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# Relationship between labor force participation and unemployment in Pakistan

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## Abstract

This paper investigates the relationship between labor force participation and unemployment in Pakistan using the annual time series data for the period 1990-2021. Johansen's cointegration and Gregory and Hansen's cointegration tests determine the long-run relationship between unemployment and labor force participation rate for aggregate male and female workers. Both cointegration procedures confirm no long-run relationship between the variables. Therefore, the results confirm the unemployment invariance hypothesis for aggregate and male and female workers in Pakistan.

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## 1. Introduction

Because of the relevance of labor issues to the well-being of any nation and its citizens, researchers and policymakers have shown considerable interest in studying several labor characteristics and their labor market outcomes. Examining the relationship between labor force participation and the unemployment rate is one of the areas of interest among policymakers due to its importance in long-run macroeconomic policy modeling as well as significant labor market policy implications (Österholm, 2010; Emerson, 2011; Tansel and Ozdemir, 2018; Tansel, Ozdemir and Aksoy, 2016; Lee and Parasnis, 2014). A high unemployment rate and low labor force participation also have a negative impact on economic growth and development in a country; with these two problems, people's skills are not used to their full potential, which would affect the country's long-term growth and development (Ozerkek, 2013).

Due to the specific cyclical characteristics of the labor force participation rate, the existence of the long-run relationship between unemployment and the labor force participation rate may raise a pro- or counter-cyclical behavior. The discouraged worker's effects reflect the pro-cyclical effect. It is characterized by workers withdrawing from the labor market because those searching for jobs fail to get a job opportunity. The added worker effect reflects the counter-cyclical behavior. It is associated with increased labor supply response due to spousal unemployment (Murphy and Topel, 1997; Tansel and Ozdemir, 2018; Dagsvik et al., 2013).

On the other hand, if no long-run relationship exists between labor force participation and the unemployment rate, it indicates the unemployment invariance hypothesis. This hypothesis indicates that the long-run labor force participation rate has no statistically significant impact on the long-run unemployment rate (Layard et al., 1991). Therefore, the labor market policies to counter unemployment by increasing labor force participation may not be suitable in the long run. The lack of dependence between labor force participation and the unemployment rate stems from the fact that the labor market utilizes the labor demand, supply, and wage settings mechanism to offset the changes in productivity growth, capital stock, and labor force participation. (Tansel et al., 2016).

The validity of the unemployment invariance hypothesis is a controversial topic among researchers and policymakers; even though a large number of studies are available for both developed and developing countries, no conclusive evidence exists about the cyclical behavior of labor force participation. The existing empirical literature can be categorized into the studies that found evidence of cyclical sensitivity and those that did not find evidence of cyclical behavior between the two labor market indicators. For the UK, Layard et al. (1991) found supporting evidence for the UK, while Karanassou and Snower (2004) failed to determine the existence of the unemployment invariance hypothesis in the UK. Emerson (2011) for the USA, Österholm (2010) for Sweden, and Van (2016) found evidence of the unemployment invariance hypothesis for Australia. Kakinaka and Miyamoto (2012) found support for the invariance hypothesis for male workers in Japan, while Liu (2014), using the regional data, found that a statistically significant long-run relationship exists between labor force participation and unemployment in Japan in the regional context, thus, rejecting the unemployment invariance hypothesis in Japan.

Similarly, statistically significant evidence for the unemployment invariance hypothesis for Canada by (Tansel and Ozdemir, 2018), while Janko (2022) rejected the invariance hypothesis for Canada. Kleykampa and Wan (2014) also found supporting evidence for the USA, and Nemore et

al. (2021) rejected the invariance hypothesis for Italy. Altuzarra et al. (2019) found supporting evidence for aggregate and male workers; however, they found a significant long-run relationship between the labor force participation rate and the unemployment rate for female workers in Spain. For Romania, Otoiu and Titan (2015) found evidence in support of the unemployment invariance hypothesis, while for Turkey, both Tansel et al. (2016) and Arisoy (2018) also found no long-run relationship between unemployment and labor force participation rate, confirming the presence of unemployment invariance hypothesis. Because of the mixed evidence, especially when aggregate level data was used, a number of scholars have explored the relationship between labor force participation and unemployment rate by age, gender, region or country groups (Benati 2001; Congregado et al., 2014; Otoiu and Titan, 2015; Kakinaka and Miyamoto 2012; Lee and Parasnis, 2014; Emerson 2011; Altuzarra et al. 2019; Gałecka-Burdziak and Pater 2019).

Despite its macroeconomic and labor market significance, the relationship between labor force participation and the unemployment rate has received much attention in Pakistan, even though some studies have studied the determinants of unemployment in Pakistan (see, for example, Azra and Muhammad, 2018), they focused on factors such as investment, output gap, inflation etc. This study aims to contribute to the existing literature by providing fresh insight into the relationship between labor force participation and unemployment in Pakistan. This study investigates whether a long-run relationship exists between the unemployment rate and labor force participation in Pakistan at aggregate and gender-specific levels.

## 2. Methodology

### 2.1. Data Description

Due to the non-availability of high-frequency data, this study is based on annual time series data of the unemployment rate (Unemp) and labor force participation rate (Lfpr) for 1990-2021. For robustness and to identify the gender difference in the labor market, this study has also incorporated the annual time series data for male and female labor force participation and unemployment rate. The sample consists of a working-age population (aged 15+). All the data is taken from the World Bank. Seasonally adjusted series are used for the analysis in this paper. Table 1 presents the summary statistics of selected variables.

**Table 1: Summary Statistics**

| | Labor Force Participation (Total) | Labor Force Participation (Male) | Labor Force Participation (Female) | Unemployment rate (Total) | Unemployment rate (Male) | Unemployment rate (Female) |
|---|---|---|---|---|---|---|
| Mean | 50.51 | 81.23 | 18.75 | 4.19 | 3.44 | 8.28 |
| Median | 50.44 | 81.03 | 18.80 | 4.53 | 3.66 | 8.41 |
| Maximum | 52.73 | 84.89 | 24.53 | 7.83 | 6.24 | 17.07 |
| Minimum | 48.36 | 78.63 | 11.31 | 0.40 | 0.40 | 0.25 |
| Std. Dev. | 0.96 | 1.79 | 4.016 | 2.36 | 1.80 | 6.03 |

Figure 1 presents the aggregate and gender-based unemployment and labor force participation rate trends in the country. The cyclical pattern can be observed in the unemployment and labor force participation rates.

The figure shows that the total labor force participation rate hovered between 48% and 52% throughout the study period. There was a consistent decline in the participation rate from 1990-1995. In the later period, participation rates rose consistently, reaching over 52% by 2021.

Compared to the labor force participation rate, the total unemployment rate has an upward trend, rising from 2% in 1990 to 7% in 2005; a sharp decline is observed in the total unemployment rate during 2006-2011. However, the total labor force participation figures remained at 50% during the same period. Since 2012, the unemployment rate has risen again and reached 6.3% in 2021, while the total labor force participation remained around 52%. The male labor force participation rate remained around 80% on average throughout the period, while an upward trend can be observed in the male unemployment rate during the same period. The female labor force patriation rate has significantly improved from 11% in 1990 to 24% in 2021. There is also an improvement in the female unemployment rate, which declined to around 6% in 2021 compared to 16% in 1991.

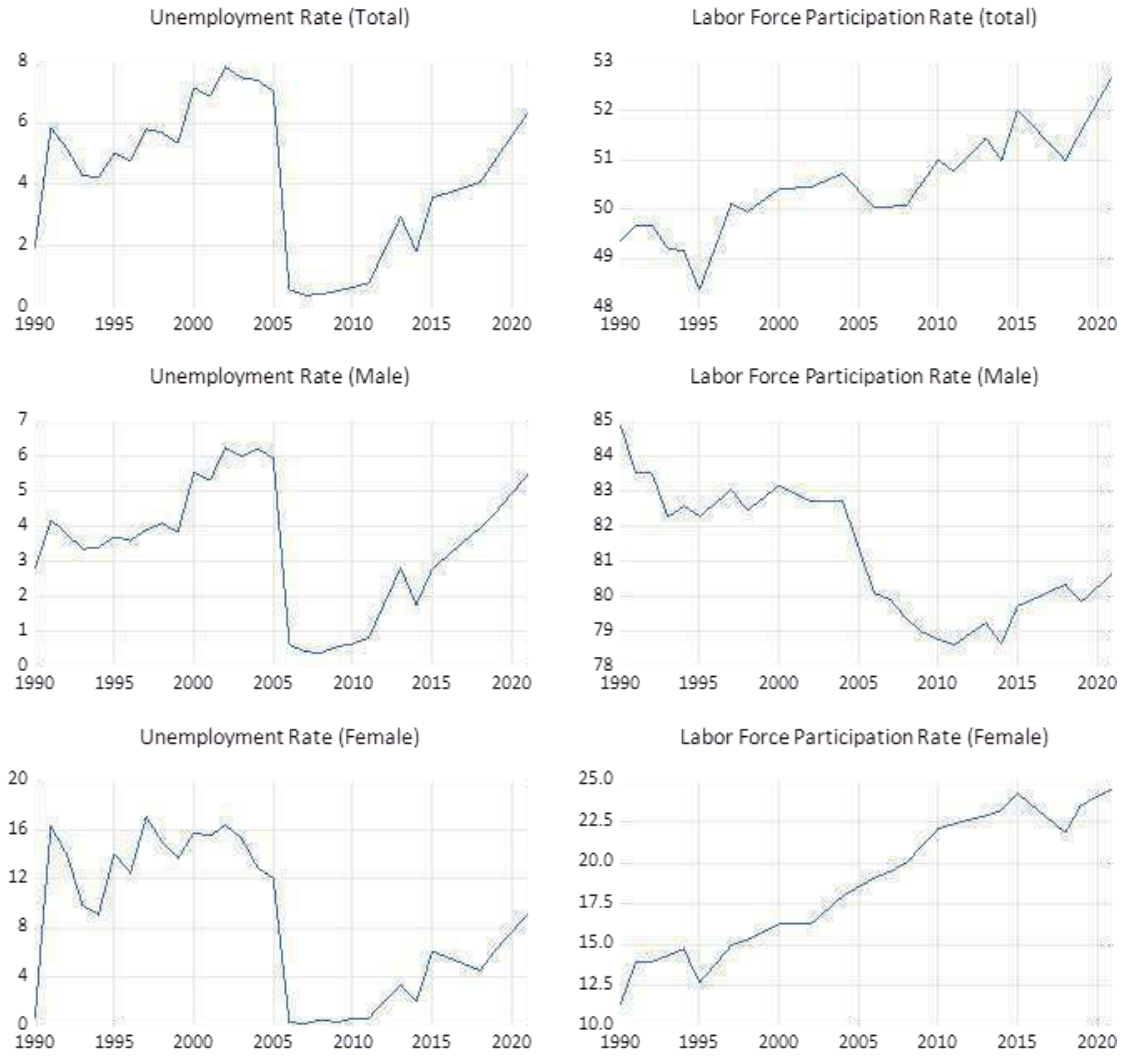


**Figure 1: Unemployment and Labor Force Participation Trends in Pakistan (1990-201)**

## 2.2. Estimation Procedure

This study is based on the pioneering work of Österholm (2010), who first used the cointegration analysis to determine the relationship between unemployment and labor force

participation rate. The study used the variables in level form rather than taking the log of the series. As Österholm (2010) mentioned, "as both the unemployment and labor 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." Since then, a growing number of studies have used the same procedure to determine the relationship between the unemployment and labor force participation rate (see, for example, Emerson, 2011; Tansel, 2016; Altuzarra et al., 2019; Arisoy, 2018; Liu, 2021; Maridueña-Larrea, and Martín-Román, (2023). Therefore, this study follows existing empirical literature to determine the relationship between selected series using cointegration analysis.

As a starting point, different unit root tests are used to determine the stationary process. Dickey-Fuller (ADFC) test (Dickey and Fuller 1979); and the Dickey-Fuller generalized least squares (ADF-GLS) approach introduced by Elliott, Rothenberg, and Stock (1996) are used to determine the order of integration for all series. Since Figure 1 shows some sharp trends in the data during the selected period, which can be due to a possible structural shock, this study also incorporates Zivot Andrews unit root that accounts for one structural break in time series data.

After confirming the order of integration between the variables, the next step is to test the long-run relationship between the variables using the cointegration framework[1]. Johansen's cointegration procedure (1988, 1991) determines the long-run relationship between labor force participation and the unemployment rate. Additionally, to account for structural breaks in the cointegrating relationship, this study has used Gregory and Hansen's (1996) cointegration procedure. The Gregory and Hansen (GH) method under three specifications accounts for long-run structural change. The first two models are known as the 'level shift' models. The first model accounts for the change in intercept (C). The second model accounts for the change in the intercept with a linear trend (C/T). The third model, known as regime shift, accounts for the change both in the intercept and slope (C/S).

## 3. Results and Discussion

Following the existing empirical literature, this study begins by determining the unit root properties of the individual times series using the unit root test. This study has used the conventional Dickey-Fuller (ADFC) test (Dickey and Fuller 1979), the Philip-Parron (PP) unit root test (Phillips and Perron 1988) and the Dickey-Fuller generalized least squares (ADF-GLS) approach introduced by Elliott, Rothenberg, and Stock (1996). The optimal lag length used for unit root tests was 1. The results of the unit root test are presented in Table 2. All the unit root test procedures indicate that the null hypothesis of non-stationarity cannot be rejected at 1%, 5% and 10% significant levels for all the series; however, all series become stationary at the first difference, at least at the 5% significance level. Therefore, it can be concluded that the series are integrated of order I (1). These findings are consistent with the previously available empirical literature.

[1] For cointegration analysis, the number of observations typically ranges from 32 to 35 years. This range is deemed sufficient to apply the Central Limit Theorem, Maddala and Kim (1998), argue that once a baseline of 30 observations is met, the effectiveness of unit root and cointegration tests relies more on the duration covered by the data rather than the sheer count of observations. Therefore, a dataset spanning 32 years with 32 observations could potentially yield more robust unit root test results than a dataset with 100 observations spanning only 100 days.

**Table 2 Unit Root Test**

| Variables | ADF Level | | ADF First Difference | | Result |
|---|---|---|---|---|---|
| | Constant | Constant and Trend | Constant | Constant and Trend | |
| Lfpr_Total | 0.0498 | -2.3876 | -5.7002 | -5.7925 | I(1) |
| Lfpr_Male | -2.0995 | -1.5446 | -5.3718 | -5.4964 | I(1) |
| Lfpr_Female | -1.2591 | -2.7396 | -6.7697 | -6.5165 | I(1) |
| Unemp_Total | -2.0252 | -2.1423 | -5.9352 | -5.8895 | I(1) |
| Unemp_Male | -1.8192 | -1.7565 | -5.2537 | -5.2404 | I(1) |
| Unemp_Female | -2.2531 | -3.3025 | -7.7739 | -7.6513 | I(1) |
| | ADF-GLS Level | | ADF-GLS First Difference | | |
| | Constant | Constant and Trend | Constant | Constant and Trend | |
| LFPR_TOTAL | -0.28 | -2.92 | -5.28 | -5.67 | I(1) |
| Lfpr_Male | -1.05 | -1.30 | -1.68 | -5.08 | I(1) |
| Lfpr_Female | -.07 | -2.60 | -3.51 | -5.03 | I(1) |
| Unemp_Total | -1.73 | -1.88 | -3.63 | -4.97 | I(1) |
| Unemp_Male | -1.65 | -1.67 | -4.61 | -5.14 | I(1) |
| Unemp_Female | -1.86 | -2.48 | -2.85 | -4.75 | I(1) |

Note: The critical values for ADF-GLS (evel) at 1%, 5% and 10% are: -2.64, -1.95, -2.77. The critical values for ADF-GLS (first difference) at 1%, 5% and 10% are: -2.64, -1.95, -1.61.

The Zivot-Andrews unit root tests on various labor market variables from Table 3 reveal significant insights regarding stationarity. For all variables—unemployment and labor force participation rates for total, male, and female populations—the tests at the level indicate non-stationarity. However, when these variables are transformed into their first differences, they demonstrate stationarity. Additionally, structural breaks, identified in different years across these series, imply notable shifts in the labor market. These breakpoints need special attention because they highlight points where significant changes have impacted the behavior of the labor market. One particular breakpoint occurred in the series of unemployment rates during 2006. Figure 1 depicts a sharp decline in the unemployment rate during 2006. This sharp decline indeed represents a structural break. The declining trend in the data was caused by two main factors: (1) as mentioned in the labor force survey 2005-2006, around 4.9 million people got jobs during the two years, resulting in a significant decline in the unemployment rate. (2) there was a revision of the estimation methodology of unemployment during the year 2006. These factors might have caused the structural break in unemployment during that particular period.

**Table 3: Unit Root with Structural Break Results (Zivot-Andrew)**

| Variable | Break (Intercept) Level | Break (Intercept) First Difference | Break (Trend) Level | Break (Trend) First Difference | Break (Both) Level | Break (Both) First Difference |
|---|---|---|---|---|---|---|
| Unemp_Total | -4.404 (2006) | -6.812 (2004) | -2.914 (2012) | -6.413 (2007) | -3.943 (2006) | -7.107 (2006) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Unemp_Male | -3.889 (2006) | -6.223 (2005) | -2.365 (2012) | -5.666 (2007) | -2.623 (2006) | -6.510 (2006) |
| Unemp_Female | -4.867 (2006) | -8.692 (2003) | -4.040 (2012) | -8.222 (2007) | -4.414 (2006) | -8.444 (2008) |
| Lfpr_Total | -3.410 (2005) | -6.016 (1996) | -2.963 (1995) | -5.645 (1998) | -3.527 (1996) | -6.209 (2017) |
| Lfpr_Male | -4.267 (2005) | -7.134 (2005) | -2.200 (2012) | -6.081 (2007) | -4.311 (2005) | -7.266 (2005) |
| Lfpr_Female | -3.653 (2016) | -6.618 (2016) | -3.092 (2014) | -6.299 (2010) | -3.898 (2009) | -7.314 (2016) |

Note: Critical Values for the Zivot-Andrews unit root test with a structural break are as follows: For Intercept: 1%: -5.34, 5%: -4.80, 10%: -4.58. For Trend: 1%: -4.93, 5%: -4.42, 10%: -4.11. For Both: 1%: -5.57, 5%: -5.08, 10%: -4.82.

Johansen's cointegration procedure (1988, 1991) determines the long-run relationship between labor force participation and the unemployment rate separately for aggregate data and gender-specific data. Johansen's cointegration procedure provides two complementary tests (trace and the maximum-eigenvalue) statistics to determine the long-run relationship in the model. The estimated value of the cointegration test is reported in Table 3. The trace and the maximum-eigenvalue statistics show no significant long-run relationship for aggregate data.

The cointegration test between unemployment and labor force participation rate is also performed separately for males and females. The result of Johansen's cointegration test by gender is also presented in Table 3. The gender comparison also shows no long-run relationship between labor force participation and the unemployment rate for both genders. These findings are also consistent with the results obtained using the aggregate data.

**Table 3: Cointegration Test**

| | **Aggregate** | | **Male** | | **Female** | |
|---|---|---|---|---|---|---|
| Hypothesized No. of CE(s) | Trace Statistic | Max-Eigen Statistic | Trace Statistic | Max-Eigen Statistic | Trace Statistic | Max-Eigen Statistic |
| None | 15.39963 | 13.36638 | 13.22475 | 12.41662 | 14.68884 | 13.12436 |
| At most 1 | 2.033256 | 2.033256 | 0.808129 | 0.808129 | 1.564484 | 1.564484 |

Notes: Lag lengths in the VAR (in levels) are selected using the SIC and AIC criteria

Considering the trends of total and gender-wise unemployment and labor force participation rates, there is a strong possibility that the long-run effect of labor force participation on the unemployment rate is affected by structural breaks. Gregory and Hansen's (1996) cointegration (GH) determines the possibility of the long-run relationship while incorporating the structural breaks in the models. The results of the GH cointegration model are presented in Table 4. According to the findings, the Null hypothesis of no cointegration cannot be rejected in each case. Therefore, it can be concluded that the unemployment rate does not depend on Pakistan's labor force participation rate.

**Table 4: Gregory and Hansen Cointegration**

| Variables | **C** | Break | **C/T** | Break | C/S | Break Date |
|---|---|---|---|---|---|---|
| All | -4.51 | 2006 | -4.50 | 2005 | -4.44 | 2006 |
| Male | -4.29 | 2005 | -4.44 | 2005 | -5.31 | 2015 |
| Female | -4.37 | 2004 | -4.50 | 2004 | -5.27 | 2009 |

Note: critical values at the 5% level are -4.61, -4.95 and -5.50, respectively.

## 4. Conclusion

The relationship between unemployment and labor force participation has theoretical and empirical significance in labor and macroeconomics. However, empirical evidence of the relationship between the two indicators is scarce in Pakistan. This study contributes to the empirical literature by providing evidence of the validity of the unemployment invariance hypothesis in Pakistan across genders. The results show no long-run relationship between the labor force participation rate and the unemployment rate in Pakistan. These findings also hold for gender-specific data. These findings are in contrast to a number of studies related to developed countries such as Österholm (2010) Sweden; Emerson (2011) for the United States; Liu (2014) for Japan; Tansel and Ozdemir (2018) and Janko (2022) for Canada. However, these findings align with several studies on developing countries such as Romania and Turkey (see Tansel et al., 2016; Arisoy, 2018; Otoiu and Titan, 2015). The findings confirm that the unemployment rate does not depend on the labor force participation rate in the country. One implication of these findings is that the policies increasing the labor force participation rate (especially the female labor force) will have a negligible effect on reducing the unemployment rate in Pakistan. The findings of this study should be helpful for policymakers as they contribute to our understanding of how the labor market of Pakistan functions and the protentional of the current labor market policies in Pakistan. Finally, as future research direction, one particular issue that needs attention is the revisions in the estimation methodologies, especially in the case of employment and unemployment rates. There is a strong need to assess the implications of these revised methodologies in determining the unemployment rate in Pakistan.

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