

## CONVERGENCE OF WORK STOPPAGES – A GLOBAL PERSPECTIVE\*

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### ABSTRACT

*This paper analyses the changing pattern of work stoppages at a global level for the period 1960 to 2002. Rather than analysing the pattern for individual economies, it analyses the data for a two-fold division of the world's economy: namely the North American economy (comprising the USA and Canada) and the rest of the non-North American world economy (comprising the 36 economies for which data are available). This involves an approach to the analysis of international data and an accompanying perspective on global interdependence and convergence that has not thus far been explored. The evidence presented suggests that these two parts of the global economy display broadly converging patterns of stoppage rates. It is suggested that the converging pattern of stoppages is, in turn, symptomatic of a general worldwide convergence of general politico-economic perceptions broadly in favour of, or at least receptive to, an approach to political-economy management that might be summarily labelled: neoliberal.*

### INTRODUCTION

There has been much debate regarding the tendency for socioeconomic systems to converge over time. These ideas can be traced back to the work of Saint-Simon, Marx, Hayek and others.<sup>2</sup> In the post-World War II years, general socioeconomic convergence, of one form or another, has been advanced by Tinbergen (1959, 1961), Kerr et al. (1960), Kerr (1983), Wilensky (2002) and others. In addition to broad socioeconomic convergence, specific areas

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<sup>2</sup> For further background discussion of the historical roots of convergence theory see Kerr (1983) and Wilensky (2002). See also Durkheim (1958) for a discussion of Saint-Simon, and Marx (1867) and Hayek (1944).

of convergence have attracted the attention of researchers. Converging and diverging patterns of per capita income have been analysed by Kuznets (1973), Baumol (1986), De Long (1988), Baumol and Wolff (1988), Peacock, Hoover and Killian (1988), Barro and Sala-i-Martin (1992), 1997), Aghion and Howitt (1998), Temple (1999), Firebaugh (1999), Korzeniewicz and Moran (2000), Goesling (2001), Islam (2003), Aghion, Howitt and Mayer-Foulkes. (2004), Firebaugh and Goesling (2004), Parente and Prescott (2006) and many others.<sup>3</sup> Converging and diverging patterns of various aspects of labour market relations have been studied by Poole (1986), Adams (1995), Keenoy (1995), Warhurst (1995), Gall (1996), Hansen, Madsen and Jensen (1997), Western (1997), Andersen (1997), Blasehke (2000), Wilensky (2002), Vernon (2006) and others. In short the issue of convergence is one of ongoing interest; it is a topic about which much has been written and will be written; and it is a topic about which judgements differ.

This paper focuses on one particular measure of labour market relations, namely work stoppages (due to strikes and lockouts). It examines the data for evidence of convergence at a global level, building upon, though also in some ways departing from, the work of Fisher (1973), Walsh (1983), Shalev (1992), Edwards and Hyman (1994), Blyton and Tumbull (1996), Aligisakis (1997), Stokke and Thornqvist (2001), Piazza (2005), Chernyshev (2003), Beardsmore (2006), Scheuer (2006) and others.

The next section of this paper explores the concept of convergence and some of the ways convergence might be tested empirically, with special reference to global work stoppages. This is followed by a discussion of the data used in this study. The penultimate section reports on the results of the global aggregation of data and the results of a number of statistical tests carried out on the data. Conclusions then follow. Technical aspects of the study appear in the appendices.

## CONCEPTUALISING CONVERGENCE

As mentioned above, the idea of convergence has long been around - sometimes implicitly, at other times explicitly - in the work of many influential writers. Convergence itself occurs when socioeconomic systems, or components thereof, take on common characteristics, perhaps increasingly common characteristics when the forces of convergence are strong. During the post-war period much has been written on the tension between the forces of convergence and divergence. It is not possible to briefly review this vast literature and do it justice, so we will focus instead on identifying the form that the forces of convergence and divergence might take with reference to our particular topic of interest: work stoppages.

### A Framework for Testing for Convergence

The variable to be analysed in this paper, work stoppages due to strikes and lockouts, is a measure of industrial conflict between the owners and representatives of capital and labour resources. The exact form of the measure will be elaborated upon in Section 3. In this subsection we shall seek to explain the particular approach adopted in this paper to analysing the data

In the literature on work stoppages and the forces of convergence and divergence, the focus has, to date, been mainly on country by country comparisons (for example Shalev 1992, Edwards and Hyman 1994, Aligisakis 1997, Piazza 2005 and Beardsmore 2006). The approach adopted in this paper is to analyse work stoppages in terms of a two-fold split of the

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<sup>3</sup> The debate has been particularly contentious with respect to the role that globalisation may have played in fostering the convergence of per capita income. For example, the recent notable contribution of Firebaugh and Goesling (2004) arguing that globalisation has been associated with *declining* inequality has attracted a critical response from Wade (2004b). See also Wade (2004a) and Edward (2006).

global economy. That split involves North America as one “half” of the global economy. The other “half” of the global economy is the rest of the (non-North American) world.

The rationale for this split is as follows. First, North America, which for the purposes of this exercise is composed of the USA and Canada, is of course dominated by the USA. The USA is the world’s largest economy and has been so throughout the period of this study. Of the countries incorporated in this study, the USA accounts for about 40 per cent of global GDP (as defined).

The USA was the driving force behind the resurrection of a tattered European economy after the World War II via the Marshall Plan and it was similarly important in giving a new direction to the Japanese economy at around the same time. In the early 1990s, with the disintegration of the Soviet Union, the singularly powerful position of the USA became further entrenched. Thus the split of the global economy into a North American “half” is based, in part, on recognition of the singularly powerful position of the USA in the political economy of the globe since World War II.

The other “half” of the globe is composed of the rest of the world. In fact the rest of the world excludes both China and the Russian Federation. This is because there are no official data on work stoppages for China and data for Russia has only recently become available for the last decade or so. The “rest of the world” is composed of a collection of countries for which data on work stoppages are available in one form or another for the period 1960 to 2002. More details of how the index of stoppages for the rest of the world is constructed are given below and in Section 3 of the paper.

The second reason for the global split is that we hypothesise that the North American economy and the rest of the world (as defined) (a) respond to one another and (b) respond to common stimuli that affect, to varying degrees, all the economies of the world. In other words, we hypothesise both (a) interdependence between North America and the rest of the world and (b) sensitivity of both North America and the rest of the world to global stimuli such as global changes in (say) energy costs, telecommunications technology, political perceptions and so on.

The third reason for the global split is that we argue that convergent tendencies can be understood and measured from various perspectives. A micro perspective might focus on the convergent behaviour of (say) individual firms. A couple of levels up from that might involve convergent behaviour by regions within a country. A further level up might involve the convergent behaviour of nation states. And a further level up might involve convergence by global regions. The latter perspective is of course the one of interest in this paper. We note that all approaches offer insights into the dimensions of convergence. However, to date, convergence at a global level has not been explored, and our purpose is to do just that.

The final reason for the global split, and perhaps the reason most central to providing this approach with its own particular form of theoretical leverage (so to speak), is that this approach mitigates the potential influence of small idiosyncratic countries whose atypical experiences may be assigned a greater degree of significance than is, in an aggregate sense, warranted. This needs elaboration.

Imagine, for the purpose of illustration, that the world is made up of just five countries: North America plus countries *A*, *B*, *C* and *D*; and that all countries have the same per capita income levels and the same initial stoppage rates. Imagine further that North America and country *A* experience a 20 per cent fall in work stoppage rates, while countries *B*, *C* and *D* each experience a 100 per cent rise in work stoppage rates. In country-by-country comparisons, we would be drawn to the *prima facie* conclusion that, at a global level, there are very mixed trends in stoppage rates; though, a majority of countries have experienced a *rise*. Now imagine further that North America and Country *A* have populations of 300 million each; while countries *B*, *C* and *D* each have a population of 1 million. When the relative size of economies is allowed for, there will be an overall *decline* in stoppages; in other words there will be decline in stoppages for countries *A*, *B*, *C* and *D combined*, as well as a decline in North America.

The above illustration indicates a central advantage associated with taking, what might be called, a “super-macro” approach. It offers an alternative *global* perspective that country-by-country approaches typically ignore.

In this study we focus on the overall stoppage rate for the rest of the world by weighting each country’s contribution to the global stoppage rate according to the relative size of its Gross Domestic Product. Thus the Japanese and German economies are accorded more influence in the index than, say, Nigeria and Bangladesh. We argue that labour market events in Japan and Germany register more profoundly in North America than do labour market events in Nigeria and Bangladesh in spite of the fact that the labour forces are somewhat similar in size.

### Visualising the Processes of Convergence

The forces of convergence can take different forms (Kerr 1983, Wilensky 2002, Islam 2003, Parente and Prescott 2006). With reference to the area of interest of this paper, we can envisage a number of different possible forms of convergence that will act as a frame of reference for later sections of the paper. We start with Panel A of Figure 1. Here we have a relation between two variables ( $X$  and  $Y$ ) which is obviously divergent over time. Variable  $X$  is trending down over time, while variable  $Y$  is moving in the opposite direction. Panel B of Figure 1 depicts what has been labelled “complete convergence”. Variables  $X$  and  $Y$  eventually merge to travel identical paths. Panel C depicts what we have labelled “parallel convergence”. Here the two variables are moving in the same direction, perhaps responding in much the same way to some exogenous force, but their underlying values differ. This is a weaker form of convergence than the “complete” form, though it may be the case that the short-run dynamic path travelled by the variables in the “parallel convergence” story is highly similar, indeed conceivably identical. Panel D depicts what we have labelled “cross-over convergence”. Here the two variables are moving in the same broad direction; however the short-term paths that the variables take are often at odds. The short-term path, as reflected in the proportional (say) annual change in the variables, may differ quite markedly, but in the longer term, the two variables will end up in a similar long term position.

The impression that variables are converging or diverging over time can be affected by the timeframe chosen. For example, if we had chosen a period of time up until the crossover point “a” in Panel D of Figure 1, the impression would have been formed of complete convergence. If we had chosen a time frame from crossover point “a” to point “b”, the impression would have been formed of a divergent relation. Point “c” following on, on the other hand, is suggestive of the emergence of parallel convergence. It is important, thus, to keep in mind that the results of any empirical analysis are specific to the timeframe under consideration. Broad generalisations and extrapolations beyond the period under study can be hazardous.

### Drivers of Convergence

What is it that might generate a tendency for social systems and/or the subcomponents (e.g. labour markets) of those social systems to converge, not necessarily completely, but at least partially and noticeably?

We suggest that, in the first instance, the core of any explanation of convergence requires an appreciation of some of the characteristics of the single key element of all social systems. That irreducible key element is of course the human primate. Among many other things, humans have evolved to copy the behaviour of others. The copying instinct enables humans to acquire know-how and skills that are advantageous, more often than not, for survival. Human society is replete with manifestations of the human proclivity to imitate. Fashions in clothing design, hair styles and expression serve as common illustrations. Fashions also influence the world of ideas where abstract “isms” of one form or another attract adherents, for varying amounts of time. Communism, monetarism, postmodernism,

existentialism, Confucianism, atheism and so on are examples of templates for bringing a form of order to the world. Imitation is not the only human behavioural characteristic that produces convergence. Tribalism, the sense of belonging to one or another clan or extended group of individuals, is also a powerful motivator of human behaviour. At times, tribalism may cause patterns of behaviour to diverge. For example when one group, informed by one set of theological stories, sets itself apart from another group beholden to another set of stories. Nevertheless, even when tribal groups have apparently little in common, it may still be the case that they will learn from one another, if only in their weaponry.

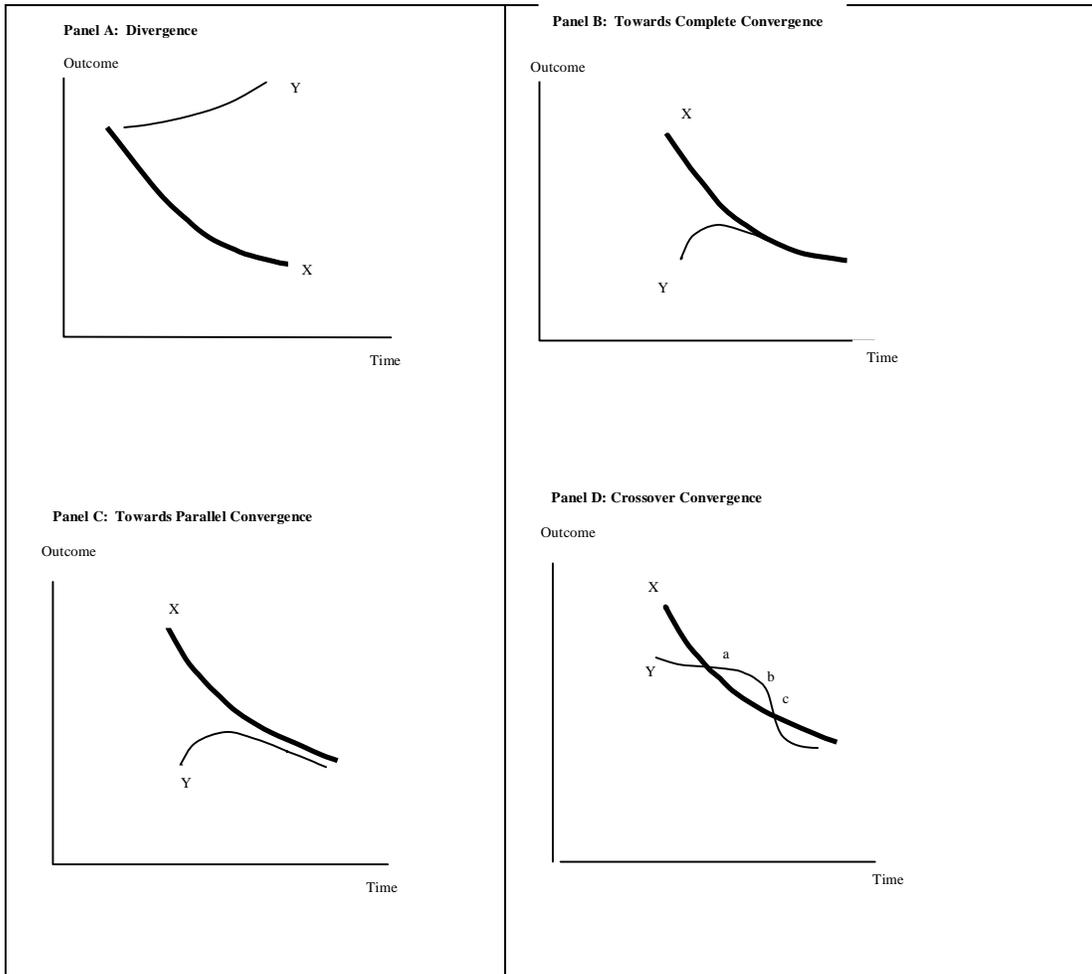


Figure 1: Visualising Convergence

There is a tension between forces of convergence and forces of divergence; and over time, the relative strength of these forces may rise and fall. The separation of societies in time and space and the absence of communications between different societies will act to generate divergence. Indeed, over the millennia, human societies have adapted in different ways to all manner of different environments. It has been this capacity to adapt and be different that has enabled humans and their societies to survive. Drawing on a number of anthropological studies, Kerr (1983) observed that:

“Humans have spread around the world in all kinds of climates and into all types of natural resource situations, and have adapted to each more creatively than any other living organism. This is one source of their worldwide dominance” (p. 2).

Thus, the underlying forces for convergence – the scope for imitation and learning from the actions of others – will likely increase if communications between individuals in different societies are allowed to flourish. The spectacular growth in global communications in recent years will likely more strongly foster the forces of convergence, at least in some areas. Similarly, the continued growth in international trade in goods and services and the freeing up of capital and labour flows globally might also be expected to have a positive impact on the forces of convergence.

### Choosing between “Attractants”

We distinguish in this paper between, firstly, the innate propensity for copying and imitation that leads to a convergence of individual and group behaviour and, secondly, the acquired or learned behaviour itself – which we shall refer to as the “behavioural attractant”, or more simply the “attractant”.

To illustrate, imagine a new menswear fashion emerges of wearing a black tie dangling from the back of the neck in combination with a collarless shirt; and this fashion becomes known as the “back-dangling tie look”. We might imagine that the instigator of the fashion is a particularly popular movie actor who was required to assume that appearance in a top-grossing movie.

The first element in our illustration is the innate propensity for copying and imitation. This is reflected in this example in the *adoption* of the behaviour of wearing a back-dangling tie by various individuals within the community. Community members will adopt this fashion for various apparent reasons. The prime movers may take up the fashion because it bestows upon them a vague resemblance to the character portrayed in the movie and, by consequence, a greater ability to get a date with adoring females fans of the movie actor. Others may subsequently take up the fashion because their peers have; while somewhat further down stream, others may adopt the fashion because back-dangling ties are all that is available in the stores (assuming that the fashion catches on) and these individuals tend to wear whatever happens to be available.

All of the adopters of the fashion will, we argue, take to the fashion for various self-gratifying reasons. In other words, they will adopt the fashion because it yields them perceived benefits. The “prime movers” will perceive a benefit of having more dates. Others will perceive a benefit associated with gaining peer-group approval; while still others, further down stream, will perceive a benefit associated with minimising their search time and wearing whatever is on the racks.

The second element in our illustration is the “behavioural attractant” itself. We have imagined thus far that the attractant is wearing a back-dangling tie. But other attractants – i.e. patterns of behaviour – may also attract followers. Other attractants might include having long hair or having no hair or wearing thin-rimmed glasses or thick-rimmed glasses or wearing baseball caps back-to-front and so on.

Potential attractant can be viewed as being, in many ways, quite independent of the copying process. There are very many potential attractants. However, in a society that permits choices, those attractants that gain the greatest number of adherents are likely to be those that are *perceived* to generate the greatest benefits to their adopters.

### Contextualizing Concepts

Now let us contextualise the notions developed in the preceding subsection so as to relate them to the issues of political economy to which this paper is addressed.

During the period under examination (1960-2002), there were two very broad approaches to economic management vying for ascendancy in the market place of ideas and ideologies, as well as vying for ascendancy on various battlefields – both hot and cold. One approach or paradigm favoured individual choice, free markets and minimum government involvement in the day-to-day management of the processes of production. This approach is

broadly consistent with what is generally known as neoliberal economics. The other approach or paradigm favoured collectivism in various forms, production and distribution by government decree, and government involvement in the day-to-day management of the production process. At its most extreme, this approach was broadly consistent with the policies pursued by the former Soviet Union and China under the leadership Mao Zedong.

It is important, of course, to recognise that there have been many intermediate systems in place during the period under review. The USA has never had anything but a neoliberal economy, but it has, at different times, had various degrees of government involvement and intervention in the economy. Many Western European economies have pursued social-democratic (i.e. socialist-inclined) policies, at various times; as has India, particularly during the Prime-Ministerial periods of Nehru and Sonya Gandhi. Thus there have been, at different times, various degrees of neoliberalism and collectivism simultaneously present in the mix of policies employed in managing various economies.

These various systems of economic management can be viewed as “attractants” to governments, policy advisors and citizens in general. Those policies that are perceived to generate the greatest benefits will likely attract the greatest support. Different sections of the citizenry will be attracted to different policies because of the perceptions of benefits to be gained. Democratically accountable governments are typically mindful of the need to succeed in providing for the material wellbeing of their citizens and, in the long run, will likely adopt policies that work (and thus win votes) rather than simply conform to ideology. Thus governments of all leanings, and especially democratic governments, will in the long run likely adopt or converge on those policies that are perceived to be most likely “to deliver”. In coming to a judgement as to which policies (ideas and ideologies) work best, governments and policy advisors will be obliged to evaluate the evidence as revealed by the successes and failures and near misses of other nations.

It will be argued in Section 4 that perceptions about the effectiveness of different (“attractant”) paradigms of economic management changed quite noticeably during the period under review, and these changes contributed *in part* to the changing global pattern of work stoppages. More specifically, it will be argued that in the early 1980s there was a marked general shift towards the adoption of the “attractant” neoliberalism and a concomitant shift away from the “attractant” of collectivism. This shift and the accompanying convergence of policy in turn impacted on labour market management approaches in general and work stoppages in particular. These issues will be further explored in Section 4.

## THE DATA

We base our comparative analysis on days not worked (DNW) due to strikes and lockouts per labour force (LF) member – hence forth abbreviated DNW/LF – for the period 1960 to 2002. For these years data are available from the International Labour Organisation – the ILO – (augmented by a number of local sources and international bodies, see Appendix A) for 38 countries.<sup>4</sup> These include 14 countries from Europe, 6 from the Americas, 14 from Asia and Australasia and 4 from Africa. Our intention, as discussed in the previous section, is to compare North American experience with that of the rest of the world. In other words, we wish to explore the possibility of there being a long-term *convergence* in DNW/LF due to work stoppages in North America with the rest of the world.

Before proceeding, we note that there are well-known limitations placed on comparisons of international data on working days lost due to work stoppages. Different countries employ different methodologies in calculating these data (Walsh 1983, Beardsmore

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<sup>4</sup> Those countries are: Austria, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, UK, Canada, Guyana, Peru, Puerto Rico, Trinidad & Tobago, USA, Australia, Bangladesh, Cyprus, India, Israel, Japan, Korea, Malaysia, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, South Africa, Mauritius, Morocco and Nigeria.

2006) and thus caution needs to be exercised when drawing strong conclusions from these data. Nevertheless, it is not unreasonable to employ these data for the purposes of this exercise for the following reasons. First, the possible effect of definitional and collection differences are limited when the focus is on (as in this study) DNW, rather than, say, the raw number of stoppages. This is because DNW statistics tend to be dominated by major disputes about which relatively reliable data are recorded on account of their high visibility (Turner, 1969). Thus numerous smaller disputes, the dimensions of which may not be recorded as accurately as for larger disputes (Kelly and Nicholson 1980, Korpi 1981), have collectively a much less sizable impact on the shape (i.e. the volatility) of the aggregate data, than do the relatively small number of large-scale disputes.<sup>5</sup> A second reason for applying these data is that these are the officially recorded data that signal to the world community the state of affairs in different countries around the world. It is this information – for better or for worse – to which much of the world community respond after perhaps factoring in an allowance for characteristics of the data that are idiosyncratic to particular countries. Finally, these are the only data available that come in any way close to being an objective long-term measure of changing patterns of conflict in the labour market. There simply are no alternative or superior measures available of this important labour market dimension.

As discussed in the preceding section, our data are split into two semi-global aggregates. The first aggregate is for North America, which is composed of the USA and Canada. The second aggregate is for the rest of the non-North American world for which data are available for the whole 42 years of the study.

### More on USA Data

The North American Series is the weighted average number of DNW/LF for the USA and Canada. The weights are determined by the ratio of each country's nominal GDP denominated in USA dollars to the combined GDP of the two countries. The shape of this series is dominated by the pattern of DNW/LF in the USA.

One important adjustment to the USA data should be noted. In 1982 the USA ceased collecting and publishing data for *small-scale* stoppages and continued publishing data solely on *large-scale* stoppages, i.e. stoppages involving 1000 workers or more and lasting at least one full shift (Bureau of Labor Statistics 1982a, p 102 and 1982b, p. 111). This was a major definitional change. Between 1947 and 1981, small scale disputes had accounted for, on average, about 30 per cent of all days not worked. To correct for this change, we adjust or “gross-up” the post-1981 data for the definitional change. Rather than simply grossing up the data by apportionment, we model DNW/LF for small-scale stoppages and forecast small scale dispute numbers. The overall shape of the aggregate DNW/LF series are similar regardless of whether small-scale DNW/LF numbers are forecast through a simple apportionment procedure or whether forecast via regression analysis. However, given that in the past the DNW/LF for small-scale stoppages was much less volatile than DNW/LF for large-scale stoppages and the forecasts based on regression analysis generate forecasts more comparable to past patterns, we have elected only to employ regression-based forecasts in our tests.<sup>6</sup>

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<sup>5</sup> For the USA, for example, between 1947 and 1981 approximately 70 percent of all DNW were attributable to large-scale strikes (involving one thousand or more workers). These large-scale stoppages accounted for merely 7 per cent of all stoppages. See Bureau of Labor Statistics (1982a), p. 102 and (1982b), p. 111.

<sup>6</sup> We hypothesise that the change in the log-linear value of DNW per employee in small-scale stoppages is a function of the change in the log-linear value of the following 5 variables: (i) DNW per employee in large-scale stoppages, (ii) union density, (iii) the unemployment rate, (iv) the price level and (v) real GDP. The data are stationary and coefficient estimates are all significant at (minimally) the 5% level. The adjusted coefficient of determination is 0.72. Further details will be supplied on request.

### More on the Rest of the World

The stoppage rate for the rest of the world is calculated on the following basis. First, for each country, DNW/LF data are calculated. Second, each country's contribution to the "global" index is weighted according to its relative size amongst the 36 non-North American economies that make up the index. The relative size of each country is determined by each country's nominal US\$ GDP for each year. Because of this weighting procedure, the rest of the world's "global" index is most strongly affected by stoppages in those economies with the largest GDP. Less developed economies with large populations but small GDPs are much less influential.

The rationale for the weighting arrangements is that we have sought to construct a global index of stoppages that reflects the influence of such stoppages on the world economy in general, as discussed in the preceding section. Thus while Nigeria, for example, may have had an explosive increase in stoppages during the mid 1990s, the global economic impact of its experience has arguably been quite small. On the other hand, the explosive increase in stoppages in France during May and June of 1968 *did* register around the world, and arguable *did* influence perceptions and mind sets around much of the world, because of the relative importance (i.e. size) of the French economy.

Finally note that the comparative GDP figures are *not* based on purchasing power parity adjusted estimates. The GDP estimates are all denominated in terms of nominal \$US values. These values, it is suggested, may better reflect commercial perceptions of the relative international economic status of the various economies that are constituents of the rest of the world's "global" index.

### TESTING FOR CONVERGENCE

In this section we, firstly, chart the DNW/LF data so as to gain a visual impression of the pattern of change in the data. Secondly, we test the statistical properties of the data so as to gain a fuller appreciation of the relationship, if any, between the pattern of work stoppages in North America and the pattern in the rest of the world. Finally, we comment on how these results might be interpreted.

#### Visualising Data

Figure 2 depicts the pattern of DNW/LF for North America (USA plus Canada) and the rest of the (non-North American) world. So as to get a better visual sense of the underlying relation between the two series, Figure 3 presents a smoothed rendition of the data. The following observations are offered. First, there are broad similarities in the data for the two series. During the 1960s and 70s both series record, on average, relatively high values. During the 1980s and beyond, both series have, on average, relatively low values. Second, the North American series peaked in 1970; two years after the series for the rest of the world peaked in 1968. During that year, major disruption accompanied student strikes and protests in France during May and June. Phelps-Brown (1975) observed that the: "French students revolt in 1968, and the near general strike that followed, sparked a prairie fire of strike action that spread across Europe in the next two years ..." (p. 5-6). Third, from 1970 to 2002, DNW/LF for North America trended down; while for the rest of the world from 1968 to 2002, DNW/LF trended down. Fourth, the data suggest that North America has been, on average, relatively more dispute prone than the rest of the world (as defined). Fifth, both series appear in broad terms to converge over the entire time frame, this is more in evidence in Figure 3. During the 1960s the data initially diverge but then converge by the end of that decade. During the 1970s the series initially diverge but then

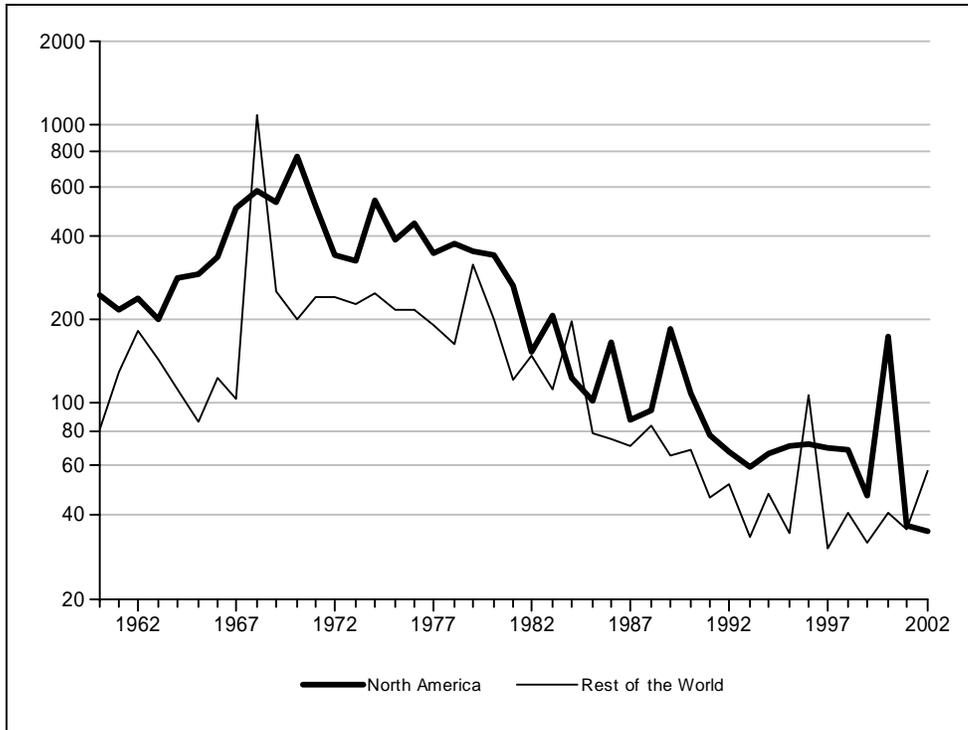


Figure 2. Work Stoppage Rates – North America and the Rest of the World

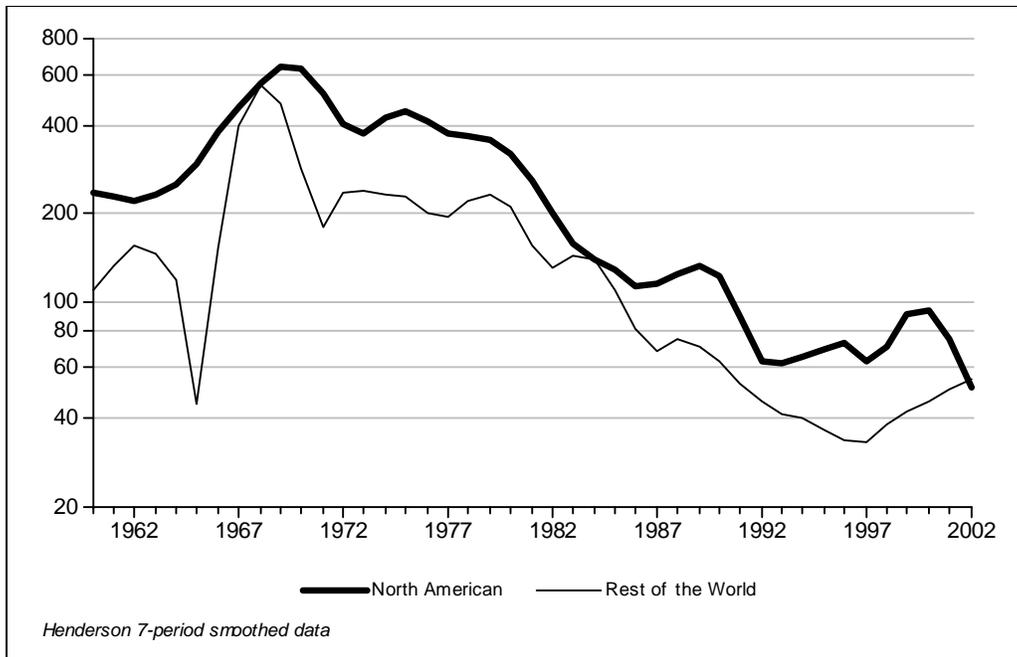


Figure 3. Smoothed Stoppage Rates - North America and the Rest of the World

converge by the end of that decade. From the 1980s onwards both series trend down, diverging a little along a common downward trend to re-converge by the end of the period under review.

### Statistical Tests

We next conduct a number of statistical tests on the data. The intention behind this section is to check on the stability of the relation between the two series over the timeframe under consideration. In other words, we are testing for evidence of a durable relation between the two series, as well as for the possibility that there may have been, at various times, fundamental (or structural) breaks in the underlying relationship between the two series that cannot be attributed to chance events. So as to avoid being side-tracked by technicalities that might be expected in a statistical section, we place the details of the statistical testing procedures in Appendix B, focussing here instead on the broad findings.

The statistical test results are consistent with a view that the series exhibit a significant long-term equilibrium relationship (i.e. the two series are cointegrated). However, there is also evidence of a break in the long-term relation most likely on or around 1967.<sup>7</sup> A visual inspection of Figures 1 and 2 might suggest that this result is not unexpected. The stoppages series for the rest of the world does after all noticeably spike in 1968 because of the explosive increase in time lost due to strikes in France during the period of the aforementioned student revolt. Also, for some years prior to the 1968 spike in stoppages, stoppage rates were diverging. Thus our statistical results confirm the significance of the jolt to the long-term relation in 1968.

The evidence of a jolt to the long-term equilibrium relation does not in anyway negate the evidence that there is a statistically significant long-term equilibrium or durable relation between the two series over the timeframe under review. Rather it adds to the detail of the relation. The tests also suggest the *long-term* relation has remained in tact since 1967, in other words undisturbed for over 30 years.<sup>8</sup>

### Interpreting results

There is strong evidence of linkages in the global pattern of stoppages as defined. These linkages can be gleaned from a simple visual inspection of Figures 2 and 3, and are confirmed more formally through the statistical tests. It is suggested that these data are consistent with a view that, at a very broad “super-macro” level, what has happened in one part (i.e. one approximate half) of the world economy has impacted on what has happened in the other part of the world, and both “halves” of the globe have responded somewhat similarly, in the long run, to various socioeconomic stimuli.

We suggest, somewhat speculatively, that *one* of the major forces giving shape to the work stoppages series in Figures 2 and 3 has been the general perception of the relative effectiveness of two broad policy approaches to economic management.<sup>9</sup> In Section 2, we

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<sup>7</sup> There is evidence of a possible break in the long-term equilibrium relation on or around either 1967, 1978 or 1981. However, the tests most strongly support the case for a break on or around 1967 for two reasons. First, the author of the tests (Inoue 1999) argues that, when a break date is not known *a priori*, a particular form of structural break test is preferred (Form B discussed in Appendix B). When this preferred form is tested for, it is only in evidence in 1967. Second, the test statistics for a break in 1967 are stronger than the test statistics for a break at other dates (where different structural breaks assume different forms to the form of the break in evidence for 1967).

<sup>8</sup> Short-term (year by year) changes in the relation are not precluded.

<sup>9</sup> It is recognised that at a global level, as well as at a nation-by-nation level, a number of factors influence stoppages, as well as being influenced by stoppages (Franzosi 2002, Piazza 2003, Perry and Wilson 2003, Scheuer 2006). For example, during the 1980s and beyond

referred to two competing paradigms (i.e. attractants) vying for support. These were neoliberalism versus collectivism, though it was noted that there have been many approaches to economic management involving various mixes of neoliberalism and collectivism.

We argue that during the early 1980s a major shift occurred in perceptions of the relative effectiveness of neoliberalism versus collectivism. Specifically, a critical mass of support emerged in favour of neoliberalism sufficient to propel the progressive introduction of numerous reforms including those that reduced the power and influence of unions and their capacity and inclination to strike.

This raises two questions. First, what were the changes during the early 1980s that propelled the ascent of the neoliberal attractant and contributed to a marked reduction in global stoppage rates? Second, what were the circumstances and events – the antecedents, so to speak – that promoted a perception more favourable to neoliberalism and less favourable to collectivism?

First, we point to two key and iconic changes that propelled the ascent of the neoliberal attractant and subsequent decline in stoppages. One was the coming to power in the UK of the Thatcher Administration in 1979; the other was the coming to power in 1980 of the Reagan Administration in the USA. Both of these conservative administrations succeeded in defeating various challenges to their authority by militant unions (Pettersson 2004, Reagan 1990, Western 1997). The conflicts were well publicised and relayed graphically around the world. Arguably the disputes and their outcomes had a strong demonstration effect worldwide.

Second, we point to 3 antecedent developments that helped form perceptions that were increasingly in opposition to collectivism in its various forms and manifestations. The first antecedent development was the sense of community frustration and antagonism towards the way in which unions in much of the world exercised power during the economically-troublesome 1970s. In the UK, for example, during the 1978-79 so-called “winter of discontent”, public services such as garbage collections, ambulance services and nursing were severely disrupted as a result unions refusing to abide by government attempts to restrain wage and price inflation. These disruptions and the chaos and disorder they promoted became increasingly unpopular, as did their instigators. A second antecedent development involved the jettisoning of collectivism in China. China’s collectivist policies, under the leadership of Mao Zedong, had long been a role model to many sympathetic politicians, unionists and intellectuals in the “West”. When Deng Xiaoping abandoned these failed policies in favour of individual responsibility, market forces and the encouragement of international trade, much of the credibility of collectivism collapsed. The third antecedent development to affect perceptions – but more so we suspect the perceptions of policy makers than the general citizenry – was the rise to prominence of the “Asian Tiger” economies during the 1960s and 1970s. These economies (South Korea, Taiwan, Hong Kong and Singapore) experienced high growth and falling unemployment rates while other developed economies experienced the opposite. The Asian Tiger economies eschewed collectivist policies, and their conspicuous successes stood in stark contrast to the flat performance of, for example, China’s failed dictatorially-driven collectivist policies and India’s failed democratically-endorsed collectivist policies (Little, Scitovsky and Scott 1970, Riedel 1989).

Doubtless other historical events and circumstances contributed to changing perceptions about market-oriented policies versus collectivist policies. The critical point,

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union density (the fraction of employees in unions) fell in many, though not all, countries (Visser 2006). For developed countries some of these falls have been linked to a relative rise in female employment, services sector employment and casual employment (Franzosi 2002). Inflation in developed countries fell. The forces of globalisation of trade and investment may have weakened domestic bargaining power of labour (Katz and Darbishire 1999, Munck 2004, Silver 2003, O’Brien 2004, O’Brien and Williams 2004). Moreover, neoliberalism itself may have partly influenced changes in these areas. We plan to explore these issues in a later paper. At this stage, we seek to focus, in a preliminary fashion, on the possible influence on labour market outcomes of different broad policy frameworks or paradigms.

though, is probably not so much exactly which historical events were most influential, but rather that, by the early 1980s, relatively significant reforms found approval and were introduced at various times in a large number of countries. The eventual collapse in 1990 of the Soviet Union, which was for a long time the world's pre-eminent collectivist state, further reinforced the ascendancy of the neoliberal paradigm.

Neoliberalism that found favour during and after the 1980s has been generally unsuited – if not hostile - to the interests of unions and their capacity to engage in work stoppages. The widespread adoption, in one form or another, of neoliberal approaches to socioeconomic management has meant that, over time, an increasing number of countries have opted for policies that have either directly or indirectly acted as a constraint on union activity and the capacity of unions to invoke work stoppages as a vehicle for getting what they want.

## CONCLUSIONS

This paper has applied the general notion of convergence to global work stoppage rates. A “super-macro” perspective is taken on the patterns of work stoppages, by dividing the globe into two approximate “halves”: North America and the rest of the world. This approach gives an alternative perspective on trends in work stoppage rates that augments existing approaches that analyse the forces of convergence at, for example, (i) an industry level, (ii) a national level and (iii) an international, i.e. country-by-country, level.

It has been argued that there have been strong forces generating a broad convergence in the pattern of global work stoppages over the period 1960 to 2002. It has been suggested that the global decline in work stoppage rates has been linked, in part, to the worldwide ascent of neoliberal socioeconomic policies. Nevertheless, other factors have also likely contributed to the long-term pattern of declining stoppage rates. These influences, as well as determinants of short-term (year-to-year) fluctuations in stoppages, warrant separate investigation, which the authors hope to be able to pursue some time in the future.

## REFERENCES

- Adams, Roy J. 1995. "Industrial Relations in Europe and North America: Some Contemporary Themes." *European Journal of Industrial Relations* 1(1):47-62.
- Aghion, Philippe and Peter Howitt. 1998. *Endogenous Growth Theory*. Mass: MIT Press.
- Aghion, Philippe, Peter Howitt, and David Mayer-Foulkes. 2004. "The Effect of Financial Development on Convergence: Theory and Evidence." NBER Working Paper No. 610358. Accessed September 2006. <http://www.nber.org/papers/w10358>.
- Aligisakis, Maximos. 1997. "Labour Disputes in Western Europe: Typology and Tendencies." *International Labour Review* 136(1):73-94.
- Andersen, Torben. 1997. "Do Institutions Matter? Convergence and National Diversity in the Restructuring of Employment in British and Danish Banking." *European Journal of Industrial Relations* 3(1):107-24.
- Barro, Robert, J. and Xavier Sala-i-Martin. 1992. "Convergence." *Journal of Political Economy*, 100(2):223-51.
- \_\_\_\_\_. 1997. "Technological diffusion, Convergence and Growth." *Journal of Economic Growth* 2(1):1-27.
- Baumol, William J. 1986. "Productivity Growth, Convergence and Welfare: What the Long-Run Data Show." *American Economic Review* 76(5):1072-85.
- Baumol, William J. and Edward N. Wolff. 1988. "Productivity Growth, Convergence and Welfare: Reply." *American Economic Review* 78(5):1155-9.
- Beardsmore, Rachel. 2006. "International Comparisons of Labour Disputes in 2004." *Labour Market Trends* 125(4):117-28.
- Bureau of Labor Statistics. 1982a. *Monthly Labor Review*. May, US Department of Labor.
- \_\_\_\_\_. 1982b. *Monthly Labor Review*. June, US Department of Labor.
- Blasehke, Sabine. 2000. "Union Density and European Integration: Diverging Convergence." *European Journal of Industrial Relations* 2000 6(2):217-36.
- Blyton, Paul and Peter Tumbull. 1996. "Confusing Convergence: Industrial Relations in the European Airline Industry - A Comment on Warhurst." *European Journal of Industrial Relations* 2(1):7-20.
- Chernyshev, Igor. 2003. "Decent Work Statistical Indicators: Strikes and Lockout Statistics in the International Context." ILO Discussion Paper.  
<http://www.ilo.org/public/english/bureau/stat/download/articles/2003-3.pdf>
- De Long, Bradford. 1988. "Productivity Growth, Convergence and Welfare: Comment." *American Economic Review* 78(5):1138-54.
- Durkheim, Emile. 1958. *Socialism and Saint-Simon*. Yellow Springs, Ohio: Antioch Press.
- Edward, Peter. 2006. "Examining Inequality: Who Benefits from Global Growth." *World Development* 34(10):1667-95.
- Edwards, Paul K. and Richard Hyman. 1994. "Strikes and Industrial Conflict: Peace in Europe?" In Richard Hyman and Anthony Ferner (eds.) *New Frontiers in European Industrial Relations*. Oxford: Blackwell, 250-80.
- Enders, Walter. 2004. *Applied Econometric Time Series*. Wiley, Hoboken, NJ.
- Engle, Robert F. and Clive W. J. Granger. 1987. "Co-integration and Error Correction: Representation, Estimation and Testing." *Econometrica* 55(2):251-76.
- Firebaugh, Glenn. 1999. "Empirics of World Income Inequality." *American Journal of Sociology* 104(6):1597-630.
- Firebaugh, Glenn and Brain Goesling. 2004. "Accounting for the Recent Decline in Global Income Inequality." *American Journal of Sociology* 110(2):283-312.
- Fisher, Malcolm. 1973. *Measurement of Labour Disputes and their Economic Effects*. Paris: OECD.
- Franzosi, Roberto. 2002. "Strikes: Sociological Aspects." In Neil J. Smelser and Paul B. Baltes, (eds.) *International Encyclopedia of the Social and Behavioral Sciences*, Oxford: Elsevier Science.

- Gall, Gregor. 1996. "Converging on Conflict? A Further Comment on Warhurst." *European Journal of Industrial Relations* 2(2):255-60.
- Goesling, Brian. 2001. "Changing Income Inequalities within and between Nations: New Evidence." *American Sociological Review* 66(5):745-61.
- Gregory, Allan W. and Bruce E. Hansen. 1996a. "Residual-based Tests for Cointegration in Models with Regime Shifts." *Journal of Econometrics* 70(1):99-126.
- \_\_\_\_\_. 1996b. "Tests for Cointegration in Models with Regime and Trend Shifts." *Oxford Bulletin of Economics and Statistics* 58(3):555-60.
- Hansen, Lise. L., Jørgen S. Madsen and Carsten S. Jensen. 1997. "The Complex Reality of Convergence and Diversification in European Industrial Relations Systems: A Review of the 1996 IREC Conference." *European Journal of Industrial Relations* 3(3):357-76.
- Hayek, Friedrich A. von. 1944. *The Road to Serfdom*. London: Routledge Press.
- Hirsch, Barry T. 2003. "Union Membership and Coverage Database from the Current Population Survey: Note." *Industrial and Labour Relations Review* 56(2):349-54.
- Inoue, Atsushi. 1999. "Tests of Cointegrating Rank with a Trend-break." *Journal of Econometrics* 90(2):215-237.
- International Labour Office (ILO). 2006a. *Yearbook of Labour Statistics*, Geneva.
- \_\_\_\_\_. 2006b. *Yearly Statistics*. <http://laborsta.ilo.org/>
- \_\_\_\_\_. 2006c. "Vol. 7: Strikes and Lockouts." *Sources and Methods: Labour Statistics* as displayed at: <http://laborsta.ilo.org/>
- Islam, Nazrul. 2003. "What Have We Learnt from the Convergence Debate?" *Journal of Economic Surveys* 17(3):309-61.
- Johansen, Soren. 1988. "Statistical Analysis of Cointegration Vectors." *Journal of Economics Dynamics and Control* 12(2/3):231-54.
- Johansen, Soren and Katarina Juselius. 1990. "Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demand for Money." *Oxford Bulletin of Economics and Statistics* 52(2):169-209.
- Katz, Harry C. and Owen Darbishire. 1999. *Converging Divergences: Worldwide Changes in Employment Systems*. Ithaca: Cornell University Press.
- Keenoy, Tom. 1995. "Review Article: European Industrial Relations in Global Perspective." *European Journal of Industrial Relations* 1(1):145-64.
- Kelly, John and Nigel Nicholson. 1980. "Strikes and Other Forms of Industrial Action." *Industrial Relations Journal*. 11(5):20-31.
- Kerr, Clark, John T. Dunlop, Frederick H. Harbison, and Charles A. Myers. 1960. *Industrialism and Industrial Man: The Problems of Labor and Management in Economic Growth*, Cambridge, Mass: Harvard University Press.
- Kerr, Clark. 1983. *The Future of Industrial Societies. Convergence or Continuing Diversity?* Cambridge, Mass: Harvard University Press.
- Korpi, Walter. 1981. "Unofficial Strikes in Sweden." *British Journal of Industrial Relations* 19(1):66-86.
- Korzeniewicz, Roberto P. and Tim P. Moran. 2000. "Measuring World Income Inequalities." *American Journal of Sociology* 106(1):209-14.
- Kuznets, Simon. 1973. *Population, Capital and Growth*. New York: Norton.
- Little, Ian M.D., Tibor Scitovsky, and Maurice F. Scott. 1970. *Industry and Trade in Some Developing Countries*. New York: Oxford University Press.
- MacKinnon, James G., Alfred A. Haug and Leo Michelis. 1999. "Numerical Distribution Functions Of Likelihood Ratio Tests For Cointegration." *Journal of Applied Econometrics* 14(5):563-77.
- Marx, Karl. 1867. *Capital*, Edited by Friedrich Engels. Translated from the 3rd German ed. by Samuel Moore and Edward Aveling, 1967. New York: International Publishers.
- Mitchell, Brian. R. 2003a. *International Historical Statistics: Africa, Asia and Oceania 1750-2000*, 4th Ed. New York: Palgrave Macmillan.
- \_\_\_\_\_. 2003b. *International Historical Statistics: Europe, 1750-2000*, 4th Ed. New York: Palgrave Macmillan.

- \_\_\_\_\_. 2003c. *International Historical Statistics: The Americas and Australasia, 1750-2000*, 4th Ed. New York: Palgrave Macmillan.
- Munck, Ronaldo. (ed.) 2004. *Labour and Globalisation: Results and Prospects*. Liverpool: University Press.
- O'Brien, Robert. 2004. "Continuing Incivility: Labor Rights in a Global Economy." *Journal of Human Rights* 3(2):203-14.
- O'Brien, Robert and Marc Williams. 2004. *Global Political Economy: Evolution and Dynamics*. New York: Palgrave.
- Peacock, Walter. G., Greg A. Hoover and Charles. D. Killian. 1988. "Divergence and Convergence in International Development: A Decomposition Analysis of Inequality in the World System." *American Sociological Review* 53(6):838-52.
- Parente, Stephen. L. and Edward C. Prescott. 2006. "What a Country Must Do to Catch-Up with the Industrial Leaders" in Balcerowicz, L. and S. Fischer. *Living Standards And the Wealth of Nations: Successes And Failures in Real Convergence*. Mass: MIT Press.
- Perman, Roger. 1991. "Cointegration: An Introduction to the Literature." *Journal of Economic Studies* 18(3):3-30.
- Perry, Leonard J. and Patrick J. Wilson. 2003. "An Analysis of International linkages in Strike Activity." *International Journal of Employment Studies* 11(2):47-74.
- \_\_\_\_\_. 2003. "Trends in Work Stoppages: A Global Perspective." Working Paper No. 47, November, Policy Integration Department, Statistical Development and Analysis Unit, International Labour Office.
- Pettersson, Kjell. 2004. "20<sup>th</sup> Anniversary of an Historic Battle: The British Miners' Strike." *Socialist Action*, [www.geocities.com/mnsocialist/britishminers.html](http://www.geocities.com/mnsocialist/britishminers.html).
- Phelps-Brown, Henry. 1975. "A Non-Monetarist View of the Pay Explosion." *The Three Banks Review* 105:3-24.
- Piazza, James A. 2005. "Globalizing Quiescence: The Effects of Globalization on Strikes in 14 Industrialized Countries." *Economic and Industrial Democracy* 26(2):289-314.
- Poole, Michael. 1986. *Industrial Relations: Origins and Patterns of National Diversity*, London: Routledge & Keegan Paul.
- Reagan, Ronald. 1990. *An American Life*, New York: Simon & Schuster.
- Riedel, James. 1988. "Economic Development in East Asia: Doing What Comes Naturally?" in Helen Hughes (Ed.) *Achieving Industrialization in East Asia*. New York: Cambridge University Press.
- Scheuer, Steen. 2006. "A Novel Calculus? Institutional Change, Globalization and Industrial Conflict in Europe." *European Journal of Industrial Relations* 12(2):143-64.
- Shalev, Michael. 1992. "The Resurgence of Labour Quiescence." in Mario Regini (Ed) *The Future of Labour Movements*. London: Sage Publications.
- Silver, Beverly J. 2003. *Forces of Labor: Workers Movements and Globalization since 1870*. Cambridge: Cambridge University Press.
- Stokke, Torgeir A., and Christer Thornqvist. 2001. "Strikes and Collective Bargaining in the Nordic Countries." *European Journal of Industrial Relations* 7(3):245-67.
- Temple, Jonathan. 1999. "The New Growth Evidence." *Journal of Economic Literature* 37(1):112-56.
- Tinbergen, Jan. 1959. "The Theory of the Optimum Regime." *Selected Papers*. Amsterdam: North Holland.
- \_\_\_\_\_. 1961. "Do Communist and Free Economies Show a Converging Pattern?" *Soviet Studies* 12(4):333-41.
- Turner, Henry. A. 1969. *Is Britain Really Strike Prone? A Review of the Incidence, Character and Costs of Industrial Conflict*. Occasional Paper No 20, University of Cambridge, Department of Economics. Cambridge: Cambridge University Press.
- U.S Bureau of Economic Analysis. 1973. *Long Term Economic Growth 1860-1970*. Washington DC, Government Printing Office.

- Vernon, Guy. 2006. "Does Density Matter? The Significance of Comparative Historical Variation in Unionization." *European Journal of Industrial Relations* 12(1):189-209.
- Visser, Jelle. 2006. "Union Membership Statistics in 24 Countries." *Monthly Labor Review* 129(1):38-49
- Wade, Robert H. 2004a. "Is globalization reducing poverty and inequality?" *World Development* 32(4):567-89
- \_\_\_\_\_. 2004b. "Inequality and Globalization: Comments on Firebaugh & Goesling." Paper CGIRS-2004-10. Center for Global, International and Regional Studies, 12 November. <http://repositories.cdlib.org/cgirs/CGIRS-2004-10>
- Walsh, Kenneth. 1983. *Strikes in Europe and the United States: Measurement and Incidence*. London: Frances Pinter.
- Warhurst, Russell. 1995. "Converging on HRM? Change and Continuity in European Airlines' Industrial Relations." *European Journal of Industrial Relations* 1(2):259-74.
- Western, Bruce. 1997. *Between Class and Market: Postwar Unionization in the Capitalist Democracies*. Princeton: Princeton University Press.
- Wilensky, Harold L. 2002. *Rich Democracies: Political Economy, Public Policy and Performance*. Berkeley: University of California Press.

**APPENDIX A: DATA AND SOURCES**

(i) USA small-scale stoppages equation data sources: US Department of Labor, Bureau of Labor Statistics (BLS), *Monthly Labor Review*, various issues; BLS, Bureau of Labor Statistics Data (online), [www.bls.gov](http://www.bls.gov); BLS, *Employment and Earnings*, various issues; U.S. Bureau of Economic Analysis (1973); Hirsch (2003). (ii) Days not worked per 1000 in the labour force. Sources: International Labour Office (2006a,b,c) and earlier editions; Organization for Economic Cooperation and Development (OECD), *Main Economic Indicators*; Mitchell (2003a,b,c); Central Bank of Nigeria, *Annual Report and Statement of Account*. Certain refinements and updates were communicated directly to the authors via direct correspondence with respective national statistical collection agencies. Note: USA data are grossed up as described in the paper and Nigerian data after 1998 are based on the Authors' interpretation of qualitative commentary employed in the previously cited Central Bank of Nigeria source. (iii) Labour force data: *World Bank World Tables*, various issues.

**APPENDIX B: STATISTICAL TESTS**

Section 4 tests for evidence of cointegration. If two variables are cointegrated then this implies that there is some common (stochastic) trend that "holds" the variables together (i.e. does not allow them to drift too far apart) over the long term. Consider a simple example from economic theory.<sup>10</sup> It has been well established that there is an equilibrium relationship between consumption and income, which maybe written in equation form as:

$$C_t = bY_t \quad (\text{B1})$$

Where the subscript refers to an observation in some given time period,  $t$ , and  $b$  refers to the proportion of each extra dollar income that is spent on consumption (known as the marginal propensity to consume). In this form, equation B1 is portraying an equilibrium relationship between the two variables  $C$  and  $Y$ . Equation B1 can be re-written as:

$$C_t - bY_t = 0 \quad (\text{B2})$$

However, it is unrealistic to expect equation B2 to hold exactly at every possible time period. Instead, for a variety of reasons, one would expect random departures from this relationship at any time,  $t$ , and we can measure these random departures as:

$$C_t - bY_t = e_t \quad (\text{B3})$$

Where the term  $e_t$  captures short-term movement away from the long-run equilibrium position that holds between the two variables. If, in fact, there is a long-run equilibrium relationship between  $C$  and  $Y$ , then  $e_t$  should fluctuate around some value which is the average of the  $e_t$ , or even decline over time. This is basically saying that there is some linear combination of the two variables,  $C_t$  and  $Y_t$  that is said to be stationary. In its simplest form, then, the two step test for cointegration as developed by Engle and Granger (1987), examines the behaviour of this "disequilibrium" error term to ascertain whether there is a long-term relationship between the variables in question (in our simple example,  $C$  and  $Y$ )<sup>11</sup>. If it can be

<sup>10</sup> An excellent introduction to the concept of cointegration may be found in Perman (1991).

<sup>11</sup> The two steps of the Engle-Granger process consist of a regression to estimate the long run relationship between  $C_t$  and  $Y_t$  and extract the estimated residuals,  $e_t$ . The second step is to run a further regression of the differenced residuals against residuals lagged one period. The

established that the variables are cointegrated, then this implies that there is a long-run equilibrium relationship between these variables. In summary, cointegration is a test to establish if there is evidence of a statistically significant long-term relation between the two variables; such a relation is consistent with the presence of a long-term equilibrium relation, subject to short-term variations. A cointegrated relation is, in turn, evidence of a form of convergence – such as parallel convergence as discussed in Figure 1 Panel C, or crossover convergence as discussed in Figure 1 Panel D.

Our tests to establish the presence or otherwise of a long-term cointegrated relation between our two super-macro variables of work stoppage rates involves three sequential procedures.

The first procedure is to establish that the variables, (i) the natural log of North American DNW/LF and (ii) the natural log of the rest of the world's DNW/LF, are stationary in terms of their first differenced values. A well-established battery of tests show the differenced series are stationary. In order to keep things brief these results are not tabled, but will be supplied on request.

The second procedure is to test for cointegration between the variables described above. While Engle and Granger (1987) introduced the concept of cointegration, and developed a two step procedure to test for the existence of such a relationship, this procedure had certain limitations.<sup>12</sup> A more general test was developed by Johansen (1988) and Johansen and Juselius (1990) which is commonly known as the Johansen “rank” test - so called because it tests for the number of cointegrating vectors in a system of equations, which is called the cointegrating rank of the system. While the Johansen rank test also examines “disequilibrium” behaviour it does so in a much more sophisticated fashion that can incorporate any number of variables (at least theoretically) and does not need the analyst to distinguish between dependent and independent variables for the regression equations in the system under study. Very briefly, one undertakes a Johansen procedure within what is known as a Vector AutoRegression (VAR) framework. For example, in a VAR framework with two variables, say  $C_t$  and  $Y_t$  from our earlier economics example, there will be two equations, such that in one equation the dependent variable is  $C_t$ , and in the other equation, the dependent variable is  $Y_t$ . The regressors in both equations are lagged values of both variables - this can be extended to any number of variables.

Now, in the Johansen procedure two types of regressions are estimated. First a VAR of differences is estimated. So in this case, to continue our consumption/income example, we would run the differenced value of  $C$  against lagged values of the differenced value of  $C$  and  $Y$  and we would repeat the procedure for differenced  $Y$ . We would save the residuals from these estimations in two vectors (because we have run two regressions), let us call these vectors  $u_1$  and  $u_2$ . A second battery of regressions is now run. In this case we regress the level of each variable against a set of lagged differenced values of each variable. Again, we save the residuals in two vectors, let us call these vectors  $v_1$  and  $v_2$ . Next the variance-covariance matrices of these four residuals are calculated (these are generally termed product moment matrices). These product moment matrices are then used to find the cointegration vector (or vectors if a large number of variables are being examined and the possibility of more than one common trend exists). Without delving into technical detail this is done by forming a larger matrix from these product matrices and then finding the eigenvalues of a determinant of this matrix such that this determinant is zero (i.e. “vanishes”). An eigenvalue, also known as a characteristic root, is simply a number (scalar) that ensures the determinant of the matrix vanishes, i.e. equals zero. If the determinant vanishes then the matrix is said to be singular. A singular matrix is one in which there exists linear dependence between at least two rows or columns (a cointegration test is checking for such linear dependence). The Johansen procedure is often referred to as the rank test since the rank of a matrix is defined as the maximum number of linearly independent rows or columns there are in a matrix (hence this

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regression coefficient from this second regression is then tested for stationarity which will determine whether the variables  $C_t$  and  $Y_t$  are cointegrated or not.

<sup>12</sup> For a discussion of these limitations see Enders (2004).

allows the determination of the number of linearly dependent rows or columns there are – the cointegrating rank). How many such numbers (eigenvalues) there may be will depend on the number of variables in our system. Once all such eigenvalues are found they are arranged in order of “significance” – in the first instance this will be a high to low ordering in terms of the size of the eigenvalue, with “significance” being determined by further tests. It is these further tests that will resolve the number of cointegrating equations (vectors) there are in the system. Let us suppose the eigenvalues are denoted  $\lambda_i$  and these are ordered  $\lambda_1 > \lambda_2 > \lambda_3 > \dots$  etc. Now, if the variables are *not* cointegrated the cointegrating rank will be zero and all eigenvalues (characteristic roots) will equal zero. Johansen devised two statistics to test this, viz. a trace test (statistic) and a maximum eigenvalue test, which effectively determine whether the eigenvalue is significantly different from zero. Johansen adopted a clever approach to this test. First we note that  $\ln(1)=0$  (i.e. the natural logarithm of one is zero). Consequently each of the expressions  $\ln(1 - \lambda_i)$  will equal zero if the variables are *not* cointegrated (since all eigenvalues will equal zero). Following this reasoning Johansen developed two tests for the number of eigenvalues that are *insignificantly different from unity* – the trace statistic and the maximum eigenvalue statistic. The trace statistic tests the null hypothesis that the number of distinct cointegrating vectors (equations) is less than or equal to  $r$  (where  $r$  ranges from zero i.e. no cointegration, up the maximum number of variables being tested). The maximum eigenvalue statistic tests the null hypothesis that the number cointegrating vectors is  $r$  against the alternative that it is one greater than  $r$  (i.e.  $r+1$ ). So the testing procedure is sequential from no cointegrating vectors up through at least one, at least two and so on. For example, in the trace statistic rejection of the null that  $r=0$  implies the alternative of at least one cointegrating vector and so on.

So, the Johansen procedure just outlined can test for the presence of a cointegrated relation between our two variables – North America and the rest of the world - *without* any allowance for a change in the structure of that relation. By this is meant that there is no allowance for the possibility that there has been some change in the estimated coefficients within the system that might impact on the outcome from the procedure used to estimate the cointegrating rank. For example, there may have been a change in the levels (reflected in a changed intercept) or a change in the trend slope (reflected in a “bend”), or a change in both. The results of this test are given in Table 1 below. This table indicates the presence of a long-term (cointegrated) relation between our variables.

**Table 1: Johansen Rank Tests\***

|            | Nth America and ROW |           |
|------------|---------------------|-----------|
| $H_0:$     | $I_{Trace}$         | $I_{Max}$ |
| $r=0$      | 26.7 (a)            | 21.4 (a)  |
| $r \leq 1$ | 8.3                 | 8.3       |

\*The results presented are the Johansen trace and maximum Eigenvalue statistics. Results tabulated assume a trend component and critical values are taken from Mackinnon-Haug-Michelis (1999). A sequential estimation procedure was used to determine lag order. ROW refers to the rest of the world. (a) indicates reject null at 5% level.

Our third and final procedure is to test for the presence of a cointegrated relation between our two variables but this time *with* an allowance for a possible structural break in the trend that may impact on the conventional Johansen approach, since other research has shown that trend-breaks can produce an incorrect outcome from conventional tests of cointegration (Gregory and Hansen, 1996 a,b and Inoue, 1999). In this instance we employ the methodology developed by Inoue (1999) since it is a Johansen type test where an entire system can be analysed in one pass as described above (as opposed to the Engle-Granger (1987) type test developed by Gregory and Hansen (1996) where a two step procedure is

employed thereby increasing the likelihood of an error being introduced to the test)<sup>13</sup>. The results of this approach are reported in Table 2 below. Note that the Inoue methodology does not presuppose (i.e. it does not assume *a priori*) any particular year or set of years when a break may, for one reason or another, have occurred. Instead, the Inoue approach is entirely data driven. The Inoue methodology allows for three varieties of trend-break. The first, referred to as Model A in Table 2, tests for a possible shift in the constant term in the linear equation linking the two series. If we assume this type of shift *alone* in the relation, there is evidence of cointegration with a possible break on or around 1978. The second variety of structural change, referred to as Model B in Table 2, tests for a possible shift in the slope coefficient in the trend component of the cointegrating equation. If we assume this type of shift *alone*, there is evidence of cointegration with a possible break on or around 1967. Finally, the third variety of structural break, referred to as Model C in Table 2, tests for a possible simultaneous shift in both the constant term and the slope coefficient. If we assume this type of trend break, there is evidence of cointegration in the presence of a possible break on or around 1981.

**Table 2: Inoue Rank Tests**

| Nth America and ROW |                    |           |                    |           |                    |           |
|---------------------|--------------------|-----------|--------------------|-----------|--------------------|-----------|
| $H_0$ :             | Model A            |           | Model B            |           | Model C            |           |
|                     | $I_{Trace}$        | $I_{Max}$ | $I_{Trace}$        | $I_{Max}$ | $I_{Trace}$        | $I_{Max}$ |
| $r=0$               | 32.5 (b)<br>(1978) | 27.7 (b)  | 57.1 (a)<br>(1967) | 42.1 (a)  | 34.5 (a)<br>(1981) | 28.2 (a)  |
| $r=1$               | 7.3                | 7.3       | 15.6               | 15.6      | 8.1                | 8.1       |

Critical values for the trace and maximum Eigenvalue statistics are taken from Inoue (1999). ROW refers to the rest of the world. (a) indicates reject null at 1% level, (b) at 5%.

We note that reasonable arguments can be mounted to support the possibility of a structural break in the equilibrium relation between the two series on or around 1967 or on or around 1981 (or perhaps 1978). For instance, we have argued that a structural break in 1967 can be aligned to the spectacular increase in work stoppages in France in 1968. Or, a break around 1981 (or perhaps 1978) can be aligned to the successful rebuttal of militant unionism in the USA and the UK and the beginning of the decline in the status of collectivist policies starting in China with the coming to power of Deng Xiaoping. However, it is not our purpose here to develop an elaborate rationalisation for a break in the relation on or around one of these date since our purpose is simply to test for cointegration under the scenario of a possible trend-break that might otherwise yield incorrect results using a conventional Johansen approach. Now, if the precise form of the trend-break is unknown, Inoue (1999) recommends the use of model B which, in this case, identified cointegration with a possible break on or about 1967.<sup>14</sup> Ultimately it comes down to a matter of judgement as to what weight we might

<sup>13</sup> As explained in an earlier footnote the Engle-Granger procedure uses two regressions or passes through the data. The first regression estimates the residuals and these residuals are then used in a further regression. Two such “passes” increase the likelihood of an incorrect finding from the test. In addition, it is possible that the outcome may be different depending on which variable is used as the dependent variable. In contrast to this, the residuals from the Johansen procedure are not used in a further regression. In addition, since the procedure is developed in a VAR framework, all variables become dependent variables.

<sup>14</sup> In hypothesis testing the probability that the test correctly rejects the null when the alternative is true is known as the power of the test. The three models that Inoue (1999) developed – Models A, B and C - tested the null of no cointegration against alternatives that allowed for mean and/or trend breaks in the cointegrating equation. In his Monte Carlo

choose to attach to different historical episodes. Nevertheless it would be incorrect to overstate the significance of these trend-breaks to the underlying long-term relation between the two variables. The evidence of cointegration in the presence of possible trend-breaks merely enhances the detail of the long term relation, the relation itself is not defined by possible structural breaks; rather it is defined by the durability of the long-term association – that has been shown to exist between the current series.

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simulations and development of asymptotic critical values Inoue found that (a) the power of his tests was not sensitive to the location of the break and (b) his Model B produced the highest probability of correctly rejecting the null compared with the other models. Under these circumstances Inoue suggested that, if the exact form of the trend break was unknown, then Model B should be the preferred model (see Inoue, 1999:233). In addition it should be noted that the Inoue methodology does not set out to identify a break-date, but rather to test for cointegration in the presence of a potential break. Consequently the procedure may miss the true breakpoint by an observation or two and, with annual data, this means a year or two.