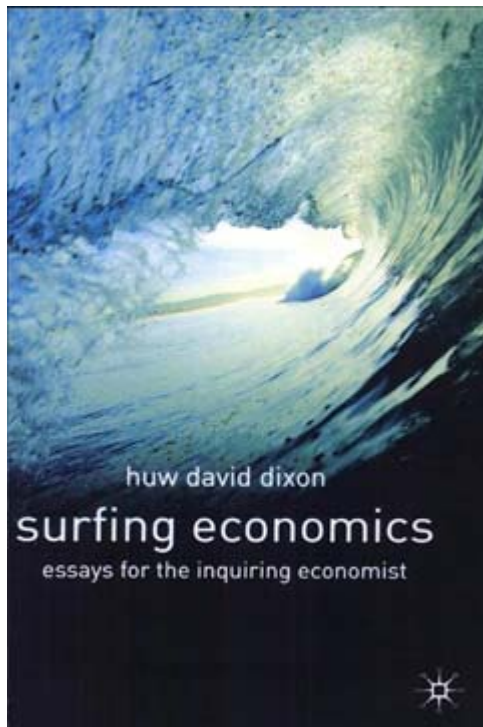# New Keynesian macroeconomics (New Keynesian economics).

Huw Dixon.

Entry For New Palgrave Dictionary of Economics, 2nd Edition

Key words: nominal rigidity, sticky prices, imperfect competition, economics, macroeconomics, Keynesian, new.

**Cardiff Economics
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Abstract.

This dictionary entry defines the development of new Keynesian macroeconomics (NKM) since the 1980s. I argue that the key defining feature NKM is the introduction of imperfect competition, making price and/or wage setting endogenous and hence allowing for a rigorous understanding of nominal rigidity. This has led to a shift away from perfect competition in macroeconomics. The combination of NKM with dynamic macroeconomic modelling has led to the current orthodoxy: the new-neoclassical synthesis. Dynamic wage and price models lead to monetary neutrality in steady-state, non-neutrality out of steady-state. Other themes in NKM include efficiency wage theory and coordination failure.

Keywords: Keynesian, nominal, rigidity, new.

JEL: E1, E3, E4, B22.

The term "new Keynesian economics" came into popular usage in the 1980's. The origins of the term are fairly easy to understand in broad historical terms. In the Classical approach of the pre-Keynes world (prior to 1936), wages and prices were seen as perfectly flexible and markets competitive (or at least ideally so). The Keynesian revolution argued that prices and more importantly wages were rigid and in order to understand phenomena like prolonged mass unemployment it was necessary to see how the economy operated when not in competitive equilibrium. In the post second world war period there emerged the neo-classical synthesis model which dominated macroeconomics from the 1950's to the mid-1970's. The essence was that in the *long-run* all prices are perfectly flexible and the competitive or "Walrasian" equilibrium will hold. However, in the *short-run* we could treat prices and/or wages as given. Thus we had the IS-LM and AD-AS (aggregate supply and demand) models which were the workhorse of macroeconomic research until the mid-1970's and have remained established in many textbooks to the present day.

This approach was in the process of being overtaken at the level of research by the "New Classical" or rational expectations revolution of the 1970's. One aspect of the neo-classical synthesis was that not only prices, but expectations were treated as fixed in the short-run, or subject to ad-hoc adjustment as under the adaptive expectations hypothesis. The New Classical approach was based on the idea that wages and prices are perfectly flexible, but that agents did not have full information: even though they used the information they had optimally (rational expectations), markets could deviate from the full information equilibrium because information was imperfect. For example, agents might not know about the values of certain current variables such as aggregate price or the money supply when deciding how much output to produce or labour to supply.

New Keynesian economics was to incorporate the rational expectations framework. However, it was to focus on the key issue of nominal rigidity: how do we understand the short term rigidity of wages and/or prices in terms of providing a micro-foundation which will explain why prices might not be perfectly flexible. Now, this required a "revolution" of the order of magnitude of the rational expectations revolution. That revolution consisted in one idea: in order to understand nominal rigidity, you needed to abandon the approach of perfect competition with price-taking agents, and replace it with an approach where there are wage and price-setting agents. This is self-evident in hindsight: if you want to understand why wages and prices are rigid in the short-run, you have to have agents who set the price, so that you can understand the microeconomics of price-adjustment. If all agents (firms, households) are price-takers, prices can only be explained by some notion of "demand equals supply" and a shadowy Walrasian auctioneer acting like an invisible puppet-master cum market maker, the auctioneer adjusts prices gradually in response to excess demand or supply.[1] This is hardly the basis for a rigorous theory of why prices and wages are not always at their market clearing levels: the auctioneer called in sick or went on holiday!

Just to complete the historical setting, alongside New Keynesian ideas there was the Real Business Cycle research programme which put forward the radical idea that nominal wage and price behaviour were irrelevant for understanding macroeconomic

dynamics. Changes in output and employment were driven by real things such as productivity shocks, and that the savings and investment decisions of agents were inherently dynamic. This was a radical agenda which also pushed macroeconomics into trying to provide a quantitative explanation of economic fluctuations based on a competitive equilibrium model. However, despite many successes, the methodological idea of ignoring nominal things was an unsustainable self-limitation. For one thing, governments and central bankers are interested in the nominal side of things: inflation, the transmission mechanism of monetary policy etc.

So, in the mid-1990s there emerged the "New" neo-classical synthesis (NNS). This combined the dynamic framework of the RBC approach with dynamic pricing models developed by the New Keynesian approach. The key idea is that in the long-run money is neutral, but in the short run there is some nominal rigidity resulting from the price-setting behaviour of firms (and wage-setting behaviour of unions). This approach to modelling has certainly become the dominant school of thought, at least in Central Banks of Europe and the US.

The microfoundations of wage and price rigidity.

So the problem in the late 70s and early 80s was clear. Most of economics was based on models of perfect competition,[2] where all agents are price-takers. An agent is a "price-taker" if it believes that it can trade any quantity at the market price which it treats as given, as exogenous. Price-taking only makes sense when markets clear, supply equals demand. If supply does not equal demand, then something has got to give because the chosen trades do not add up to zero. An alternative was needed. Up until then, various ad hoc assumptions had been made: the simplest was that wages and or prices were simply assumed to be fixed (this was justified by the notion that the model was a short-run model). Another ad hoc fix was that the market was competitive but that the price cleared the market *ex ante*: the invisible auctioneer sets the price which she expects to clear the market before it opens. The basic and fundamental new Keynesian insight was that the assumption of price-taking behaviour had to be abandoned. Real agents such as firms, households or unions needed to be price makers. But, this meant that the notion of perfectly competitive equilibrium needed to be abandoned: the alternative was going to be an imperfectly competitive equilibrium where (some) agents have market power. The classic imperfectly competitive equilibrium is pure monopoly: a monopolist can set any price he pleases, and will maximize profits. The monopolist equates marginal revenue with marginal cost: if he faces a downward sloping demand curve, this means that the monopolist will set a price above the competitive price and output will be lower than in the competitive equilibrium. Whilst the firm increases its profits there is also a decline in consumer surplus and the total surplus (consumer plus producer) declines.

In the absence of market failure, the perfectly competitive equilibrium is Pareto optimal. If we are adopting a representative agent framework (as has most often been the case in macroeconomics since the neoclassical synthesis), Pareto optimality means that the equilibrium outcome maximizes the utility of the representative agent. Hence, if we look at small deviations from equilibrium (in terms of output, employment and so on), they will not have a first order effect on welfare. This is an envelope theorem: the first order conditions for optimality state that the first order effect is zero at the optimum. With imperfect competition, by contrast, we start away from the optimum.

Hence there are first order effects of changes in output and employment: since the monopolist restricts output, an increase is good and a decrease bad. To many macroeconomists, this seems more plausible and common sense than the implication of the first welfare theorem that starting from the competitive equilibrium increases and decreases in output and employment are both (slightly) bad.

The introduction of imperfect competition into a tractable general equilibrium framework (albeit a static one) was achieved by Oliver Hart (1982), and he did stress the "Keynesian features" of the model. However, Hart's was a real model without money: what was needed was to link this idea to nominal rigidity. It was a few years later that the penny dropped simultaneously in three papers: Akerlof and Yellen (1985), Mankiw (1985) and Parkin (1986). The new idea was that of "menu costs": the idea that there might be "costs" to changing a price, which might be interpreted broadly as decision and implementation costs (the line taken by Akerlof and Yellen and interpreted as a sort of bounded rationality) or as literally the cost of implementing a price change (having new menu's printed). This idea was not new: the (S,s) models of pricing with inflation developed in the 70's's by Sheshinski and Weiss (1977) used it, as did some other papers in the non-macroeconomic literature.

The insight is that if a monopolist sets its price optimally, a small deviation from the optimum will have no first order effect on *profits*. If there is a small but lump-sum cost of changing a price, then the effect of a price-setting monopolist to an increase in demand (or cost) might be to leave the price where it is, not to change it. Thus, even small menu costs can give rise to some nominal rigidity: because at the optimum there is no first order effect on profits, the menu costs only have to overcome the smaller higher order effects. Thus, we now had the beginnings of a theory of nominal rigidity based on monopolistic competition and menu costs. The nice feature of the model was that although the menu costs could be small, the nominal rigidity they created would give rise to first order welfare effects (since we start from a level of output and employment below equilibrium). Whilst the idea is very simple and powerful, it did alas run into a problem. In static models it is easy to use the menu-cost approach. However, macroeconomists in the 80s were interested in dynamic models, and menu-cost models have proven very difficult to solve except under very special cases. For example Caplin and Spulber (1987) looked at steady-state inflation and found that although the menu costs caused individual firms to have prices that remained fixed for a time, in aggregate prices drifted up with the aggregate money supply yielding the same aggregate output and inflation as with flexible prices. It has only been much later since the new Millenium dawned that these models are beginning to be solved for interesting dynamic cases (under the new name "state-dependant pricing" models).

However, the menu cost idea spawned a large literature looking into how certain features of the economy might allow even smaller menu costs to give rise to nominal rigidity. For example, Ball and Romer (1990) argued that if there were some real rigidity in the economy, it would interact with the nominal rigidity of prices, reducing the size of menu costs required to induce nominal rigidity. The real rigidity might take the form of an efficiency wage model for example, where the equilibrium determined the real wage which was not sensitive to the level of economic activity. On the empirical level, Ball Mankiw and Romer (1988) argued that the menu-cost theory had a clear prediction for the relation between inflation and the inflation-output trade-off. If steady-state inflation was higher, this would mean that for a given level of menu

costs, firms would change prices more frequently (there is less nominal rigidity). This in turn would mean that changes in nominal demand would have less effect on output when inflation is higher. Thus the non-neutrality of money in the short run was higher in low inflation economies than in high inflation economies, which was confirmed in the data.

Whilst there has been until recently quite some difficulty in making state-dependant or menu cost models tractable enough to model wage and price dynamics out of steady state, another class of models proved well suited to a dynamic setting. These were the *time-dependant* models of pricing, which focussed on the notion of staggered wage and price setting: Taylor (1979) and Calvo (1983). Indeed, these two models have become the work horses of the New Neoclassical synthesis framework. John B Taylor's model focussed on wage-setting: the empirical evidence suggests that many wage contracts take the form of a nominal wage being set for a period of 4 quarters. However, wages in different sectors are negotiated at different times. It is usually assumed that there are 4 equally sized cohorts, one cohort resetting the wage each quarter. Whilst this framework does not explain why wage contracts last for a particular period, it does start out from firm empirical observation and works out the implications of this for the resultant process. What we find is that wages gradually adjust to their new steady state values. The reason for this is that when setting wages the current cohort is facing an aggregate price level partly determined by cohorts that have moved previously. At any one time, with 4 cohorts, 3 cohorts will not reset the wage: they reset their wages in the previous three quarters. When the union sets its wage, it looks at what the aggregate price level and demand will be over the period of the contract: in this sense the wage-setting rule is dynamic and forward looking. However, it is also looking back at the previous wages insofar as they are reflected in the current price. This results in a gradual adjustment of wages and prices in response to a nominal shock. Taylor (1999) provides a good survey of this approach.

Calvo's model of nominal rigidity is based on a constant hazard rate model: each period, the firm or union faces a given probability of re-setting its price or wage. The expected duration of the price or wage when it is set is the reciprocal of the reset probability. The firm when it sets its price looks into the infinite horizon, and takes into account the future price with the probability that the current price being set will still be in force. Thus, if the reset probability is 0.25 per quarter, we will observe 25% of firms resetting price in any one quarter. When they set the price, each firm expects that the price it is setting will last for 4 quarters, but there is en ever diminishing probability that the price might last ever longer. If we look across all firms, the average contract length will be about twice the life expectation at birth (twice the life expectation at birth minus 1). Thus a reset probability of 0.25 implies an average lifetime of prices set by all firms across the economy of 7 quarters (See Dixon and Kara 2006). The firms choose an optimal price in a dynamic setting, but the setting itself leaves the fundamental probability of resetting the price is not explained. However, the model is highly tractable and has since become very popular.

Other New Keynesian themes.

Whilst the theoretical microfoundations of nominal rigidity was the main theme of new Keynesian economics, there were other themes that shared the theme of

establishing the implications of imperfect competition and other market imperfections as an alternative equilibrium concept to perfect competition.

One theme that that ran through the new Keynesian literature that did not involve nominal rigidity was the effect of imperfect competition on the government expenditure multiplier. Two papers by Dixon (1987) and Mankiw (1988) found that in simple general equilibrium models an increase in the degree of imperfect competition reflected in a bigger markup of price over marginal cost meant that the balanced budget government multiplier was bigger. The intuition behind this result was that there was a profit feedback effect: as output increased, so did profits of firms, who paid it back to households in dividends who then spent part of it again and so on. This feedback effect was bigger the bigger the markup. In a constant returns to scale world, there were no profits in a perfectly competitive equilibrium, so the effect was completely absent. In a follow-up paper, Startz (1989) argued that whilst the Dixon-Mankiw result held in the short-run with a fixed number of firms, in the long-run free entry would eliminate profits and the relationship between profits and the multiplier would disappear. This argument turned out to be true in general only in the case of constant returns to scale. The point is that when you allow for a concave production function with diminishing marginal product of labour, a second mechanism comes into effect: as employment rises, the real wage falls which tends to reduce consumption. In the Walrasian case of perfect competition, the real wage effect always dominates the profit effect: the long-run multiplier with free entry is always greater than the short run multiplier. It follows that if there is only a little imperfect competition, this will still be true, as shown in Dixon and Lawler (1996). Startz's result holds because with a constant marginal product of labour the real wage mechanism is absent and only the profit feedback is present.

It should be noted that the fiscal multiplier is still always less than unity. What is happening is that in equilibrium imperfect competition leads to lower real wages (the markup in the product market leads to real wages being below the marginal product). Households react to this by choosing more leisure and less consumption for any given utility level (the level of economic activity is below the perfectly competitive level). Now, an increase in government expenditure financed by a lump sum tax makes the household worse off: it reacts by reducing its consumption and leisure, (less leisure means working harder). The reason the short-run multiplier tends to be larger when there is more imperfect competition is that the equilibrium ratio of leisure to consumption is larger, so the effect of the tax on labour supply is larger, resulting in a bigger overall increase in labour supply and hence less crowding out of consumption. The mechanism underlying this is essentially a supply side effect, which is not exactly what some people might think of as "Keynesian".

The notion of "coordination failure" was also important in new Keynesian thought. The idea arose out of the concept of strategic complementarity. Strategic complementarity occurs when the marginal benefit from the action of one agent is increasing in the level of activity chosen by other agents. Effectively, the reaction functions are upward sloping. Cooper and John (1988) applied this idea to several macroeconomic applications, including search models and demand spillovers in multi-sector economies and the subsequent literature has applied this concept to a almost any model with positive externalities. One interesting feature of the coordination failure approach is that there may be multiple equilibria: if this is so and

the equilibria are symmetric the equilibria will be Pareto ranked. With positive externalities the high activity equilibria will Pareto dominate the low level equilibria. The existence of multiple equilibria is not easy to establish: it requires as a necessary condition that the slope of the reaction function must be greater than one for some values in between the two symmetric equilibria.

In the labour market, there were several developments in the new Keynesian literature. Perhaps the most important were the development of efficiency wage models. Whilst the model of efficiency wages had a long pedigree, it was seen as a way of modelling how firms might set wages at a level different to the competitive level. In Shapiro and Stiglitz (1984), the internal monitoring problem faced by the firm is influenced by the level of unemployment, since the higher the level 0of unemployment the costlier it is for an employee to lose his or her job. Unemployment can therefore act as a disciplining device. This model predicts that firms will be forced to pay workers a higher wage when unemployment is lower, leading to a theoretical explanation of pro-cyclical wages.

The New Neoclassical Synthesis (NSS).

In the 1990's, New Keynesian ideas become part of the NNS approach, which is a combination of the dynamic structures developed by RBC theory with a nominal side to the economy which is based on imperfect competition and nominal rigidity. One of the main contributions has been the new Keynesian Phillips curve: this can be derived form both the Calvo and Taylor models of dynamic pricing (see Roberts 1995). The equation relates current inflation to current output and expected inflation next period

$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t$$

Where inflation is π_t, the discount rate is β and output (deviation from capacity) is y_t. This differs from the traditional Phillips curve in which the expectation of current inflation appears on the RHS. The coefficient on the output gap is related to the probability the firm can reset its price, the discount rate and a parameter capturing the sensitivity of marginal cost to output. Empirically, the new Keynesian Phillips curve has not done that well. The evidence seems to support the idea that lagged inflation needs to be included as well (resulting in the so called "hybrid Phillips curve"). This has led to the idea that indexation might be important: in the periods between when firms can set prices or wages explicitly, they are updated by a "rule of thumb" using last periods inflation rate (see Eichenbaum et al 2005) which results in a hybrid Phillips curve.

The Keynesian notion of demand management is very much at the centre of the analysis of monetary policy: the central bank is seen as using interest rate policy to stabilise the economy in two senses. The overall policy design should be to stabilise expectations and rule out explosive or indeterminate solutions: the possibility of economic turbulence caused by sunspot equilibria is seen as welfare reducing to be avoided (this is called *extrinisic uncertainty*). Thus policy should give rise to a unique rational expectations equilibrium path. In most models, a necessary condition for a unique equilibrium path is that the interest rate policy satisfies the *Taylor principle*, which states that if nominal inflation rises the central bank should raise the nominal interest rate by more, so that the real interest rate rises. Monetary policy should also be designed to stabilise the economy in response to real shocks, the *intrinsic*

uncertainty facing the economy. This has been dubbed by some the "science of monetary policy" (see Clarida et al 1999).

An Evaluation.

The most lasting legacy of new Keynesian economics was to put imperfect competition and non-competitive models at the heart of macroeconomics. For a long time many economists had been impatient with the assumption of market clearing, demand equals supply as a basis for macroeconomics. However, a quest for a rigorous and consistent alternative has been underway since Keynes' *General Theory* in 1936 had raised more questions than it answered. Whilst it had given rise to the notion of using fiscal and monetary policy to stabilise the economy, this remained a practical art without a proper theoretical framework to underpin it. The real achievement of the new Keynesian literature was to provide the theoretical alternative to demand and supply economics. Economics has always been ideological as well as scientific. There are those free market ideologues who believe that the free market is almost always the best and that the state should intervene as little as possible in the market. There are also those that believe that although markets are pretty good at many things, markets can also malfunction and maybe there is a role for some sort of public policy. In macroeconomics this polarity was at its most obvious. The real Business cycle theorists used models with perfect markets and were largely of the "free market" variety of economists. New Keynesian economics provided a rigorous alternative to the free market perspective and as such has left a lasting legacy which we can see is firmly embedded in the way nominal rigidity is understood and monetary policy is practised.

Further Reading.

Insofar as there is a defining text of new Keynesian macroeconomics, it is Mankiw and Romer's two volume edited collection (1991). There are some good surveys made in the early 90s: Silvestre (1993) focuses on the issue of imperfect competition; Dixon and Rankin (1994) more on the implications for macroeconomic policy issues.
On the NNS approach, the monetary policy aspects are well surveyed by Carida et al (1999), and for text book treatment of the modelling foundations turn to Walsh (2003) chapter 5 and Woodford (2003) chapter 3. There is also an excellent survey of several NNS models of nominal rigidity in Ascari (2003).

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[1] Indeed, such was the theory of the tatonnement, but this did not allow for out of equilibrium trading, so was largely irrelevant for macroeconomics and is found only in microeconomics textbooks.

[2] There were some big exceptions, notably Industrial Organization which was based on oligopoly and monopolistic equilibrium models and labour economics in which union models were commonplace.