An Economic Analysis of the Crime Rate in England and Wales, 1857-1892
School of Economics and Finance, The University of Hong Kong

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AN ECONOMIC ANALYSIS OF THE CRIME RATE IN ENGLAND AND WALES, 1857-1892

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Abstract

This is an economic analysis of the determinants of the crime rate in England and Wales during 1857-1892. In this period the overall crime rate first rose and subsequently fell. Various analysts have interpreted this to imply that criminal behaviour in this period cannot be explained by economic incentives. Our study finds that the overall crime rate responded to incentives for pursuing legal and illegal activities. Growing economic prosperity and rising educational standards contributed to the overall decline in the crime rate during the second half of the nineteenth century. Cyclical economic fluctuations as proxied by the unemployment rate was also a significant determinant of the crime rate.

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Yue-Chim Richard Wong*

I. Introduction

One of the social issues which attracted a great deal of controversy and debate among nineteenth-century contemporaries in England and Wales was that of criminal activity. Two issues have been of particular interest: first, the fluctuation of the crime rate with the business cycle, and second, the long term secular rise of the crime rate in the first half of the nineteenth century, and its subsequent long term decline.

Some nineteenth-century students of crime, for example Morrison (1891), argued on the basis of a variety of figures that criminal activity was unconnected with economic conditions associated with fluctuations in the business cycle (see Tobias, 1972). Many contemporaries were convinced that the crux of the question was not economic want but the existence of a distinct criminal class lurking in the big cities. They did not deny that social and economic circumstances contributed to the existence of such a class, but down played the importance of economic incentives as a factor in determining criminal behaviour. A criminal generation was alleged to exist whereby criminal activity was a phase through which many people passed at a certain period of their life and out of which they later grew. The evidence often cited was the disproportionately large numbers of youthful offenders.

This view was rehabilitated by Tobias (1967), using as evidence mostly materials from contemporary literary sources. He put emphasis on the idea that criminal activity could be better explained in terms of the irremediable depravity of the habitually drunk -- the so-called criminal class. Drink was the ultimate cause of crime, and that if there was a relationship between criminal activity and the business cycle it manifested itself in the overall increase in crimes in good years when the consumption of liquor was high.

On the issue of trends in the crime rate, Tobias argued that the Industrial Revolution created an environment conducive to criminal activities. In particular, the shortage of housing, the lack of education, extensive internal migration, and overcrowded urban settings provided an atmosphere of moral degradation and easy access to criminal opportunities. The situation continued to exist up until mid-century. In the second half of the nineteenth century, the rising tide of Victorian prosperity increased the attractiveness of respectable work, the reformatory and industrial school broke the informal but very effective apprenticeship system that had bound boys to the crime industry very early in life. Better educational facilities and more effective police organization and judicial administration also reduced the crime rate.

Tobias was suspicious of the utility of criminal statistics and preferred to rely on literary sources. But there were quite a few quantitative studies of the relationship between economic conditions and crime. Bonger (1916) after surveying a large number of these contemporary

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studies found "[t]he great majority of authors are of the opinion that economic conditions occupy a more or less important position, but that other factors besides these are also at work....[a] small number of authors are of the opinion that the influence of economic factors is sovereign." The first systematic attempt to relate fluctuations in nineteenth-century crime to the business cycle was made by Thomas (1925). She found weak negative correlations between various crime rates and the business cycle and positive correlations between drunkenness and the business cycle. In general the negative correlations were stronger in the period 1857-74 and weaker during 1875-94.

More recent studies of criminal statistics by Gatrell and Hadden (1972) and Gatrell (1980) showed a clear inverse correlation between the swings of the business cycle and the figures for all offenses and all property offenses. Like Thomas they also found a direct correlation between offenses of drunkenness and assault and the business cycle swings. They drew the conclusion that in times of depression, property offenses tended to rise and offenses of drunkenness and assault tended to fall; suggesting that economic distress was likely to drive people to theft, but it also meant less money spent on drink, and hence less drunkenness and assault. The correlation breaks down by the 1880s, and on the whole it is more convincingly established for the first half of the century than for the second.

To explain this and also to account for the reversed trend in the crime rate in mid-century, Gatrell and Hadden postulated that a significant structural shift in criminal behaviour took place. Aside from the creation of a more efficient police force and judiciary system, they argued that stable and somewhat declining food prices, less severe unemployment fluctuations due to the expansion of export markets for industrial products, and growing prosperity had allowed the working class to ride out short-term periods of unemployment. Crime became more "prosperity induced" than "poverty induced". In other words, criminals were attracted by gains from crime because of an increasingly prosperous society, than forced into crime due to economic misery. By mid-century, according to Gatrell and Hadden, poverty induced crimes simply became less important. For the same reason, the correlations between the crime rate and the business cycle also became weaker over time.

The Gatrell and Hadden view differs from that of Tobias in substantive emphasis and also in terms of methodology. For Tobias quantitative data are not to be trusted and whatever relationship which may exist between crime and economic conditions is uncertain at best. The lack of correlation between crime and economic conditions in the final quarter of the nineteenth-century is interpreted as favouring such a view. On the other hand, Gatrell and Hadden believed in the usefulness of statistical sources and the uncertain correlations are to be interpreted as indications of changes in behaviour due to other intervening factors. What these two views have in common is a reluctance to rely on an incentives based approach to explain changes in the pattern of the crime rate in nineteenth-century England and Wales.

Whether the concept of a criminal class is a tenable one has been examined by Philips (1977) and Emsley (1987). Philips demonstrated that no clear distinction could be drawn between a dishonest criminal class and a poor but honest working class. Emsley showed that

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Tobias and other nineteenth-century contemporaries considered the criminal class as synonymous with the poor working class. However, court records and statistics show that the overwhelming majority of thefts reported and prosecuted were opportunistic and petty, and most incidents of violence against persons involved people who were either related or who were known to each other. While this may cast some doubt on the usefulness of thinking about criminals as "irremediably depraved and habitually drunk", the important methodological issue is that interpretations based on the opinions of nineteenth century contemporaries may be flawed because they are not always able to establish accurately what actually happened.

The focus of our study is to present an incentives based interpretation of British crime in the second half of the nineteenth-century, which does not have to invoke different factors to separately explain trends in the crime rate on the one hand and fluctuations on the other. The essence of this economic approach is that offenders or potential offenders respond to incentives. The distinction between "prosperity induced" versus "poverty induced" crimes is best considered from the perspective of incentives. Both "pull" factors associated with prosperity and "push" factors associated with poverty can act on incentives for crime in a totally analogous way. The task of the researcher is to identify the factors and measure their effects in determining the relative gains from pursuing legal and illegal activities. Such an approach is not incompatible with theories that rely on unique personal characteristics, but permits the separation of the effect of opportunities from that of preferences in explaining criminal behaviour. The theoretical framework and model for such a study is now quite well established (see Becker and Landes, 1974). Wolpin (1978) had conducted a similar time series study for the period 1894-1967 and Field (1990) for the post-war period. Carr-Hill and Stern (1979) had performed an analogous study for the 1960s and 1970s using cross section data. Their findings could be compared with our results.

II. Crime in the Nineteenth Century

English criminal statistics are described in considerable detail in Gatrell and Hadden (1972). Three kinds of statistics were identified by them: (1) Indictable offenses known to the police - regardless of whether or not the offender was actually traced or brought to trial, (2) Summary committals - a less serious offence brought before a magistrate on summary jurisdiction, and (3) Indictable committals - a serious offence triable before a jury in the superior courts of assize or quarter sessions.

The continuity of these series was affected by two major reorganisations in the reporting of criminal statistics in 1833-34 and in 1856-57. In the first period 1805-33 there is only information on indictable committals. In the second period 1834-56 there is also information on summary committals. In the final period 1857-92 information is available for all three kinds of statistics. The completeness of the data is clearly much better in the second half of the century. In figure 1 the number of offenses per 100,000 of the population is plotted for each of the three different statistics on criminal activity. It is apparent that regardless of the statistic employed, all the series uniformly declined over time with some rather sharp but synchronized fluctuations.

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Figure 1

Although the police and judicial reforms continued into the second half of the nineteenth century, most of the changes in the reporting of criminal statistics were completed before the second half. For example, the Juvenile Offenders Act of 1847, a second Juvenile Offenders Act of 1850, the Criminal Justice Act of 1855, and the County and Borough Police Act of 1856 were all in place before the period of our study. Legislation which shunted indictable offenses into summary jurisdictions would not have distorted the crime statistics we are interested in (see Philips, 1977). However, between the census years 1861 and 1891, the ratio of police to population in England and Wales increased by over 30 percent from 102 to 135 per 100,000 (see Martin and Wilson, 1969). The severity of the punishment also declined substantially over time, both in terms of statutory penalties and the actual sentencing of offenders (see Gatrell, 1980). The effect of these changes can have a significant effect on the reporting of crimes. Gatrell and Hadden (1972) suggested that the more serious distorting effects are likely to occur among the less severe types of crime. For this reason, indictable offenses known to police may still be the most consistent series over this entire period despite its shortcomings.

The social characteristics of prisoners and offenders also changed considerably in this period. After examining records contained in Prison and Police Returns, Gatrell and Hadden (1972) found that their "average literacy improved less than that of the population at large; a higher proportion of those imprisoned had previous gaol records; and their average age increased sharply." From 1840 onwards there was a rapid rise in national literacy rates, and particularly after the Elementary Education Act of 1870. Education effects crime in various ways. One of the direct effects of schooling, according to Ehrlich (1975), is that it reduces the amount of time available for criminal activities to those who are enroled in schools. Between 1840 and 1890, primary school enrolment in England and Wales increased at an annual rate of 6 percent, when the number of persons aged 5-14 was only rising at the rate of 1.5 percent. Emsley (1987) cited figures showing that the Elementary Education Act of 1870 resulted in 96601 parents being brought before the courts in the first year and, allegedly, half a million were prosecuted in the first twenty years of the legislation. One would expect that such strong measures may be quite effective at keeping children in schools, whom might otherwise become juvenile offenders. Over time these measure can result in a significant decline in the number of juvenile offenders. Prison figures compiled by Gatrell and Hadden (1972) showed that the proportion of juvenile prisoners declined from 12.4 percent to 3.2 percent among men in 1841, and from 9.9 percent to 1.0 percent among women in 1891. An alternative interpretation for the decline in the proportion of juvenile prisoners is that it is affected by changes in juvenile court procedures and sentencing policies.[1] The relative importance of these two factors may be difficult to ascertain.

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Another effect of schooling is to enhance human capital skills in legal activities more than illegal ones. If this is the case then over time we would observe a rising proportion of older criminals among the pool of offenders. These are people who are unable to benefit from improved schooling opportunities. This would be reflected in both the age distribution of the prisoners and the proportion of them who have previously been gaoled. These are borne out by evidence from prison records compiled by Gatrell and Hadden (1972). In 1860 the proportion of prisoners who had been previously gaoled was 26.1 percent from men and 42.4 percent for women. The figures rose to 45.6 percent and 63.0 percent, respectively, in 1890. There was a similar marked increase in the proportion of prisoners aged thirty years and over from 30.1 percent among men and 31.2 percent among women in 1841 to, respectively, 50.8 percent and 59.4 percent in 1891. The sharp increase is not merely a result of the decrease in the proportion of juvenile offenders, but results from an upward shift in the age composition of the offenders. Throughout this period the age composition of the population as a whole had remained relatively stable.[2] Therefore, relative to the population as a whole, the pool of potential offenders were becoming a less and less representative group in terms of educational attainment and access to opportunities in legal activities.

The explanation for the reduction over time in crime rates in England and Wales in the second half of the nineteenth century may well have been partly a result of the rapid spread of education, which reduced the supply of potential offenders, especially among juveniles. Criminals were becoming an increasingly specialized group of older offenders, who had probably acquired considerable skills in criminal activities, but were too late to benefit from the spread of educational opportunities.

III. Supply of Offenses: Model and Variables

The economic approach to criminal behaviour assumes that potential offenders act within a maximizing framework in making time-allocation decisions between legal and illegal sectors. The formal economic model is spelled out in detail in Ehrlich (1973) and Block and Heineke (1975). The implications of the model can be studied by specifying a supply curve for participation in illegal activities. Without specifying a formal supply model, the general function dependence can be expressed as:

$$C_t = g(P_t, F_t, U_t, W^l_t, W^i_t, E_t) \qquad (1)$$

where C_t is the crime rate, P_t is the probability of being apprehended and convicted of the offence, F_t is the severity of the punishment, U_t is the economic risk of legal activity, W^l_t and W^i_t are the gains from legal and illegal activities, and E_t is the effect of rising educational standards in the population.

The crime rate is defined as all indictable offenses known to the police, C_t.[3] The probability of apprehension and conviction is defined as the ratio of the number of convictions to the number of indictable offenses known to police, P_t. The severity of the punishment is defined as the average number of years of imprisonment sentenced by the courts, F_t. Both

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variables are calculated from data available in the annual volumes of the Parliamentary Papers and are expected to have negative effects on the crime rate. The economic risk of legal work is measured by the unemployment rate, U_t, and is expected to have a positive effect on the crime rate.[4]

It is extremely difficult to measure gains from illegal activities independent of gains from legal activities. One plausible solution is to observe that the economic gain in legal activities are correlated with the wages of potential offenders and those in illegal activities depend on the state of the economy. Potential offenders are more likely to be those whose legal skills have not grown over time with the rest of the population. A plausible proxy for this is the index of real wages for workman of unchanged grade, W^*_t.[5] A common proxy for the state of the economy is the real per capita net national income, Y_t, and it is used as a measure of illegal gains.[6] Since goods available for theft may be purchased over a number of years, therefore, per capita income will be a lagging measure of potential illegal gains. This may be of particular relevance in relation to sharp downswings in the business cycle. An alternative measure of illegal gains would be to use the index of real wages for all workers, W_t, as an indicator of the standard of living of the population.[7] This latter measure is less affected by business cycle fluctuations and will be less correlated with the unemployment rate used to measure the economic risk of legal activity. In a cross-sectional study of regional crime rates, Carr-Hill and Stern (1979) used the rateable value of property per unit area as a measure of illegal gains, which is not available for this period.

In time series data, most of the proxies for legal and illegal gains are likely to be highly correlated with each other making identification a challenging econometric task. While one may think of wages and national income as capturing the effects of "prosperity induced" crimes and the unemployment rate as measuring the effects of "poverty induced" crimes, such an interpretation would be erroneous. The key problem is to distinguish sharply between those factors that effect legal as against illegal gains. Whether our proxies can serve this purpose is largely an empirical issue.

The impact of education on crime rates is extremely difficult to capture because of the paucity of data. A possible proxy is the per capita primary school enrolment rate, S_t.[8] However, this variable is more likely to be a good measure of the effect of education on crimes committed by juveniles, but not of other potential offenders. Since it is generally believed that educational standards rose more rapidly after the enactment of the Elementary Education Act of 1870, we constructed an alternative proxy using a linear spline variable, $EEA(1870)_t$, with zero values until 1870 and positive trend values after 1870.

IV. Supply of Offenses: Econometric Estimation

Estimation of equation (1) using time series data poses a number of problems. Variables like P_t and F_t are probably endogenously determined in the model since law enforcement activities are in part determined by the level of crime. This problem can be handled in part by lagged variables. Further distributed lag reactions arise because of the way agents form

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expectations about P_t, F_t, and other right-hand side variables and because of possible lagged responses to them.

Most of the variables used in the empirical analysis are likely to be highly serially correlated and possibly non-stationary. The relative merits of modelling in level or difference form have to be considered seriously. A test for unit roots using the following autoregressive equation was estimated for each series:

$$\Delta x_t = \alpha_0 + \alpha_1 x_{t-1} + \sum_{i=1}^{4} \alpha_{1+i} \Delta x_{t-i} + u_t \qquad (2)$$

All the variables are measured in logarithmic values. Table 1 presents the Dickey-Fuller (DF) and the augmented Dickey-Fuller (ADF) test statistics together with the associated critical values. The unit root hypotheses could not be rejected at the 95 percent level of significance for all variables with the exception of the unemployment rate. While these findings do not imply that the differenced data series alone merit analysis, it does suggests that the econometric model is best estimated in difference form.

A model which embeds both equations (1) and (2) is a linear equation involving all the variables with the lag lengths used in (2). Estimating such an unrestricted autoregressive distributed lag model is not feasible given the number of observations in the data set. Using shorter lag lengths for equation (2) appear arbitrary and may fail to capture essential features of the dynamic model. It is necessary to choose a model with a more restricted parametrization by deleting certain lagged variables. Several considerations guided the simplification procedure. Firstly, the overall dynamic specification has to yield a plausible static equilibrium solution with interpretable parameters. Secondly, a model with relatively few independent variables is not only more easily understood, but also, it avoids the danger that an excessive number of variables induces overfitting. Another benefit of simplification is sample size considerations. Thirdly, where a selection is otherwise equivocal, is seems sensible to use lagged rather than contemporaneous variables to avoid dependence on questionable exogeneity assumptions. Finally, diagnostic tests for white noise, functional form, normality and homoscedastic residuals are employed to check any specific selection.

Table 2 presents estimates and test statistics of four autoregressive distributed lag equations with restricted parametrization. All variables used in the regression equations are in logarithmic values and are expressed in lower case acronyms. Almost all the coefficients are statistically significant and have the expected signs. Table 3 calculates the hypothetical steady state equilibrium results, defined by all change ceasing. Since the coefficients of the lagged crime rate variable, c_t, are negative in all the regressions presented in Table 2, the corresponding coefficients in Table 3 are identical to those in Table 2.

In all four equations the probability of apprehension and conviction has a significant negative effect on the crime rate. Similar effects were obtained for the twentieth-century by Wolpin (1978) and Carr-Hill and Stern (1979). The effect of the average length of sentence is

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significantly negative in all cases. This contrasts with results obtained by Wolpin for a later period.[9]

The unemployment rate is found to have a significant positive effect on the crime rate, implying that increasing the risk of finding legal work encourages crime. This contradicts the Gatrell and Hadden view that changes in unemployment due to business cycle swings became unimportant as a determinant of the crime rate in the second half of the nineteenth century.

The real wage rate for workman of unchanged grade, a proxy for legal gains of potential offenders, was found to be significantly negative in three of the four regressions. The real per capita net national income and the real wage rate, both serving as proxies for illegal gains, were found to have weak positive effect on the crime rate. Our results differ from Wolpin's earlier findings for the modern period where the effects of income or wage variables on the crime rate when entered individually were generally insignificant. By contrast, Carr-Hill and Stern who used the rateable value of property per area to measure illegal gains found a significant positive effect on the crime rate. These results indicate that distinguishing between legal and illegal gains is important in explaining the effect of economic variables on criminal activity.

The spline variable as a proxy for the effect of the 1870 Elementary Education Act is found to be significantly negative in one regression. The per capita primary school enrolment rate is found to have an insignificant negative effect on the crime rate. There is only weak evidence that a faster growth rate in the average level of education reduces the rate of crime.

Most of the estimated results are as expected, but they should be interpreted with some caution because of the difficulties inherent in historical data.

V. Conclusion

This paper has shown that a relatively simple economic model focusing on a few key variables can help explain the crime rate in England and Wales in the second half of the nineteenth century. It was found that offenders respond to incentives. In particular, changes in the opportunities for legal and illegal gains as measured by the real wage rate of workman of unchanged grade, the real per capita net national income, and the unemployment rate have the expected effects on the crime rate. Such findings contradict claims made by Tobias about the irrelevance of incentives explicitly stated in his conception of a habitual criminal class. Our results, however, can be consistent with the observation that over time criminals were increasingly drawn from the pool of frequent offenders whose legal opportunities lagged behind the population in general. The most important point of this study is to emphasize the importance of making sharp distinctions between variables which primarily affect legal gains and those which affect illegal gains.

The effects of the variables relating to law enforcement and criminal justice are more difficult to assess. Measurement problems in a period with considerable institutional changes and misspecifications in the estimation model are part of the problem.

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Finally, it is worth noting that only the real wage index of unchanged workman grade, the real per capita net national income, the education spline, and the primary school enrolment variables displayed a consistent secular trend with values that rose more or less consistently over the period 1857-92. This means that the declining crime rate observed in this period is primarily explained by the rising economic prosperity and educational standards of the population. These were important variables because they altered the incentives of the people to enter into criminal activities over time.

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Footnotes

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1. I owe this point to a referee.

2. The percentage of the population between the ages of 30 and 59 out of the base group between the ages of 10 and 59 were 42.7 percent among men and 42.8 percent among women in 1841, and 43.6 percent among men and 44.2 percent among women in 1891 (see Mitchell and Deane, 1962 and 1975).

3. The crime data is given in Gatrell and Hadden (1972) and Gatrell (1980), both are compiled from Parliamentary Papers. The definition we use includes all indictable offenses known to the police, which were overwhelmingly property related offenses. Although finer classification is available, we prefer to analyze an aggregate index because it is not always meaningful to allocate police activity to different types of offenses.

4. The unemployment rate is obtained from Feinstein (1961).

5. The index of real wage rates of workman of unchanged grade is obtained from Wood (1909).

6. The real net national income per capita is given in Mitchell and Deane (1962).

7. The index of real wage rates is also obtained from Wood (1909).

8. The primary school enrolment rate is obtained from Mitchell and Deane (1975).

9. We also experimented with two other definitions: the proportion of convicted criminals who were imprisoned and the proportion who were sentenced to penal servitude. Both variables performed less well than the average length of imprisonment in the regressions. These results are not reported. Wolpin (1978) and Carr-Hill and Stern (1979), however, obtained significantly negative coefficients when similarly defined variables were used. We are inclined to believe that these alternative measures are of poor quality because of changes in penal and judicial institutions in the nineteenth-century (see Bailey, 1981 and Jones, 1982).

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Table 1

Unit Root Tests of Variables

Dependent	DF	ADF(1)	ADF(2)	ADF(3)	ADF(4)
c_t	-0.3113 (-2.95)	-0.8323 (-2.95)	-0.1212 (-2.95)	-0.3698 (-2.96)	-0.0855 (-2.96)
p_t	-2.2187 (-2.95)	-1.6794 (-2.95)	-1.9431 (-2.95)	-1.8759 (-2.96)	-1.6157 (-2.96)
f_t	-0.9412 (-2.95)	-0.6380 (-2.95)	-0.4483 (-2.95)	-0.9551 (-2.96)	-0.6906 (-2.96)
u_t	-2.7403 (-2.94)	-5.1507 (-2.95)	-3.1432 (-2.95)	-2.9885 (-2.96)	-2.7128 (-2.96)
s_t	-1.5129 (-2.95)	-0.8761 (-2.95)	-0.3050 (-2.95)	-1.0934 (-2.96)	-1.0866 (-2.96)
w^*_t	-0.9232 (-2.95)	-0.6096 (-2.95)	-0.5508 (-2.95)	-0.6591 (-2.96)	-0.8379 (-2.96)
w_t	-0.9753 (-2.95)	-0.5359 (-2.95)	-0.4580 (-2.95)	-0.6326 (-2.96)	-0.9445 (-2.96)
y_t	-0.9900 (-2.95)	-0.5339 (-2.95)	-0.6805 (-2.95)	-0.6779 (-2.96)	-0.3189 (-2.96)

(1) 95 percent critical values in parentheses (see Dickey and Fuller (1979).
(2) All variables are measured in logarithmic values.

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Table 2
OLS Regressions of All Indictable Offenses Known to the Police

Dependent Variable	Δc_t	Δc_t	Δc_t	Δc_t
Intercept	11.0405	9.8073	10.9763	11.2421
	(6.06)	(5.99)	(6.87)	(6.67)
c_{t-1}	-1.4109	-1.0966	-.1895	-1.1155
	(8.79)	(7.94)	(9.56)	(9.35)
p_{t-1}	-0.3028	-0.3737	-0.4247	-0.3742
	(2.39)	(1.87)	(3.96)	(2.08)
f_{t-1}	-0.5008	-0.4386	-0.2238	-0.2046
	(4.65)	(3.18)	(2.13)	(1.59)
u_{t-1}	0.0501	0.0326	0.0271	0.0237
	(3.00)	(2.03)	(1.87)	(1.55)
w^*_t	-2.7499	-1.8952	-1.1066	-1.1102
	(2.15)	(1.39)	(3.68)	(3.52)
w_t	1.0473	0.4640		
	(1.93)	(1.39)		
y_t			0.2495	0.3610
			(1.36)	(1.91)
s_t		-0.1115		-0.0366
		(1.43)		(1.05)
EEA(1870)$_t$	-0.0130	-0.0062		
		(3.27)	(1.71)	
Δc_{t-1}	0.6262	0.5171	0.5372	0.5144
	(4.82)	(4.05)	(4.77)	(4.43)
Δc_{t-2}	0.5193	0.4824	0.5162	0.5316
	(3.64)	(3.27)	(4.25)	(3.93)
Δp_{t-3}	0.2056	0.2370	0.1955	0.2432
	(1.97)	(1.98)	(1.88)	(2.35)
Δf_{t-1}	0.4031	0.3603	0.2173	0.2368

	(3.56)	(2.86)	(1.92)	(1.93)
Δu_t	-0.0585	-0.0343	-0.0316	-0.0335
	(3.17)	(2.01)	(2.26)	(2.31)
Δw^*_{t-2}	1.0334			
	(1.15)			
Δw_{t-2}	-1.0947			
	(1.48)			
Δy_{t-2}			-0.2587	
			(1.19)	
Δs_{t-1}		0.6191		0.3961
		(2.08)		(1.71)
^{2}	0.7574	0.7360	0.7933	0.7786
	0.0263	0.0271	0.0239	0.0248
$\xi_1(1)$	3.2531	1.3425	2.7240	2.1745
$\xi_2(1)$	2.9721	1.9603	0.3656	0.0169
$\xi_3(2)$	0.3053	0.7502	1.2149	2.7732
$\xi_4(1)$	0.0001	0.0278	0.9427	0.4355

(1) $\xi_1(1)$ is the Lagrange multiplier test for residual serial correlation and is distributed as $\chi^2(1)$.
(2) $\xi_2(1)$ is Ramsey's (1969) RESET test of functional form specification using the square of the fitted values and is distributed as $\chi^2(1)$.
(3) $\xi_3(2)$ is Bera and Jarque's (1980) test for normality and is distributed as $\chi^2(2)$.
(4) $\xi_4(1)$ is Koenker's (1981) test for heteroscedasticity based on the regression of squared residuals on square fitted values and is distributed as $\chi^2(1)$.
(5) Absolute t-values in parentheses.
(6) All variables are measured in logarithmic values.

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Table 3

Computed Steady State Coefficients and Test Statistics

Dependent Variable	c_t	c_t	c_t	c_t
Intercept	7.825	8.9436	9.2277	10.0785
	(8.08)	(7.90)	(7.35)	(9.02)
p_{t-1}	-0.2146	-0.3408	-0.3571	-0.3355
	(2.44)	(1.80)	(3.83)	(2.04)
f_{t-1}	-0.3550	-0.3999	-0.1882	-0.1834
	(5.63)	(3.68)	(2.27)	(1.60)
u_{t-1}	0.0355	0.2978	0.0228	0.0213
	(3.16)	(2.00)	(1.95)	(1.53)
w^*_t	-1.9490	-1.7283	-0.9304	-0.9953
	(2.33)	(1.50)	(4.27)	(4.03)
w_t	0.7423	0.4231		
	(1.95)	(1.40)		
y_t			0.2098	0.3236
			(1.32)	(1.94)
s_t			-0.1017	-0.0328
			(1.45)	(1.05)
$EEA(1870)_t$	-0.0092		-0.0053	
		(3.76)		(1.81)
$\xi_5(1)$	30529.8	7648.2	21335.6	5575.1

(1) ξ_5 is a Wald test of all estimated coefficients being zero and distributed as $\chi^2(7)$.
(2) Absolute t-values in parentheses.
(3) All variables are measured in logarithmic values.