Baumol and the post-industrial trilemma: examining the relationship between productivity, prices and wages

Lewis, Paul and Peng, Fei

December 2012

Baumol and the post-industrial trilemma: examining the relationship between productivity, prices and wages

Paul Lewis*† and Fei Peng*

* Birmingham Business School, University of Birmingham, Birmingham, West Midlands, UK

†Corresponding Author, Birmingham Business School, University House, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. Telephone 0121 414 8786; Email: lewispc@bham.ac.uk

Abstract

This paper challenges the economic constraints associated with the so-called post-industrial trilemma. Following Iversen's and Wren's seminal 1998 paper, it has been widely accepted that differential industry-level productivity increases rule out a solidaristic structure of wages, due to the fact that private services will become priced out of the market. We challenge this assumption both theoretically and empirically. Theoretically, we highlight the questionable assumptions within William Baumol's 1967 economic model that underpins the trilemma, contrasting it with alternative neoclassical theory and 'power theories of industries'. Building upon this, we empirically demonstrate that productivity increases have a very small effect upon industry wages. Much more important is the pricing power of an industry, which results from the complex interaction of firms with their physical and institutional environment. Contrary to the trilemma, this suggests that wage increases are not primarily constrained by sectoral productivity increases. More equal paying societies will certainly have a different structure of relative prices for goods and services to unequal ones. Whether they have sufficient demand to ensure high levels of employment in private services depends upon multiple factors that are not fixed but vary by place and over time. We argue that distributional choices over earnings continue to be open to social and political influence with much less rigid economic constraints than have perhaps been assumed.

JEL classification: C33, J24, J31, L16

Keywords: labour productivity, industrial price, wage structure, simultaneous model, panel data

Preliminary, please do not quote or cite without permission

Introduction

It has become conventional wisdom in political economy that changes in the structure of developed economies since the late 1960s, the transition to so-called post-industrialism, has created inescapable economic constraints that circumscribe politics. Echoing the Mundell-Fleming 'trilemma', applicable to open economies with free capital movements, Torben Iversen and Anne Wren proposed a second trilemma facing post-industrial states. They argued that only two of the following policy objectives are possible: earnings equality, high levels of employment, and public sector budget restraint. Whilst the choice of national policy configurations are a consequence of 'political coalitions, institutions, and political-economic constraints that support or challenge the perpetuation of any particular model', the underlying 'economic constraint' is taken as given (Iversen and Wren, 1998:516). A large literature has combined this argument with that of changing demographics and the disciplining effect of international capital markets to question the continued viability of European welfare states and social democratic projects in general (e.g. Pierson, 2001; Ferrera, 2008:91). The underlying theme is affordibility – affordibility of wages for the firm and industry, affordibility of public services and debt levels for governments.

This paper re-examines the assumed economic constraints acting upon the distribution of wages. It does not seek to directly challenge Iversen's and Wren's macro-empirical findings of a negative relationship between economy wide earnings equality and growth in the ratio of service sector employment. Nor does it challenge the predictable observation that the size of the public sector budget is related to the size and change in public sector employment.

Their first finding implies that more equal wages mean higher prices and lower demand for many private services compared to economies with purer 'market' determined wages. As with Iversen and Wren, we do not directly examine the pattern of demand for services over time. However, there are good reasons to question whether their finding should be treated as an ahistorical law. Whilst it provides an average view across selected industries and countries for the period studied,[1] the price elasticity of demand is unlikely to be uniform or stable across industries and countries.

Our analysis suggests that the proportion of household budgets available for the sorts of services that Iversen and Wren were examining is continuously rising, due to the falling cost of goods and services that exhibit productivity increases and benefit from the cheaper labour that globalisation incorporates. Hence, changes in working patterns, family life and cultural influences may increase demand for these services at the same time that the budget available for them is increasing, resulting in growing service sectors that *do not* depend upon very cheap labour for their existence.

[1] It should be noted that Iversen and Wren exclude a number of higher paying services – finance, insurance, real estate and business services - for reason of incomplete data, and transport, storage and communication due to ambiguity in their categorisation as manufacturing or services. They suggest that wage structure and employment growth are not related for these services and therefore they would not affect the observed equality-employment trade-off (Iversen and Wren, 1998:520). However, this raises the question of why these services should be exempt from the main argument of the paper, which is never addressed.

The second finding, as Iversen and Wren recognise, is the consequence of national political choices. However, this need not imply that the budget is spiralling out of control in countries that opt for wider public sector provision of certain services. It is not the Nordic countries, taken as the exemplar for the public provision of services, that are currently facing sovereign debt crises.

The focus of this paper is to challenge whether these macro level findings provide sufficient support for the underlying causal process that Iversen and Wren adopt. That is, sectoral wage increases must be linked to sectoral productivity increases otherwise low levels of demand and/or increasing public sector delivery result. It is this 'economic constraint' relating productivity to wages that we wish to challenge, first theoretically and second through new empirical analysis.

We argue that the most significant factor in supporting average sectoral wage levels and increases, whilst avoiding the undesirable macroeconomic consequences that Iversen and Wren highlight, is not whether or not sectors are able to increase their productivity, but whether they are able to maintain or increase high levels of economic output per input.[2] The latter is necessarily a nominal measure that incorporates the pricing power of an industry over both buyers and suppliers. What matters most is an industry's 'power position', its ability to generate and sustain high levels of value-added per input at *current* prices. As we demonstrate, this is not simply a function of whether an industry is able to increase its productivity.

Baumol's cost disease as foundation of the post-industrial trilemma

The trilemma is constructed upon William Baumol's work on the 'cost disease' of the service sector of the economy. Baumol developed a simple macroeconomic model to assess the consequences of solidaristic wage bargains. He admitted that it does not have 'the elegance and rigour of microeconomic analysis at its best,' but considered it still able to, 'shed light on a variety of economic problems of our generation' (1967, 415).

The model contains four assumptions. First, economic activity may be categorised into two sectors; a productivity increasing progressive sector, benefitting from 'innovations, capital accumulation, and economies of large scale', and an inherently stagnant sector.[3] The former tends to be constituted of traded manufactured goods, the

[2] Conceptually, productivity is a *real* measure, indicating volume of output or value-added produced by given input(s) whilst holding prices constant. A good way to think of labour productivity in output terms, for example, is the number of widgets produced per man-hour. Therefore, in tightly specified industries, productivity levels and changes in productivity may be measured directly in units of the product produced. A small proportion of volume series in national accounts, around 15%, are measured directly in this way (Lequiller and Blades, 2006:47).
However, prices come back into the calculation when multiple different outputs need to be combined, for example, when calculating value-added, which is outputs minus inputs, or at higher levels of aggregation. In these cases, the volume levels or changes in each output have to be weighted by their prices at some point in time, or an average of prices over time, in order to be combined. This means that the price structure of the past is central to measuring a *volume* level or change today. If prices reflect relative power, then the volume measures of today reflect not only physical changes in output per input but also the distribution of pricing power in the past.

[3] In later work, a third sector referred to as 'asymptotically stagnant' is added. This sector, usually certain types of services, is said to combine some progressive inputs and some stagnant ones. Over time

latter, untradable services. Second, the unit cost of output is proportional to the average quantity of labour input per unit. Third, wage movements in the two sectors are linked due to mobility of labour between sectors. Fourth, money wages increase at the rate of productivity increases in the progressive sector due to the power of organised labour (Baumol, 1967:415-19).

By assuming that wages in the progressive sector grow at the rate of productivity, Baumol implicitly assumes that unit prices in this sector remain stable, i.e. none of the productivity increase is passed to consumers as lower prices. This means that the nominal productivity of the sector, output per worker at current prices, increases at the rate of real productivity growth, whilst the cost and price per unit is stable. The final step is for the wage increase to be adopted by stagnant sectors through a combination of labour mobility and trade union organisation, causing the cost and price per unit of this sector to 'rise without limit'. This is Baumol's famous cost disease. The unit cost and price of output in the 'progressive' sector will fall relative to that in the 'stagnant' sector.[4]

The consequence of this for employment in both sectors depends upon their price elasticities of demand. Historically, from the 1920s until the 1970s, a virtuous cycle was experienced, whereby productivity increasing manufacturing, benefitting from increasing economies of scale, could both reduce relative prices and increase employment to meet rising household demand associated with rising incomes (Salter and Reddaway, 1960; Appelbaum and Schettkat, 1995:609). However, as productivity increases in manufacturing became labour shedding during the 1980s (Appelbaum and Schettkat, 1995:619-20), manufacturing workers had to be absorbed by lower productivity increasing services.

The only way that this can occur, according to Iversen and Wren, is either if 'wages in services, especially in the lowest-paid occupations, can be permitted to fall in order to lower prices and increase demand and employment' (1998:512-13), or if solidaristic wages are 'artificially' maintained by delivery of such services through the public sector. The former is identified with the Neoliberal Model, the latter with the Social Democratic Model. The third choice, identified with the Christian Democratic Model, is to pursue relatively solidaristic wages through institutional bargaining systems, without public sector expansion, but to pay the price of relatively lower levels of employment

Iversen and Wren interpret Baumol's model as outlining an economic constraint upon wage increases. Wage increases should not exceed productivity increases within an industry otherwise the relative price of the output of the industry will increase. Their reasoning leads to the somewhat strange conclusion that the structure of prices at some point in time, *prior* to differential productivity increases, is in equilibrium and stable and that any deviation in relative prices from this cannot be absorbed by the

---

the stagnant elements come to dominate with initially rapid productivity growth reducing towards a stagnant asymptote (Baumol et al., 1985).

[4] Baumol makes the point that the degree of wage increase is not significant for this conclusion, only that both sectors have the same *change* in wages and different rates of productivity growth (Baumol, 1967:418). This means that if there were zero wage increases and all of any productivity increase automatically passed to consumers, which happens to be the neoclassical outcome, that the relative prices of progressive and stagnant sectors would still diverge.

market and will lead to underemployment. This will be the unfortunate consequence of solidaristic wage bargains that move away from sectoral productivity increases.

Implicit in this analysis, is that the market, left to its own devices, would result in productivity equalling wage increases in every industry, stable relative prices, and full employment. However, this logic is far from clear when we examine mainstream neoclassical theory, let alone more heterodox theory.

Productivity and wages in neoclassical economics

Given the concern with sectoral productivity and wages, it is interesting that mainstream economic theory determines rewards at the level of the economy *not* in specific sectors, and that an increase in productivity in any one sector benefits *all* workers in their dual role as consumers.

Factor inputs, capital and labour, have their returns (cost to firms) and corresponding marginal value products determined in economy-wide factor markets. Product prices are determined in product markets large enough to be immune from the decisions of any one firm. Every firm in every industry optimises profitability by employing a quantity of each factor input so that marginal cost and marginal value product are equal.

If one firm increases its labour productivity, perhaps through a technological innovation, it is now producing more physical units of output per worker than before.[5] In understanding the consequence of this, neoclassical theory has to jump to the next static equilibrium. The factor markets will be largely unaffected, there is still very similar supply and demand for labour and capital, and so nominal wages, return on capital and their corresponding marginal value products are unchanged. However, the innovation would have been rapidly copied across the firms in the industry. This would have the consequence of reducing the unit price of output and passing the productivity increase as a saving to consumers.

In terms of wages, the 'real product wage' of workers in the sector, that is the number of units of directly produced output that their money wage can purchase, will have increased according to the increase in productivity. The nominal wage will be unchanged. The 'real consumption wage', which matters most to workers and is defined as the nominal wage divided by a price index of a basket of consumption goods, will have increased slightly, to the extent that the product of that industry is included in the consumption basket. However, this increase in the 'real consumption wage' will be the same for all workers in their dual role as consumers, not just workers within the productivity increasing industry.

The conclusion from mainstream economic theory is that real product wages should increase proportionally with increasing sectoral productivity, but that this increases the real consumption wage of all workers equally. A further consequence is that the labour and capital shares of output remain stable (Glyn, 2009:104-5).[6] Departures

[5] Under assumptions of constant returns to scale and perfect competition, the average product of labour equals its marginal product.

[6] The functional distribution of output only makes conceptual sense at the level of the whole economy, because the factors of labour and capital have their rewards determined in economy-wide markets.

from this equilibrium, result in either a 'profits squeeze' or a declining labour share, which are usually attributed to market imperfections.

Within this framework, returns to capital and labour are marginal product equilibria determined at the level of the economy *not* within industries. Therefore, rewards should vary by the human capital of workers, not by the industry worked within and not related to productivity increases within those industries. This is an entirely different mechanism linking productivity to wage increases to that outlined for Baumol's model in the previous section. Baumol's model implies that progressive sectors maintain a degree of pricing power, at least for a period after the productivity increase, resulting in nominal benefits for the industry and hence the inputs which lay claim to it, in Baumol's model, labour.

Power theories of industries

Theoretically, the choice is not limited to factor-centric neoclassical economics or Baumol's industry focused macro-model. Baumol's model may be seen as a particular case of post-classical or post-Keynesian mark-up pricing, where prices are calculated by business planners to achieve a target level of return after covering costs. Such theories have a long, empirically grounded, history dating back to a reaction against marginalism in the 1920s. Contributors include Gardiner Means' (1935, 1936) *administered prices*, Hall and Hitch's (1939) and Andrews' (1949) *normal cost pricing* and Kalecki's later work on *mark-up pricing* (1954, 1971) (Lee, 1998:6-7). In reviewing seventy-one studies of firm pricing, spanning the 1920s to the 1990s, Lee finds strong evidence for the existence of mark-up pricing, with firms using assumptions of volume to be sold, and differing in their pricing decisions based on the type of cost-accounting and target returns used (1998:ch.11).

What is particular about Baumol's model is that productivity increases are captured by the progressive sector in terms of increased nominal value-added per worker (VA/L), which is then also largely captured by workers in that sector. Other firm-centric theories do not assume this automatic transmission from productivity increases to nominal performance, wages and a return to capital. Instead, they highlight the role of power – both at firm and industry levels – in determining nominal outcomes. One body of theory from business strategy comes at this by asking how competitive advantage is generated and sustained, whilst a second from development studies asks which activities within 'global value-chains' generate the greatest value-added. Both may be understood as modern day elaborations of points that Thorstein Veblen made over one hundred years ago regarding the distinction between business and industry and the role of business power rather than industrial productivity in determining pecuniary performance (Nitzan and Bichler, 2009:ch.12; Veblen, 1921).

From the business strategy literature, something of a polarisation has emerged between 'resource-based theories' (e.g. Penrose, 1995; Wernerfelt, 1984) and 'environmental theories' (e.g. Porter, 2004 [1980]). The former explain performance by emphasising the heterogeneous resources that a firm possesses that are scarce, immobile and difficult to replicate, whilst the latter emphasise the context that shapes the attractiveness of different industries (Barney, 1991). The divison has arisen

However, the same reasoning would also apply to sectors if industry specific factor rewards were determined at this level of analysis.

because environmental analysis implicitly assumed resource homogeneity amongst firms within an industry (Barney, 1991:100), whilst resource-based theories have emphasised the ability of firm managers to both perceive and shape their environments differently (Penrose, 1995:xiii; Pitelis and Penrose, 2002:26). In other words, they differ on whether agency or structure is most important in determining economic performance.

Whilst resource-based theories are no doubt correct to highlight the differences between the capabilities of individual firms that may be long-lived and create barriers to entry, it seems entirely plausible, and desirable, to link these firm-level phenomena to explaining the level of potential competition and rewards within an industry. In fact many of the unique resources that firms possess, will be due to the way that they have historically constructed capabilities that interact effectively with their institutional, legal and social environment. This interactive relationship between structure and agency, a form of 'structuration' (Giddens, 1984; Jessop, 1996) is what Porter latterly claims he has always proposed (2004 [1980]:xiv-xvi).

The global-value chain literature, which grew out of development studies, has come to a similar conclusion regarding the importance of barriers to entry for generating high levels of economic performance. However, it is less concerned with whether such barriers are due to internal resources or external structures rather than their interplay. Raphael Kaplinsky (1998; , 2001) (Kaplinsky and Morris, 2001) has been influential in developing the theory of value generation within this literature (Gibbon et al., 2008:331). Activities which generate most value-added per input are de-commodified, with strong barriers to entry and because of their strategically important positions, a great deal of power over suppliers. In contrast, commodified activities operate in competitive markets with limited scarcity and product differentiation. Because of this they exercise little power over suppliers. In such circumstances prices and value-added are driven down to a minimum, just sufficient to cover costs, including wages, and a minimal level of profitability (see also Porter, 2004 [1980]:5).

Kaplinsky suggests that anything which allows a firm to construct barriers to entry and limit competition decommodifies its output and will allow it to generate rent.[7] In our view, Kaplinsky's rents are complementary to Porter's analysis of the forces that drive industry competition. Rents, understood as above-average returns, arise when companies are able to establish defensible positions that maximise their power to realise economic value (Porter, 2004 [1980]:ch.1).

Kaplinsky identifies a range of types of rent: Some are due to access to scarce inputs – resource rents; some to the historical strategies and actions of firms – organisational, human resource, technology, and product and marketing rents; some to the legal, institutional and infrastructural environment in which firms operate – policy, infrastructural and finance rents; and some arising from relationships with other firms

[7] Kaplinsky's concept of rent is not reducible to the neoclassical idea of a scarce factor return, in excess of the equilibrium marginal product of the factor because of its extra-productivity in particular circumstances (Alchian, 1987:142). Rather, it arises from control of scarce resources, which, following Schumpeter, may be constructed by firms in coordination with their physical and institutional environment, resulting in returns above an average benchmark (Kaplinsky, 1998:10-13; Kaplinsky and Morris, 2001:25-6). In our view, these complex resources are irreducible to a treatment as factors of production.

– relational rents. These different possible causes of rent help to explain how Porter's more directly economic analysis, such as low intensity of competition, low supplier and buyer power and low threat of substitution, can come about.

The rents identified here interact with one another to produce complex, contingent outcomes that may be relatively stable over time. Similar to Porter, Froud et al. (2006:118) suggest that rents are best understood at the level of industries rather than firms, because from their research, business models are largely shared within sectors and economic performance is within tight bounds across competitors within an industry. In other words, industry level structures are at least as significant as the effect of individual firm resources (for further empirical research see McGahan and Porter, 1997).

According to this theoretical framework, the ability of a firm/sector to translate productivity increases into sustainable nominal economic performance will depend upon the extent to which its output is de-commodified, which in turn depends upon the power-position that it enjoys. It also suggests that those sectors able to achieve the highest levels and increases in nominal VA/L need *not* be those that increase real productivity at the greatest rate. This is because increasing productivity in a highly competitive and commodified sector will result in suppliers and/or buyers benefiting most, the latter being the same outcome as in competitive neoclassical theory.

The power-theories of industries do not directly address the question of the distribution of economic product, as this was never their analytical focus. However, it is implicit, if in tension with neoclassical theory, that where the greatest nominal levels of productivity are achieved is where returns to labour and capital are likely to be highest. Indeed, a significant focus of the GVC literature has been upon labour conditions and remuneration in those parts of chains located in developing countries but ultimately supporting Western consumers and the profitability of Western corporations (e.g. Millberg, 2008; Palpacuer, 2008; Lane and Probert, 2009).

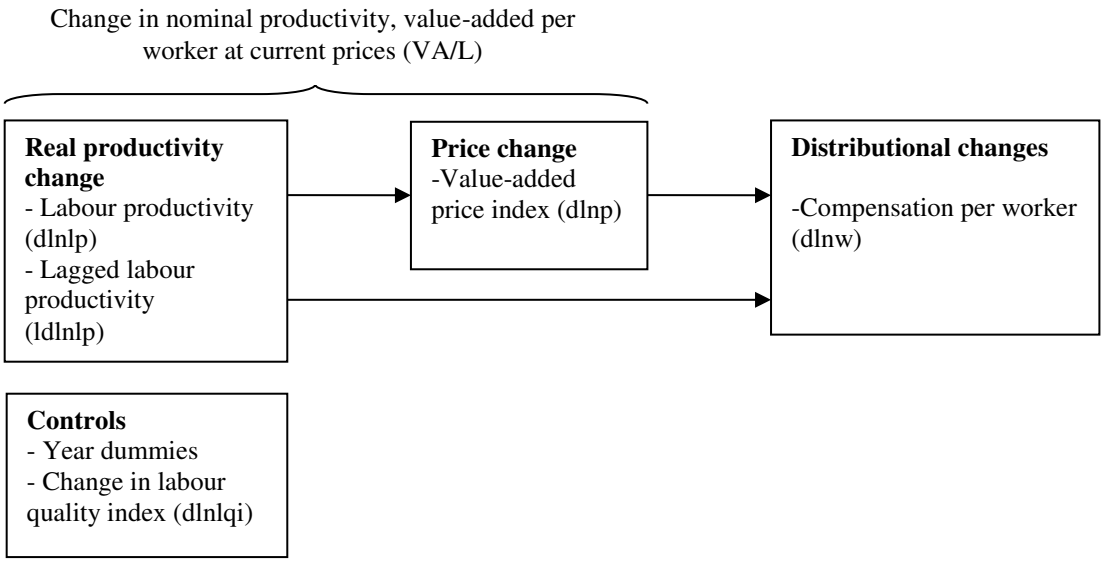
Empirically testing theoretical claims

The previous sections have highlighted the different ontological frameworks of competing theories. It is not possible to directly test these ontologies as they operate at a conceptual level below the observable (Lawson, 1998; Hay, 2002:62). For example, there is no direct observation for whether economic product is created by firms and subsequently distributed, or by factors who automatically receive their marginal products. What we may do, however, is to identify the predictions that competing theories make at the empirical level. This form of empirical work is able to lend more or less support to the underlying theory.[8]

The basic mechanism that we are examining is the relationship between changes in real productivity and nominal productivity and their effect upon average labour compensation and return on capital at an industry level.

[8] Some philosophers of science would say that it also depends upon the sociological features of the particular academic community whether a theory is retained or superceded.

Figure 1 – Path diagram of the causal mechanisms between changes in productivity and price and changes in average compensation



The first step is from real productivity increases (quantities) $\Delta Q/\Delta L$ to nominal productivity increases (values at current prices) $(\Delta P. \Delta Q)/\Delta L$ at an industry level. It is an accounting identity that changes in nominal VA/L are a consequence of changes in real productivity and price. Therefore, changes in price are the mechanism by which changes in real and nominal value-added, and productivity, are connected.

If prices are static then real and nominal productivity changes are related one-to-one, as per Baumol's model. If prices decrease with increases in real productivity, then the relationship between real and nominal productivity is weakened and may be zero, as suggested by neoclassical theory, or it may even become negative.[9] The power theories of industries suggest that pricing power depends upon the particular industry; those with defensible positions are able to convert a greater proportion of real productivity gains into nominal ones, whilst those in commodified sectors are unable to do so. This suggests diversity between industries, but on average price changes should be negatively correlated with real productivity increases, but not enough to completely offset them as predicted by neoclassical theory.

The second step is to examine the consequence of sectoral productivity increases, real and nominal, for rewards to labour employed in the sector. The most direct way to investigate this is to compare the effect of real productivity and price index increases upon average compensation and return on capital.

Neoclassical theory suggests no significant industry level effect, from either productivity or price increases, due to the functioning of product and labour markets at an economy-wide level, discussed earlier. It is possible that identifying such a relationship could still be consistent with neoclassical theory, but this would require that changes in average industry productivity would have to be perfectly correlated

[9] If prices increase with real productivity increases, not suggested by any of the theories examined, then the relationship between real and nominal increases becomes greater than one-to-one.

with changes in the average level of human capital within an industry. This is not a prediction of neoclassical economics and there is no reason why such a relationship should occur as high productivity workers would be rewarded irrespective of industry worked within (Hildreth and Oswald, 1997:330).

Baumol's theory suggests a strong positive relationship for real productivity increases with labour compensation, as real and nominal productivity increases should be equal, due to stable prices, examined in the first step.

The power theories of industries suggest that it is increases in nominal productivity which are most significant for labour compensation. This means that both changes in real productivity and changes in price should have a significant positive effect. However, changes in price should be negatively associated with changes in real productivity, tested in the first step.

Dataset and variable construction

The dataset that we use is the March 2011 release of EU-KLEMS, which provides standardised data constructed from national accounts at a detailed thirty-two industry level for the EU-25 countries plus Australia, Korea, Japan and the USA. Data is available annually from 1970 until 2007 for the EU-15 countries, Australia and Korea, from 1995 until 2007 for the EU-10 accession countries, from 1973 for Japan and 1977 for the USA. We exclude those industries where there is not an agreed measure of real productivity due to their non-market nature, including health, education and public administration. We also exclude real-estate which is based on imputed rents and so not an independent reflection of productivity changes. The resulting twenty-three two digit industries were selected to ensure a high degree of cross-country coverage.

This dataset contains gross value-added price and quantity indices derived from national accounts. The Paasche price indices are calculated annually and chain-linked using detailed price series on inputs and outputs combined with value (expenditure) series. The Laspeyre or Tornquist volume indices are derived, in approximately 85% of series, by deflating value data using the price indices. In the remaining 15% of series, quantity series are constructed directly and weighted by the annual price structure. These indices are also chain-linked and therefore fix the structure of prices to calculate volume changes for a year at a time (see Lequiller and Blades, 2006:ch.2 for an overview).[10]

We construct the change in real labour productivity variable by dividing the volume indices by the number of persons engaged in each industry and then calculating the ln

[10] We are sympathetic to Nitzan's and Bichler's critique of the ability of national accountants to independently distinguish between price and volume changes. They make the important point that changes in volume depend upon the base year of prices chosen and that these prices have to be assumed to be an equilibrium reflection of utilities derived from buying the products (Nitzan and Bichler, 2009). Recently, national accountants have tried to minimise this problem by holding prices fixed for a maximum of one year, calculating volume changes for each year separately, and then chain-linking them. Nitzan's and Bichler's critique, which is fundamentally conceptual, still holds, however, volume changes based on the most recent structure of prices are the closest that we can get to an empirical separation of price and volume changes. The alternative is to accept that all that we may measure is value changes in each industry.

difference between each year. We could have used total factor productivity rather than labour productivity, but this would have greatly reduced the number of countries analysed due to the limited availability of capital stock series.

The average industry compensation is calculated by dividing labour compensation by the number of employees in each industry.[11] Average industry-level compensation is, by definition, calculated across a range of workers with different skills, performing different roles organised by different occupations.[12] We control for fixed effects in worker and occupational characteristics by examining first differences in measures organised at an industry*country level. Second, in the labour compensation regressions we control for changes in a labour quality index, which is calculated in EU-KLEMS based on the proportion of hours worked by workers with different levels of educational achievement (O'Mahony and Timmer, 2009).

Following the method used by O'Mahony and Peng (2008) each industry*country is weighted according to the average employee compensation (*COMP*) share of each industry over the available period, a standard approach in the literature to take account of industry heterogeneity (also see e.g. Kahn and Lim, 1998).

It would have been possible to examine the relationship between real and nominal productivity, labour compensation and return on capital using levels data. However, this would be problematic because many time-invariant factors relevant to the determination of each dependent variable cannot be controlled for, introducing potential misspecification bias (Durlauf et al, 2005). By calculating annual differences in each of the measures at an industry*country level we are able to control for fixed effects, including the skill composition of the workforce and different national and sectoral wage-bargaining processes. By also examining lagged independent variables we try to control the potential problem of reverse causation.

Our analysis was conducted at different levels of spatial aggregation, examining the EU-15, EU-10 and Asia-Pacific-4, separately, and with these combined.

Analysis and Findings

The relationship between labour productivity and industry value-added prices

Looking at the relationship between productivity growth and prices, prior studies have found a negative relationship. This was observed in the US over various periods between 1947 and 2001 (Baumol et al., 1985:811; Nordhaus, 2008:10), in Britain between 1924 and 1950 (Salter and Reddaway, 1960), and in a cross-country study between 1979 and 1989 (Appelbaum and Schettkat, 1995:613).

We first examine the correlation coefficients between the change in real labour productivity and price from a country perspective across the same twenty-three industries. We then examine this from an industry perspective across the different

[11] This is because compensation is measured only for employed persons not all persons engaged, which includes the self-employed.

[12] It has been found that there is a significant overlap between occupations and well-defined industries (Helwege, 1992:77-80), therefore pure occupational effects, independent of industry, do not have a clear meaning and should be small.

country groups. For all results, *** indicates statistical significance at the 1% level, ** at the 5% level and * at the 10% level.

Table 1 – Summary statistics of the correlation coefficients of change in labour productivity and change in price index by country for twenty-three industries (2dp)

	EU-15	EU-10	Asia-Pacific 4
Min	-0.14*** (Spain)	0.00 (Latvia)	-0.15*** (S Korea)
Max	-0.45*** (Belgium)	-0.58*** (Slovakia)	-0.68*** (USA)
Mean	-0.33***	-0.31*	-0.60**
SD	0.07	0.16	0.14

Table 2 – Summary statistics of the correlation coefficients of change in labour productivity and change in price index by industry across country groups (2dp)

	EU-15	EU-10	Asia-Pacific 4
Min	-0.09*** (Renting of manufacturing equipment and other business activities)	0.07 (Other non-metallic mineral)	-0.06 (Basic and fabricated metals)
Max	-0.45*** (Machinery, NEC)	-0.60*** (Chemical, rubber, plastics and fuel)	-0.67*** (Chemical, rubber, plastics and fuel)
Mean	-0.25**	-0.25	-0.40**
SD	0.09	0.17	0.17

Consistent with previous studies, our findings indicate a largely universal negative correlation between changes in labour productivity and industry prices with the EU-15 most homogeneous across countries and industries and the EU-10 least. Two EU-10 countries – Cyprus and Malta – are only significant at the 10% level, and Latvia and Lithuania do not have a statistically significant relationship. This is also the case for eight of the twenty-three industries examined across the EU-10, and for two industries in the AP4.

To measure the elasticity of a change in labour productivity upon price, we ran an OLS regression including both change and lagged change in labour productivity (dlnlp and ldlnlp) and dummies for every year. The model is

1. $Dlnp_{cit} = dlnlp_{cit} + ldlnlp_{cit} + \text{Year dummies} + \varepsilon_{cit}$

ε_{cit} is the residual variation of $dlnw_{cit}$ which cannot be explained by our model. The subscripts represent country c, industry i and year t, which for simplicity we do not display in subsequent discussion, tables or equations, but which apply to every variable except the year dummies.

The results for each group of countries are below. The coefficients may be interpreted as the percentage change in price for a 1% change in each independent variable. The standard errors are shown below each coefficient.

Table 3 – Regression of change in value-added price index upon change and lagged change in labour productivity, for twenty-three industries, various countries and years between 1970 and 2007

	All countries	EU-15	EU-10	Asia-Pacific 4
dlnlp	-0.435***	-0.373***	-0.294***	-0.475***
	0.007	0.01	0.014	0.014
ldlnlp	-0.088***	-0.076***	-0.093***	-0.096***
	0.007	0.01	0.014	0.014
R-squared	0.406	0.384	0.354	0.449
N	17851	12373	2487	2991

As may be seen, labour productivity change in the same period has the largest statistically significant effect on price, -0.435 for all countries, with a smaller elasticity for the EU-10 and a greater one for the AP-4. The size of the effect for dlnlp is between Baumol's model, which suggests zero, and neoclassical theory which suggests -1. It is consistent with a power theory of industries, which suggests a variable negative effect dependent upon the ability of each industry to convert productivity increases into nominal economic performance. Productivity change for the previous period has a very small, although statistically significant effect. The R-squared value indicates that around 40% of the variation in price changes may be explained by changes in productivity. This is also consistent with a complex determination of price changes, where shifts in power, both nationally and internationally, related to multiple possible drivers identified by Porter and Kaplinsky, e.g. technology, marketing, resources, legislation etc., may explain the remaining variation.

The relationship between labour productivity and prices upon labour compensation

To investigate this relationship we ran an OLS regression for change in average labour compensation (dlnw) upon change and lagged change in labour productivity (dlnlp and ldlnlp) and change in the value-added price index (dlnp), plus year dummies. In addition, we included change in the industry labour quality index (dlnlqi) as this should directly effect change in labour compensation according to neoclassical theory. A small number of countries drop out of the analysis because of the availability of dlnlqi. The model is

2. $Dlnw = dlnlp + ldlnlp + dlnp + dlnlqi + \text{Year dummies} + \varepsilon$

The coefficients for dlnlp and ldlnlp indicate the direct effects of labour productivity and lagged labour productivity upon labour compensation. We may also calculate their indirect effects by multiplying the effect of labour productivity upon price (table 3) by the effect of price upon labour compensation (dlnp in table 4). A graphical representation of the two effects is shown in Fig.1. Summing the direct and indirect effects produces aggregate labour productivity effects (Aggdlnlp and Aggldlnlp).

These provide a better comparison with the price effect, dlnp, than just using the direct labour productivity coefficients. The results are shown in table 4 below.

Table 4 – Regression of change in average labour compensation for twenty-three industries, various countries and years between 1970 and 2007

	All available countries	EU-15 excluding Portugal and Luxembourg	Czech Republic, Hungary, Slovakia and Slovenia	AP-4
dlnlp	0.378***	0.329***	0.057**	0.416***
	0.007	0.01	0.025	0.014
ldlnlp	0.024***	0.042***	-0.046**	0.014
	0.006	0.009	0.02	0.012
dlnp	0.425***	0.390***	0.053	0.448***
	0.007	0.008	0.034	0.016
dlnlqi	-0.044***	-0.065***	-0.264***	0.001
	0.009	0.011	0.042	0.017
R-squared[i]	0.509	0.549	0.229	0.486
Aggdlnlp	0.193***	0.184***	0.041**	0.203***
	0.007	0.010	0.021	0.014
Aggldlnlp	-0.013*	0.012	-0.051***	-0.029**
	0.007	0.010	0.019	0.013
N	12095	8368	978	2749

[i]R-squared does not include Aggdlnlp and Aggldlnlp as these are calculated subsequent to the regression using coefficient values estimated within it.

With the exception of the four accession countries, the most prominent results are that change in labour productivity for the current period (dlnlp) and change in price (dlnp) have by far the largest, statistically significant effects upon change in labour compensation. The aggregate labour productivity effects are smaller than the direct ones, because of the fall in the value-added price index associated with a productivity increase (see table 3). The result is that the price effect is more than twice that of aggregate labour productivity effect (Aggdlnlp).

Whilst still broadly statistically significant, lagged labour productivity, direct and aggregate, has a very small effect. The same is true of change in the labour quality index. The negative sign for dlnlqi for the EU-15 is counter-intuitive, but a problem of over-education (sometime known as Heckman selection biases) has been identified in other wage studies (Lacuesta et al, 2011) and the index is a fairly crude measure of labour quality.[13]

The four accession countries with available data do not have the same relationships as the EU-15 and AP-4 countries. The price and labour productivity effects are much

[13] There is currently an EC FP7 research project underway tasked with improving the measure of labour quality in the EU KLEMS database (see more details in the website of INDICSER: http://s317585353.initial-website.co.uk/workpackages/wp1-input-output-productivity/).

smaller, with a much lower R-squared. This may be due to the accuracy of data that is available over a shorter time period, and/or because these countries have experienced radically different labour markets in their transitions to capitalism. The large negative coefficient for the labour quality index is likely attributable to both of these reasons.

The result that both changes in labour productivity and the industry value-added price index have large and significant effects upon average industry labour compensation runs counter to neoclassical theory, which suggests that these industry level features should have minimal effect, with the most important feature being change in labour quality. They also run counter to Baumol's model, which puts all of the weight on the change in productivity and does not consider the possibility of changes in industries' pricing power. They are consistent with a power theory of industries which allows for both effects to play a role in industry performance and factor compensation, depending upon the circumstances of the particular industry.

Estimating the proportion of labour compensation increases attributable to price changes versus labour productivity changes

Using the coefficients that were estimated in the previous regression models we are able to simulate the proportion of changes in labour compensation that are attributable to changes in labour productivity and price using the actual data. We have done this at an industry level for each year for the EU-15 and AP-4 country groups, as the EU-10 countries for which data are available behaved so differently in our previous models. We calculate the aggregate (direct and indirect) effect of current and lagged labour productivity combined and compare this with the effect of price changes.

The model is a modified version of equation 2 to include the aggregate current and lagged labour productivity variables.

3. $Dlnw = dlnp + Aggdlnlp + Aggldlnlp + dlnlqi + Year\ dummies + \varepsilon$

The proportion of labour compensation accounted for by change in labour productivity is

4. $(Aggdlnlp + Aggldlnlp)_{estimated\ eq.3}/dlnw_{actual}$

The proportion of labour compensation accounted for by change in value-added price index is

5. $dlnp_{estimated\ eq.3}/dlnw_{actual}$

Because proportions are calculated for every year for which there is data, we calculate the median proportions for each industry to minimise the impact of extreme years. These results are displayed in Appendix 1. From these we are able to calculate the range and weighted mean and standard deviation across all industries, shown in table 5 below.

Table 5 – Summary statistics for the percentage of change in average industry labour compensation accounted for by change in labour productivity and change in the value-added price index

	EU-15		Asia-Pacific 4	
	Labour productivity (%)	Price (%)	Labour productivity (%)	Price (%)
Weighted Mean	5.9	26.2	8.6	21.2
Weighted SD	3.5	7.8	9.7	19.5

As can be seen, changes in industry price indices hugely outweigh changes in labour productivity in their effect upon labour compensation. The fact that the majority of wage changes remain unexplained is due to the range of factors not considered in the model including different systems of wage bargaining and processes of individual wage determination. However, this result is important in that it indicates the relative insignificance of real productivity gains in increasing industry level wages compared to the significance of an industry being able to increase its pricing power vis-à-vis customers and suppliers.

Conclusion

The new empirical analysis performed in this paper challenges the assumption within Baumol's model that productivity increases are automatically captured by the industries in which they occur and pass to workers within those industries. Whilst productivity increases do have an effect upon labour compensation, this is relatively small, particularly because such increases are associated with offsetting price decreases.

We find that increases in the value-added price index at an industry level are far more significant in increasing wages. Such increases do not sit easily within either Baumol's model or the standard neoclassical framework, which suggests that factor returns are determined at an economy rather than an industry level. They fit much better with the range of theoretical literature that we label 'power theories of industries'.

These results are significant, not only because of the evidence that they lend to competing economic theories, but also because social and political arguments have been constructed upon particular theory. The central argument of the widely cited post-industrial trilemma thesis is that wage increases *must* relate to productivity increases to ensure sufficient market demand for a high level of employment. As discussed, this uncritically adopts Baumol's model as its economic foundation.

In contrast, our results demonstrate that this foundational assumption is at best partial and at worse wrong. What matters in supporting sectoral wage increases is not purely, or even largely, productivity increases, but the ability of an industry to increase its nominal value-added, which largely depends upon its pricing power.[14] This is why

[14] Consistent with neoclassical theory, it is clear that sectoral productivity increases benefit everyone's real consumption wages and hence standard of living, however, following the 'power theories of

some service sectors have been able to hugely increase their compensation (and profitability) *without* a corresponding increase in productivity. Finance and professional business services, left out of Iversen's and Wren's quantitative analysis, are obvious examples. This is not to say that such sectors have had no productivity increases, simply that these are insufficient to explain their increased economic performance and the distribution of that to workers, and to a lesser extent, shareholders/owners.

Where does this leave the possibility that societies might achieve more equal patterns of earnings? It means that contrary to the differential productivity-wage relationship prescribed by the trilemma, there is no foundational economic law that rules out relatively equal wages.

It is true that for international trade in the same product to occur, trading partners need to achieve productivity ratios corresponding to their average wage ratios (Krugman, 1996:57-9). However, even this constraint is not so clear-cut once the power structure of industries is considered. Our empirical findings indicate that pricing power is a much more significant factor than productivity increases in determining wage increases across all industries considered. As discussed, this pricing power results from the complex interaction of firms with their physical and institutional environment.

Although an elaboration is beyond the scope of this paper, national institutional systems also directly influence the earnings distribution. Whatever the shortcomings of the Varieties of Capitalism literature, it has highlighted a range of relevant interacting national institutional systems. The education and training, industrial relations, financial/corporate governance and social security systems, plus inter and intra-firm relations all interact to influence the distribution of earnings within national economies (see Becker, 2009:ch.3) (Lewis, 2009:ch.7). So too do shifting national social codes of pay norms (Atkinson, 2008:72-9) .

Where the outcome of these complex social systems is to compress the wage distribution and raise the compensation of the lowest paid, it does not automatically follow that private services will be priced out of the market. The extent to which there is demand for private services depends upon the preferences, pressures and budget constraints of consumers, who let us not forget are also paid workers.[15] These are not fixed, but change over time.

Clearly higher wages at the bottom of the earnings distribution is going to alter the relative prices of goods and services in an economy. It would mean a greater proportion of national income spent on labour intensive services, which could sustainably increase over time if the cost of manufactured goods continues to fall. For some countries, particularly the Anglophone ones, such a change would perhaps be unthinkable to an upper middle class used to being served by an underclass operating at working poverty wage levels. However, the point is that the distribution of earnings remains a fundamentally social and political choice. The economic constraints on the

industries' and our findings, sectoral workers only benefit additionally when the industry is in a position to achieve greater nominal productivity per worker.

[15] Their preferences might include universal public sector provision of key services through taxation.

wage distribution are much less rigid than have been assumed, and, as we have shown, have little to do with sectoral productivity increases.

Bibliography

Alchian (1987) Rent Theory in Eatwell, J., Milgate, M. & Newman, P. (Eds.) ***The New Palgrave: a dictionary of economics.*** **London, Macmillan.**

Appelbaum, E. & Schettkat, R. (1995) Employment and productivity in industrialised economies. ***International Labour Review,*** **134, 4-5, pp 605-23.**

Atkinson, A. B. (2008) ***The Changing Distribution of Earnings in OECD Countries,*** **Oxford, Oxford University Press.**

Barney, J. (1991) Firm Resources and Sustained Competitive Advantage. ***Journal of Management,*** **17, 1, pp 99-120.**

Baumol, W. J. (1967) Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis. ***The American Economic Review,*** **57, 3, pp 415-26.**

Baumol, W. J., Blackman, A. B. & Wolff, E. N. (1985) Unbalanced Growth Revisited: Asymptotic Stagnancy and New Evidence. ***The American Economic Review,*** **75, 4, pp 806-17.**

Becker, U. (2009) ***Open Varieties of Capitalism - Continuity, Change and Performances,*** **Basingstoke, Palgrave Macmillan.**

Durlauf, Steven N, Paul A Johnson, and Jonathan R. W Temple (2005). "Growth Econometrics." in: Philippe Aghion & Steven Durlauf (ed.), ***Handbook of Economic Growth*****, edition 1, volume 1, chapter 8, pp 555-677, Elsevier**

Ferrera, M. (2008) The European Welfare State: Golden Achievements, Silver Prospects. ***West European Politics,*** **31, 1-2, pp 82-107.**

Froud, J., Johal, S., Leaver, A. & Williams, K. (2006) ***Financialization and strategy: narrative and numbers,*** **London, Routledge.**

Gibbon, P., Bair, J. & Ponte, S. (2008) Governing global value chains: an introduction. ***Economy and Society,*** **37, 3, pp 315-338.**

Giddens, A. (1984) ***The constitution of society: outline of the theory of structuration,*** **Cambridge, Polity.**

Glyn, A. (2009) Functional Distribution and Inequality in Salverda & Smeeding, T. (Eds.) ***The Oxford Handbook of Economic Inequality.*** **Oxford, OUP.**

Hay, C. (2002) ***Political analysis: a critical introduction,*** **Basingstoke, Palgrave.**

Helwege, J. (1992) Sectoral Shifts and Interindustry Wage Differentials. ***Journal of Labor Economics,*** **10, 1, pp 55-84.**

Hildreth, A. K. G. & Oswald, A. J. (1997) Rent-sharing and wages: Evidence from company and establishment panels. ***Journal of Labor Economics,*** **15, 2, pp 318.**

Iversen, T. & Wren, A. (1998) Employment and Budgetary Restraint: The Trilemma of the Service Economy. ***World Politics,*** **50, 4.**

Jessop, B. (1996) Interpretative Sociology and the Dialectic of Structure and Agency. ***Theory, Culture and Society,*** **13, 1, pp 119-28.**

Kahn, James A. and Lim, Jong-Soo (1998). Skill labour augmenting technical progress in U.S. manufacturing. ***Quarterly Journal of Economics*** **113, 1281-1308.**

Kaplinsky, R. (1998) Globalisation, Industrialisation and Sustainable Growth: The Pursuit of the nth Rent. ***Ids - Institute of Development Studies Discussion Paper,*** **365.**

Kaplinsky, R. & Morris, M. (2001) A Handbook for Value Chain Research.

Krugman, P. R. (1996) ***Pop internationalism,*** **Cambridge, Mass.; London, MIT Press.**

Lacuesta, Aitor; Sergio Puente and Pilar Cuadrado (2011) "Omitted Variables in the Measurement of Labour Quality Index: The case of Spain". ***Review of Income and Wealth Volume.*** **57, Issue 1, pages 84–110,**

Lawson, T. (1998) Economic science without experimentation / Abstraction in Archer, M., Bhaskar, R., Collier, A., Lawson, T. & Norrie, A. (Eds.) ***Critical Realism, Essential Readings.*** **Abingdon, Routledge.**

Lee, F. S. (1998) ***Post-Keynesian price theory,*** **Cambridge, Cambridge University Press.**

Lequiller, F. & Blades, D. (2006) ***Understanding National Accounts,*** **Paris, Economica and OECD Publishing.**

Lewis, P. (2009) Understanding Income Distribution in Modern Capitalist Economies. Ph.D. thesis, Political Science and International Studies, University of Birmingham.

McGahan, A. M. & Porter, M. E. (1997) How Much Does Industry Matter, Really? ***Strategic Management Journal,*** **18, (Summer Special Issue), pp 15-30.**

Nitzan, J. & Bichler, S. (2009) ***Capital as power: a study or order and creorder,*** **London, Routledge.**

Nordhaus, W. D. (2008) Baumol's Diseases: A Macroeconomic Perspective. ***The B.E. Journal of Macroeconomics,*** **8, 1, pp 1-37.**

O'Mahony, M. & Peng, F. (2008) Skill Bias, Age and Organisational Change. ***EUKLEMS Working Paper no.36*****.**

O'Mahony, Mary and Marcel P. Timmer (2009), "Output, Input and Productivity Measures at the Industry Level: the EU KLEMS Database", ***Economic Journal*****, 119(538), pp. F374-F403**

Penrose, E. T. (1995) ***The theory of the growth of the firm,*** **Oxford, Oxford University Press.**

Pierson, P. (2001) Post-Industrial Pressures on Mature Welfare States in Pierson, P. (Ed.) ***The New Politics of the Welfare State.*** **Oxford, Oxford University Press.**

Porter, M. E. (2004 [1980]) ***Competitive strategy: techniques for analyzing industries and competitors,*** **New York; London, Free.**

Salter, W. E. G. & Reddaway, W. B. (1960) ***Productivity and Technical Change,*** **Cambridge, Cambridge University Press.**

Veblen, T. (1921) ***The Engineers and the Price System*****, pp. 169. B. W. Huebsch: New York.**

Wernerfelt, B. (1984) A resource based view of the firm. ***Strategic Management Journal,*** **5, pp 171-80.**