

Unemployment and Labour-Force Participation in Sweden

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Summary in Swedish

Denna arbetsrapport undersöker sambandet mellan arbetslöshet och arbetskraftsdeltagande i Sverige. Kointegrationsanalys stödjer ett robust långsiktssamband mellan dessa två variabler, vare sig aggregerade eller könsuppdelade data används. Dessa resultat leder till ett ifrågasättande av hypotesen om arbetslöshetens långsiktiga oberoende av arbetskraften.

Unemployment and Labour-Force Participation in Sweden*

Pär Österholm[#]

Abstract

This paper investigates the relationship between Swedish unemployment and labour-force participation. Cointegration analysis supports a robust long-run relationship between the two variables, regardless of whether aggregate or gender-specific rates are used. This finding puts the empirical relevance of the unemployment invariance hypothesis into question.

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Keywords: Cointegration, Discouraged worker

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[#] National Institute of Economic Research, Box 3116, 103 62 Stockholm, Sweden
e-mail: par.osterholm@konj.se Phone: +46 8 453 5972

Contents

1. Introduction	9
2. Data and empirical analysis.....	9
3. Conclusions.....	14
References.....	15

1. Introduction

In the 1970s and 1980s, when many European countries were plagued by high unemployment, Swedish unemployment was low by international standards. This observation generated a fair amount of academic attention and Sweden's labour market has since then often been the focus of economic research. In particular, the Swedish labour market has an interesting structure with, for example, strong unions, centralised wage bargaining and highly active labour-market policy. It is, accordingly, often considered to be at the other end of the spectrum relative to the United States and therefore of general interest when labour-market arrangements and policies are discussed.

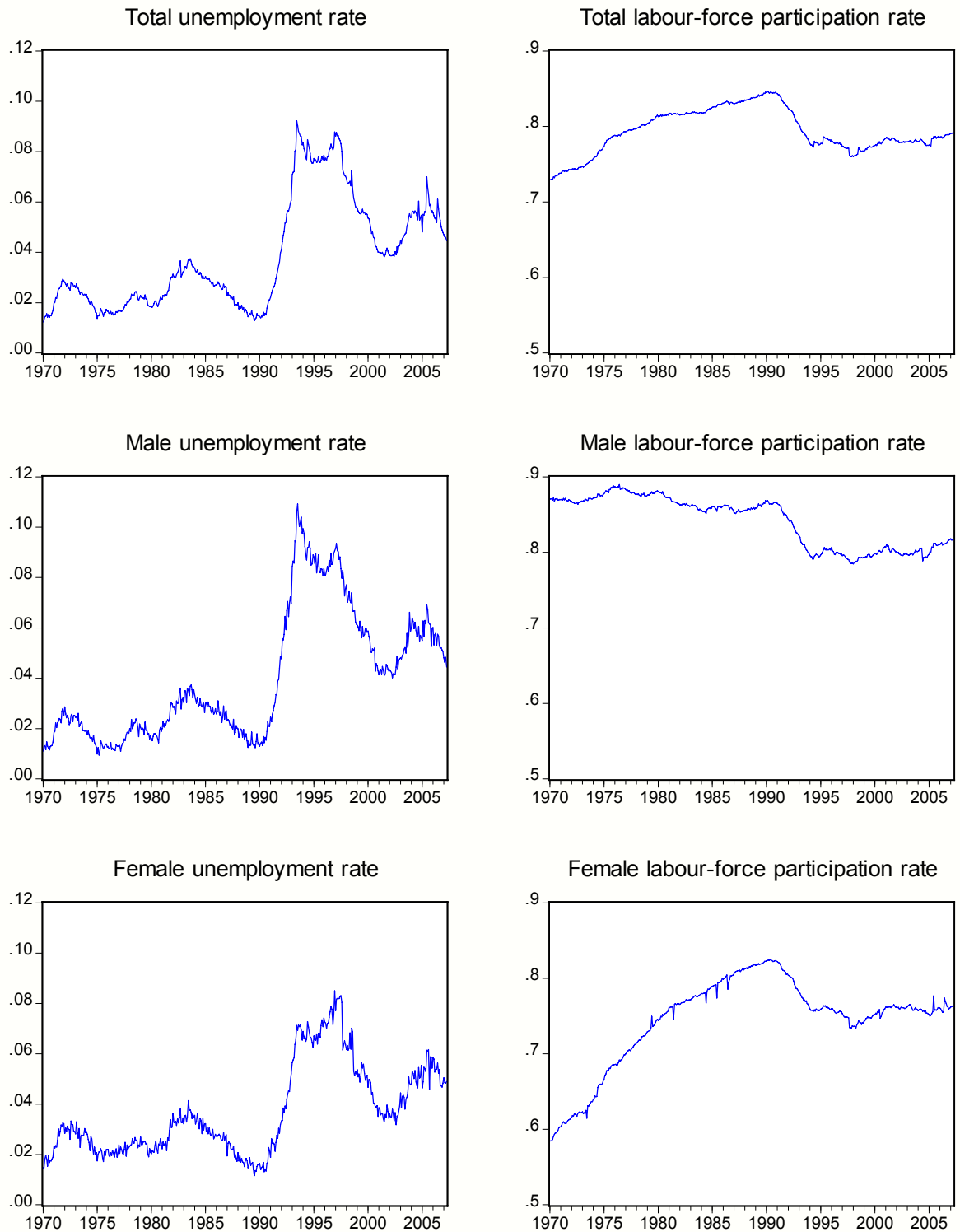
The purpose of this paper is to investigate the long-run relationship between unemployment and labour-force participation in Sweden. Whether unemployment is related to labour-force participation is an issue that has important implications for theory, empirical modelling and policy in both labour and macroeconomics. For example, so-called *discouraged-worker* effects, which imply that individuals' labour-force participation may change over time for market-driven reasons, can substantially affect the informational value of the unemployment rate as a macroeconomic indicator (Murphy and Topel, 1997; Gustavsson and Österholm, 2006). Another interesting aspect of the relationship between these two variables is the relevance of the so-called *unemployment invariance hypothesis* which suggests that the long-run unemployment rate is independent of the labour force.¹ In this paper, we take a macro-level approach to the empirical investigation of the long-run relationship between Swedish unemployment and labour-force participation and based on the time-series properties of the data, the issue is addressed using cointegration techniques.

2. Data and empirical analysis

Seasonally adjusted monthly data on unemployment (u_t) and participation (p_t) rates are used for our empirical analysis. Apart from the aggregate rates, we also conduct analysis on the male and female unemployment and participation rates to see how robust our findings are. All series range from January 1970 to April 2007 and are shown in Figure 1. Worth noting are the very large increase in unemployment associated with the crisis of the early 1990s, the upward trend in female participation until the late 1980s, and the downward trend in male participation throughout the sample.

¹ This hypothesis also suggests that the long-run unemployment rate should be independent of the capital stock and productivity. See, for example, Layard *et al.* (1991) in support of unemployment invariance, and Karanassou and Snower (2004) for a critique of this hypothesis.

Figure 1. Unemployment and labour-force participation rates in Sweden, January 1970 to April 2007.



Initially, we want to establish the time-series properties of the variables in question as these affect both methodological choices and inference procedures. Moreover, if the unemployment and participation rates are integrated of different orders, no long-run equilibrium relationship can exist between the two. We employ two different unit-root tests to the six series: the Augmented Dickey-Fuller test with GLS detrending (Elliot *et al.*, 1996) and the KPSS test (Kwiatkowski *et al.*, 1992). The ADF-GLS test has a unit root under the null hypothesis, whereas the KPSS test reverses the burden of proof as it has stationarity under the null. Results, where we have tested for reversion around a constant level, can be found in Table 1. Whilst the evidence regarding the Swedish unemployment rate has been mixed in the empirical literature, it is generally concluded that it is generated by a unit-root process;² our results clearly support this conclusion, regardless of aggregation level. This might not come as a complete surprise when Sweden's institutional settings are considered though, as the presence of strong unions was the initial explanation for unemployment hysteresis (Blanchard and Summers, 1986). Regarding the different labour-force participation rates, these are also all found to be unit-root processes.

Table 1. Univariate unit-root tests on individual series.

	All		Men		Women	
	p_t	u_t	p_t	u_t	p_t	u_t
ADF-GLS	-0.266	-0.474	-0.155	-0.982	1.231	-0.313
KPSS	0.510*	1.419*	2.188*	1.463*	1.295*	1.358*

ADF-GLS is the test statistic from the Augmented Dickey-Fuller test with GLS detrending.

Lag length in the ADF-GLS test is chosen based on the Schwarz information criterion.

KPSS is the test statistic from the KPSS test.

* indicates significance at the 5% level.

Sample is January 1970 to April 2007.

Having established that all series are unit-root processes, it makes sense to test the issue of whether there is a long-run relationship between unemployment and labour-force participation rates in a cointegration framework.³ If the variables are in fact cointegrated, a long-run relationship exists whereas the opposite would be true if cointegration cannot be supported. Regarding the economic implications, finding cointegration would, for example, lead us to conclude that the unemployment invariance hypothesis cannot be supported. We employ Johansen's methodology to test for cointegration between *i*) aggregate u_t and p_t , *ii*) u_t and p_t for men and *iii*) u_t and p_t for women.

Letting $\mathbf{y}_t = (p_t \quad u_t)'$, we can write the cointegrated VAR as

² See, for example, Assarsson and Jansson (1998), Jacobson *et al.* (1997) and Camarero and Tamarit (2004).

³ Clearly, as both the unemployment and labour-force participation rates are bounded between zero and one, neither series can be a linear unit-root process with an additive error term fulfilling standard assumptions. However, the approximation error from this assumption is – as can be inferred from the extremely large literature that models unemployment rates as unit-root processes – expected to be negligible.

$$\Delta \mathbf{y}_t = \boldsymbol{\mu} + \boldsymbol{\Pi} \mathbf{y}_{t-1} + \sum_{i=1}^{p-1} \boldsymbol{\Gamma}_i \Delta \mathbf{y}_{t-i} + \boldsymbol{\varepsilon}_t \quad (1)$$

where

$$\boldsymbol{\Pi} = \sum_{i=1}^p \mathbf{A}_i - \mathbf{I} \text{ and } \boldsymbol{\Gamma}_i = - \sum_{j=i+1}^p \mathbf{A}_j . \quad (2)$$

In this setting, u_t and p_t are cointegrated if the coefficient matrix $\boldsymbol{\Pi}$ has rank equal to one, in which case there exist 2×1 vectors $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ each with rank one such that $\boldsymbol{\Pi} = \boldsymbol{\alpha} \boldsymbol{\beta}'$ and $\boldsymbol{\beta}' \mathbf{y}_t$ is stationary. The elements of $\boldsymbol{\alpha}$ are the adjustment parameters in the vector error correction model and $\boldsymbol{\beta}$ is the cointegrating vector.

Table 2 presents the results from the cointegration tests using Johansen's (1988, 1991) maximum eigenvalue and trace tests. As can be seen, one – and only one – cointegrating vector is supported in all three cases. This suggests that there is a long-run relationship between the two variables.

Table 2. Cointegration tests.

	All		Men		Women	
	J_{\max}	J_{trace}	J_{\max}	J_{trace}	J_{\max}	J_{trace}
$H_0 : r = 0$	26.411*	30.651*	17.972*	20.601*	50.643*	53.079*
$H_0 : r = 1$	4.240	4.240	2.628	2.628	2.436	2.436

J_{\max} and J_{trace} are the test statistics from Johansen's maximum eigenvalue and trace tests respectively.

Lag length in the VAR (in levels) is based on the Schwarz information criterion.

* indicates significance at the 5% level.

Sample is January 1970 to April 2007.

However, since there is some concern that the labour-force participation and unemployment rates may not have exact unit roots, we should take some extra caution since the Johansen tests are known to have size distortions in such cases; see, for example, Hjalmarsson and Österholm (2007).

We therefore test whether the restrictions $\boldsymbol{\beta} = (1 \ 0)'$ and $\boldsymbol{\beta} = (0 \ 1)'$ can be rejected; if they cannot, we conclude that the cointegration found is not due to a relationship between the variables but a single stationary variable. (Labour-force participation in the first case and unemployment in the second.) Results from these likelihood ratio tests can be found in Table 3. As can be seen, the null hypothesis is rejected at the five percent level in all cases.

Table 3. Tests of restrictions in cointegrated VAR.

Restriction	All	Men	Women
$\boldsymbol{\beta} = (1 \ 0)'$	21.072*	15.246*	20.007*
$\boldsymbol{\beta} = (0 \ 1)'$	6.180*	12.076*	17.922*
$\boldsymbol{\alpha} = (0 \ \alpha_2)'$	16.408*	14.924*	48.884*
$\boldsymbol{\alpha} = (\alpha_1 \ 0)'$	11.503*	0.829	4.173*

* indicates significance at the 5% level.

Sample is January 1970 to April 2007.

Having established that a long-run relationship between unemployment and participation rates actually exists, we are finally interested in whether there is any other information that our VAR can give us regarding the Swedish economy. From this point of view, both the cointegrating vector and the error-correction terms are potentially of interest. Looking at the estimated cointegrating vector (constant has been omitted for convenience) from the cointegrated VAR model first, it is given by $\hat{\boldsymbol{\beta}}' = (1 \ 2.555)$ for the aggregate data, $\hat{\boldsymbol{\beta}}' = (1 \ 1.504)$ for men and $\hat{\boldsymbol{\beta}}' = (1 \ 3.479)$ for women. We argue that these estimates can be interpreted as favouring discouraged-worker effects. To see this, note that a higher unemployment rate is associated with a lower participation rate. The very large number for women is likely to be a result of a *reversed discouraged-worker effect*; during the era of low unemployment, women chose to enter the labour force in large numbers.⁴

However, it does not seem unreasonable to argue that there is endogeneity here; it is hence not obvious that the cointegrating vector describes adjustment of participation rates to unemployment rates (consistent with only a discouraged-worker effect). We therefore finally turn to the error-correction terms, where we are interested in whether we can impose any of the restrictions $\boldsymbol{\alpha} = (\alpha_1 \ 0)'$ or $\boldsymbol{\alpha} = (0 \ \alpha_2)'$. The former restriction implies that the unemployment rate does not error correct but that the labour-force participation rate does, whereas the opposite would be true if the latter restriction holds. Testing these restrictions for our three models using likelihood ratio tests, we find that both restrictions are rejected for the aggregate level and women. For men, on the other hand, the restriction $\boldsymbol{\alpha} = (\alpha_1 \ 0)'$ cannot be rejected. This means that the male participation rate adjusts to the male unemployment rate but not vice versa, a finding that further confirms our earlier statement regarding discouraged-worker effects. Regarding the fact that we could reject both restrictions on $\boldsymbol{\alpha}$ for the aggregate rates and women's rates, this could be due to some "deeper" omitted force. For example, emancipation could lead to women, more or less exoge-

⁴ It should be noted that in a system with women's labour-force participation rate and aggregate or male unemployment rate, the results are identical in terms of cointegrating rank and very similar in terms of the estimate of the cointegrating vector.

nously, choosing to enter the labour market, thereby affecting the unemployment rate. Table 4, finally, presents the cointegrating vectors, where relevant restrictions regarding α have been imposed.

Table 4. Estimated cointegrating vector in preferred model.

	All	Men	Women
$\hat{\beta}$	(1 2.555)'	(1 1.439)'	(1 3.479)'
$se(\hat{\beta}_2)$	0.483	0.165	0.761

Sample is January 1970 to April 2007.

3. Conclusions

To conclude, this paper has shown that there exists a long-run relationship between unemployment and labour-force participation in Sweden. The result is robust and also found when using gender-specific data. This means that the unemployment invariance hypothesis has not found support in Sweden, which should be kept in mind when performing empirical work; any researcher should seriously question whether it makes sense to impose a long-run restriction which is so forcefully contradicted on a rather long sample. Moreover, cointegrating vectors support important discouraged-worker effects in the data. Given that both unemployment and participation rates are integrated of order one, it is also clear that these effects are permanent.

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