Economics Bulletin

Volume 29, Issue 4

# Further Evidence on the Dynamics of Unemployment by Gender

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## Abstract

We present empirical evidence regarding differences in unemployment dynamics across gender for a group of twenty-three OECD countries. Our results indicate that there are substantial differences in the unemployment persistence for men and women across countries. Further, the female unemployment rates are relatively more persistent compared to the male unemployment rates.

Hervé Queneau acknowledges support from the PSC-CUNY Grant Program, 2008-2009. Amit Sen acknowledges support of the O'Conor Professorship at Xavier University.
**Citation:** Herve Queneau and Amit Sen, (2009) "Further Evidence on the Dynamics of Unemployment by Gender", *Economics Bulletin*, Vol. 29 no.4 pp. 3162-3176.
**Submitted:** Sep 22 2009. **Published:** December 23, 2009.

## 1. Introduction

In a recent paper, Queneau and Sen (2008) argue that there can be significant differences in unemployment dynamics both across gender and across countries owing to differences in: labor force attachment, job search behavior, distributions of employment by gender among industries, and institutional factors including system of unemployment insurance, provision of mandatory family benefits, and extent of employment discrimination.[1] Our main objective is to extend the empirical evidence of Queneau and Sen (2008) by assessing the difference in unemployment dynamics across gender in a group of twenty-three OECD countries.[2] Specifically, we: (a) characterize the female and male unemployment rates within each country among the competing 'natural rate' hypothesis, the 'structuralist' view of unemployment dynamics, and unemployment 'hysteresis;' and (b) ascertain differences in this characterization both across gender and across countries.[3]

While the issue of unemployment persistence in industrialized countries has received attention in the literature, see for example Papell, Murray, and Ghiblawi (2000), there is, to the best of our knowledge, only one study by Queneau and Sen (2008) that examines gender differences in the structure of unemployment across countries. The main objective of this paper is to extend the empirical results of Queneau and Sen (2008). Two interesting patterns regarding unemployment dynamics emerge. First, we find more evidence of persistence in female unemployment rates compared to male unemployment rates across our sample of countries. Specifically, there is evidence of persistence for the female unemployment rate in twelve out of twenty-three countries compared to four countries for the male unemployment rate. Second, there are gender differences in the unemployment dynamics in eight countries, and so the female and male unemployment rates follow the same characterization of unemployment dynamics in the remaining fifteen countries.

## 2. Data, Methodology, and Empirical Results

We assess the annual unemployment rate series by gender obtained from the "OECD.Stat Extracts" database (`http://stats.oecd.org/WBOS`) for a group of twenty three OECD countries: Austria, Australia, Canada, Belgium, Denmark, Finland, France, Germany,

[1] For a discussion of the effect of these factors on the dynamics of female and male unemployment rates, see Queneau and Sen (2008).

[2] Queneau and Sen (2008) used data over the period 1965-2002 for the following eight countries: Australia, Canada, Finland, France, Germany, Italy, Japan, and United States. Our sample includes an additional 15 countries.

[3] Friedman (1968) and Phelps (1968) provide a detailed discussion regarding the natural rate hypothesis, Phelps (1994) discusses the structuralist view, and Blanchard and Summers (1986) consider unemployment hysteresis.

Greece, Ireland, Italy, Japan, South Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States. Table 1 summarizes the time periods over which the gender unemployment rates are analyzed for each country in our sample. The plots of the male and female unemployment rates are shown in Figures 1-23. For each country, we use different versions of unit root tests to determine the appropriate characterization of unemployment dynamics in both the female and male unemployment rates, denoted respectively by $u^F$ and $u^M$. While the presence of a unit root in the unemployment series suggests hysteresis, the absence of a unit root implies that the unemployment rate evolves according to either the natural rate hypothesis or the structuralist hypothesis.

We, first, calculate the Augmented Dickey-Fuller (ADF) unit root tests using the following regressions:

$$y_t = \hat{\mu} + \hat{\alpha}\, y_{t-1} + \sum_{j=1}^{k^*} \hat{c}_j\, \Delta y_{t-j} + \hat{e}_t \qquad (1)$$

$$y_t = \hat{\mu} + \hat{\beta}\, t + \hat{\alpha}\, y_{t-1} + \sum_{j=1}^{k^*} \hat{c}_j\, \Delta y_{t-j} + \hat{e}_t \qquad (2)$$

The ADF test from regression (1) without a time trend is denoted by $t_\mu$, and the ADF test from regression (2) with a time trend is denoted by $t_\tau$. The results for all series are summarized in Table 2 for the $u^M$ series and in Table 3 for the $u^F$ series.[4] The significance of the $t_\mu$ statistic for $u^M$ for Canada, Denmark, South Korea, Portugal, and the U.S. and for $u^F$ for South Korea suggests that these unemployment rates follows the natural rate hypothesis, that is, macroeconomic shocks have a temporary effect around a relatively stable natural rate of unemployment. The $t_\tau$ statistic is significant for $u^M$ for Germany, Japan, Luxembourg, Netherlands, Sweden, and Switzerland and for $u^F$ for Austria, Finland, Germany, Japan, Luxembourg, and Sweden. The significance of the $t_\tau$ statistic for an unemployment rate series implies that it is trend-stationary, and so the unemployment rate evolves around a deterministic trend but all shocks to it are transitory in nature. This characterization is consistent with the structuralist view of unemployment dynamics.

In the eventuality that the unit root null hypothesis was not rejected by the ADF tests ($t_\mu$ and $t_\tau$), we used the minimum LM unit root test proposed by Lee and Strazicich (2004) that allows for a one time break in the trend function at an unknown break-date.[5] Lee and

[4] Based on the plots of the unemployment series, we decided not calculate t for the male unemployment rate series for Austria, Germany, France, Luxembourg, and Switzerland, and for the female unemployment rate series for Austria, Greece, Luxembourg, and Switzerland.

[5] Our data spans, at best, the period 1955-2007, and for most countries, data is available for an even shorter time period. In addition, Lee and Strazicichs (2003, 2004) testing procedure requires specification of the trimming parameter $\lambda_0$ (= 0.1) that reduces further the sample over which we search for a break in the trend function. Given that we view structural breaks as fundamental shifts in the economy, we decided to use the one-break unit root tests of Lee and Strazicich (2004) rather than the two break unit root tests of Lee and Strazicich (2003).

Strazicich (2004) specify the underlying data generating process as:

$$y_t = \delta' Z_t + X_t \qquad , \qquad X_t = \beta X_{t-1} + e_t \tag{3}$$

where $Z_t = [1, t, D_t, DT_t]$, $D_t$ and $DT_t$ are indicator functions defined as $D_t = 1_{(t=T_b+1)}$ and $DT_t = (t - T_b)\, 1_{(t \geq T_b+1)}$ respectively. For a given break-date $T_b = [\lambda T]$ for any $\lambda \in [\lambda_0, 1 - \lambda_0]$, we calculate the t-statistic for $H_0 : \phi = 0$, denoted by $\tilde{\tau}$, from on the following regression based on the LM (score) principle:

$$\Delta y_t = \delta' \Delta Z_t + \phi \tilde{S}_{t-1} + \textstyle\sum_{j=1}^{k^*} c_j \Delta \tilde{S}_{t-j} + u_t \tag{4}$$

where $\tilde{S}_t = y_t - \tilde{\psi}_x - \tilde{\delta} Z_t$, $\tilde{\delta}$ are the coefficients in the regression of $\Delta y_t$ on $\Delta Z_t$, and $\tilde{\psi}_x$ is the restricted MLE of $\psi_x (\equiv \psi + X_0)$ which is given by $y_1 - \delta Z_1$. The extra '$k^*$' regressors $\{\Delta \tilde{S}_{t-j}\}_{j=1}^{k^*}$ are included in the regression to account for additional correlation in the time series $\{y_t\}$. In practice, the value of the lag-truncation parameter ($k^*$) is unknown, and so we use Perron and Vogelsangs (1992) $k(t - sig)$ method for selecting the lag-truncation parameter $k^*$.[6]

We calculated Lee and Strazicichs (2004) statistic for all $u^M$ and $u^F$ series for which the ADF tests did not reject the unit root null hypothesis. The results for the $u^M$ and $u^F$ series are presented in Tables 4 and 5 respectively. For each series, we report the Lee and Strazicichs (2004) statistic, the estimated break-date, the estimated break-fraction, the estimate of $\beta$ implied by $\hat{\phi}$ of regression (4), and the estimated standard error of regression (4). The minimum LM unit root statistic is significant in $u^M$ for Australia, Austria, Belgium, Finland, Greece, New Zealand, Norway, and Spain, and in $u^F$ for The Netherlands, New Zealand, Norway, and the United States. It follows, therefore, that these series evolve according to the structuralist hypothesis.

In all other cases, there is evidence of unemployment hysteresis, and so any macroeconomic shocks have a highly persistent or possibly a permanent effect on the corresponding rate. This includes twelve of the $u^F$ series, namely, for Australia, Belgium, Canada, Denmark, France, Greece, Ireland, Italy, Portugal, Spain, Switzerland, and the United Kingdom, and four of the $u^M$ series, namely, for France, Ireland, Italy, and the United Kingdom. We measure the degree of persistence in the unemployment series characterized by hysteresis using the half-life of a unit shock ($HL_\alpha$), and these are reported in Tables 2-5. The half-life, calculated as $|log(1/2)/log(\alpha)|$, measures the time required for a shock to decay to half its

[6] First, we specify an upper bound 'kmax' for the lag-truncation parameter. The chosen value of the lag-truncation parameter ($k^*$) is determined according to the following 'general-to-specific' procedure: the last lag in an autoregression of order $k^*$ is significant, but the last lag in an autoregression of order greater than $k^*$ is insignificant. The significance of the coefficient is assessed using the 10% critical values based on a standard Normal distribution.

initial value.[7] In the eventuality that the unit root null hypothesis is not rejected for a series based on either the augmented Dickey-Fuller test or the minimum LM test of Lee and Strazicich (2004), we can gauge the extent of persistence based on the half-lives reported in Tables 4 and 5.[8] It can be seen that the half-lives for male unemployment rates are relatively low ranging from 0.80 years for Canada to 2.97 years for Italy. The half-lives of the female unemployment rates that exhibit persistence are higher, ranging from 0.66 years for Greece to 3.84 years for Belgium.

## 3. Concluding Remarks

We empirically examine the dynamics of unemployment across gender and across twenty-three OECD countries. We find that there are substantial differences between the female and male unemployment dynamics both within and across countries. While the characterization of unemployment dynamics by gender is important in itself, we suggest that future research examine the extent to which various labor market factors can explain gender differences in the dynamics of unemployment across countries. Labor market factors may include differential between male and female labor force participation rates, the wage-setting institutions, the unemployment benefit ratio, the proportion of women in the manufacturing and service sectors, the level of mandatory family benefits, and the extensiveness of equal employment opportunity laws. An understanding of labor market factors will allow policy makers to address any sources of inequalities that contribute to gender differences in the unemployment dynamics.

## Acknowledgments

The comments of both referees and the Associate Editor substantially improve the paper. We would like thank Professor Junsoo Lee for making available the Gauss program on his website. Hervé Queneau acknowledges support from the PSC-CUNY Grant Program, 2008-2009. Amit Sen acknowledges support of the OConor Professorship at Xavier University.

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[7] See Andrews (1993) for a discussion of the half-lives measure for persistence.

[8] We feel that Lee and Strazicichs (2004) characterization of the unemployment dynamics is the most robust as it guards against possible misspecification in the form of trend-stationarity.

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**Table 1: Countries and the Corresponding Time Periods**

| Country | Country Code | Period | Sample Size (T) |
|---|---|---|---|
| Australia | AUS | 1964 - 2007 | 44 |
| Austria | AUT | 1968 - 2007 | 40 |
| Belgium | BEL | 1956 - 2007 | 52 |
| Canada | CAN | 1956 - 2007 | 52 |
| Denmark | DEN | 1969 - 2007 | 39 |
| Finland | FIN | 1959 - 2007 | 49 |
| France | FRA | 1963 - 2007 | 45 |
| Germany | DEU | 1956 - 2007 | 52 |
| Greece | GRC | 1977 - 2007 | 31 |
| Ireland | IRL | 1961 - 2007 | 47 |
| Italy | ITA | 1958 - 2007 | 50 |
| Japan | JPN | 1955 - 2007 | 53 |
| South Korea | KOR | 1963 - 2007 | 45 |
| Luxembourg | LUX | 1975 - 2007 | 33 |
| Netherlands | NLD | 1975 - 2007 | 33 |
| New Zealand | NZL | 1975 - 2007 | 41 |
| Norway | NOR | 1956 - 2007 | 52 |
| Portugal | PRT | 1974 - 2007 | 34 |
| Spain | ESP | 1970 - 2007 | 38 |
| Sweden | SWE | 1963 - 2007 | 45 |
| Switzerland | CHE | 1975 - 2007 | 33 |
| United Kingdom | GBR | 1956 - 2007 | 52 |
| United States | USA | 1956 - 2007 | 52 |

**Table 2: ADF Tests for the $u^M$ series of OECD Countries**

| | Without Trend | | | | | With Trend | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Series | $k^*$ | $t_\mu$ | $\hat{\alpha}$ | $\hat{\mu}$ | $HL_\alpha$ | $k^*$ | $t_\tau$ | $\hat{\alpha}$ | $\hat{\mu}$ | $\hat{\beta}$ | $HL_\alpha$ |
| $u^M(AUS)$ | 2 | -1.56 | 0.924 | 0.498 | - | 2 | -0.32 | 0.976 | 0.583 | -0.0179 | - |
| $u^M(AUT)$ | - | - | - | - | - | 1 | -3.06 | 0.613 | 0.359 | 0.0396 | - |
| $u^M(BEL)$ | 1 | -2.02 | 0.921 | 0.478 | - | 1 | -2.55 | 0.850 | 0.398 | 0.0185 | - |
| $u^M(CAN)$ | 1 | $-2.55^*$ | 0.831 | 1.291 | 3.74 | 1 | -2.67 | 0.792 | 1.298 | 0.0114 | - |
| $u^M(DEN)$ | 1 | $-2.65^{\mathrm{d}}$ | 0.762 | 1.414 | 2.55 | 0 | -1.85 | 0.836 | 1.346 | -0.0187 | - |
| $u^M(FIN)$ | 2 | -1.62 | 0.934 | 0.488 | - | 3 | -2.59 | 0.818 | 0.403 | 0.0364 | - |
| $u^M(FRA)$ | - | - | - | - | - | 1 | -1.64 | 0.890 | 0.309 | 0.0179 | - |
| $u^M(DEU)$ | - | - | - | - | - | 4 | $-4.14^{\mathrm{b}}$ | 0.704 | -0.105 | 0.0593 | 1.97 |
| $u^M(GRC)$ | 4 | -2.23 | 0.834 | 0.970 | - | 4 | -1.99 | 0.739 | 1.221 | 0.0194 | - |
| $u^M(IRL)$ | 1 | -1.51 | 0.929 | 0.670 | - | 1 | -1.27 | 0.939 | 0.945 | -0.0161 | - |
| $u^M(ITA)$ | 2 | -1.66 | 0.947 | 0.336 | - | 1 | -1.81 | 0.906 | 0.382 | 0.0073 | - |
| $u^M(JPN)$ | 3 | -2.06 | 0.937 | 0.156 | - | 3 | $-3.83^{\mathrm{b}}$ | 0.809 | 0.144 | 0.0134 | 3.27 |
| $u^M(KOR)$ | 1 | $-3.35^{\mathrm{b}}$ | 0.700 | 1.326 | 1.94 | 1 | $-3.60^{\mathrm{c}}$ | 0.605 | 2.230 | -0.0202 | 1.38 |
| $u^M(LUX)$ | - | - | - | - | - | 3 | $-4.52^{\mathrm{a}}$ | 0.169 | 0.403 | 0.0553 | 0.39 |
| $u^M(NLD)$ | 1 | -1.64 | 0.891 | 0.576 | - | 2 | $-3.35^{\mathrm{d}}$ | 0.709 | 2.767 | -0.0714 | 2.01 |
| $u^M(NZL)$ | 1 | -1.55 | 0.926 | 0.335 | - | 1 | -1.40 | 0.906 | 0.250 | 0.0085 | - |
| $u^M(NOR)$ | 2 | -1.37 | 0.937 | 0.183 | - | 3 | -2.55 | 0.808 | 0.131 | 0.0164 | - |
| $u^M(PRT)$ | 2 | $-4.04^{\mathrm{a}}$ | 0.525 | 2.292 | 1.08 | 2 | $-4.32^{\mathrm{a}}$ | 0.504 | 2.093 | 0.0186 | 1.01 |
| $u^M(ESP)$ | 1 | -2.30 | 0.911 | 1.050 | - | 1 | -1.98 | 0.917 | 1.177 | -0.0106 | - |
| $u^M(SWE)$ | 2 | -1.75 | 0.921 | 0.411 | - | 1 | $-3.24^{\mathrm{d}}$ | 0.790 | 0.123 | 0.0359 | 2.95 |
| $u^M(CHE)$ | - | - | - | - | - | 1 | $-3.53^{\mathrm{d}}$ | 0.623 | -0.082 | 0.0475 | 1.47 |
| $u^M(GBR)$ | 4 | -1.77 | 0.928 | 0.504 | - | 4 | -1.30 | 0.926 | 0.496 | 0.0010 | - |
| $u^M(USA)$ | 1 | $-3.15^{\mathrm{c}}$ | 0.699 | 1.701 | 1.94 | 1 | -3.08 | 0.697 | 1.682 | 0.0014 | - |

*Note*: The superscripts 'a,' 'b,' 'c,' and 'd' denote respectively significance at the 1%, 2.5%, 5% and 10% significance level. The superscript '*' denotes near significance at the 10% level. The finite sample critical values corresponding to T=25 and T=50 were taken from Table 4.2, pp. 103 in Banerjee, Dolado, Galbraith, and Hendry (1993). The critical values for the ADF unit-root tests (t) without trend: for T=25 are -2.63 at the 10% level, -3.00 at the 5% level, -3.33 at the 2.5% level, and -3.75 at the 1% level; and for T=50 are -2.60 at the 10% level, -2.93 at the 5% level, -3.22 at the 2.5% level, and -3.58 at the 1% level. The critical values for the ADF unit-root tests with trend (tt): for T=25 are -3.24 at the 10% level, -3.60 at the 5% level, -3.95 at the 2.5% level, and -4.38 at the 1% level; and for T=50 are -3.18 at the 10% level, -3.50 at the 5% level, -3.80 at the 2.5% level, and -4.15 at the 1% level. We extrapolated the critical values for the given sample sizes based on these critical values.

**Table 3: ADF Tests for the $\mathbf{u^F}$ series of OECD Countries**

| | Without Trend | | | | | With Trend | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Series | $k^*$ | $t_\mu$ | $\hat{\alpha}$ | $\hat{\mu}$ | $HL_\alpha$ | $k^*$ | $t_\tau$ | $\hat{\alpha}$ | $\hat{\mu}$ | $\hat{\beta}$ | $HL_\alpha$ |
| $u^F(AUS)$ | 0 | -1.69 | 0.913 | 0.619 | - | 0 | -0.82 | 0.950 | 0.684 | -0.0137 | - |
| $u^F(AUT)$ | - | - | - | - | - | 1 | $-3.55^c$ | 0.497 | 1.071 | 0.0399 | 0.99 |
| $u^F(BEL)$ | 1 | -1.89 | 0.958 | 0.434 | - | 1 | -1.53 | 0.954 | 0.404 | 0.0026 | - |
| $u^F(CAN)$ | 1 | -1.91 | 0.924 | 0.582 | - | 3 | -0.46 | 0.974 | 0.597 | -0.0138 | - |
| $u^F(DEN)$ | 1 | -2.42 | 0.829 | 1.280 | - | 0 | -1.49 | 0.895 | 1.338 | -0.0272 | - |
| $u^F(FIN)$ | 2 | -1.66 | 0.949 | 0.346 | - | 1 | $-3.52^d$ | 0.821 | -0.015 | 0.0430 | 3.50 |
| $u^F(FRA)$ | 1 | -2.13 | 0.953 | 0.475 | - | 1 | -0.28 | 0.988 | 0.464 | -0.0124 | - |
| $u^F(DEU)$ | 2 | -0.89 | 0.974 | 0.215 | - | 1 | $-3.24^d$ | 0.788 | 0.008 | 0.0462 | 2.90 |
| $u^F(GRC)$ | - | - | - | - | - | 0 | -0.50 | 0.957 | 1.553 | -0.0449 | - |
| $u^F(IRL)$ | 0 | -0.98 | 0.954 | 0.350 | - | 0 | -0.71 | 0.965 | 0.598 | -0.0145 | - |
| $u^F(ITA)$ | 3 | -1.80 | 0.941 | 0.742 | - | 3 | -0.26 | 0.987 | 0.577 | -0.0171 | - |
| $u^F(JPN)$ | 3 | -1.83 | 0.953 | 0.121 | - | 3 | $-3.32^d$ | 0.845 | 0.137 | 0.0099 | 4.11 |
| $u^F(KOR)$ | 0 | $-3.57^b$ | 0.719 | 0.749 | 2.10 | 0 | -3.24d | 0.726 | 0.682 | 0.0021 | 2.16 |
| $u^F(LUX)$ | - | - | - | - | - | 3 | $-3.66^c$ | 0.464 | 0.595 | 0.0359 | 0.90 |
| $u^F(NLD)$ | 1 | -1.52 | 0.933 | 0.493 | - | 1 | -2.50 | 0.881 | 1.596 | -0.0430 | - |
| $u^F(NZL)$ | 4 | -1.53 | 0.921 | 0.469 | - | 4 | -0.05 | 0.996 | 0.621 | -0.0252 | - |
| $u^F(NOR)$ | 1 | -1.70 | 0.928 | 0.214 | - | 1 | -1.67 | 0.848 | 0.170 | 0.0098 | - |
| $u^F(PRT)$ | 1 | -2.45 | 0.877 | 1.052 | - | 1 | -2.63 | 0.842 | 1.671 | -0.0189 | - |
| $u^F(ESP)$ | 1 | -1.73 | 0.952 | 0.942 | - | 1 | -0.66 | 0.977 | 1.366 | -0.0457 | - |
| $u^F(SWE)$ | 1 | -2.38 | 0.892 | 0.474 | - | 1 | $-3.46^d$ | 0.775 | 0.299 | 0.0292 | 2.72 |
| $u^F(CHE)$ | - | - | - | - | - | 1 | -3.00 | 0.665 | -0.072 | 0.0567 | - |
| $u^F(GBR)$ | 1 | -1.48 | 0.947 | 0.274 | - | 3 | -2.01 | 0.896 | 0.181 | 0.0123 | - |
| $u^F(USA)$ | 1 | -2.52 | 0.775 | 1.398 | - | 1 | -2.83 | 0.746 | 1.883 | -0.0119 | - |

*Note*: The superscripts 'a,' 'b,' 'c,' and 'd' denote respectively significance at the 1%, 2.5%, 5% and 10% significance level. The superscript '*' denotes near significance at the 10% level. The finite sample critical values corresponding to T=25 and T=50 were taken from Table 4.2, pp. 103 in Banerjee, Dolado, Galbraith, and Hendry (1993). The critical values for the ADF unit-root tests (t) without trend: for T=25 are -2.63 at the 10% level, -3.00 at the 5% level, -3.33 at the 2.5% level, and -3.75 at the 1% level; and for T=50 are -2.60 at the 10% level, -2.93 at the 5% level, -3.22 at the 2.5% level, and -3.58 at the 1% level. The critical values for the ADF unit-root tests with trend (tt): for T=25 are -3.24 at the 10% level, -3.60 at the 5% level, -3.95 at the 2.5% level, and -4.38 at the 1% level; and for T=50 are -3.18 at the 10% level, -3.50 at the 5% level, -3.80 at the 2.5% level, and -4.15 at the 1% level. We extrapolated the critical values for the given sample sizes based on these critical values.

Table 4: **Minimum LM Unit-Root Test for the $u^M$ series of OECD Countries**

| Series | Sample | $\hat{T}_b$ | $\hat{\lambda}$ | $k^*$ | $\hat{\beta}$ | Test Statistic | $\hat{\sigma}$ | $HL_\alpha$ |
|---|---|---|---|---|---|---|---|---|
| $u^M(AUS)$ | 1964-2007 | 1993 | 0.68 | 1 | 0.4118 | $-4.6837^{\mathrm{b}}$ | 0.7574 | 0.78 |
| $u^M(AUT)$ | 1968-2007 | 1980 | 0.33 | 1 | 0.2897 | $-4.8437^{\mathrm{b}}$ | 0.3283 | 0.56 |
| $u^M(BEL)$ | 1956-2007 | 1980 | 0.48 | 4 | 0.4250 | $-4.6982^{\mathrm{b}}$ | 0.6207 | 0.81 |
| $u^M(CAN)$ | 1956-2007 | 1980 | 0.48 | 7 | 0.4205 | -3.7124 | 0.8327 | 0.80 |
| $u^M(FIN)$ | 1959-2007 | 1991 | 0.67 | 1 | 0.4195 | $-5.2377^{\mathrm{a}}$ | 1.1180 | 0.80 |
| $u^M(FRA)$ | 1963-2007 | 1994 | 0.71 | 1 | 0.6775 | -3.6916 | 0.4542 | 1.78 |
| $u^M(GRC)$ | 1977-2007 | 1991 | 0.48 | 5 | 0.2189 | $-4.7490^{\mathrm{b}}$ | 0.2953 | 0.46 |
| $u^M(IRL)$ | 1961-2007 | 1986 | 0.55 | 5 | 0.4979 | -2.8659 | 1.2288 | 0.99 |
| $u^M(ITA)$ | 1958-2007 | 1990 | 0.66 | 7 | 0.7917 | -2.7266 | 0.3545 | 2.97 |
| $u^M(NZL)$ | 1975-2007 | 1989 | 0.45 | 2 | 0.1789 | $-4.4063^{\mathrm{c}}$ | 0.8335 | 0.40 |
| $u^M(NOR)$ | 1956-2007 | 1988 | 0.63 | 1 | 0.5430 | $-4.6393^{\mathrm{b}}$ | 0.4527 | 1.14 |
| $u^M(ESP)$ | 1970-2007 | 1993 | 0.63 | 3 | 0.6218 | $-4.5277^{\mathrm{b}}$ | 0.9304 | 1.46 |
| $u^M(GBR)$ | 1956-2007 | 1987 | 0.62 | 1 | 0.7371 | -3.5822 | 0.9085 | 2.27 |

*Note*: $\hat{\beta}$ is estimated as $\hat{\phi}+1$ based on regression (4). The Test Statistic is the minimum LM unit root test devised by Lee and Strazicich (2004). We used kmax=8 for all series except $u^M(FIN)$ and $u^M(NZL)$ for which we used kmax=4 and kmax=2 respectively. The superscripts 'a,' 'b,' and 'c' denote respectively significance at the 1%, 5% and 10% significance level. We extrapolated the critical values for the minimum LM unit root statistics based on Table 1 of Lee and Strazicich (2004) based on the estimated break-fraction.

**Table 5: Minimum LM Unit-Root Test for the $\mathbf{u^F}$ series of OECD Countries**

| Series | Sample | $\hat{T}_b$ | $\hat{\lambda}$ | $k^*$ | $\hat{\beta}$ | Test Statistic | $\hat{\sigma}$ | $HL_\alpha$ |
|---|---|---|---|---|---|---|---|---|
| $u^F(AUS)$ | 1964-2007 | 1983 | 0.45 | 1 | 0.6000 | -3.1238 | 0.7350 | 1.36 |
| $u^F(BEL)$ | 1956-2007 | 1978 | 0.44 | 1 | 0.8348 | -3.2406 | 0.8881 | 3.84 |
| $u^F(CAN)$ | 1956-2007 | 1985 | 0.58 | 1 | 0.5869 | -3.8277 | 0.6351 | 1.30 |
| $u^F(DEN)$ | 1969-2007 | 1978 | 0.26 | 2 | 0.4313 | -3.8623 | 1.0336 | 0.82 |
| $u^F(FRA)$ | 1963-2007 | 1988 | 0.58 | 5 | 0.6221 | -2.9202 | 0.4797 | 1.46 |
| $u^F(GRC)$ | 1977-2007 | 2000 | 0.77 | 3 | 0.3476 | -3.3327 | 0.9980 | 0.66 |
| $u^F(IRL)$ | 1961-2007 | 1983 | 0.49 | 6 | 0.6184 | -3.0260 | 1.5434 | 1.44 |
| $u^F(ITA)$ | 1958-2007 | 1981 | 0.48 | 3 | 0.7427 | -3.3232 | 0.7224 | 2.33 |
| $u^F(NLD)$ | 1975-2007 | 1989 | 0.45 | 7 | 0.1692 | $-5.8686^{a}$ | 0.5041 | 0.39 |
| $u^F(NZL)$ | 1975-2007 | 1989 | 0.45 | 2 | 0.1912 | $-4.4226^{c}$ | 0.7187 | 0.42 |
| $u^F(NOR)$ | 1956-2007 | 1989 | 0.65 | 1 | 0.4951 | $-4.3090^{c}$ | 0.3999 | 0.99 |
| $u^F(PRT)$ | 1974-2007 | 1985 | 0.35 | 2 | 0.6599 | -3.8367 | 0.7069 | 1.67 |
| $u^F(ESP)$ | 1970-2007 | 1995 | 0.68 | 6 | 0.4852 | -3.4987 | 1.4012 | 0.96 |
| $u^F(CHE)$ | 1975-2007 | 1995 | 0.64 | 2 | 0.4245 | -4.1237 | 0.4278 | 0.81 |
| $u^F(GBR)$ | 1956-2007 | 1978 | 0.44 | 8 | 0.7022 | -3.4350 | 0.7515 | 1.96 |
| $u^F(USA)$ | 1956-2007 | 1985 | 0.58 | 1 | 0.4677 | $-4.2082^{c}$ | 0.7073 | 0.91 |

*Note*: $\hat{\beta}$ is estimated as $\hat{\phi}+1$ based on regression (4). The Test Statistic is the minimum LM unit root test devised by Lee and Strazicich (2004). We used kmax=8 for all series except $u^M(FIN)$ and $u^M(NZL)$ for which we used kmax=4 and kmax=2 respectively. The superscripts 'a,' 'b,' and 'c' denote respectively significance at the 1%, 5% and 10% significance level. We extrapolated the critical values for the minimum LM unit root statistics based on Table 1 of Lee and Strazicich (2004) based on the estimated break-fraction.

Figure 1: Male and Female Unemployment Rate
Australia, 1964 – 2007

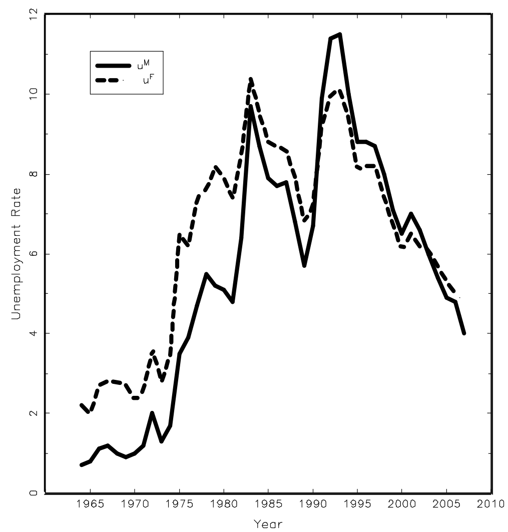


Figure 2: Male and Female Unemployment Rate
Austria, 1968 – 2007


Figure 3: Male and Female Unemployment Rate
Belgium, 1956 – 2007

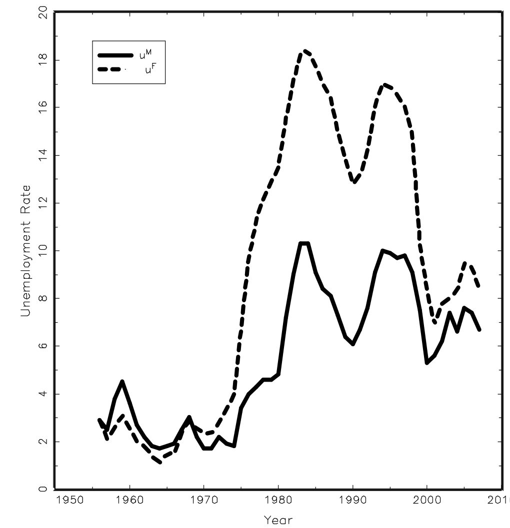


Figure 4: Male and Female Unemployment Rate
Canada, 1956 – 2007

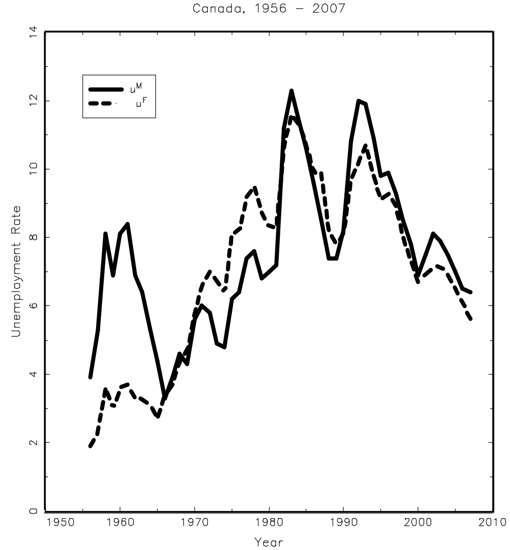


Figure 5: Male and Female Unemployment Rate
Denmark, 1969 – 2007

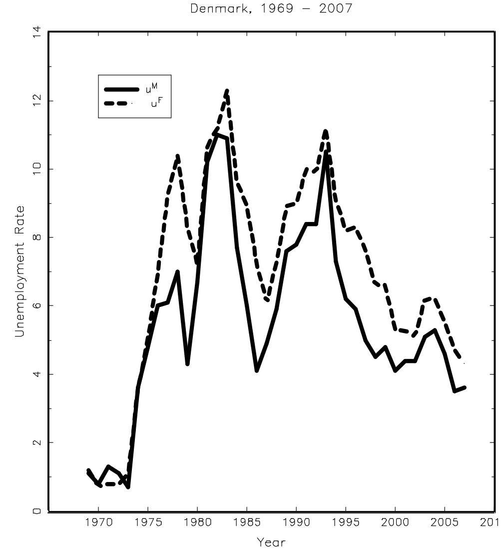


Figure 6: Male and Female Unemployment Rate
Finland, 1959 – 2007

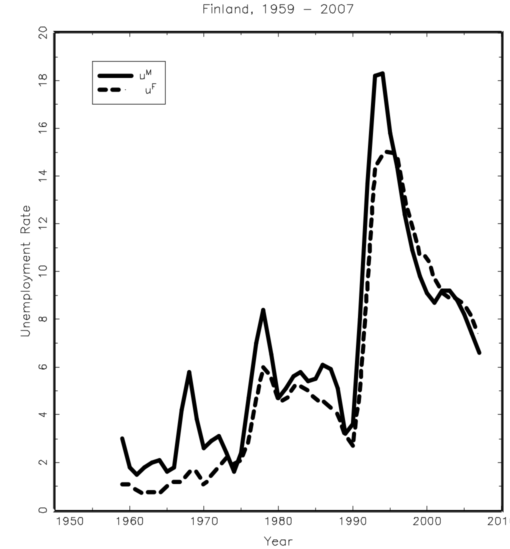

Figure 7: Male and Female Unemployment Rate
France, 1963 – 2007

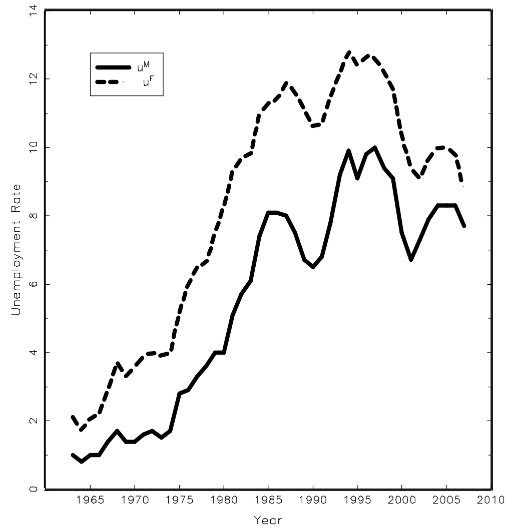


Figure 8: Male and Female Unemployment Rate
Germany, 1956 – 2007

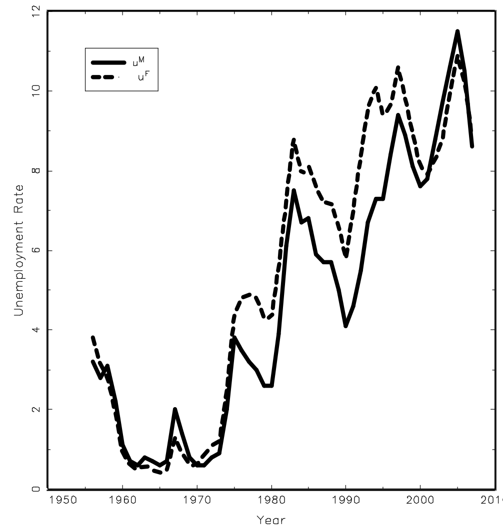


Figure 9: Male and Female Unemployment Rate
Greece, 1977 – 2007

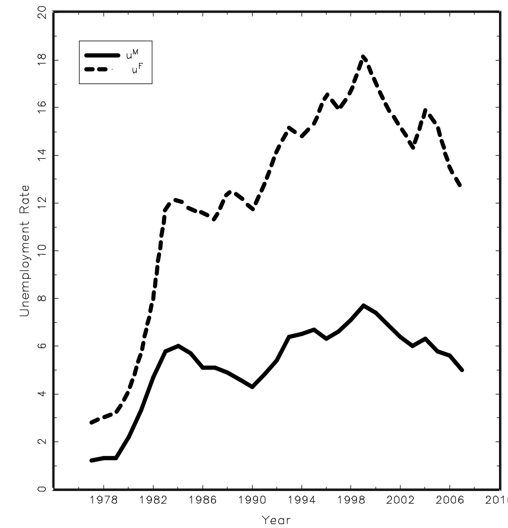


Figure 10: Male and Female Unemployment Rate
Ireland, 1961 – 2007

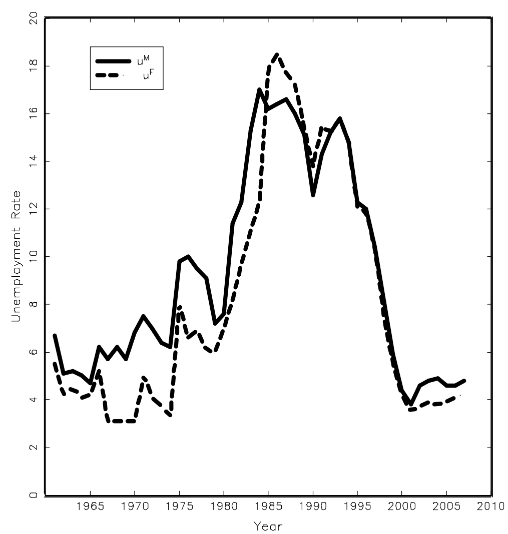


Figure 11: Male and Female Unemployment Rate
Italy, 1958 – 2007

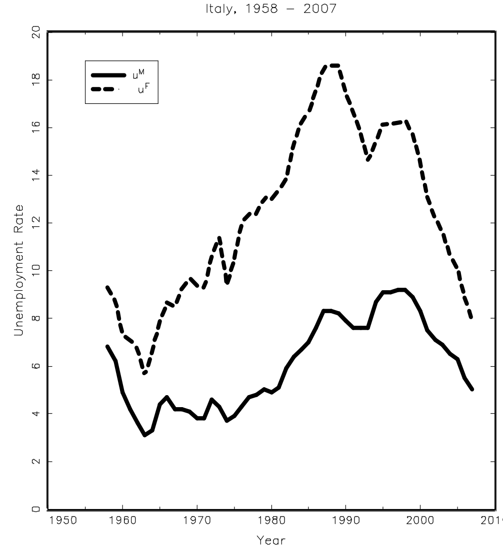


Figure 12: Male and Female Unemployment Rate
Japan, 1955 – 2007

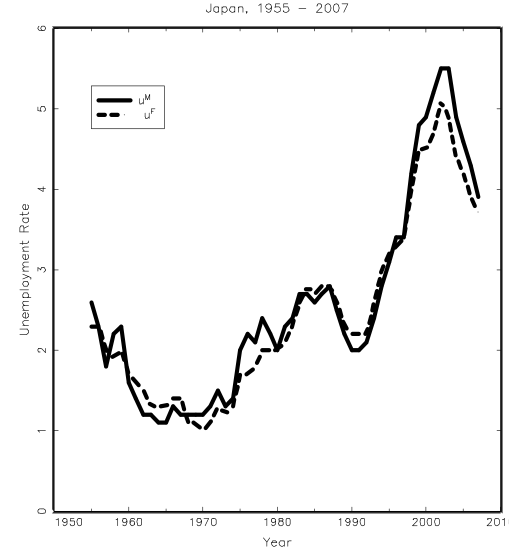

Figure 13: Male and Female Unemployment Rate
Korea, 1963 – 2007

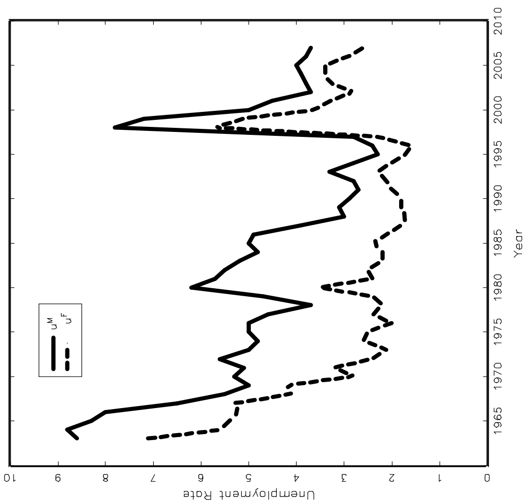


Figure 14: Male and Female Unemployment Rate
Luxembourg, 1975 – 2007

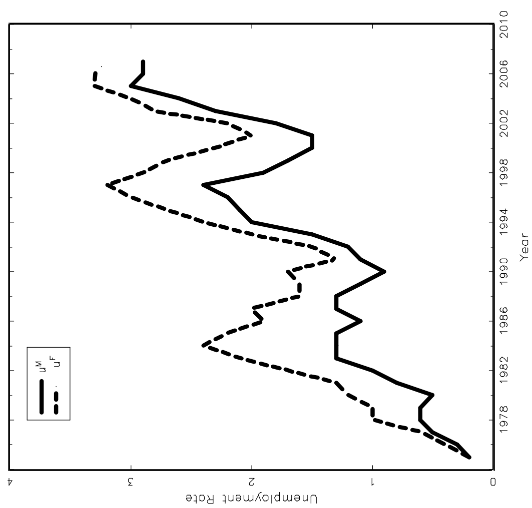


Figure 15: Male and Female Unemployment Rate
The Netherlands, 1975 – 2007

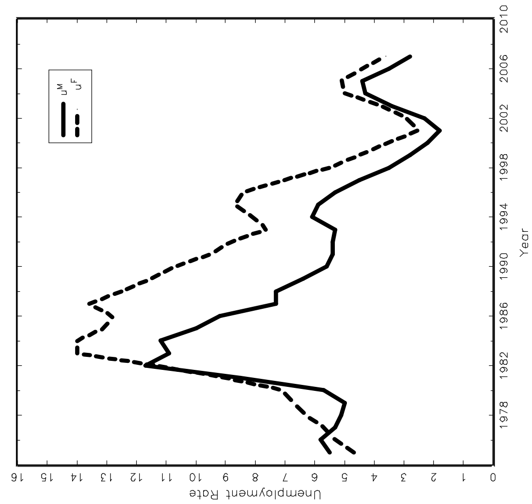


Figure 16: Male and Female Unemployment Rate
New Zealand, 1965 – 2007

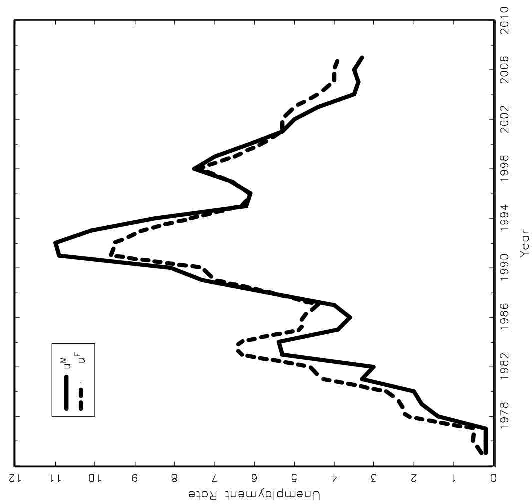


Figure 17: Male and Female Unemployment Rate
Norway, 1956 – 2007

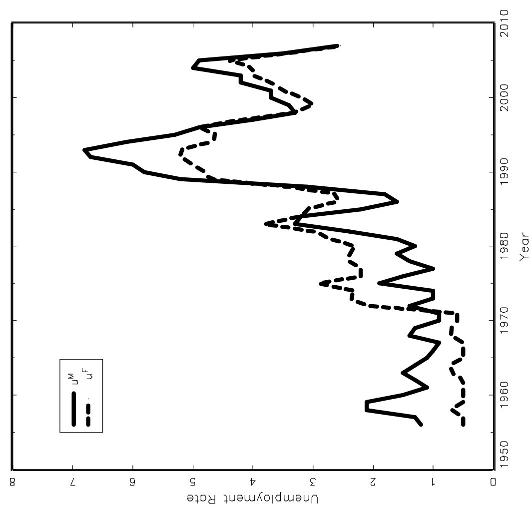


Figure 18: Male and Female Unemployment Rate
Portugal, 1974 – 2007

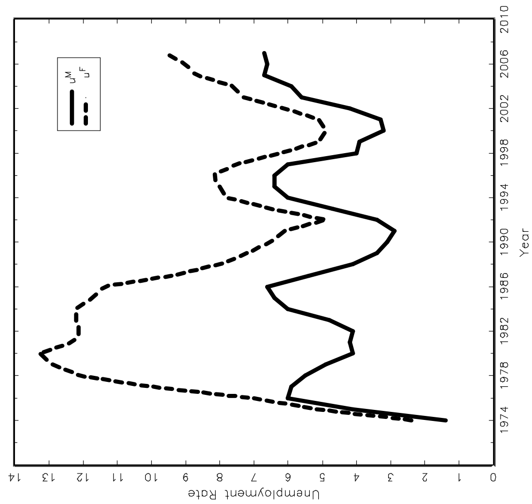

Figure 19: Male and Female Unemployment Rate
Spain, 1970 – 2007

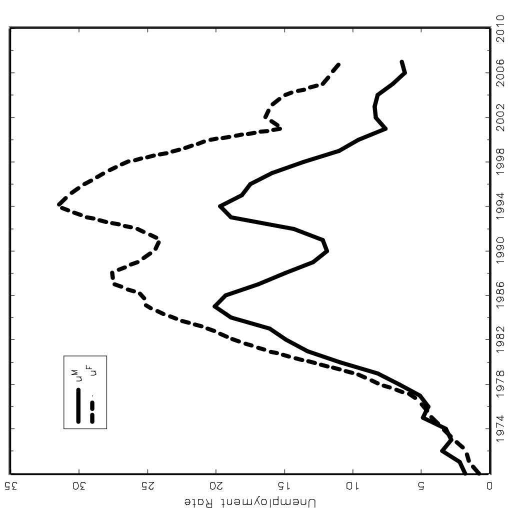


Figure 20: Male and Female Unemployment Rate
Sweden, 1963 – 2007

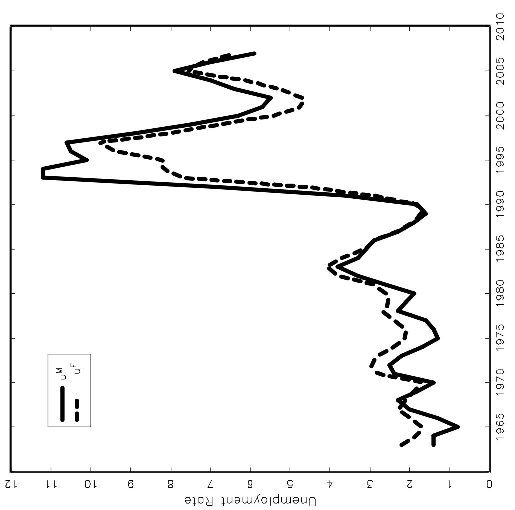


Figure 21: Male and Female Unemployment Rate
Switzerland, 1975 – 2007

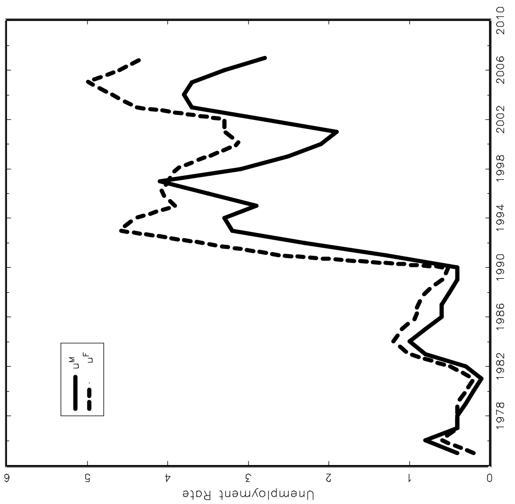


Figure 22: Male and Female Unemployment Rate
United Kingdom, 1956 – 2007

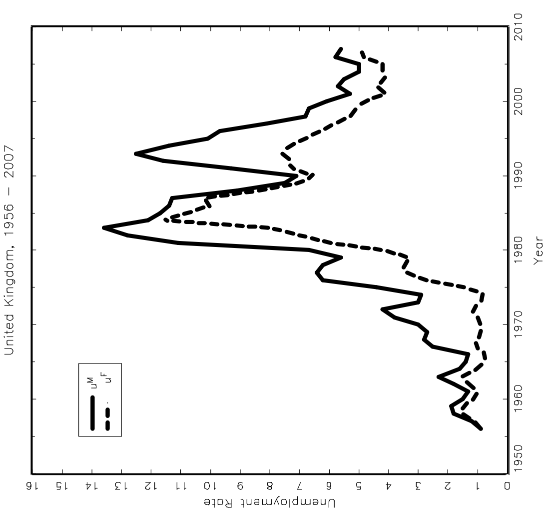


Figure 23: Male and Female Unemployment Rate
United States, 1956 – 2007