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Article abstract

This paper tests a macroeconomic strike model widely used to study the incidence of labour conflict in developed countries on data from the world-at-large. Previous investigations of the influence of labour demand and worker wage expectations on strike frequency have produced contradictory results. Perhaps one reason for this is that these studies have left out all but the most developed countries and have rarely been comparative. This study uses a data set that includes data for 41 countries (approximately half of which are considered developing) from 1953-1985.

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Extending a Western Strike Model

MICHAËL SEGALLA

This paper tests a macroeconomic strike model widely used to study the incidence of labour conflict in developed countries on data from the world-at-large. Previous investigations of the influence of labour demand and worker wage expectations on strike frequency have produced contradictory results. Perhaps one reason for this is that these studies have left out all but the most developed countries and have rarely been comparative. This study uses a data set that includes data for 41 countries (approximately half of which are considered developing) from 1953-1985.

Many models of strike frequency have been examined by scholars over the past decades. Two major classes of strike models, however, have emerged in the strike literature in recent years. The first is based on Hicks' (1963) assumption that strikes are mistakes in the bargaining process. The second class includes private information models[1] which suggest that strikes are Pareto optimal ex ante, in that they help uncover important information normally hidden from one of the bargaining parties.

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1. See Morton (1983); Hayes (1984); Fudenberg, Levine, and Rund (1985); Kennan (1986); Tracy (1987); McConnell (1989).

Empirical testing of the first group has historically relied on macroeconomic data[2] and, unfortunately, little consensus has emerged concerning the empirical influence of the various macroeconomic variables used to explain strike incidence (Gramm 1986; Franzosi 1989).[3] Even the two most commonly accepted macroeconomic measures, the wage expectations of workers (often measured by wage changes) and the state of the labour market (often measured by the unemployment rate), have failed to exhibit a consistent relationship to strike frequency. Perhaps one explanation for this is the lack of a truly comparative focus. Specifically, past studies (whether using macro or micro level data) tend to be limited to different time frames and subsets of economically developed countries.

Strike researchers have generally neglected to investigate empirically strike activity in developing countries.[4] In this paper, one of the most well-known models of strike activity for developed countries (Ashenfelter and Johnson 1969), is used to investigate this phenomenon in countries other than the most developed. This model's extension to the world-at-large also attempts to explain the contradictory findings reported in the literature (e.g., Scoville 1979; Blejer 1981; Paldam and Pedersen 1982; Gramm 1986) concerning the two primary components of the model: (1) the influence of wage changes on strike frequency; and (2) the impact of labour demand on strike frequency. As suggested by Kerr, Dunlop, Harbison and Meyers (1962), such an extension also needs to address the effect of industrialization on strike frequency. Therefore in this study, the Ashenfelter and Johnson's seminal macroeconomic model (1969) is adapted to analyze ILO

2. Farber (1978), Gramm (1986), Gramm, Hendricks, and Kahn (1988), and Vroman (1989) are examples of studies utilizing microeconomic data. These models have examined the linkages between strike incidence and corporate profits (Ashenfelter and Johnson 1969; Tracy 1986), the costs of disagreement (Reder and Neumann 1980; Kennan 1980), inflation (Turkington 1975; Edwards 1978; Kaufman 1981; Beggs and Chapman 1987; Gramm et al. 1988; Vroman 1989), various measures of the state of the labour market (Ashenfelter and Johnson 1969; Turkington 1975; Snyder 1975, 1977; Edwards 1978; Scoville 1979; Skeels 1982; Tracy 1986; Beggs and Chapman 1987), various measures for worker wage expectations or minimum acceptable wage increases (Ashenfelter and Johnson 1969; Snyder 1975, 1977; Hibbs 1976; Shalev 1980; Paldam and Pedersen 1982; Skeels 1982; Gramm et al. 1988), worker characteristics (Tracy 1986; Gramm 1986), and contract characteristics (Card 1988; Vroman 1989).

3. Wheeler (1984) is particularly critical of even the theoretical influence of macroeconomic variables, arguing that they are too far removed from the level of the theories they are used to test.

4. Those studies examining less developed countries, with a few exceptions, have usually been case studies. Blejer (1981) examines strike activity and wage determination under conditions of rapid inflation. He uses Chile to test his model, which is derived from A & J's work. For a selection of case studies see the April 1979 issue of *Development and Change* which is devoted to third-world strike studies.

data from 41 countries (half of which are commonly considered developing) over the period 1953-1984 using a pooled time-series, cross-sectional model.

Although this data set can not be used to test many of the newer models proposed (see for example, Reder and Neumann 1980; Kaufman 1981; Gramm et al. 1988) nor any of the private information models which are generally tested with microeconomic (sometimes referred to as contract-specific) data, it does provide an opportunity to test the classic macroeconomic strike model on a broad scale.

THE CLASSIC APPROACH

Almost every major investigation of strike activity uses Ashenfelter and Johnson's (1969) [hereafter A & J] study as a point of departure. Its premises and findings dominated subsequent macroeconomic strike research for at least a decade. A & J's most enduring arguments concern the influences that workers' wage expectations and the state of the labour market have on strike frequency. They argue that the probability of a strike is positively related to the size of the workers' minimum acceptable wage increase. They further contend that the size of this acceptable wage increase is influenced by previous wage increases, and that a series of large past real wage increases helps decrease current wage demands. Since smaller minimum acceptable wage demands reduce the probability of a strike, A & J predict a negative relationship between previous real wage changes and strike frequency.

With regard to the state of the labour market, as measured by the rate of unemployment, A & J suggest three reasons why it should negatively influence strike frequency. First, low unemployment generally increases workers' opportunities to find other, higher paying, jobs. Before bearing the cost of a job change, however, the typical worker will try to increase his or her present wage. This will inflate the minimum acceptable wage demanded thereby increasing the probability of a strike. Second, union leaders are likely to be politically indifferent to the trade-off between employment losses and income gains during times of low unemployment and are therefore unlikely to try to reduce the rank and file's minimum acceptable wage demands. Given the increased availability of strike funds following periods of low unemployment, the risk of lost income is minimized. Finally, the ease of finding alternate employment will increase the rank and file's willingness to accept the consequences of a higher acceptable minimum wage demand.

Although many researchers, notably Snyder (1975), Hibbs (1976), Farber (1978), Edwards (1978), Shalev (1980), Kaufman (1981, 1982),

Skeels (1982), Gramm (1986), and Vroman (1989) have further developed the A & J model by adding economic, political, union organization and/or contract-specific variables, few seriously challenge its basic premises concerning the direction of the influences of real wages and unemployment.[5] However, several have reported contrary empirical findings. Reder and Neumann (1980), Gramm (1986), and Gramm et al. (1988) question the findings related to unemployment, and Blejer's (1981) findings question the wage expectation findings. The comparative studies of Scoville (1979) and Paldam and Pedersen [hereafter P & P] question both the premises and findings of the A & J model.

Scoville, while not directly criticizing the A & J premises, provides an alternative viewpoint by focusing more explicitly on the role of the "state of the labour market." He argues that factors causing equilibrium changes in the labour market also explain strike activity. Scoville envisions four states of the labour market, each characterized by different labour supply or labour demand conditions which influence strike activity. Strike frequency increases when either the supply of labour decreases or the demand for labour increases as both conditions provide a strategic advantage for unionized workers.

Scoville does not explicitly consider the influence of workers' wage expectations. However, his model associates higher strike frequency with high wage conditions rather than low wage conditions. As such, if one assumes that large past wage increases are likely to be associated with higher wage levels, Scoville's model is somewhat at odds with the A & J model since they believe that higher wage increases reduce strike frequency.

Scoville used annual data (1970-1976) for five Asian countries: Hong Kong, Japan, Korea, Singapore, and Thailand. His results generally support his hypothesis with the notable exception of Korea, a country which Scoville concludes does not satisfy the necessary political preconditions[6] allowing the full influence of the market to be reflected in its strike activity.

5. Snyder (1975) examines the importance of a worker's expectation-achievement gap and its influence on labour conflict; Shalev (1980) provides a particularly thorough critique of A & J's premises and methodology, particularly with respect to the influence of real wages.

6. A political precondition, though not spelled out in detail by Scoville in his article, refers to a government's willingness to be open and responsive to various protest groups as opposed to repressive and unresponsive. Governments which attempt to restrict union growth or guarantee freedom from labour problems to foreign investors do not provide the necessary political preconditions to ensure that market influences have an unhampered influence on strike activity. The data set used in the present study includes observations from countries where unions are restricted in some manner. However, the dummy variables should be able to capture some of this effect.

Unfortunately, Scoville's research examines only a few countries over a seven-year period and is designed to explore the area. He essentially makes a visual examination of the data which, given its short time span, is adequate for his purpose, but which makes analysis and comparisons of his results difficult.

P & P explicitly challenge the premises, operationalization, and findings of A & J's research. Their critique is essentially based on their results, but they also point out that A & J develop a model designed to explain American strike activity. Accordingly, in countries where the industrial relations environment might be more political, more highly centralized, or less developed, their hypotheses may not be supported. In any case, since it has not been adequately tested outside of a highly developed economy, its true value is unknown. P & P's criticism about the single country focus of the A & J model joins that of other researchers. Hyman (1979) argues strongly that the proper focus for the study of labour conflict is global, not national or regional. He believes that "... many of the key problems of [strike] theory and practice are universal in incidence" (1979: 333). For their part, P & P expand the model to include a political variable pertaining to the orientation (liberal or conservative) of the government.[7]

P & P's findings challenge A & J's results. They examine two periods between the years 1948 and 1975 using aggregated data from 17 OECD countries. In one specification, they follow A & J's specification (using annual rather than quarterly data) and find that only in the U.S. does a negative relationship between previous real wage changes and strike frequency exist. Unemployment's negative relationship is only significant in Italy. In many of the countries (either 30 percent or 80 percent depending on the time frame examined) a positive relationship is reported. These results call into doubt the generalizability of the A & J hypotheses to other countries.[8]

In summary, the model proposed by A & J has come under theoretical attack for its limited geographic focus and under empirical attack by contradictory findings in later studies. Scoville focuses more explicitly on the state of the labour market, whereas P & P attempt to broaden the model; both expand on the data used to explain strike frequency. Although

7. Actually P & P also included an election year dummy but found no significant relationships for this political variable. See Snyder (1975) where an election year dummy is found to be positively significant for Italy but negatively significant for France.

8. P & P do not use raw strike frequency as do A & J. Rather they compute indices by dividing the annual strike level by the mean strike level and multiplying by .01. As such, their findings are not strictly comparable. They are sufficiently useful, however, to create doubt as to the relevance of A & J's findings to countries other than the United States.

Scoville's pioneering work lacks scope and time span, and P & P's study examines only developed countries, each uniquely contributes to understanding strikes. Both provide evidence that the A & J model needs to be tested across a wider cross-section of countries. Therefore, a better test of the model requires a more extensive investigation encompassing the world-at-large.

ADAPTING THE CLASSIC MODEL TO THE WORLD-AT-LARGE

Adapting A & J's model to the world-at-large poses theoretical and empirical problems. Past research on labour conflict proposes four sets of influences on strike activity — economic, institutional, organizational, and political — so any purely economic model may be too limited by design. Furthermore, it should not be a foregone conclusion that any of these four sets of influences examined separately have identical, or even similar, effects across countries. It is very likely that there are interaction effects between the variables included in each set. This theoretical problem is further compounded by an empirical difficulty. The proxies usually chosen to model the underlying constructs are not always uniformly collected or available. They vary across time periods and countries. In developing a strike model for the world-at-large, it is therefore necessary to examine both the theoretical importance and data requirements of the two macroeconomic factors under examination and other factors which may be relevant.

STATE OF THE LABOUR MARKET

The state of the labour market has long been thought to have an important influence on the number of strikes (see Reder and Neumann (1980) for an alternative view). The rate of unemployment is the most frequently used measure of this factor. The basic argument is that low unemployment rates provide a strategic advantage to organized labour.[9] A & J outline three advantages (discussed earlier) that accompany low

9. A second measure sometimes used, based on the work of Ashenfelter and Pencavel (1969), is trough unemployment. Trough unemployment attempts to measure the "stored up" grievances of workers and is defined as the rate of unemployment experienced at the bottom of the most recent economic recession. It is assumed that there is a positive relationship between the level of grievances and strike frequency. This measure would be hard to adapt to the world-at-large because it is dependent on the availability of economic cycle data. Skeels uses the National Bureau of Economic Research's method of determining the cyclical intervals for the United States. Edwards (1978) uses his own method based on the unemployment data, itself but this method was later discredited by Skeels (1982).

unemployment. These advantages are based upon the key assumption that low unemployment is associated with an economic boom caused by high consumer demand and a high demand for labour.[10]

Unfortunately, the rate of unemployment is usually unavailable for the developing countries, although the absolute level of unemployment is often (if imperfectly) measured. This makes it difficult to adopt the most frequently used measure without drastically restricting the size of the data set.[11] For this reason, the annual percentage change in the level of unemployment will be used to measure the state of the labour market. This is similar to the Scoville measure for the state of the labour market in that he measures the annual percentage change in the demand for labour. The proposed measure should be adequate because even in a very depressed labour market, decreases in unemployment (i.e., increases in labour demand) should provide some short-term strategic advantage to workers due to the costs associated with hiring and training (Scoville 1979:26). This measure is expected to have a significant negative influence on the number of strikes.

WAGE EXPECTATIONS OF WORKERS

That workers desire a good standard of living hardly needs justification. Measuring their expectation, however, is not easy. Four approaches are characteristic of strike models. The first two are based on changes in the level of real wages. The approach developed by A & J and used by Snyder (1975, 1977), Hibbs (1976), and P & P is to create a distributed lag variable based on a moving average of previous changes in real wages. The assumption here is that a worker's wage demand is some function of previous wage gains. The other real wage based measure is simply the rate of change in real wages lagged by one period. This approach was used by Edwards (1978), Scoville and P & P. The assumption here is the same as for the distributed lag measure except that only the most recent year's change is considered necessary. In practice, both Skeels (1982) and Snyder (1977) report that whether a distributed multi-period lag or a single-period lag is used makes little difference as there is little empirical difference between the two.

10. This is a critical assumption that may not be true for countries with planned economies.

11. Even though the level of total employment is often available and could theoretically act as a denominator, thus yielding a rate, this avenue should be rejected. In many developing countries the level of unemployment is measured only in the major or capital city. Total employment, however, is often based on country-wide data or estimates.

The third approach is to measure the rate of change in nominal wages and is used by A & J, Edwards (1978), Shalev (1980), P & P, and Skeels (1982). The selection of a nominal wage based proxy is often justified by the possibility of money illusion by workers. Both A & J and P & P test real wage and nominal wage based measures. The former research team replaced the real wage measure with the nominal wage measure and added the changes in the consumer price index (CPI) to the model. They conclude that wage and price changes are mirror images of each other in their effect on strike activity and therefore there is little difference between using real wage changes, or nominal wages and CPI changes, as an indicator of the demand for wages. P &P conclude that the nominal wage measure is slightly better than the real wage measure, but they do not test it with CPI. As such, their conclusion is based on less reported evidence than the A & J test.

The fourth approach is to estimate the expected inflation rate for the next period. This method assumes that workers make the same estimation and use it to develop their wage expectations. Empirical evidence has been mixed. Kaufman (1981) and Vroman (1989) report no significant relationship between expected inflation and strike incidence, while Gramm et al. (1988) report a strong, positive relationship.

This study will estimate worker expectations using the rate of change in real wages lagged by one period. There are several reasons for this choice. First, measuring real wages is preferred by A & J and subsequent research has not convincingly demonstrated that a nominal measure is preferable. Second, the choice of the lag period is defended by the empirical findings of Snyder (1975) and Skeels (1982). Furthermore it is seldom noted that the primary reason A & J employ a moving average is because their analysis uses quarterly data. Since they use nine periods to determine the moving average they, in effect, examine only a bit more than two annual periods. This is equivalent to using the current and past year if one uses annual data. Additionally, given that some countries contribute relatively few observations to the data set, employing a multi-year moving average would decrease the available observations. Finally, the fourth approach, estimating expected inflation, is not a viable alternative given the available data. Kaufman (1981), Gramm et al. (1988) and Vroman (1989) all use Livingston surveys which are not available for other countries.

Despite Scoville's insights, the empirical findings of Paldam and Pedersen, and with full awareness that not all researchers even agree that lagged real wage measure provide a sufficient proxy for worker expectations, this study is guided by the seminal Ashenfelter and Johnson study in predicting a negative relationship between past real wage changes and strike frequency.

LEVEL OF INDUSTRIALIZATION

There are significant differences between the less developed countries and the previously examined countries. The most obvious, by definition, is their degree of industrial development. Kerr, Dunlop, Harbison, and Meyers (1962) [hereafter KDHM] argue that the level of industrialization exerts a major influence on the level and type of labour protest. They report that a wide cross-section of the scholarly community also believes this to be true. Marx (1955) links the intensity of protest to increasing levels of capitalist production. Veblen (1919) holds similar, though less polemic, beliefs. Tannenbaum (1921) contends that the loss of status caused by the skill democratization (i.e., loss of unique occupational skills) of industrialization leads to increased worker protest, although as new status structures form protest decreases. KDHM conclude that worker protest peaks early in the industrialization process and then begins a gradual decline as workers become committed to industrialization and establish bargaining relationships with their employers (KDHM 1962: 208).

It is necessary, therefore, to measure the influence of industrialization. The percentage of the population engaged in agricultural employment is extensively used as an inverse proxy for industrial development. The justification for using this measure is that industrial development requires an industrial labour force. As industrial development grows, so too does its prerequisite labour force. Indeed, Fei and Ranis (1964) argue that the main goal of a developing country is to reallocate as much labour as possible from its agricultural to its industrial sector. If a country is successful in this respect, the percentage of the labour force engaged in agricultural production will decrease as more of the labour force is moved into industrial employment. Therefore, tracking this change provides a proxy for a country's level of industrial development.

There are theoretical and methodological considerations that must be addressed in adopting this measure.[12] Many theorists[13] believe that strike

12. There is also a hidden problem. Fei and Ranis (1964) believe that a major landmark in the industrialization process is reached when agricultural labour force redundancy (i.e., disguised unemployment) has been eliminated through the transfer of this excess to the industrial labour force (Fei and Ranis 1964: 205). But the unemployment in the agricultural labour force may simply be transferred to the secondary or tertiary sectors in the form of government-sponsored featherbedding. Many governments of developing countries provide jobs (either directly or through subsidies) to meet the population's demand for nonagricultural employment. Over-employment in the industrial or services sectors should not necessarily constitute increased industrialization. Despite this problem, the percentage of the labour force engaged in agricultural employment remains a useful, if imperfect, indicator of industrial development.

13. KDHM report that Perlman believed that workers, if not interfered with by intellectuals, would show no significant increase or decrease in strike activity during the course of industrialization (KDHM 1962: 208).

frequency slowly begins to decline as industrialization is achieved. If this is true the assumption of linearity would be violated without some modification to the model. Thus, a test for a second-order relationship between industrialization and strike frequency is included in this model. Should the effect of the degree of industrialization be positive while the effect of its square be negative, a response function similar to that suggested by KDHM would be indicated. The expected relationship then is that strike frequency is positively associated with lower levels of industrialization, but negatively associated at higher levels.

OTHER IMPORTANT CONSIDERATIONS

Stern (1978) argues that it is important to estimate the influences of changes in the population-at-risk (i.e., the number of potential strike-producing relationships) by including such a measure as an independent variable (rather than directly correcting the dependent variable by dividing it by the number of potential strikers) in a proposed strike model. For instance, countries with larger work forces are likely to have more strikes simply because they have more unionized workers and more bargaining relationships. This leads to an increased opportunity to strike and therefore to a higher probability of strike occurrence. The variable most often preferred to capture this influence is the number of unionized workers. Unfortunately this variable is simply unavailable for most developing countries over the time period being examined. These records have not been collected or cataloged, or they are wildly inaccurate. In many African countries, for instance, workers join several unions in order to be assured a job. Therefore two other variables were used to capture this influence. The impact of each countries' total labour force or total nonagricultural labour force was estimated by including it in the model. Two different measures were used because the range of economic development is large. For countries with large agricultural labour forces, especially those with active labour movements in that sector, the first estimate best represents the "population-at-risk". In more industrialized economies, the latter measure is usually considered more appropriate. However, Snyder (1975) reports finding no substantial difference regardless of the way in which he estimated the "population-at-risk". Furthermore, tests[14] conducted in this study also failed to find any significance in the model. Therefore it was dropped from the model and is not reported. The dependent variable therefore follows A & J's specification, as well as those of almost every

14. Several tests were conducted using either nonagricultural labour force or total labour force as the denominator.

other researcher (Snyder 1975; Edwards 1978; Scoville 1979; Paldam and Pedersen 1982), by using strike frequency as reported by the ILO.

Another consideration deals with potential country-specific effects. As discussed in the next section, data collection methods varied considerably over time and across countries. Variations over time, when noted by the ILO, were corrected. Variations across countries and other unmeasured cultural, economic, institutional, structural, organizational, and/or political variables could cause specification errors. Including a country dummy variable in the model can minimize this problem and captures the net impact of these unmeasured factors (Suits 1957). This is the method that Hibbs (1976) employs and is a common econometric technique for dealing with this sort of problem.

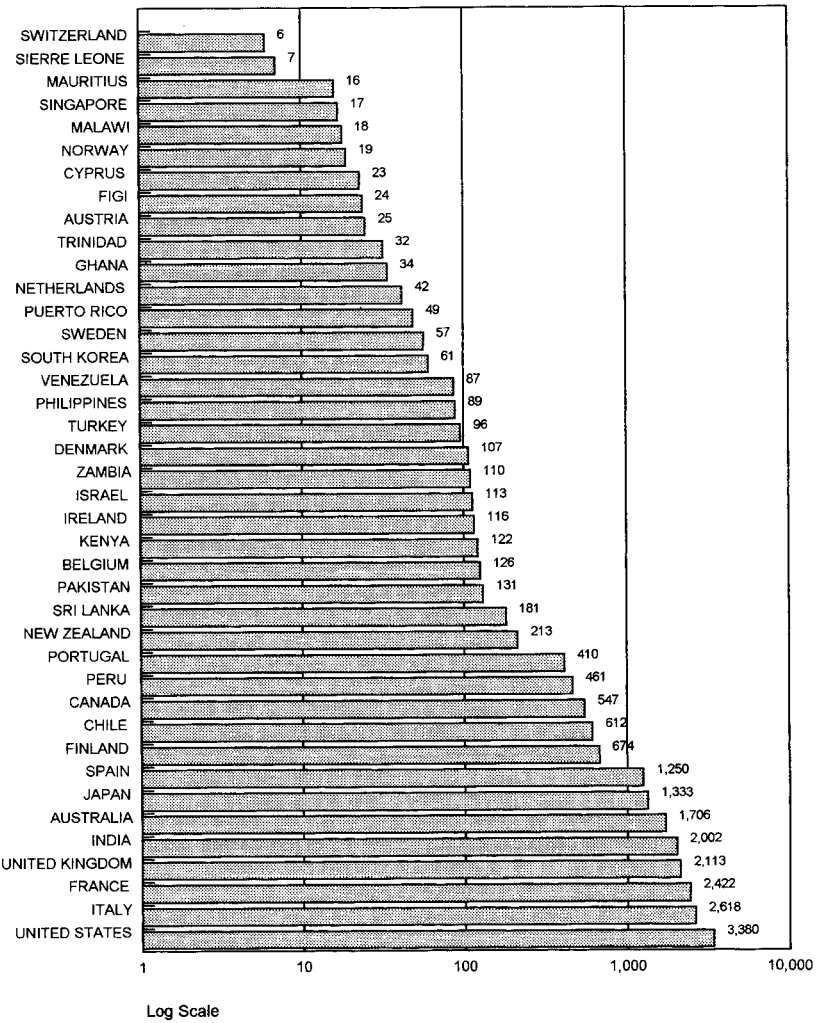
DATA AND METHODOLOGY

The strike, wage, and employment data used for this study are 618 yearly observations across 41 countries between 1953 and 1984 obtained from the *International Yearbook of Labour Statistics*. (An appendix for the countries and data series used in this study and summary statistics are available from the author upon request.) Strike data are available for about 70 countries during this period, however many did not consistently report strike and/or other economic data and were excluded from the analysis. Chart 1 displays the annual mean number of strikes for each of the countries included in the analysis. The mean number of strikes across the sample is 810. Of the eight countries with yearly strike averages greater than the sample mean, one – India – is usually characterized as less developed.

With regards to collection methods, many countries tabulate strike data nominally following the first international guidelines adopted in 1926 by the Third International Conference of Labour Statisticians and various international conventions and recommendations adopted later by ILO member states. Unfortunately, despite these standards, international strike data suffers from comparability problems. These problems are caused by definitional, classification, and coverage differences and by the quality and budget of the infrastructure charged with collecting the data (ILO 1990). While caution should be used in interpreting this data, the country dummy variable provides a methodological safeguard to control for systematic cross-country reporting differences. For a full description of the problems with international data sets of this type, see Shalev (1978), Stern (1978), Walsh (1983), and the ILO (1990).

CHART 1

Annual Mean Strike Frequency
1953-1984



While one would expect smaller comparative studies to employ a country-by-country analysis (see Snyder 1975; Scoville 1979), those with larger sample sizes might be expected to use pooled data for their analysis (see Hibbs 1976). P & P and Beggs and Chapman (1987) use aggregate country data which allow them to determine the country-specific influences of various macroeconomic variables but which offers little guidance concerning the applicability of the strike model across the entire data set. Besides its value as a general test of applicability, pooling the data also maximizes the usefulness of data covering a relatively short period. Therefore the use of pooled data seems more appropriate for the present study. The initial model tested is, Equation 1.0

$$S_{it} = \alpha + \beta_1 U_{it} + \beta_2 RW_{it-1} + \beta_3 I_{it} + \beta_4 I^2_{it} + \beta_5 D_1 + \ldots \beta_{44} D_{40} + \varepsilon_{it}$$

Where: S = strike frequency; U = the annual percentage change in the level of unemployment; RW = the lagged annual percentage change in real wages; I = the percent of the workforce not engaged in agricultural employment; D = a dummy variable for each country (minus one); i = country (1-40); and t = year (1953-1985).

RESULTS

A summary of the results of the pooled model are displayed in Table 1. As anticipated, the data exhibited serial correlation which was corrected with an auto-regressive technique.[15] Examining the results of Equation 1.0 shows the model explaining 57 percent of the variation in strike frequency. The unemployment measure is significant ($p<.10$) and negatively associated with strike frequency. The real wage measure is significant ($p<.05$) and positively associated with the dependent variable. The industrialization measures fare poorly, with neither I nor I^2 achieving significance. Furthermore, the expected sign for each variable, positive for I and negative for I^2, is the opposite of what was found. To determine whether the addition of

15. Maximum likelihood estimates were estimated for this model. The decision to use ML estimates is based upon work by Kitagawa and Akaike (1981) which compares the effects of missing observations across various estimation procedures. They find the ML method superior in that it can continue to reproduce the spectrum of values very well. They found that with even 70 percent of the total observations missing, the ML method performed adequately. Since this data set contains a substantial number of missing values, the ML method is used to good advantage. Serial correlation was found with OLS estimates but were adequately corrected with a basic model where $Y = \beta X + V$ where V is an error term assumed to be generated by an autoregressive process of the order p (AR(p)). This amounts to, $V_t = E_t - A_1 V_{t-1} - \ldots - A_p V_{t-p}$, where E_t is a sequence of independent normal error terms with zero mean and variance of σ^2. (See SAS/ETS Version 5 autoregressive procedure).

I and I^2 significantly increases the explanatory power of the model, a joint F-test was computed.[16] The test result indicates that I and/or I^2 adds significant ($p < .001$) explanatory value to the model. Since I^2 was added to the model as a test for nonlinearity, and because it did not improve the model's goodness of fit, it was dropped.

TABLE 1

Regression Results for Adapated Macroeconomic Strike Model Using Pooled Time-Series Cross-Section Data for 41 Countries between 1953-1984

Results after Autoregressive Correction

EQUATION[1] (1 year lag)	U_t	RW^{t-1}	I_t	I^2	R^2	DW	DFE
1.1	.86 *	3.06 **	11.28 ***		.57	1.81	566
	(-1.8)	(2.5)	(2.9)				

1. Dummy variable for country included in model. t-statistic in parentheses; significance levels: * < .10, ** < .05, *** < .01 (two-tailed test). Where: U = the annual rate of change in the level of unemployment; RW = the annual rate of change in real wages; I = the percent of the labour force not engaged in agricultural employment; D-W = Durbin-Watson; DFE = degrees of freedom; t = year.

The respecified model is reported in Table 1 as Equation 1.1. In this model, the coefficients for U and RW change little or not at all and the coefficient of determination remains virtually unchanged. The industrialization coefficient, however, is significant ($p<.01$) and positive, and is clearly associated with strike frequency. Thus a 1 percent increase in industrialization is accompanied by 11.28 more strikes. Changes in past real wages are positively related to strikes with 3.06 more strikes occurring with every percentage point increase. Finally, a 1 percent increase in the level of unemployment is associated with a .86 reduction of strike frequency.

DISCUSSION OF THE RESULTS

The overall explanatory power of the pooled model compare favorably with the results of macroeconomic studies by A & J, Hibbs (1976), P & P, Beggs and Chapman (1987), and with microeconomic studies by Gramm (1986) and Vroman (1989). However, individual components of the model

16. This test was, Ho: $\beta_3 = \beta_4 = 0$; Ha: $\beta_3 \neq 0$ or $\beta_4 \neq 0$.

exhibit exceptions to previous findings. The most significant and interesting exception is the positive regression coefficient estimated for the real wage variable. This result contradicts the findings of A & J, Hibbs, Gramm, and Vroman, all of whom report a significant negative real wage coefficient, but it closely parallels the findings of Scoville (1979), Blejer (1981), and P & P. Naturally results which contradict the findings of most previous research are first examined for technical or data-related problems. None were found in this analysis after examining residual patterns, outliers, and other common indicators of problems. The data were carefully scrutinized for recording errors and ILO officials were interviewed and asked to estimate the overall quality of each country's data collection infrastructure. The data were certainly different from data used in earlier studies since it included a large number of developing countries. This suggests that the factors influencing strike frequency may be related to the state of industrial development or some other factors. Perhaps, as the scope of the data set used to study strike activity expands to include countries economically less similar to the U.S., support for the original A & J hypothesis concerning the influence of previous real wage changes can no longer be empirically supported. To examine the possibility of an interaction effect between real wage changes and industrialization, Equation 1.1 was modified to include an interaction term between these two variables.

Equation 1.2

$$S_{it} = \alpha + \beta_1 U_{it} + \beta_2 RW_{it-1} + \beta_3 I_{it} + \beta_4 IW_{it} + \beta_5 D_1 + \ldots \beta_{44} D_{40} + \varepsilon_{it},$$

Where: the terms are as specified in Equation 1.0 and IW is the interaction term between RW and I.

A significant interaction term with a negative coefficient would indicate that the effect of changes in real wages is relatively smaller as countries industrialize and would support the speculation that the changing real wage effect is due to the inclusion of countries that are less industrialized. The result of this test, however, does not support this speculation as the regression coefficient, $\beta 4$, is not significantly different from zero.

Having ruled out technical problems and finding support in the results of the Scoville and P & P studies, it appears that a re-examination of past assumptions regarding the relationship between past real wage changes and strike frequency is needed. The critical question must centre on determining why, in countries other than the United States, worker propensity to strike increases as wages rise. An examination of the theoretical foundations of A & J, Hibbs (1976), and a number of other scholars in this area reveals that most base their wage-related hypotheses on expectation-achievement theory. There are several variants to this "family" of social-psychological theories, but all have at their base the idea that if

expectations are not achieved workers will react aggressively, even violently, to release frustration caused by a sense of relative deprivation (Wheeler 1985:178-179). Expectation-achievement theories have been criticized (Shorter and Tilly 1974; McCarthy and Zald 1987) for understating or ignoring important structural factors (e.g., extent of union organization) but their basic assumptions provide a plausible theoretical framework to study the influence of wage changes on strike frequency.

In applying this theory, A & J, Hibbs (1976) and other scholars contend that rapidly increasing real wages reduce strike frequency because they reduce the workers' minimum acceptable wage increase. However, this would only be true under two conditions: 1) expectations are static or increase proportionally to the economy's growth, and 2) expectations adjust fairly rapidly to deteriorating economic conditions. But neither of these conditions appear to be part of the expectation-achievement paradigm. For instance, one common variant, relative deprivation (Graham and Gurr 1969), claims that during periods of economic growth the expectations of workers rise faster than the ability of the economy to satisfy those expectations. The consequence is an intolerable gap between expectation and achievement which leads to frustration. This frustration may then fuel violent protest. Another variant, the J-curve hypothesis (Davies 1969), also argues that expectations are rising, not static, and that when economic growth eventually declines, such as during a recession, the expectation-achievement gap widens causing a sense of frustration and hopelessness which in turn leads to a violent response.

The key point is that in these theories, worker expectations increase rapidly but do not readjust downward quickly enough to prevent an extreme sense of deprivation. In countries where economic growth continues to exceed worker expectations or where, due to institutional or organizational arrangements, workers are able to adjust their expectations more quickly to changing economic conditions, it is reasonable to expect a negative relationship between past real wage gains and strike frequency. In countries where neither of these conditions are true, however, the opposite relationship should be expected. Blejer's (1981) study of strikes in Chile supports this conjecture since he reports a positive relationship between past real wage changes and strike frequency.

One characteristic of the expanded data set is that it includes a number of countries that, during at least some of the period considered, had governments with liberal or worker orientations. P & P found that in countries where the political orientation of the government had an influence on strike frequency, pro-labour governments were overwhelmingly associated with increased strike frequency. Workers may develop "rising [wage] expectations" as a labour-supported party campaigns and wins election. At

least temporarily, the new government strives to satisfy worker expectations which further strengthen these expectations. Finally, however, the optimistic promises of the government may not be realized fast enough to satisfy worker expectations. The cessation or slow down of economic growth then fuels worker discontent, leading to increased strike activity as the workers' "expectation-achievement gap" becomes intolerable. Hibbs' (1976) finding that labour governments are unable to deter short-run increases nor consistently bring any long-term decline in strike frequency, adds credibility to this explanation.[17]

This scenario may explain why the expanded data set exhibits a different relationship between real wages and strikes. The economic growth rates of the developed countries most often studied (and, according to P & P, only the U.S.) were more able to exceed worker expectations and/or, through institutional or organizational arrangements, able to reduce workers' expectation when necessary, to minimize conflict. Less developed countries, with neither the resources to sustain rapid economic growth nor the infrastructure to quickly readjust expectations, suffered the consequences hypothesized by the expectation-achievement paradigm.

A second explanation offered for the reversal of the wage-strike relationship can be found in equity theory (Adams 1963). Adams believes that a person's satisfaction with their pay is based on their perception of how good a "deal" they make with their employer in comparison with other persons (or even with themselves in an earlier period). Applying this theory to a unionized setting suggests that if other occupations, unions, or sectors of society are, or have been, achieving large increases in wages, the initial failure to do so by any specific group would increase discontent which in turn is likely to be expressed as a strike. The well-known "orbits of coercive comparison" (Ross 1948) concept in the collective bargaining literature reflects similar ideas (see also Shalev 1980 and Wheeler 1985).

This implies that changes in the wage structure (a phenomenon probably positively related to large real wages changes) may be a major factor in determining the frequency of strikes. That certain traditional occupational wage differentials have existed for years in the developed countries is commonly known. Since the same type of differentials exist in the developing countries (Taira 1966), a complex set of wage relationships are likely to exist in the labour market. This would have two consequences.

17. Spending habits and credit obligations acquired during consecutive periods of rising real wages may require substantial wage increases to maintain. Ross and Hartman (1960) believe that the need for cash flow may decrease strike propensity but the opposite can easily be argued. Strikes, if they can be settled quickly, may actually increase if they result in the expected wage increase. The general belief that spending patterns are sticky downward reinforces this proposition.

First, changes in the traditional occupational differentials caused by rapid economic investment are likely to lower worker satisfaction. Equity theory implies that workers are constantly comparing their wage to input ratio with the same ratio of some other comparison group. If the comparison is unfavorable, dissatisfaction increases and the corresponding increase in their minimum acceptable wage demand produces more strike activity. That some comparisons will probably be unfavourable is an inescapable fact unless every occupations' or groups' wage changes move in unison.

Secondly, there is likely to be a positive correlation between wage structure changes and the changes in real wages. Because it is unlikely that wage changes in different sectors of the economy would move equally in opposing directions (thus cancelling each other out in the overall rate of change) this correlation makes intuitive sense. P & P offer this explanation for their finding of a preponderance of significant, positive relationships between nominal wages and strike frequency.[18] One might argue that this relationship should apply to all countries. But such a contention need not be true for the relationship to hold. The smoothness of real wage changes across occupations, industries, or economic sectors, is likely to be influenced by institutional factors (such as level of bargaining, pattern bargaining, COLA arrangements, bargaining agreement length, and government regulations) or by political factors (such as a liberal government with a mandate to promote income equality across the population). The developed countries are probably better at maintaining traditional wage differentials because of a more elaborate and organized set of institutional arrangements and because their growth is more balanced and therefore less hectic.

In Sweden, the Confederation of Swedish Trade Unions (LO) actively pursued a policy designed to eliminate extreme wage differentials since 1923 with little success until 1965 (Korpi 1981). It is probably not coincidental that a major increase in strike frequency began a few years after the policy began to achieve effectiveness. During the 1953-1965 period, Sweden averaged eighteen strikes annually, whereas during the 1966-1985 period, the country averaged eighty-two strikes annually. Therefore in highly developed countries, absent any policy akin to the LO's, a positive

18. This specification, unreported here, estimates positive, significant coefficients for only ten of the seventeen countries in their data set. The remaining seven countries have no significant nominal wage coefficients. Paldam and Pedersen experiment with both a nominal and a real wage measure. For their real wage based specification one country, the United States, was reported as having a significant ($p < .05$) negative coefficient, and two others, Holland and Norway, had negative but not significant coefficients. For the nominal wage specification France, Holland and Norway had negative coefficients which were not significant ($p < .05$).

wage-strike relationship would not be expected since economic growth would spread across the populations more rapidly.

A second contradiction to some of the existing literature is relative weakness of the relationship between the unemployment measure and strike frequency. Although the direction of its influence supports the findings of A & J, Hibbs (1976), Beggs and Chapman (1987), and Vroman (1989), the fact that it is not significant at a lower p value may indicate a basic instability across countries and/or time in this relationship, which supports the findings of Reder and Neumann (1980), P & P, Gramm (1986), and Gramm et al. (1988). Two possible explanations are offered.

The first is that this study uses the rate of change in the level of unemployment because the actual rate of unemployment is seldom reported by developing countries. Only annual changes could be determined using the ILO data. Whether this substitution causes or contributes to the marginal influence of the unemployment measure is difficult to determine.[19] The second explanation arises from differing definitions of unemployment. Technically, unemployment should measure the number of available workers who are not employed. These are the workers whose labour is not currently demanded by the market but who are capable of working. In market economies, unemployment more or less accurately represents the inverse demand for labour. However, in "less-than-free" economies, unemployment may not accurately reflect labour demand due to the employment of redundant workers. For example, the Soviet Union traditional claimed that only frictional unemployment could exist in its system as the opportunity to work is a basic right of Soviet citizens. Consequently, considerable redundancy has plagued the Soviet Union for years according to recent press accounts. The current estimates for future unemployment rates in much of eastern Europe as a result of the collapse of their nonmarket economies provides a good example of this problem.

In market economies redundancy is less tolerable, although redundancies are probably common in many developing countries. In its efforts to industrialize and satisfy the employment needs of their citizens, governments may overstaff state owned or subsidized companies. Therefore an accurate measurement of labour demand may have to rely on measures other than unemployment since the basic concept of strategic bargaining

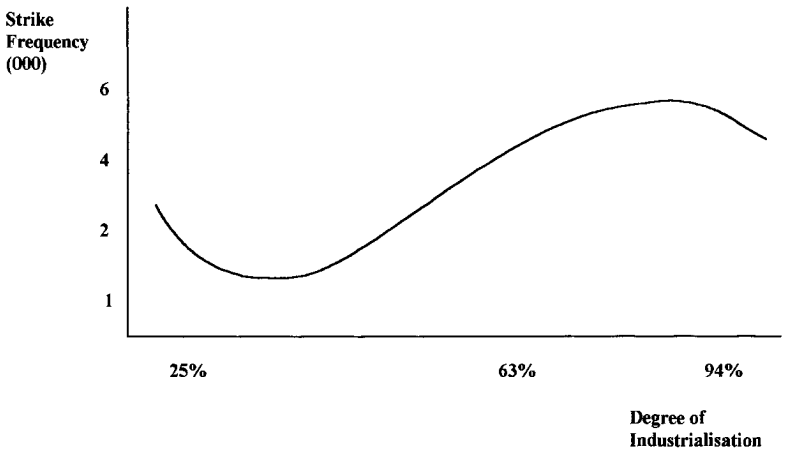
19. However, in a replication of A & J model using standardized coefficients, Shalev (1980) reports a beta coefficient of -.51 for the rate of unemployment. Standardization based upon a common unit of measurement in the independent variables (e.g., percent of change) is not strictly comparable to a statistical standardization (i.e., using the standard deviations of the x and y observations [see Neter et al. 1985]). However, it does provides sufficient evidence to suggest that this study's findings may not be too dissimilar from the A & J findings.

power is based on the assumption of a real, rather than artificial, demand for labour. Examining other indices of labour demand is beyond the scope of this study. Clearly, however, it should be investigated in the future.

The strong positive influence of the level of industrialization is consistent with the expectations of most earlier theorists. However, the polynomial response function used to test the linearity of industrialization in Equation 1 did not produce coefficients significantly different from zero for either I_t or I^2_t and β_3 is negative while β_4 is positive. If significant, such a finding would provide evidence to refute the hypothesis of KDHM that strike frequency at first increases and then declines as countries become industrialized. However, the very weak evidence of a polynomial response function, especially one which suggests a relationship opposite of the KDHM prediction, warrants further investigation. Figure 1 presents a plot of strike frequency by degree of industrialization for this data set. KDHM's suggestion that worker commitment to the industrial system would tend to reduce strike frequency could explain either the initial decrease or the decrease at the 94 percent level. Similarly, Ross and Hartman's (1960) argument that increases in union density (which may be associated with the number of workers employed in the industrial work force) tend to increase strike frequency, might explain the rapid increase in strike frequency at the higher levels of industrialization.

FIGURE 1

Plot of Strikes and Level of Industrialisation



Note: Vertical Axis not to Scale

A problem associated with the KDHM hypothesis is that it does not suggest at what levels of industrialization this worker commitment is likely to begin deterring strikes, although it is clear that they do not believe it occurs at the very beginning of the industrialization process. The initial decrease found in this data is probably the result of the cessation of strikes used to rally support for independence in the developing countries. The later decrease could be the result of rising worker commitment, but one wonders about the high level of industrialization and the presumably long period preceding it. Do workers really require that much time to become committed to an industrialized economy? Ross and Hartman's (1960) hypothesis seems better supported but does not explain the decrease found at the upper levels of industrialization. Although union density declined in the U.S., it had not declined during the period considered in many other industrialized countries. Clearly, future studies will have to examine this issue more closely.

The use and effects of the dummy variables employed to capture country-specific effects was barely discussed by Hibbs (1976). One reason perhaps is that dummy variables by their very nature are difficult to interpret. However, the effectiveness of the dummy variables in capturing country-specific effects can be measured. An F-test on the joint significance of the dummy variables was computed for the estimates generated in Equation 1.1.[20] The result ($p < .0001$) provides clear evidence that a significant country effect exists. It also suggests that there are more influences on strike frequency than the economic and institutional variables used in this model.

CONCLUSION

This paper reports a study designed to extend the Ashenfelter and Johnson (1969) model of strike activity to the world-at-large. This is considered necessary to move the development of this model forward by considering its usefulness in explaining strike activity in countries other than the most developed. Furthermore, the contradictory findings of previous research concerning some of the key empirical findings needed to be addressed. Changes in real wages, the level of unemployment, and the level of industrialization are shown to have significant association with strike frequency over large variations in time and geography. However, the direction of some of these influences do not support earlier theory.

Changes in the level of unemployment are found to have a negative, but weak relationship to strike frequency. The level of industrialization is

20. This test was, Ho: $\beta_4 = \beta_5 = \ldots \beta_{44} = 0$; Ha: At least one coefficient does not equal zero.

found to have a strong, positive association with strike frequency. However, this influence may not be linear, which raises interesting questions about current theories concerning the industrialization process. Surprisingly a positive relationship between past real wage changes and strike frequency is evidenced. Explanations based upon a re-examination of the expectation-achievement theories and their application to differences in the political orientation of individual governments and the application of equity theory to uneven changes in a country's wage structure are offered to explain this.

Although this study settles none of the issues that often accompany macroeconomic models of strike behaviour, it may be used as support for those who believe the macroeconomic approach to explaining strike variation is inappropriate. To this extent this research, while testing the macroeconomic model to its logical extreme, may provide evidence that the model relies on measures too far removed from an individual workers' decision-making process. On the other hand, this study does add more information about the relationships between certain economic factors, human psychology, and labour conflict. Further integration of the theories from the fields of psychology, sociology, political science, and economics can only enhance our understanding of labour conflict. Perhaps this will also aid us in developing better institutional and orgainzational solutions.

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RÉSUMÉ

Le conflit industriel dans les pays développés et en voie de développement : l'extension d'un modèle de grève occidental

Les chercheurs travaillant dans le domaine de la cessation collective du travail ont généralement négligé l'étude empirique de ce phénomène dans les pays en voie de développement. Dans la présente recherche, un des modèles de grèves les plus connus — celui conçu pour l'Amérique

par Ashenfelter et Johnson (1969) — est utilisé pour comprendre ce phénomène dans des pays autres que ceux qui sont les plus développés. L'extension de ce modèle aux pays du monde entier constitue en outre une tentative de réconciliation des conclusions contradictoires issues de plusieurs travaux de recherche (par exemple, Scoville 1979, Blejer 1981, Paldam et Pedersen 1982, ou Gramm 1986) à propos des composantes principales de ce modèle, à savoir : l'influence des variations (1) du niveau des rémunérations réelles et (2) du nombre d'offres d'emplois, sur la fréquence des grèves. De plus, comme l'ont suggéré Kerr et al. (1960), l'étude des pays en voie de développement doit tenir compte du niveau d'industrialisation. Le modèle de base proposé par Ashenfelter et Johnson (1969) est donc adapté en conséquence et inclut des variables muettes afin de mettre en évidence les effets spécifiques de chacun des 41 pays pour lesquels les données — couvrant les années 1953 à 1984 — apparaissent complètes dans le livre annuel des statistiques du travail (cf. Figure 1). En résumé, la recherche est basée sur ce modèle modifié. En effet, un premier test montre que l'interaction entre le niveau d'industrialisation et les variations d'ordre salarial n'est pas significative tandis qu'un second ne permet pas de conclure que l'effet d'industrialisation est quadratique. Par ailleurs, les problèmes d'autocorrélation sont corrigés.

Conformément aux propositions théoriques d'Ashenfelter and Johnson (1969), les hausses salariales (hors inflation) sont supposées être reliées négativement à la fréquence des grèves. Ainsi, une série d'augmentations des salaires réels dans le passé est susceptible d'accroître le bon vouloir des travailleurs à accepter des hausses salariales plus modestes, et donc de décroître la fréquence des grèves. De même, l'ampleur du chômage est associée négativement à la fréquence des grèves, parce que l'on ne s'attend pas à ce que les travailleurs risquent leur emploi pour en trouver un autre dans ces conditions. Finalement, puisque le processus d'industrialisation s'accompagne d'un accroissement du nombre de travailleurs dans le secteur industriel, et donc du nombre de négociations contractuelles, la fréquence des grèves est susceptible de croître (Kerr et al. 1960).

Les résultats sont résumés dans le Tableau 1 et montrent que le pouvoir explicatif du modèle (coefficient de détermination de 57 %) peut être avantageusement comparé à ceux des modèles du même type (par exemple, Hibbs 1976, Paldam et Pedersen 1984). En outre, toutes les variables du modèle sont significativement associées à la fréquence des grèves. Tout d'abord, l'industrialisation apparaît contribuer le plus largement à l'augmentation de la fréquence des grèves. Pourtant, si l'effet du niveau de chômage est conforme aux prédictions, il n'en reste pas moins faible. Quant aux résultats concernant les hausses salariales en termes réels, ils ne corroborent pas les prédictions.

Afin d'expliquer cette dernière anomalie, il est peut être utile de sortir du champ des relations industrielles et d'emprunter d'autres cadres théoriques. Pour commencer, la relation positive existant entre les augmentations des rémunérations réelles et la fréquence des grèves apparaît cohérente avec la théorie de l'*expectancy-achievement* (Graham et Gurr 1969, Davies 1969). En effet, une série d'augmentations des salaires réels dans le passé est susceptible d'accroître les attentes des travailleurs et leurs frustrations si on ne leur donne pas satisfaction. Or, puisque peu de pays — et spécialement peu de pays en voie de développement — peuvent contenter d'une manière continue les attentes salariales de leurs travailleurs, on peut penser que les grèves augmenteront en conséquence, même après une série d'augmentations de salaires relativement courte. On remarquera d'ailleurs que durant les années 60 et 70, de nombreux pays connurent une croissance rapide aboutissant à des hausses des rémunérations réelles.

La théorie de l'équité (Adams 1963) apporte également de nouveaux éléments expliquant le sens de la relation mise en évidence. Ainsi, avec une croissance économique rapide s'accompagnant d'augmentations inégales de salaires réels selon les secteurs d'activité, on peut s'attendre à ce qu'un sentiment de frustration habite les travailleurs défavorisés. Selon toute probabilité, ce phénomène aboutit à un nombre accru de grèves puisque les laissés-pour-compte tentent de rattraper le décalage dont ils souffrent. Le concept de « l'orbite de comparaison coercitive » (Ross 1948), issu de la littérature des relations industrielles, reflète des idées similaires (voir aussi Shalev 1980 et Wheeler 1985).

En conclusion, la direction ou l'intensité de certaines variables du modèle ne corroborent pas les propositions théoriques de ce champ d'investigation, et peuvent donc remettre en cause le bien-fondé de l'approche macroéconomique. Dans une certaine mesure, cette recherche repoussant les limites d'applicabilité du modèle macroéconomique montre que celui-ci repose sur des variables trop éloignées du processus décisionnel du travailleur. Cependant, les résultats éclairent d'un jour nouveau le rôle joué par les facteurs économiques dans les phénomènes de grèves. De fait, l'intégration des dimensions économiques et psychologiques dans de futurs travaux de recherche devrait offrir de meilleures solutions organisationnelles aux conflits industriels.