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Unemployment and Crime: Toward Resolving the Paradox

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While official crime statistics from many countries show that unemployed people have high crime rates and that communities with a lot of unemployment experience a lot of crime, this cross-sectional relationship is very often not found in time-series studies of unemployment and crime. In Australia there have been no individual-level or cross-sectional studies of unemployment and adult crime which have failed to find a positive relationship and no time-series which have supported a positive relationship. Consistent with this pattern, a time series of homicide from 1921 to 1987 in Australia reveals no significant unemployment effect. A theoretical resolution of this apparent paradox is advanced in terms of the effect of female employment on crime in a partriarchal society. Crime is posited as a function of both total unemployment and female employment. When female employment is added to the model, it has a strong positive effect on homicide, and unemployment also assumes a strong positive effect.

KEY WORDS: unemployment; homicide; crime; time-series data; cross-section data.

1. INTRODUCTION

There is a large body of literature relating criminal behavior to unemployment. In general, these studies show that there is a strong positive association between crime and unemployment at the individual level, a clear positive association at the cross-sectional level that gets weaker as the level of geographical aggregation increases, but quite an inconsistent relationship over time.[2]

This apparent paradox of unemployment and crime is explored in Section 2 of the paper through a brief review of the empirical evidence. In Section 3, a theoretical resolution to the paradox is summarized based on

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[2]For one of the more recent restatements of this proposition see Collins and Weatherburn (1995, pp. 231–32).

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the contention that crime in general is a function of both total unemployment and female employment. Although we expect various types of crime to provide differential support of this theory, the contention is that crime in general will rise with both total unemployment and female employment. Our empirical evaluation of this hypothesis (presented in Section 4) is restricted to one type of crime (homicide) in one country (Australia).

2. THE PARADOX

Many leading criminologists have deep doubts about the association between unemployment and crime (e.g., Fox, 1978; Gottfredson and Hirschi, 1990, pp. 138–139, 163–165; Orsagh, 1980; Wilson and Herrnstein, 1985). Yet for noncriminologists from radically different theoretical positions, one of the few things on which they can agree is that unemployment should be a cause of crime. Mainstream economists generally believe that unemployment is associated with crime because reduced expected utility from legitimate work decreases the opportunity costs of illegitimate work (Becker, 1968; Ehrlich, 1973). Marxist political economists since Engels (1969) have contended that the brutalization of the unemployed by capitalism is a cause of crime: "There is therefore no cause for surprise if the workers, treated as brutes, actually become such. . ." (Engels, 1969, pp. 144–145).

Scholars who argue a disparate variety of sociocultural and psychological theories of both radical and conservative hues expect unemployment to be associated with crime because of the debilitating effects of powerlessness, alienation, absence of stake in conformity, lower-class pathology, culture of poverty, relative deprivation, wasted human capital, negative effects of labeling, bad schools, blocked legitimate opportunities, and illegitimate opportunity structures in areas with high unemployment, to name just a few of the mechanisms posited (Box, 1987, pp. 28–67; Braithwaite, 1979, pp. 64–101). Needless to say, they are explanatory frameworks of variable plausibility (Braithwaite, 1979, pp. 64–101), even though they converge on a common prediction.

Consistent with the predictions of these diverse theories, individual-level data on adult crime from many countries consistently show a strong relationship between unemployment and crime. People who are unemployed are much more likely to be arrested for or convicted of crime than employed people (see many studies cited by Belknap, 1989, p. 1456; Braithwaite, 1979, pp. 23–63; Clinard and Abbott, 1973; note also Duster, 1987; Farrington *et al.*, 1986), at least for the males who dominate these studies.[3] Within cities,

[3]But note the sex disaggregation reported by Cameron (1964).

neighborhoods with high unemployment rates have high crime rates (Allison, 1972; Bechdolt, 1975; Bloom, 1966; Braithwaite, 1979, pp. 29–32; Chiricos, 1987, p. 195; Fleisher, 1966; Sampson and Wooldredge, 1988, Shaw and McKay, 1969; Sjoquist, 1973; Vinson and Homel, 1972). Between cities, those with high unemployment generally have more crime than cities with low unemployment (Carroll and Jackson, 1983; Danziger, 1976; DeFronso, 1983; Fleisher, 1966; Jiobu, 1974; Singell, 1968; Williams and Drake, 1980; for studies that do not find this see Danziger and Wheeler, 1975; Schuessler and Slatin, 1964; Spector, 1975; Land *et al.*, 1990).

Between American states, those with high unemployment tend to have more crime (Hemley and McPheters, 1974; Sommers, 1982; Chiricos, 1987); but for mixed or contrary results see Ehrlich (1973), Holtman and Yap (1978), Wadycki and Balkin (1979), and Land *et al.* (1990). Nations with higher unemployment rates have higher homicide rates (Krohn, 1976), though when less reliable international comparative data on property crime are examined, the unemployment–crime association disappears or even becomes negative (Krohn, 1976), a situation mirrored in international comparative studies of income inequality and crime (Braithwaite, 1979, pp. 203–208; Braithwaite and Braithwaite, 1980; Hansmann and Quigley, 1982; LaFree and Kick, 1986; McDonald, 1976; Messner, 1986).

At the time-series level of analysis, however, it is often not found that periods with high unemployment are periods with high crime rates. Gurr and co-workers' (1977) landmark time-series analysis of crime rates in London, Stockholm and Sydney found economic recession to be associated with jumps in the crime rate in the nineteenth century but not in the twentieth century. In Chiricos's (1987) review of other time-series studies of the unemployment–crime nexus, he found 43 positive relationships, 22 of them statistically significant, and 26 negative relationships, 5 of them statistically significant. This has been interpreted as a revisionist review showing that the balance of time-series studies, like the balance of cross-sectional studies, clearly supports an unemployment–crime association.

However, the success of time-series studies in supporting the unemployment–crime association is somewhat less than the above data indicate because no studies published before 1975 are included in this review of time-series studies. Chiricos's time-series conclusions are biased in terms of his own finding that studies including post-1970s data are much more likely to find significant unemployment effects. Only three of Chiricos's time-series studies have pre-1935 data that are vulnerable to the unexpected fall in crime during the Great Depression. Earlier reviews that are dominated by pre-1975 studies and studies that include data from the Depression reach more negative conclusions (Gillespie, 1978; Long and Witte, 1981; Sellin,

1937, Vold, 1958, pp. 164–181). Archer and Gartner's (1986) study of unemployment and homicide for 16 nations between 1900 and 1972 found 9 nations (including the United States) to have a positive association and seven nations (including Australia) to have a negative association.

A fair way of summarizing the evidence on unemployment and crime is that of a very strong, consistent, relationship at the level of individuals and intracity analyses of areas with high versus low unemployment; less consistent but still very strong support for the association at the intercity level of analysis; mixed but fairly supportive results at the interstate[4] and international levels of analysis; and mixed but fairly unsupportive results at the time-series level of analysis. Moreover, as we move away from the individual and census tract data that have engendered confidence to the more discouraging time-series results, we move away from relationships that can be very strong indeed. This is the puzzle of unemployment and crime: Why is a relationship that is so strong at the individual and census tract level so equivocal in time series?

In this paper we attempt to advance our understanding of the unemployment–crime nexus which throws light on the time-series puzzle. We test the proposed theoretical resolution of the paradox on one type of crime in one country. But the Australian context is one in which the paradox is in particularly sharp focus. The unemployed are strongly overrepresented among Australian offenders (Braithwaite, 1978, 1980; Kraus, 1978; South Australian Office of Crime Statistics, 1979, 1980a; Wearing, 1990) and there are no Australian cross-sectional studies on individual or aggregate adult offending that have refuted an unemployment effect. Yet five time-series studies have failed to support an unemployment effect.

In Withers' (1984) study, a pooled cross section for 104 data points between 1964 and 1976, unemployment has a nonsignificant *negative* coefficient for homicide and three other offense categories. Archer and Gartner (1986) found a quite strong negative correlation between unemployment and crime for the years 1903 to 1972. Mukherjee (1981) reported a weak

[4]Chiricos (1987, p. 195) interprets the less encouraging results as we move from census tract to city to state in the following terms: "Why should the U-C relationship for property crimes be most consistently significant at the intra-city level and least consistently significant at the national level? One possibility is that there is less aggregation bias at the lower levels of aggregation. That is, the lower and smaller units of analysis are more likely to be homogeneous, thereby reducing variation within each unit, and allowing for more meaningful variation between units, which is what U-C research is trying to measure. Thus, national-level data may literally cancel out the substantial differences in unemployment and crime that characterize different sections of cities or cities themselves. Given these important areal variations at lower levels of analysis, national data can only serve to 'wash-out' otherwise rich sources of between-unit variation essential to assessing the U-C relationship" (see also Land *et al.*, 1995).

negative association between unemployment and crime across the century. However, when he divided the century into "environmental sets"—historically homogeneous periods—within all but one of the seven time periods, there was a positive association between unemployment and crime. Naffine and Gale (1989), in a simple bivariate analysis, found little basis for an association between youth unemployment and youth crime across time in South Australia, particularly for females. Finally, in Grabosky's (1977, pp. 166–167) time-series regressions for Sydney in the 19th and 20th centuries (up to 1969), economic conditions had no significant effects on either violent or property offenses.

3. TOWARD A THEORETICAL RESOLUTION OF THE PARADOX

One way to resolve the puzzle of unemployment and crime is to argue that the reason for the strong cross-sectional association is not any direct causal association between unemployment and crime. Instead, common personal pathologies such as poor impulse control (Wilson and Herrnstein, 1985; Gottfredson and Hirschi, 1990) explain both unemployment and crime. Unemployment and crime are only correlated cross sectionally because they are effects of a common cause. If this view is right, changes in unemployment across time will not affect the crime rate since it is only changes in causally antecedent levels of impulse control that have such an effect.

The most sustained reformulation of the theory of unemployment and crime in the contemporary literature is in the work by Land and his coauthors (Cantor and Land, 1985; Cohen and Land, 1987; Land *et al.*, 1995). This work construes unemployment as having positive effects on crime through increasing criminal motivations at the same time as it has negative effects by reducing criminal opportunities (victim–target availability). While the empirical work arising from this theoretical respecification has its critics (Hale and Sabbagh, 1991), it is an approach that systematically attempts to resolve the inconsistencies in the unemployment–crime findings, at least within the United States. Given the limitations with the relevant Australian data, we have chosen to open up a new front in the battle to resolve the contradictions of unemployment and crime. In particular, we reconceptualize some of the ideas developed by Land and his coauthors in terms of positive effects of employment instead of negative effects of unemployment.

Our suggestion for resolving the puzzle of unemployment and crime is to consider disaggregation of the labor market by sex. It is not our hypothesis that the theory predicting that unemployment causes male crime does

not apply to female crime. When women are rejected by the legitimate labor market, the illegitimate labor market becomes more attractive for them just as it does for males. Women, as men, in poverty have less to lose from a criminal conviction, and unemployed women have more to gain from property crime than women who are accumulating property legally in a job. It is likely that the experience of unemployment is as humiliating an experience for women as it is for men since for both sexes it is likely to engender a sense of resentment at the injustice of their situation. This can spill over into anger, excessive consumption of drugs such as alcohol, and rage. A factor that might make the effect of female unemployment on the crime rate stronger than male unemployment's effect concerns victimization rather than offending. Women who cannot get a job to escape from economic dependency on a violent male breadwinner sometimes continue to expose themselves and their children to violence as a result.

In another paper (Braithwaite *et al.*, 1992) we have outlined the feminist theory which led us to the prediction that adding female employment to time-series models will cause male and female unemployment to have a positive effect on crime. It is a novel and counterintuitive prediction, perhaps especially to feminists, who tend to resist the inference that female employment causes crime. In that paper, we also explain the paradox of why a sensible policy inference from our theoretical framework is to seek to reduce crime by *increasing* employment opportunities for women. At the core of this reasoning is our postulate that patriarchy—societal relations where men dominate women—explains why female employment and female unemployment simultaneously cause crime. Increasing employment opportunities for women will (a) reduce female unemployment (reducing crime), (b) increase female employment (increasing crime), and (c) attack patriarchy (the condition which, according to the theory, makes it true that both unemployment and female employment will increase crime).

In that paper, three separate effects of rising female employment in the context of a patriarchal society (such as Australia) are posited. First, rising female employment may increase criminal opportunities (for men and women). For example, when two cars are being driven home from work each day, the probability of car theft may double. Second, rising female employment was hypothesized to increase women's vulnerabilities as victims of a variety of crime in public space, at work, and in the home—from fraud to violence.[5] Third, it may increase vulnerabilities of other members of their

[5]For example, unpublished Australian victim survey data supplied by John Walker (based on the data published by Van Dijk *et al.*, 1990) and published data in Australian Bureau of Statistics (1986, p. 18) and Braithwaite and Biles (1979, p. 198) show that employed women suffer higher rates of victimization for sexual assault, harassment, threats of violence, actual violence, theft from the person, and robbery.

families to being both victims and offenders to the extent that slack in traditional female guardianship responsibilities is not taken up by men. Patriarchy means domination by the interests of men; the more patriarchal a society is, the less will men be willing to replace the guardianship hours of women who work. Note that the effect of female employment on female crime is not central to this analysis; effects on male offending and female victimization are the core of the argument.

The theoretical framework advanced by Braithwaite *et al.* (1992), therefore, can be refined to a plethora of predictions about disaggregated effects on male versus female offending (versus victimization) for different types of crime during different periods of history. These disaggregations are mostly not possible for long time series in Australia, though they are much more so for the United States. This paper is limited to one kind of test in one country of the effect of female employment in an attempt to resolve the paradox our theory sought to explain. Why is it that cross-sectional studies in Australia always find a positive effect of unemployment on crime, while five time-series studies have all failed to do so?

Our prediction is that in time-series analyses that show no unemployment–crime relationship when female employment is omitted, there will be a significant correlation between female employment and unemployment (such that omitting female employment systematically reduces the unemployment effect on crime). This omission will be more important in time-series than in cross-sectional studies because female labor force participation has varied so enormously across time. However, in cross-sectional studies where geographical variation in female employment is substantial, our theory is that this will suppress the effect of unemployment on crime in these studies as well.

4. EMPIRICAL TESTING OF THE PROPOSED RESOLUTION OF THE PARADOX: THE AUSTRALIAN EVIDENCE

Our theory leads us to formulate the following model:

$$\begin{aligned}\text{Crime} = {} & \alpha(\text{male unemployment}) \\ & + \beta(\text{female unemployment}) \\ & + \gamma(\text{female employment}) \\ & + \delta(\text{vector of sociodemographic variables})\end{aligned}$$

with the predictions that α, β, and $\gamma > 0$.

In practice, however, since female unemployment is highly correlated across time with both total and male unemployment (the correlations in

our data are 0.91 and 0.84, respectively; see Appendix D), multicollinearity concerns counsel consideration of three separate models—one with total unemployment, one with male unemployment, and the third with female unemployment.[6] Thus, our research strategy begins with a test of the effect of unemployment on crime without controlling for female employment. Step two consists of evaluating the strength of the unemployment effect when female employment is added to the model.

As an aside, it should be noted that the potential collinearity between regressors is a statistical issue and, as such, enters the discussion at the empirical modeling stage. In particular, if an econometric model is estimated excluding an important variable, this may or may not affect our understanding of the role of an included variable. The critical issue is the statistical association between the included and the excluded variables. If there is some correlation between them, the coefficient and the standard error of the included variable are necessarily incorrect. It turns out that in our data female employment is negatively correlated with both total unemployment and male unemployment (with correlation coefficients of -0.18 and -0.28, respectively), which has the effect of biasing downward the measured effect of the unemployment variable when female employment is omitted. This statistical issue helps to resolve the paradox of previous time series results and is a major motivating factor for this study.

4.1. The Dependent Variable

For Australia, homicide is by far the best offense category for testing time-series effects since it is the only one available nationally over a long period with a uniform definition. For other offense types, time series of offenses known to the police exist only for the post-World War II period and there are worrying definitional differences among the six states. Credible testing of our model on offenses other than homicide will have to be done for countries with better time series than Australia for these offenses.

The reasons why male and female unemployment should increase homicide are clear in terms of the standard formulations of loss of hope, reduced

[6]One should be wary, however, in judging multivariate relationships on the basis of simple bivariate correlations. In fact, the joint long-term behavior of the unemployment, employment, and homicide variables is of importance, which, as explained in Appendix C, confirms the need to account for female employment when linking homicide with unemployment. Although it was not our intention to build a dynamic Error Correction Model linking homicides with the labor market variables, it is useful in this context to report simple tests for cointegration between the variables of interest. Thus, testing for cointegration between homicide, male unemployment, and female employment revealed no evidence against the null of long-run relationship (i.e., cointegration) between these variables. On the other hand, a test applied to homicide and male unemployment only rejected the null of cointegration.

stake in conformity, the humiliation and anger of failure, and giving up on loving parenting. It is important to note that in attempting to test an unemployment and crime model with homicide, we chose the least likely offense type where an effect can be accomplished. Theoretically, we have argued that opportunity effects of employment are much less profound with homicide than with property crime (Braithwaite *et al.*, 1992). Chiricos (1987, p. 193) found that only 16% of unemployment–murder studies have reported a significant positive effect, with 5% reporting a significant negative effect. This is the least impressive track record for any offense type for supporting the unemployment–crime relationship on aggregate data (see also Box, 1987, p. 87; Land *et al.*, 1990).[7] Thus, our specification can be regarded as a relatively robust testing of the theory because we have selected a least likely case (Eckstein, 1975) and the most demanding time period—the years which include the Great Depression.

Homicide rivals motor vehicle theft statistics in terms of validity, while exceeding them in seriousness and avoiding the tricky matter of how to deal with the effect of rising motor vehicle ownership across the century on motor vehicle theft rates. The data we rely on are collected for public health purposes; the error in homicide series caused by unlawful killing through the use of a motor vehicle becoming homicide at different points of time in different jurisdictions is eliminated by excluding all such deaths from the series.

Figure 1 shows a plot of homicide and total unemployment in Australia since 1915. Immediately, one reason for a limited effect of unemployment on homicide is clear. The homicide rate actually fell during the period following the most dramatic unemployment change—the Great Depression. Similar American findings that crime actually fell during the Great Depression (Henry and Short, 1954, p. 174) are one reason for Chiricos's (1987) generalization based on 63 studies of the unemployment–crime relationship that it is mostly earlier studies which fail to find a significant association between unemployment and crime. Some scholars believe that crime did not rise during the Great Depression because the rich were actually hit harder than the poor in dollar terms during the depression, so the income distribution actually became more equal (Mendershausen, 1946).[8] If one takes the view that it is income inequality rather than unemployment that is the theoretically correct predictor of crime (Box, 1987, pp. 86–90; Braithwaite, 1979), then we can make sense of the counterintuitive results

[7]Burglary has the most impressive record (Chiricos, 1987, p. 193; Cook and Zarkin, 1985).

[8]Consistent with this interpretation, Henry and Short (1954, p. 40) found that suicide by the economically privileged was more sensitive to fluctuations in the business cycle during the 1930s than suicides by the poor.

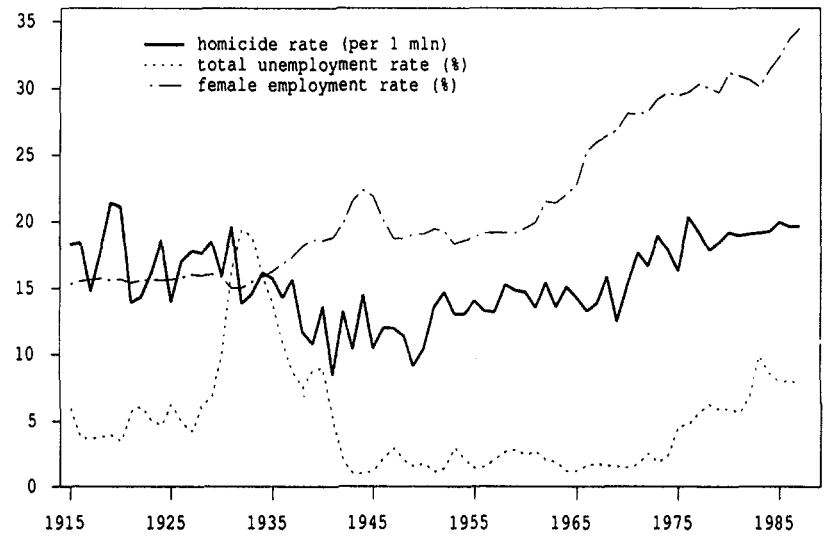

Fig. 1. Homicides, female employment, and unemployment: 1915–1987.

for the Great Depression.[9] However, this study is focused simply on resolving the paradox of unemployment and crime, leaving in abeyance whether unemployment is the most theoretically coherent index for predicting crime. To resolve it credibly, we must come up with a new model that can explain a positive effect of unemployment and crime in spite of the negative bivariate association for the Depression.

Australian homicide rates are average or slightly above-average compared to other industrialized countries' (Mukherjee and Dagger, 1991, p. 26), hovering between a quarter and a fifth of U.S. homicide rates. Sources for the homicide and all other data are given in Appendix A.

4.2. The Labor Market Variables

The two main regressors of interest are unemployment and female employment, both used as rates, that is, as proportions of the respective labor forces. Unemployment and employment rates are not, in general, the opposite sides of the same coin because the proportion of the population in the labor force (that is, the total of the employed and unemployed)—the participation rate—can vary as well.[10]

[9]Moreover, it is true that the relationship between income inequality and crime is more strongly supported in aggregate data than the relationship between the number who are poor or unemployed and crime (Belknap, 1989; Braithwaite, 1979; Box, 1987, 86–90).

[10]See also the discussion of the changing composition of the labor force in Appendix B.

In particular, while the (bivariate) correlation between male employment and male unemployment is negative (–0.58), the correlation between female employment and female unemployment is small but positive (0.15). The relationship between job search behavior and employment creation helps explain this positive correlation in our data between female employment and female unemployment. The relative stability of the male labor force over time means that the loss of a male job is more likely to translate into higher male unemployment. In contradistinction, the high trend rate of growth of the female labor force this century has meant that there has been a small tendency for the numbers of women in unemployment to expand at the same time as has the female employment. In other words, as the proportion of women in jobs increases, so too does the proportion of women actively looking for employment. In the Australian labor market (and in other similar economies) this is a commonly found phenomenon (Chapman, 1990).

It is worth mentioning that despite the many sources used (see Appendix A), the labor market variables are consistently defined. In fact the study by Keating (1973), on which our earlier data are based, not only was able to link the historical labor market data to the present official statistics but also provided extensive cross-checks with population census benchmarks throughout the century. Nevertheless, some caution is required given that, for example, the female employment variable may be subject to underenumeration of female farm labor. Also, the early unemployment series were derived from trade union sources, which may have understated the actual pool of the unemployed. If implemented, such corrections would lead to general upward revisions of the series. These would be arguably numerically small revisions that would be unlikely to translate into changes in our results.

4.3. Other Socioeconomic Control Variables

Previous theory and research indicates that certain other variables have effects on crime that should be controlled in the model. The aspiration was to operationalize as controls variables which have been argued to be consistent correlates of crime and, hence, that ought to be accommodated by any credible theory (Braithwaite, 1989, pp. 44–49). While sex is one of these variables, the proportion of females in the population does not vary substantially across the twentieth century, so a control is not needed here. However, sex-specific age composition does vary. The percentage of the population in the highest crime group—18- to 24-year-old males—was therefore utilized as one of the controls.

It should be noted that broadening of the age variable to, say, 15- to 39-year-old males has the effect of reducing the estimated impacts of female employment and the unemployment variables by approximately 20% without a significant change in the model fit. In addition, the additional higher age group variable is not statistically significant, indicating the adequacy of the original specification of this variable. It is also important to realize that such an extension of the age variable is, by definition, increasing the coverage of the population (by a factor of more than two in our data). Given that population also appears on the left-hand side of the regression (i.e., homicide rate), such a modification thus robs some explanatory power from other regressors.

Similarly, urbanization is a strong correlate of crime in official crime data, victim surveys, and self-report surveys (Federal Bureau of Investigation, 1985, pp. 145–146; McGarrell and Flanagan, 1985, pp. 286, 373). Thus, the percentage of the population living in metropolitan areas was entered into the model. Since marriage is negatively associated with crime (Martin *et al.*, 1979; Parisi *et al.*, 1979, p. 628; South Australian Office of Crime Statistics, 1980b; Wolfe *et al.*, 1984), the percentage of the population which is married is entered, as is the percentage divorced, which previous work on aggregate data has shown to be positively correlated with crime rates (Gartner, 1990; Shaw and McKay, 1969; Vinson and Homel, 1972).[11]

Two additional controls were motor vehicle ownership, which Mukherjee (1981, p. 113) found to be an important predictor of crime in Australia across the twentieth century, and the growth rate of real GDP, which Braithwaite and Braithwaite (1980) found to be important with cross-national homicide data. Criminal justice variables such as the imprisonment rate are not included because of gaps in the data and because of our theoretical position that the homicide rate is a likely cause of the imprisonment rate (see Hale, 1989). In addition, time has been included in the model, which makes it more likely that the estimation controls in part for other unmeasured trends in homicide rates and their determinants. However, the form of the equation does not allow for a diminution in the female employment–crime nexus due to possible changes in the extent of patriarchy. This is an interesting possibility we leave to further research.

4.4. Results

The estimated specifications of the models discussed at the beginning of this section are presented in Table I.[12] The big point from these

[11]It should be noted that other variables discussed by Braithwaite (1989, pp. 44–49), such as residential mobility, differential association with delinquent friends, attitudes and attachments to school, educational and occupational aspirations, and belief in the law, are not available across the century and thus are not included in the model.

estimations is the positive significance of both unemployment and female employment on homicide. As in so many previous studies, the total unemployment rate has a positive effect on the crime rate, but one that does not reach statistical significance in any specification that excludes female employment. The control variables also have weak effects on homicide with the exception of the percentage of the population married, which has a very strong negative effect on homicide.[13]

Overall the models do not present serious diagnostic deficiencies (see Table II), although there are important statistical differences depending on whether or not female employment is included in the equations. Interestingly, the traditional models—those excluding female employment—are relatively weak in statistical terms.

Unlike the equations reflecting our perspective, the conventional models exhibit evidence of second-order serial correlation, heteroscedasticity, and a lack of credible functional form (as reflected in the results of the RESET tests). The rejection of the null hypothesis by the RESET test suggests that there is something left out of the linear form of the equations which is distorting the results. The important point, however, is that these statistical difficulties are not evident in the models that include female employment.

The presence of second-order serial correlation identified in the model omitting female employment implies that a variable not included is systematically related to the homicide rate 2 years before. The presence of heteroscedasticity means that the equations as specified do not have constant error variance, resulting in biased t statistics.

[12]In common with the standard practice in applied socioeconomic research, our empirical results have been derived on the basis of "general-to-specific" methodology, which allows thorough diagnostic testing and evaluation of an estimated model. Following a suggestion from a reviewer, Appendix E also presents the results of estimating Model 2 in a nested sequence, with the initial specification including only employment and unemployment variables and the subsequent steps sequentially expanding this specification. While such a procedure can lead to a satisfactory model, it does not guarantee such an outcome given the difficulty in narrowing the options of regressor selection open at each stage. It does, however, provide an indication of the movement in the regression coefficients and summary statistics as the model is expanded. The results in this Appendix, however, demonstrate that the full effect of employment and unemployment variables cannot be determined using such a procedure due to omitted variables. In addition, all but the final specification suffer from serial correlation, indicating a misspecified model, and the test for omitted variables also indicates a problem with the intermediate specifications.

[13]This would seem to support Silberman's (1978, cited by Bayley, 1985, p. 113) view that "[t]he most compelling reason for going straight is that young men fall in love and want to marry and have children; marriage and the family are the most effective correctional institutions we have." For a more fully theorized view of the importance of marriage in crime control see Braithwaite (1989, pp. 90–92).

Table I. Estimated Models: The Dependent Variable Is Homicide Rate[a]

Regressor	Model 1		Model 2		Model 3		Model 4	
	Coefficient	*T*-ratio	Coefficient	*T*-ratio	Coefficient	*T*-ratio	Coefficient	*T*-ratio
Total unemployment	0.046	1.17	0.102*	2.26				
Male unemployment					0.043	1.16	0.09*	2.18
Female unemployment								
Female employment			1.118*	2.29			1.068*	2.22
Marriage rate	−0.696*	−3.27	−0.664*	−3.23	−0.698*	−3.29	−0.676*	−3.28
Divorce rate	0.029	0.41	0.006	0.09	0.024	0.35	−0.003	−0.05
% Urban	0.909	1.33	0.914	1.39	0.996	1.37	1.08	1.53
% 18- to 24-yr-old males	0.443	1.59	−0.436	−0.93	0.463	1.73	−0.345	−0.77
GDP growth	−0.003	−0.73	−0.001	−0.27	−0.003	−0.74	−0.001	−0.33
% motor vehicles	−0.056	−0.55	0.137	1.06	−0.057	−0.56	0.125	0.98
Time	−0.001	−0.16	−0.022	−1.87	−0.001	−0.18	−0.021	−1.81
Constant	−1.857	−0.82	−2.746	−1.24	−2.238	−0.92	−3.465	−1.43

Regressor	Model 5		Model 6		Model 7	
	Coefficient	*T*-ratio	Coefficient	*T*-ratio	Coefficient	*T*-ratio
Total unemployment						
Male unemployment					0.016	0.16
Female unemployment	0.048	1.01	0.135*	2.33	0.114	0.8
Female employment			1.262*	2.44	1.245*	2.34
Marriage rate	−0.708*	−3.21	−0.621*	−2.89	−0.623*	−2.87
Divorce rate	0.032	0.45	0.016	0.23	0.013	0.18
% urban	0.672	1.11	0.442	0.75	0.562	0.59
% 18- to 24-yr-old males	0.465	1.62	−0.589	−1.15	−0.571	−1.08
GDP growth	−0.003	−0.67	1 * E − 3	−0.04	2 * E − 4	−0.08
% motor vehicles	−0.052	−0.51	0.175	1.29	0.17	1.21
Time	−0.001	−0.07	−0.024	−1.98	−0.024	−1.95
Constant	−0.967	−0.47	−0.894	−0.46	−1.37	−0.38

[a]All models are estimated in log-linear form.

*An asterisk beside the estimate of a coefficient indicates that the variable is significant at 5% level.

Table II. Diagnostics of the Estimated Models: The Dependent Variable Is Homicide Rate[a]

Diagnostic	Model						
	1	2	3	4	5	6	7
$\bar{R}^2$	0.520	0.553	0.520	0.550	0.517	0.555	0.547
Regression SE	1.121	1.027	1.122	1.033	1.128	1.021	1.021
Durbin–Watson test	2.033	2.244	2.038	2.247	2.014	2.216	2.221
Autocorrelation at lag							
1	−0.140	−1.010	−0.170	−1.020	−0.070	−0.890	−0.910
2	2.080	1.240	2.070	1.260	2.180	1.250	1.240
3	−0.410	−0.820	−0.440	−0.870	−0.280	−0.520	−0.560
4	0.760	0.510	0.790	0.590	0.800	0.410	0.430
Jarque–Bera test	7.489	6.655	7.354	6.612	7.321	6.244	6.359
RESET (3)	3.165	1.426	3.208	1.326	3.249	1.413	1.392
Salkever's test	1.472	0.940	1.468	0.941	1.460	0.933	0.915

[a] $\bar{R}^2$ is the adjusted regression coefficient of determination (R^2). Regression SE is the standard error of the estimated regression. Autocorrelation refers to the residual serial correlation in the estimated models. The entries in the table are the *t*- ratios of the first four coefficients of the estimated autocorrelation function. The critical values at 1 and 10% significance levels are 2.66 and 1.67, respectively. Jarque–Bera is a test for residual heteroscedasticity in the regression (see Jarque and Bera, 1980). The critical values at the 1 and 10% significance levels are 6.63 and 2.71, respectively. RESET is Ramsey's (1969) test for regression misspecification, with three powers of predictions used as the additional regressors. The critical values at 1 and 10% significance levels are 4.98 and 2.39, respectively. Salkever's (1976) test is a test for predictive ability of a model. The critical values at the 1 and 10% significance levels are 4.98 and 2.39, respectively.

Though the models were estimated with data up to 1987, the later availability of 2 additional years allowed us to carry out a test of postsample adequacy of the fitted models. These results indicate that the models that include the female employment variable are better able to track accurately the behavior of the homicide rate in the late eighties.

We should also mention that, following a suggestion from a reviewer, we have reestimated our models using recursive sample specification which has the effect of identifying periods where the relationship in question may differ from other subsamples. The results revealed that the coefficients of interest are stable over time. Thus, combining all years has the effect of strengthening our tests by requiring our models to cope with diverse socioeconomic conditions over an extended sample period, while a disaggregation of the sample period would only result in a lower precision of estimates and a significant drop in the overall regression fit.

Figure 2 shows graphically the magnitude of the unemployment and female employment effects on homicide. The figure illustrates the effect on the homicide rate of 1% increases in both unemployment and female employment rates, for different models. Model 1 shows that, using the conventional approach, which excludes female employment, there is only a

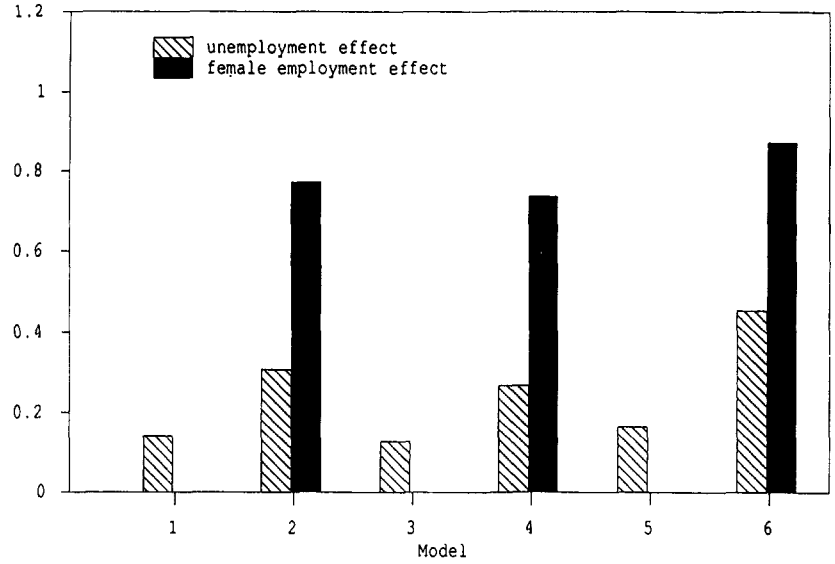

Fig. 2. Marginal effects on homicide rate (calculated at mean values).

small increase in crime as a result of higher total unemployment. This effect jumps markedly in the model which controls for the female employment rate.

Figure 2 shows changes in the homicide rate from changes, respectively, in the total male and female unemployment rates. Most noticeably, it is clear that female employment rate changes have a consistently large influence on crime and that the inclusion of this variable increases statistically the effect of unemployment.

It appears, then, that our respecification has strong statistical support. This suggests that the failure of many previous time-series studies to find a significant effect of unemployment on homicide may be a result of model misspecification through the exclusion of female employment.[14] While both unemployment and female employment are strong predictors of homicide across time in our estimations, unreported tests including both of the labor force variables are unaffected by introducing lagged effects. That is, the simple contemporaneous estimations seem to be the most trustworthy.

It is interesting in this context to note that this result also survives an empirical implication emanating from a recent respecification of the unemployment–crime relationship based on the disaggregation of criminal

[14]If we attempt to solve this problem by using male employment instead of female employment, we do not get the significant labor force effects that we get in our preferred specification.

activity into a duration component and a frequency component (Collins and Weatherburn, 1995). Such a respecification postulates a delayed (and spread over time) impact of unemployment on crime. Our results clearly indicate the strength of the contemporaneous relationship between unemployment and homicide when proper account is taken of the interactions between employment and crime.

As noted with reference to Fig. 2, models 3 and 5 (Table I) show that if we consider separately the effects of male and female unemployment on homicide, the theory is supported in both cases. Both male unemployment (model 3) and female unemployment (model 5) have insignificant effects on homicide before female employment is added to the model. Clearly, the effects of both male and female unemployment become significant when the female employment effect is added to the model. The increase in the effect of female unemployment on crime is particularly marked after controlling for female employment.

The fundamental conclusion from the statistical analysis is that female employment appears to be a significant determinant of homicides. Moreover, once this variable is included in the regression analysis, the unemployment rate assumes the role usually found in individual-level and cross-sectional analyses. As an illustration, from Model 4 the magnitude of the effects discovered is that a 1% increase in female employment leads to a 0.74% increase in the homicide rate, while the corresponding impact of a change in male unemployment is equal to 0.27.

5. CONCLUSION

A sensible scientific disposition is that to be confident about a relationship one would want to see it supported at both the cross-sectional and the time-series levels of analysis. This is because the potential sources of error under the two methodologies are very different. When there is a convergence, more confidence is warranted that the association is a result of true relationships captured under the two methodologies rather than the different sources of error that exist in the two approaches. Yet, sadly, the two methodologies all too frequently give different results.

The unemployment and crime relationship has been a classic area of cross-sectional time-series irresolution. In particular, the failure of the time-series studies to support the positive unemployment–crime association has been especially acute with time series that include the Great Depression, studies of homicide (Collins and Weatherburn, 1995), and time series conducted in Australia. Our study has confronted the worst-case scenario that includes these three features.

Consistent with these results, we fail to find a significant unemployment effect on homicide across time using the conventional approach. However, by adding female employment rate to the model it seems possible to resolve the paradox of unemployment and crime. The effect of either male or female unemployment rates becomes larger and more significant after adding the female employment rate. Female employment is associated with higher homicide rates. Thus, female employment rate changes across time in a way that masks the positive effect of female unemployment and male unemployment rates on crime.

The paper discussed the importance of theory in guiding the resolution of conflicts between time-series findings and results from other levels of analysis. It hardly begins, however, to test the implications of the theory we have advanced previously (Braithwaite *et al.*, 1992). Nor does it put our framework in contest with other theories that might, *post hoc*, account for the same results. Our purpose in this paper has been merely to give some sense of how the way we understood the effect of unemployment on crime is likely to undergo major transformation if we think in terms of gendered labor markets in which employment is not the obverse of unemployment.

APPENDIX A: DATA SOURCES AND DEFINITIONS

Variables' Definitions

Homicides:	Total number of homicides per 1 million people
Source:	Homicides—[MSDM], [ABS 3303.0]; population—[MSDM], [ABS 3102.0, 3201.0]
Unemployment:	Total, male, and female unemployment rates
Source:	[Keating], [LR 51], [LR 52], [CBCS 6.22], [ABS 6204.0], [ABS 6203.0]—for both the unemployment level and the labor-force level
Employment:	Total and female employment/population rates
Source:	Employment—as for unemployment; population—as for homicides
Marriage rate:	Total number of marriages (in each year) divided by total population
Source:	Marriages—[MSDM], [ABS 3306.0]; population—as for homicides
Divorce rate:	Total number of divorces (in each year) divided by total population
Source:	Divorces—[MSDM], [ABS 3307.0]; population—as for homicides

Urbanization:	Population in capital cities (excluding Darwin) divided by total population
Source:	Metropolitan population—[CBCS-QSAS], [ABS 3101.0], [ABS 3102.0]; total population—as for homicides
Young males:	Number of 18- to 24-year-olds divided by total population
Source:	Male population—[MSDM], [ABS 3201.0]; total population—as for homicides.
GDP growth:	Growth rate of Gross Domestic Product (GDP in 1984/1985 prices)
Source:	[MSDM], [ABS 5206.0]
Motor vehicles:	Total number of motor vehicles on register divided by total population
Source:	Motor vehicles—[MSDM], [CBCS-1926], [ABS Yearbook]; total population—as for homicides

Bibliographic Details About the Data Sources

[MSDM] S. K. Mukherjee, A. Scandia, D. Dagger, and W. Matthews (1989). *Source Book of Australian Criminal and Social Statistics 1804–1988. Bicentennial Edition.* Australian Institute of Criminology, Canberra.

[ABS 3303.0] Australian Bureau of Statistics, *Causes of Death, Australia*, ABS Catalogue No. 3303.0, Canberra.

[ABS 3102.0] Australian Bureau of Statistics, *Australian Demographic Trends, 1986*, ABS Catalogue No. 3102.0, Canberra.

[ABS 3201.0] Australian Bureau of Statistics, *Estimated Resident Population by Sex and Age, States and Territories of Australia*, ABS Catalogue No. 3201.0, Canberra.

[Keating] M. Keating (1973). *The Australian Workforce 1910/11 to 1960/61*, Australian National University, Canberra.

[LR51, LR52] Commonwealth Bureau of Census and Statistics, *Labor Report* No. 51 (1964) and No. 52 (1965–1966), CBCS Reference No. 6.7, Canberra.

[CBCS-6.22] Commonwealth Bureau of Census and Statistics, *The Labor Force, 1964–1968. Historical Supplement to "The Labor Force (Ref. No. 6.20)."* CBCS Reference No. 6.22, Canberra.

[ABS 6204.0] Australian Bureau of Statistics, *The Labour Force, Australia (Including Revised Estimates for August 1966)*, ABS Catalogue No. 6204.0, Canberra.

[ABS 6203.0] Australian Bureau of Statistics, *The Labour Force, Australia*, ABS Catalogue No. 6203.0, Canberra.

[ABS 3306.0] Australian Bureau of Statistics, *Marriages, Australia*, ABS Catalogue No. 3306.0, Canberra.

[ABS 3307.0] Australian Bureau of Statistics, *Divorces, Australia*, ABS Catalogue No. 3307.0, Canberra.

[CBCS-QSAS] Commonwealth Bureau of Census and Statistics, *Quarterly Summary of Australian Statistics*, CBCS Reference No. 1.3, Melbourne.

[ABS 3101.0] Australian Bureau of Statistics, *Australian Demographic Statistics*, ABS Catalogue No. 3101.0, Canberra.

[ABS 5206.0] Australian Bureau of Statistics, *Australian National Accounts. National Income and Expenditure*, ABS Catalogue No. 5206.0, Canberra.

[CBCS-1926] Commonwealth Bureau of Census and Statistics, *Official Yearbook of the Commonwealth of Australia, 1926 (No. 19)*, CS No. 496, Melbourne.

[ABS Yearbook] Australian Bureau of Statistics, *Yearbook, Australia*, ABS Catalogue No. 1310.0, Canberra.

APPENDIX B: THE CHANGING COMPOSITION OF THE LABOR FORCE

Figure 3 illustrates the changes in the labor force participation by both males and females. The triangular graphical presentation is especially useful in this context since the three shares of people outside the labor force, the unemployed, and the employed sum to 100% and one of the properties of an equilateral triangle is the constancy of the sum of perpendiculars from a point to the three sides of the triangle. Thus, with the perpendiculars being proportional to the shares, one can immediately determine both the size and the direction of any structural changes occurring in the labor market. In

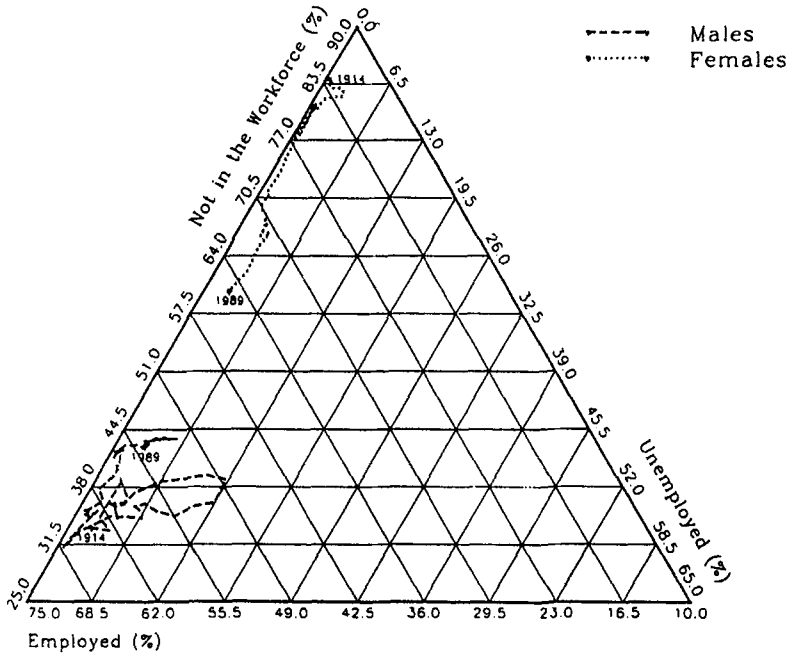

Fig. 3. The employment status of population: 1914–1989.

particular, males in Australia experienced large but temporary shifts between the states of employment and unemployment over time but made relatively slow movement toward the category of "Not in the Workforce" (from 33% in 1914 to 42% in 1989). Females, on the other hand, steadily increased their participation in the labor force over our sample period. They more than doubled their employment share (from 15 to 37%), while their unemployment share increased over sixfold over the same period (from 0.4 to 2.5%).

APPENDIX C: PRELIMINARY ECONOMETRIC ANALYSIS OF THE TIME-SERIES BEHAVIOR OF HOMICIDES AND THE LABOR MARKET INDICATORS

Given the importance of difference-stationarity of major macroeconomic time series, it is worthwhile to investigate the stationarity properties of the basic series of interest in this study, i.e., the homicide rate and the unemployment and employment series. Since the nonstationarity of time series may contribute to the problem of spurious regression (Engle and Granger, 1987), it can significantly alter tests of hypotheses concerning the impact of unemployment on homicides. In addition, series which exhibit different stationarity properties cannot be related by any equilibrium constraint in the long run, while their short-run relationship will be of a spurious nature. The economic interpretation of different stationarity properties would imply distinct and unrelated factors influencing the movements of homicides and unemployment through time.

Following Pagan and Schwert (1990), we have carried out tests of covariance stationarity of the variances of the homicides, employment and unemployment series. First, splitting the sample into two equal parts allows us to carry out a "postsample prediction test." The results, given in Table CI, indicate some instability for the homicide variable but only in one partition of the sample period and at a low level of significance. The interesting point, however, is that the lack of rejection of instability when World War

Table CI. Tests of Stationarity of Selected Variables[a]

	Variable			
Periods compared	Homicide rate	Male unemployment	Female unemployment	Female employment
1923–39 vs 1940–56	0.093	0.273	−0.300	0.031
1923–45 vs 1946–67	−1.704	−1.333	−1.427	−0.459
1924–55 vs 1956–87	−0.966	−0.880	−1.562	0.715

[a]Test statistics are normally distributed. The critical value at the 1% significance level is 2.58.

Table CII. Tests of Unit-Root Stationarity of Selected Variables[a]

Variable	Test statistic			Dickey–Fuller equation				
				AR order	ACF at lag			
	$t_{(\rho)}$	Φ_1	Φ_2		1	2	3	4
Homicide rate	−1.811	1.791	2.651	2	0.02	−0.45	−0.66	0.17
Male unemployment rate	−1.838	1.241	1.856	1	0.43	−1.25	0.65	−0.81
Female unemployment rate	−1.311	0.778	1.039	4	0.18	0.17	0.00	−0.18
Female employment rate	−2.593	3.343	3.524	6	−0.17	0.19	−0.18	−0.22

[a]The critical values for the three tests of stationarity for a sample size of 50 and at the 1, 5 and 10% siginficance levels are approximately as follows: −4.15, −3.50, and −3.18 for $t_{(\rho)}$, 7.02, 5.13, and 4.31 for Φ_1 and 9.31, 6.73, and 5.61 for Φ_2. See Fuller (1976, p. 373) and Dickey and Fuller (1981, p. 1063). The numbers in the column headed "AR order" indicate the selected autoregressive representation of the differences of each variable in the Dickey–Fuller regression. The entries for the autocorrelation function (ACF) are the t-ratios of the first four coefficients of the estimted autocorrelation function. The critical value at 1% significance level is 2.66.

Table CIII. Tests of Cointegration of Homicide Rate and Unemployment Variables[a]

Status of female employment variable	Unemployment variable		
	Male unemployment rate	Female unemployment rate	Persons unemployment rate
Excluded	−1.45	−3.03	−2.14
Included	−3.12	−3.69	−3.28

[a]The approximate critical value for the Dickey–Fuller test of nonstationarity (i.e., no cointegration) at the 1% significance level is −2.60.

II is included in the second subsample indicates the possibility of a structural break between the great depression and the beginning of the war. The second test recommended by Pagan and Schwert, the CUSUM tests, on the other hand, provided no rejections of stability for any of the series of interest. (Details are available on request.)

To evaluate the unit root stationarity of each of the basic variables we have employed three statistics proposed by Dickey and Fuller (1979, 1981): $(t_{(\rho)}$, Φ_1, and Φ_2. These statistics test for the presence of a unit root and allow for the possibility of a drift and a deterministic trend in the series. For each statistic the rejection of the null hypothesis implies the stationarity of the tested series. The results of testing for the unit root, are presented in columns 2–4 in Table CII. The three tests all suggest that we cannot reject the null hypothesis of nonstationarity at even a 10% significance level, and therefore, these variables are integrated of the first order (i.e., they possess similar time-series characteristics). In addition, the table also presents the autocorrelation functions of the residuals of the optimal specification of the Dickey–Fuller equations, which confirm the white noise assumption.

As a final step in these preliminary investigations we have tested for cointegration among the basic variables of this study. Given that any long-term relationship may exist only among cointegrated variables, such tests may provide some answers for the inadequate results of earlier studies utilizing time-series data. In fact, a rejection of cointegration implies that the long-term trends of the homicide rate and the labor force variables are not related by any equilibrium constraint and their short-run variations could only be spuriously related. The question of paramount interest in this context is whether the homicide variable and the unemployment variable form a cointegrating relationship even when the female employment variable is excluded. The results, presented in Table CIII, provide further support of our hypothesis since only in the presence of the female employment variable do the homicide rate and the traditionally used unemployment variable (i.e., male unemployment rate or total (persons) unemployment rate) form a cointegrating relationship.

APPENDIX D

Table DI. The Correlation Matrix of Variables Used in the Analysis Reported in Section 4[a]

	Homicide rate	Total UER	Male UER	Female UER	Female EMP	Marriage rate	Divorce rate	Urbanization	Young males	GDP growth
Total UER	0.405 0.001									
Male UER	0.325 0.007	0.987 0.000								
Female UER	0.596 0.000	0.909 0.000	0.836 0.000							
Female EMP	0.414 0.001	−0.178 0.149	−0.279 0.022	0.151 0.223						
Marriage rate	−0.596 0.000	−0.422 0.000	−0.373 0.002	−0.563 0.000	−0.082 0.510					
Divorce rate	0.347 0.004	−0.151 0.223	−0.220 0.073	0.126 0.308	0.915 0.000	−0.098 0.431				
Urbanization	0.403 0.001	−0.274 0.025	−0.389 0.001	0.109 0.378	0.925 0.000	−0.216 0.080	0.851 0.000			
Young males	0.270 0.027	0.537 0.000	0.488 0.000	0.538 0.000	0.148 0.233	0.110 0.375	0.005 0.968	−0.078 0.532		
GDP growth	−0.276 0.024	−0.280 0.022	−0.273 0.026	−0.298 0.014	0.038 0.762	0.329 0.007	−0.027 0.828	0.056 0.656	−0.134 0.281	
Motor vehicles	0.356 0.003	−0.232 0.059	−0.327 0.007	0.104 0.405	0.882 0.000	−0.209 0.090	0.867 0.000	0.945 0.000	−0.131 0.290	0.004 0.973

[a]The top number in each cell is the correlation coefficient; the bottom number is the marginal significance ratio of the correlation coefficient. UER, unemployment rate; EMP, employment population ratio.

APPENDIX E

Table EI. Nested Sequence of Estimating Model 2[a]

	Model 2							
Regressor	Coefficient	*T* ratio	Coefficient	*T* ratio	Coefficient	*T* ratio	Coefficient	*T* ratio
Total unemployment rate	0.121	5.01	0.056	2.26	0.055	1.52	0.102	2.25
Female employment rate	0.334	1.42	0.805	3.59	0.795	2.14	1.117	2.29
Marriage rate			0.831	5.00	−0.833	−4.71	−0.664	−3.22
Divorce rate			0.027	0.47	−0.027	−0.45	0.005	0.08
% 18- to 24-yr-old males					0.012	0.03	−0.435	−0.93
% urban							0.913	1.38
GDP growth							−0.001	−0.27
% motor vehicles							0.136	1.05
Time	0.001	0.27	−0.005	1.67	−0.005	−1.21	−0.021	−1.86
Constant	1.487	2.48	0.150	0.23	0.161	0.23	−2.745	−1.23
	Regression diagnostics							
$\bar{R}^2$	0.381		0.557		0.550		0.553	
Regression SE	0.157		0.133		0.134		0.134	
Durbin–Watson test	1.215		2.222		2.222		2.244	
Autocorrelation at lag								
1	3.21		−0.92		−0.92		−1.01	
2	3.67		1.52		1.52		1.24	
3	2.71		−0.72		−0.73		−0.82	
4	2.28		0.81		0.81		0.51	
RESET (3)	0.701		2.627		2.614		1.426	

[a]For explanatory notes see Tables I and II.

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