Unemployment Invariance Hypothesis and Added Worker Effect: Philippines' Labor Force Determinants

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***Abstract**: This paper investigates the link into the unemployment rate and labor force participation rate for male and female cohorts in the Philippines from 2000-2020, using the Johansen cointegration test and ordinary least squares. Empirical findings for the Johansen cointegration test show that the labor force participation rate is influenced by the unemployment rate, which disproves the unemployment invariance hypothesis. The ordinary least squares find no quiddity of the added worker effect. This study provides other key variables for the labor force participation in the Philippines—lastly, this paper layout policy recommendations for addressing the unemployment rate.*

***Keywords**: added worker effect, economic growth, education, labor force participation rate, unemployment invariance hypothesis, unemployment rate.*

1. Introduction

One of the primordial functions of the labor market is to match the right set of workers fitting into the correct group of jobs. Impediments, however, may arise, thereby causing friction in the pairing process of workers to jobs. Over the years, the business cycle constantly shaped workers' reallocation by smoothing the transition between labor market participants during economic expansion. Conversely, periods of recession may pose additional tension concerning labor supply allocation (Carrillo-Tudela et al., 2015). Labor force participation has been constantly regarded as a critical component in determining a country's production and growth capabilities. However, there exists an intriguing phenomenon among economists regarding whether the unemployment rate affects the labor force participation rate in the long run.

Moreover, disparity among labor market findings has created a semblance that unemployment rates can cause upticks in the labor force participation rates. A contradiction such had been refuted over time. Hence, variations in the labor supply over the business cycle have been a constant ground of in-depth study for economists and policymakers.

The association between the unemployed and workforce participants has gained attention since the 1970s. Curiosity began when OECD countries registered varied unemployment and workforce participation rates; specifically, Sweden remained with a low unemployment rate despite other OECD countries exhibiting the opposite (Osterholm, 2009). The long-run link between the unemployment rate and the labor force participation rate is the Unemployment Invariance Hypothesis, as cited by Liu (2012) from the work of Layard et al., 1991. It is assumed that in the long run, the labor force participation rate is constant and that variations in unemployment fail to trigger changes in the former. As such, unemployment rates will not affect the labor force participation rate. The unemployment variance hypothesis has been extended to include labor force size, productivity level, and capital stock.

Meanwhile, the behavior of the labor market toward unemployment during recessionary periods has been studied for decades. Such a phenomenon is recognized as the added worker effect. Alon et al. (2020), as cited in Lundberg (1985), introduced the notion of the added worker effect, a worker joining the labor force to mitigate their spouse's unemployment. Concurrently, studies have shown that AWE is significantly present in a recession. Its ideology is that the unemployment rate increases because the primary provider loses his job. Therefore, other family members will step up to find a job. Recent studies have also acknowledged the added worker effect (AWE). Hardoy and Schone (2014) defined the added worker effect as a projection that when family members lose their job and regard such a negative income shock, individuals from the same household would seek employment to augment household labor supply. Moreover, AWE is one of the oldest labor market phenomena in literature (Cardona-Sosa et al., 2016), as Woytinsky (1940) had early allegations regarding "additional workers" in measuring unemployment.

Furthermore, other aspects could affect labor force participation, namely economic growth, and education. According to Tasseven (2017), gross domestic product affects labor force participation positively. In contrast, Ustabaş and Gülsoy's (2017) findings stated the inverse relationship between the said variables. Aside from this, education also plays a factor in the labor market, as Mujahid (2012) stated that there would be an increase in participation and productivity with higher education; this was also supported by the study of Tasseven (2017).

The researchers aim to investigate if there exists an interplay

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between the unemployment rate and labor force participation rate in connection with the unemployment invariance hypothesis and added worker hypothesis. Moreover, this study will center the analysis by including the sexes. Using quarterly data from 2000 to 2020 from the Labor Force Survey (LFS) of the Philippines Statistics Authority (PSA), the key creator of data for the Philippines' labor force participation rate, unemployment rate, educational attainment, and gross domestic product per capita (constant 2018 prices).

This study contributes to the existing literature in labor economics, mainly in understanding the implications of the unemployment invariance hypothesis. Our main contribution to the literature is estimating the relationship between unemployment, gross domestic product per capita (constant 2018 prices), educational attainment, and worker's participation in the Philippines. In this way, this paper would scrutinize if the variables had a significant relationship in the long run, to determine if there are underlying conditions for added worker effects to persist in Philippines' labor force. Moreover, this paper would like to be an instrument for policymakers to make policies targeted to solve gender-based unemployment should the UIH be rejected in the Philippines. Furthermore, identifying which sex group appears to be vulnerable to unemployment can facilitate better government action to cushion the effects of such gender-based unemployment and, by extension, find ways to help those affected by the added worker effect to retain their employment status.

2. Literature Review

A. Unemployment Invariance Hypothesis

The unemployment invariance hypothesis (UIH) has been a constantly disputable topic amidst economists due to its varying results depending on the country's labor force composition. The unemployment invariance hypothesis deals with the linkage established by the variables unemployment rate and labor force participation rate. Primarily, it contends that the unemployment rate does not affect the labor force participation rate, in the long run. Emerson (2011) published that the United States does not exhibit the behavior linked to the unemployment invariance hypothesis when he conducted the Johansen cointegration test. Furthermore, he proposed that the absence of the UIH links the labor force participation rate to the unemployment rate, and as a result, changes made in reference to the numbers of unemployed resulted in variations with labor market participation. Moreover, Emerson (2011) found that as the unemployed increases, the number of people in the workforce expands as well. Hence the added worker effect applies for female cohorts in the United States for the study period.

Similar to Emerson's (2011) findings regarding the UIH were that of Liu (2014) for the regional perspective of Japan's labor force with added worker effect for the labor force of Tokai, Tohoku, Kinki, Hokkaido, and Chugoku, Gumata and Ndou (2017) for South Africa found discouraged worker effect. Apergis and Arisoy (2017) in the United States and Osterholm (2010) in Sweden found a discouraged worker effect, and Tansel and Ozdemir (2018) and Janko (2022) for Canada found AWE for male cohorts and DWE for female counterparts. Yildirim (2014) challenged that the added worker hypothesis exists for only better-educated women in Turkey. Moreover, recent studies from Nemore et al. (2021) have observed added worker effect for male and female in Italy. Altuzarra et al. (2018) stated that there is a discouraged worker effect for female cohorts alone in Spain.

Contrary to the studies above, studies have shown that the UIH is supported, establishing no linkage between the unemployed and labor force participants. Cheratian and Goldtabar (2022) found evidence in Iran for females in 20 out of 25 provinces, the same as Janko (2022) in Canada, while

Table 1
Summary of unemployment invariance hypothesis and added worker effect results

Country/Author	Period	Aggregate	Male	Female
Sweden, Osterholm, 2010	1970MI-2007M4	Reject DWE	Reject DWE	Reject DWE
USA, Emerson, 2011	1948M1-2010M2	Reject AWE	Reject DWE	Reject AWE
Japan, Kakinaka and Miyamoto, 2011	1980M1-2010M12	Reject DWE	Reject DWE	Nonreject
Japan (Hokkaido, Tohoku, Southern Kanto, Tokai, Kinki, and Chugoku) Liu, 2014	1983-2010	Reject AWE	-	-
Turkey, Yildirim, 2014	1989Q1-2012Q2	-	-	Non reject (less-educated)
Romania, Otoiu and Titan, 2015	1996Q1-2012Q2	Non reject	Non reject	Non reject
Australia, Nguyen, 2016	1978M2-2014M12	Non reject	Non reject	Non reject
South Africa, Gumata and Ndou, 2017	2001Q1-2016Q1	Reject DWE	Reject	Reject
USA, Apergis and Arisoy, 2017	1976-2014	Reject DWE	Reject DWE	Reject DWE
Canada, Tansel and Ozdemir, 2018	1976-2015M12	Reject DWE	Reject AWE	Reject DWE
Spain, Altuzarra et al., 2018	1987Q2-2016Q4	Non reject	Non reject	Reject DWE
Italy, Nemore et al., 2021	1998Q1-2019Q3	Reject AWE	Reject AWE	Reject AWE
Canada, Janko, 2022	1975M01-2019M12	Reject DWE	Reject AWE	Reject DWE
Iran, Cheratian and Goldtabar, 2022	2005Q2-2019Q2	-	-	Non reject

Yildirim (2014) supports the hypothesis for less-educated women in Turkey. Nguyen (2016), Oṭoiu and Ṭiṭan (2015), as well as Altazurra et al. (2018) for Australia, Romania, and Spain respectively have also supported the effect of the UIH but only for aggregate and male data within the setting of the studies. (See Table 1 for the conclusion of results.)

B. Added Worker Effect

Alon et al. (2020), as cited in Lundberg (1985), similar to Ahmed, M. (2016) introduced the notion of the added worker effect (AWE), a worker joining their respective labor force as a response to their spouse's job loss. Turk and Ak (2019) similarly highlighted that the added worker hypothesis, during a recession, is always higher because of the unemployment status of the primary provider. This is an essential part wherein the spouse must enter the labor force to respond to the demands of their family in times of recession. Furthermore, Hardoy and Schone (2014) defined the AWE as a projection that when family members lose their job and regard such a negative income shock, individuals from the same household would be enticed to join the labor market. Moreover, AWE is among literature's oldest labor market phenomena (Cardona-Sosa et al., 2016). Lastly, the AWE is defined as a flow into unemployment when a wedded woman enters in the workforce when her partner exits (Mankart & Oikonomou, 2016 & Guner et al., 2021) and Speltzer (1997) challenged that AWE is least seen in period of boom, while it becomes popular in economic turmoil.

C. Evidence of the Added Worker Effect

Cammeraat et al. (2021) supported the presence of AWE in the Netherlands. The unemployment of male partners, which resulted in an annual gross income decline, exhibited a small, positive, and statistically significant AWE on average. Furthermore, in the United Kingdom, male cohort's shifting towards the unemployed status is in no way responsible for the rises of aforementioned variables. Thus, male added worker effect is most likely observed in the U.K. at the aggregate level than in the U.S. (Razzu & Singleton, 2016).

Extending the analysis, the AWE for couples suffering from financial constraints and less educated ones is stronger; hence, the negative income shock paired with financial constraints influences the labor market decision of spouses (Ayhan, 2015).

Galecka-Burdziak and Pater (2015) tested AWE and DWE to determine whether the two prevail in the Polish labor market. In this context, DWE refers to the positive recurrence of the participation rate to the gross domestic product and its countercyclicality to the rate of unemployment. In comparison, the latter result provided contrasting results. The 1994-2014 quarterly data analysis results indicated that AWE persists in most business cycle frequencies. This finding is proven applicable to males and females, whereas the effect is more robust in contractions. During downturns, DWE prevails, proving the heterogeneity of labor force behavior over the cycle despite its rare occurrence. Studies from Gromadzki (2019) and Congregado et al. (2021) confirmed the presence of AWE and DWE in the Polish labor market.

A study by Turk and Ak (2019) tested if the AWE and DWE applied in the countries mentioned earlier during the crisis. The calculations proved that DWE was observed in Ireland, Great Britain, and Portugal. In contrast, the AWE was seen in Greece, while Italy and Spain exhibited the dominance of AWE over DWE. Similar to this is the claim of Lee and Paranis (2014) that DWE is rampant in developed countries while AWE dominates in the latter, leading to an increase in the LFP during the rise of unemployment.

Furthermore, Ghignoni and Veraschagina (2016) stated that the AWE weakened over time due to the partner's changing perception of the labor market changes. It has been found that at the onset of the crisis, women responded more to the decrease in earnings, and it was only in the latter part of the crisis that they responded to job loss. Likewise, such phenomena existed for Bryan and Longhi (2018). Studies from Gush et al. (2015) and Cardona-Sosa et al. (2016) have opposite findings wherein investigations revealed that in the setup of the British labor market, if the income shock is regarded as unwelcome and is not anticipated, in the long-run couples would then remain the same, maintaining the division of labor before income shock and the latter proved that increased AWE is due to income reduction.

Hardoy and Schone (2014) focus on the presence of the AWE in Norway, known for higher female participation rates, and the welfare benefits are abundant. Considering the above average labor force participation of female cohorts, results have shown that the spouse's job loss coincided with the counterpart's job loss. The negative income shock targeted the couples, damaging the labor supply. Hence, no presence of AWE was found. Similar to Hardoy and Schone (2014), no presence of the AWE was reported by Mork et al. (2020), Fuchs and Weber (2017) for the female cohort in Germany, and Tansel and Ozdemir (2018) for Canada's female cohort. Bredtmann et al. (2014) highlighted that the AWE may or may not resurface due to the state's unemployment benefits system and social security assistance in play for the unemployed, limiting women's participation since the condition is present to mitigate income shock from husbands' unemployment. Bredtmann et al. (2017) investigated the AWE by conducting an international comparative analysis to scrutinize the different states of the effect across Europe, particularly in 28 welfare regimes. Upon utilizing the linear data, from 2004-2014, results have shown the presence of AWE, yet still varies in terms of business cycles and the different welfare realities of each country. Additionally, the variation may be explained by the distinction in unemployment benefits, resulting in various incentives that wives attain in place of their spouse's unemployment. Like Alon et al. (2020), women are significantly affected by employment loss and have higher unemployment rates in response to COVID-19 shocks. Mankart and Oikonomou (2016) have documented that in the last three decades, it has been observed that the AWE increased. The increase was explained through the continuous disparity in gender pay, variations in human capital trade, and the interference of labor cost participation of women.

Conversely, the discouraged worker effect (DWE) has seen

the inverse in terms of added worker effect. As such, job finding becomes taxing, leading to the refusal of job search, leading to lower labor force participation. As Lizares and Bautista (2020) mentioned, the discouraged worker effect will stop job search due to multiple failed job search activities, thus diminishing the chances of upticks in the total workforce participation.

D. Labor Force Participation Rate

Aside from unemployment, labor force participation can be significantly affected by different factors shaping a particular labor market. Education, trade liberalization, multiple job holdings, the business cycle, culture, age, and gender. These are just some variables that can change an area's labor force participation rate; hence one can assume that the workforce participation rate is immune to internal and external shocks.

There are multiple reasons for a person to resort to various job holdings despite the business cycle's stage. Hirsch et al. (2016) highlighted that workers choosing multiple jobs could be a form of insurance to the former partly due to the primary job's nature of volatility concerning long-term employment status or income level. Additionally, it was recognized that workers choosing multiple job holdings is a form of security for financial stability for temporary labor market circumstances that may or may not plague the primary job. Hirsch et al. (2016) claimed that U.S. workers hold multiple jobs, equivalent to 5 percent of total U.S. workers. The study of Hirsch et al. (2016) promulgated that 1994-2014, in which an economic expansion and two recessions can be found, showed no relationship between national unemployment and multiple job-holding rates over such a period. The business cycle significantly affects couples' incentive to hold multiple jobs. In periods of recessions, where income decreases and employment is at stake, supply-side forces can lead to an increased desire to hold multiple jobs; however, the demand side of the labor market must be recognized as well.

E. Labor Force Participation Rates and Gross Domestic Product

Concurrently, GDP in member states of Euro 17 fell during the first year of the Great Recession, spanning from 2008 to 2009. However, the negative effect of the GDP decline was not harmonious for the rest of the region, as Southern Europe suffered more extensively than others. Italy, Spain, Greece, and Portugal suffered the most and recorded the highest unemployment rate in the Euro 17 (Baldini et al., 2014). Such presentation by Baldini et al. (2014) was also portrayed by Mork et al. (2020) as well as Khitarishvili (2013).

Serrano et al. (2019) used harmonized household surveys from 1987 to 2014 of all Ibero-American countries to establish causal relationships between the gross domestic product and labor force participation to check the driving factors that affect female LFPR in Latin America. This paper proves that female labor force directly responds to gross domestic product per capita's movement, while the inverse applied in the short-term. It was apparent that other women would worry less because they would not need to enter the labor force to seek substandard jobs. But on the contrary, it may produce low productivity among females, making them less efficient in working in the future. These results take advantage of maintaining the traditional household where wives are to remain at home, while the husbands work. This negatively affects the females to participate in the labor trade to seek employment.

Furthermore, it has been established that changes in the workforce composition could shape economic growth. Hence, Kasa and Alpetekin (2015) said that after examining Turkey's labor force participation, the result was that men's LFPR is higher compared to women's. Most women work in rural areas with unpaid family status; hence, they are less common in urban areas. Participation rates increased in E.U. and OECD countries but declined in Turkey. Although Turkey has grown economically, they have been left behind the world regarding LFPR. In the findings, a cointegration relationship has been detected between economic expansion and female LFPR. Some studies resulted in a "U" relationship which means that increases in W-LFPR happened briefly, yet eventually it gives us a reverse pattern (Akyuz & Dogan, 2017).

F. Labor Force Participation Rates and Gender

As cited in the analysis of Hardoy and Schone (2014), Norway, Denmark, and Sweden topped in terms of female participation rates among OECD members. Similarly, Cammeraat et al. (2021) had similar observations for the Netherlands. On the contrary, Norway's leading female participation rates in the OECD countries may pose a more significant threat to households as couples may be targeted negatively by the income shock rendering little room for labor supply adjustments (Hardoy & Schone, 2014). Kabeer (2015) said that as seen in a high unemployment or under-employment levels, the number of female labor force participation arises. Women had more opportunities to find employment even when men could not because they were willing to work at least for the bare minimum to reciprocate and ensure that household needs were met. And therefore, female cohorts' probability to join the labor market increases when business cycles are not that good and increase their numbers to supply the needs of their families. Turk and Ak (2019) also say the same.

Gender-based labor participation has been challenged in the Philippine labor market context. Mainly, female cohorts' participation has been the center of an in-depth analysis of why it has been constantly lower than that of their counterparts. The results of Lizares and Bautista (2020) provided that female cohorts' workforce participation from 1990 to 2015 had been constant, in contrast to the increase experienced by Indonesia, Malaysia, and Singapore. Primarily, the low female labor force participation was attached to childbearing and rearing, unpaid household work, and intra-household allocation.

Majority of females in the Philippines gets employed in vulnerable sectors (Su et al., 2018). Through this, they are less likely to be employed and to have an existing decent job and government assistance (Albert and Vizmanos 2017). Moreover, Su et al., 2018 specified that in over 200 countries, in the Philippine context, one-tenth of the population is employed. Therefore, Filipinos have become the most globalized workforce, and female workers outgrew the immigration of

male workers. As such, the correlation of gross domestic per capita and female LFPR of the Philippines is imprecise.

Philippines' unemployment status is one of the most critical problems and indicators of the economy's weakness. It is a key indicator because it indicates the ability or inability of workers to gain work and contribute to the output of the economy (Mortera et al., 2022). In the context of the Philippine Economy between 1987 - 2018, the results have found that the female unemployment rate strongly correlates to labor force participation (female), inflation rate, and government final consumption expenditure, which proved the multi-linear regression. But the impending results also show that a drop in the labor force participation rate among females will decrease the unemployment rate (females), which accepted the null assumption that there is no causal relationship between these variables in the Philippines.

G. Labor Force Participation and Education

Baldini et al. (2014) found that the transition to employment is not the same for everyone in Italy, as those having higher educational attainment posted a higher transition probability. Furthermore, Degirmenci and Ilkkaracan (2013) stated that academic achievement affects the likelihood of females in labor market outcomes. University graduate homemakers with ages ranging from 20-45 years old had the highest chance of transition. Meanwhile, high school graduates with similar demographics only registered a lower likelihood. On the other hand, couples with low educational attainment and suffering from financial constraints had a stronger drive to transition (Ayhan, 2015).

For the Philippines, Lizares and Bautista (2020) reported that educational attainment is positively related to workforce participation; as such, upticks in reference to educational attainment of the individual posed an increased likelihood to become labor force participants. Results varied as college graduates posted the highest probability of actively participating in the labor force, followed by high school graduates, then elementary graduates. In contrast, college undergraduates were negatively associated with workforce involvement because of the DWE. The findings of Choudhry and Elhorst (2018) viewed educational attainment as negatively related to destitute countries when studied using female involvement in the workforce. A positive relationship was seen in high-income countries. While Shittu and Abdullah (2018) found female education to be both positive and negative, no causal evidence was found when education and workforce involvement was paired. It was established in the study of Epetia (2019) that women are more educated than men. Yet, women had fewer chances of being employed and had a higher chance of working in poor conditions. Moreover, women posted a higher likelihood of pursuing education, hence male cohorts had higher labor force engagement. Further, men were found to be indifferent to educational attainment in viewing labor force participation. Conversely, women prioritize finishing college before entering the labor force. Thus, women had higher workforce engagement towards retirement than men's early labor force participation.

This study will be built upon two hypotheses. First, it is assumed that the unemployment invariance hypothesis does not exhibit an independent relationship between the unemployment rate and the labor force participation rate in the Philippines. Second, there is no added worker effect in the Philippines.

H. Problems Encountered

Most of the studies cited came from foreign countries, while the Philippines lacked studies on the unemployment invariance hypothesis that defines the Philippine labor market context. As such, comparisons within the Philippine labor market situation cannot be made. On the other hand, reporting standards have changed repeatedly from 2000 until 2020. Thus, consistency in the way the data were reported became a challenge. Specifically, with the advent of October 2003, the National Statistics Authority, now known as the Philippine Statistics Authority (PSA), implemented changes that are still in use until 2020.

Like most of the studies provided in the literature review, Layard et al. (1991) emphasized that there is no linkage found between the unemployed and the labor market participants. The LFPR will remain constant as the UER varies. Meanwhile, it is assumed that the gross domestic product and education will exhibit a positive relationship to the LFPR; hence as the gross domestic product per capita (constant 2018 prices) and educational attainment increases, the LFPR mimics the increase.
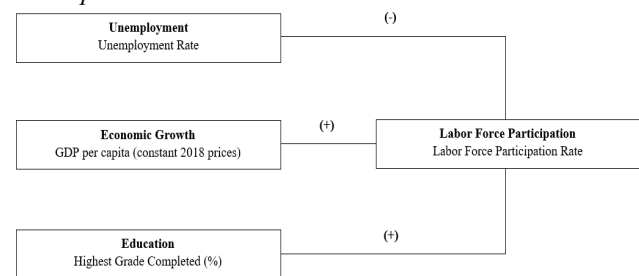
I. Conceptual Framework

Fig. 1. Research Simulacrum

Figure 1 shows the research simulacrum, which was heavily based on the study of Layard et al. (1991) regarding the unemployment invariance hypothesis, aggregately supported by Oţoiu and Ţiţan (2015), Nguyen (2016), and Cheratian and Goldtabar (2022) in linking labor force engagement and unemployment. Meanwhile, association between LFP and GDP is found on the exploration conducted by Baldini et al. (2014), Mork et al. (2020), Khitarishvli (2013), Serrano et al. (2019), and Tasseven (2017). The direct bond between educational attainment and workforce involvement was based on the studies of Mujahid (2012), Degirmenci and Ilkkaracan (2013), Ayhan (2015), Lizares and Bautista (2020), Choudry and Elhorst (2018), Shittu and Abdullah (2018), and Epetia (2019). As mentioned in the literature review, they were derived from coping with the stipulation of the study. Moreover, this would scrutinize causal link among the variables.

Table 2
Data Presentation

Variables	Indicator	Period	Data Source
Labor Force Participation	Labor Force Participation Rate	2000-2020	Philippine Statistics Authority
Unemployment	Unemployment Rate	2000-2020	Philippine Statistics Authority
Economic Growth	GDP per caiital (Constant 2018)	2000-2020	Philippine Statistics Authority
Educational Attainment	Highest Grade Completed (%)	2000-2020	Philippine Statistics Authority

3. Research Method

A. Research Design & Analysis

The research design used in this paper is quantitative and descriptive, which will result in the analysis and interpretation of the relationship among the variables. The empirical method is used in most studies that analyze and investigate the unemployment invariance hypothesis in different countries. Varying results depend on the various countries' labor market mechanisms (See Table 1 for the summarized results). Furthermore, in this context, the researchers aim to assess the dynamics between labor force participation and its determinants, such as unemployment, gross domestic product per capita, and education in the Philippine setting. The primary statistical tool used is the Eviews software to perform the tests on the variables.

B. Data Collection Techniques

Table 2 shows the data collected from the Philippine Statistics Authority, including the labor force participation rate, unemployment rate, gross domestic product per capita (constant 2018 prices), and percentage of employed persons by highest grade completed from the Philippine Statistics Authority for the period 2000 to 2020. Quarterly data will be utilized in this study. Such data were obtained via the Philippine Statistics Authority's website.

According to the Philippine Statistics Authority, persons in the labor force are persons 15 years old and over who are either employed or unemployed in the reference week. The reference week is defined as the past seven days before the date of the interviewer's visit. Unemployed persons are those without work, currently available for work within two weeks from the interview date or actively seeking employment, or not seeking work due to tiredness, awaiting results of job application, temporary illness, bad weather, and waiting for rehire. This paper will use the unemployment definition adopted in April 2005. Meanwhile, GDP per Capita (constant 2018 prices) was defined as the GDP divided by the midyear population. Educational attainment will be measured as the highest grade completed, declared in percentage.

C. Econometric Model

Most of the literature regarding the hypothesis, like the studies of Layard et al. (1991), Oţoiu and Ţiţan (2015), Nguyen (2016), Kakinaka and Miyamoto (2011), Yildirim (2014), Altuzarra et al. (2018), and Cheratian and Goldtabar (2022) have used the function wherein the dependent variable is the labor force participation (LFPR) while the independent variable is unemployment (U.E.). In this context, the researchers have added another independent variable outside the unemployment invariance hypothesis, Economic Growth (GDP) and

Educational Attainment, to find out what other factors aside from the unemployment rate can affect labor force participation in the Philippines.

$$LFPR_{it} = a_{it} + \beta_1 UER_{it} + e_{it}$$

$$LFPR_{it} = a_{it} + \beta_1 GDP_{it} + \beta_2 EDU_{it} + e_{it}$$

Wherein the subscripts *i* and *t* refer to the gender and time, respectively. The variables that will be used in the study are measured as follows; LFPR is the labor force participation rate of the country (%), UER is unemployment rates (%), and GDP is GDP per capita (constant 2018 prices). EDU is the percentage of employed persons by highest grade completed rate (%).

Such model and variables are to be tested to validate their suitability to the model: To examine the time-series properties of the data, (1) Unit-roots of the time-series data by ordinary least squares; (2) Johansen Cointegration to determine whether there is cointegration among the variables and investigate if the hypotheses are not invalid and (3) Jarque-Bera test to test the data for normality, (4) Chow breakpoint test for structural breaks in the series, (5) Ramsey RESET test for specification errors, (6) Wald test for dependence of the independent variables, (7) White's Heteroskedasticity for heteroskedasticity and; (7) Variance Inflation Factors for multicollinearity.

4. Results and Discussion

In investigating the long-run relationship between the labor force participation rate and unemployment rate, the following estimation techniques were applied to the study, specifically utilizing the Johansen cointegration test, ordinary least squares, unit root tests, heteroskedasticity white's test, Jarque-Bera test, Wald test, Chow Breakpoint test, and Ramsey RESET test.
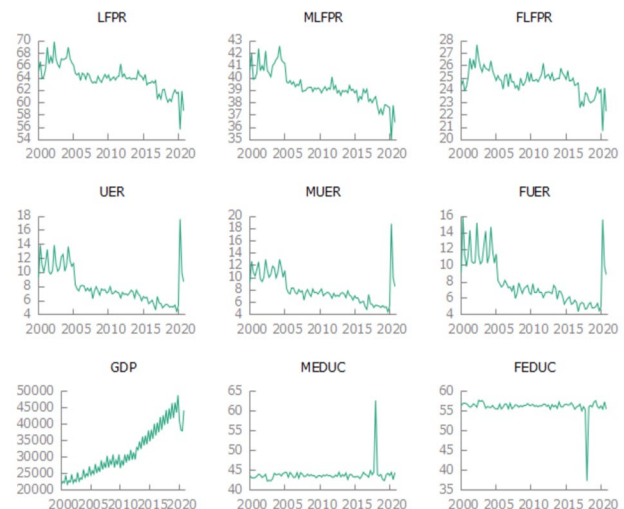

Fig. 2. Trend summary of variables

Figure 2 shows that the labor force participation rate of the Philippines was in a constant downward trend from 2000 to 2019 and was accompanied by a sharp decline in 2020 due to the global recession caused by the COVID-19 pandemic. For the unemployment rate, the Philippines had a shared experience of a constant downward trend, with a sudden uptick for the year 2020, still due to the global recession, which took away employment opportunities for the majority. Meanwhile, the gross domestic product per capita (in constant 2018 prices) exhibited an uptrend from 2000 to 2019, and a significant dip in 2020 was attributed to the COVID-19 pandemic.

Male labor force participation from 2000 - 2019 displayed a downward trend and plummeted to its lowest in quarter 2 of 2020 but regained an upward momentum by the third quarter of 2020. The same can also be observed for female labor force participation. Conversely, the male and female unemployment rates presented a constant downward trend and shifted upward by 2020, which was credited to the COVID-19 recession.

Table 3 summarizes the results of different unit root tests performed for female education, male education, female LFPR, male LFPR, female UER, male UER, GDP, LFPR, and UER. The variables female education and male education had no unit root both for at level and first difference, making the series stationary. With a p-value of less than 0.05, we reject the null hypothesis of having a unit root. male UER had no unit root for all three levels passing the threshold of having a p-value less

than the 5% confidence level. Hence, we reject the null hypothesis of having a unit root. On the other hand, female UER had no unit root for the first and second differences, pegging the p-value of less than 0.05, thereby rejecting the null hypothesis of having a unit root. Meanwhile, female LFPR and male LFPR had no unit root for the first and second differences by having a p-value of less than 0.05. Therefore, we reject the null hypothesis of having a unit root. Similar behavior was observed for the variables LFPR and UER. Conversely, the Log of GDP also had no unit root at the second difference.

Table 4 above shows that the variables are cointegrated. The results for the Johansen cointegration test presented above showed that the at-level values of male UER, the first difference of the variables female LFPR, female UER, male LFPR, and LFPR are cointegrated. This indicates a long-run relationship between the dependent variable LFPR, and the independent variable, UER, which are the critical variables in looking into the unemployment invariance hypothesis. The Johansen trace and maximum eigenvalue tests rejected the null hypothesis of no cointegration for this specific series of variables.

The unemployment invariance hypothesis contends that the unemployment rate is independent of the labor force participation rate. Furthermore, changes in the unemployment rate will not trigger changes in the labor force participation rate. In line with the results of the trace and maximum eigenvalue tests, we find statistical evidence to reject the null hypothesis of

Table 3
Summary of unit root tests

Variable	At level	Prob.	At 1st diff.	Prob.	At 2nd diff.	Prob.
EDUC FEM	-8.490268	0.0000	-11.01050	0.0001	-11.10501	0.0001
EDUC MALE	-8.489226	0.0000	-11.10462	0.0001	-6.758431	0.0000
LFPR	-1.402449	0.6208	-16.53747	0.0001	-6.699844	0.0000
LFPR MALE	-1.445536	0.5560	-16.36324	0.0001	-10.71788	0.0001
LFPR FEM	-1.765974	0.3947	-16.80555	0.0001	-8.182683	0.0000
GDP	-1.402449	0.5771	-2.450811	0.0001	-24.6347	0.0001
UER	-1.796642	0.3797	-10.74989	0.0001	-10.22424	0.0001
UER FEM	-1.781388	0.3872	-11.46486	0.0001	-11.4966	0.0001
UER MALE	-4.261534	0.0010	-10.74989	0.0001	-10.05274	0.0000

Table 4
Johansen cointegration test for the unemployment invariance hypothesis

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of C.E. (s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.698762	318.615	95.75366	0.0000
At most 1 *	0.663574	222.627	69.81889	0.0000
At most 2 *	0.561591	135.477	47.85613	0.0000
At most 3 *	0.423412	69.50860	29.79707	0.0000
At most 4 *	0.241144	25.4584	15.49471	0.0012
At most 5	0.041406	3.38298	3.841465	0.0659

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level
** MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of C.E. (s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.698762	95.9885	40.07757	0.0000
At most 1 *	0.663574	87.15008	33.87687	0.0000
At most 2 *	0.561591	65.96826	27.58434	0.0000
At most 3 *	0.423412	44.05017	21.13162	0.0000
At most 4 *	0.241144	22.07546	14.2646	0.0024
At most 5	0.041406	3.382979	3.841465	0.0659

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level
** MacKinnon-Haug-Michelis (1999) p-values

the unemployment invariance hypothesis. Hence the unemployment invariance hypothesis does not apply to the Philippines. With this, we can infer that for the Philippines, changes in the unemployment rate will result in changes in the labor force participation rate, as demonstrated by the cointegrating relationship of the variables and as proven by the Johansen cointegration test. Furthermore, we can deduce that since the unemployment rate is not invariant in the Philippines, specific measures targeted to shock the unemployment rate will cause changes in the labor force participation rate of the country.

Such similarities were also found by Emerson (2011) when he used the unemployment rates and labor force participation rates of males and females and the total unemployment and labor force participation rates in the United States. Moreover, Liu (2014) also found a cointegrating relationship using similar variables utilized in this series and found that the unemployment invariance hypothesis does not apply in Hokkaido, Tohoku, Southern Kanto Tokai, Kinki, and Chugoku, Kakinaka and Miyamoto (2011) published that the unemployment invariance hypothesis does not apply in male workers of Japan upon utilization of kindred variables found in this series. Similarly, Osterholm (2010) concluded that the unemployment invariance hypothesis does not apply to Sweden's male and female cohorts. Tansel and Ozedmir (2018) and Gumata and Ndou (2017) concluded that the unemployment invariance hypothesis does not apply in Canada and South Africa, respectively, after using the aggregate labor

Table 5
Johansen cointegration test for other determinants of labor force participation

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of C.E. (s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.904089	304.6020	69.81889	0.0000
At most 1 *	0.480942	119.4000	47.85613	0.0000
At most 2 *	0.365571	67.59649	29.79707	0.0000
At most 3 *	0.201470	31.64918	15.49471	0.0001
At most 4 *	0.161080	13.87555	3.841465	0.0002

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level
** MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of C.E. (s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.904089	185.2021	33.87687	0.0000
At most 1 *	0.480942	51.80349	27.58434	0.0000
At most 2 *	0.365571	35.94731	21.13162	0.0002
At most 3 *	0.201470	17.77363	14.26460	0.0134
At most 4 *	0.161080	13.87555	3.811465	00002

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level
** MacKinnon-Haug-Michelis (1999) p-values

Table 6
OLS results and diagnostic test results

Variable	Coefficient	Std. Error	t-statistic	Prob.
Constant	0.014222	0.036062	0.394393	0.6944
D(FEMALE_LFPR)	0.987028	0.016938	58.27447	0.0000
D(FEMALE_UER)	-0.005975	0.019815	-0.301535	0.7638
D(MALE_LFPR)	1.000741	0.019676	50.86138	0.0000
MALE_UER	-0.001937	0.004300	-0.450438	0.6537
D(UER)	0.005312	0.021206	0.250488	0.8029

R-Squared	0.997180	Mean dependent var	-0.077108
Adjusted R-squared	0.996997	S.D dependent var	1.540710
S.E. of regression	0.084437	Akaike info criterion	-2.030674
Sum squared resid	0.548982	Schwarz criterion	-1.861218
Log likelihood	90.49709	Hannan-Quinn criter.	-1.965827
F-statistic	5444.918	Durbin-Watson stat	2.738524
Prob(F-statistic)	0.000000	Jarque-Bera	3.641834
		Prob(Jarque-Bera)	0.161877
F-statistic	1.092239	Prob. F(20,62)	0.3802
Obs*R-squared	21.62469	Prob. Chi-Square(20)	0.3612
Scaled explained SS	24.89209	Prob. Chi-Square(20)	0.2056
F-statistic	0.221139	Prob. F(6,71)	0.9688
Log likelihood ratio	1.536774	Prob. Chi-Square(6)	0.9570
Wald Statistic	1.326835	Prob. Chi-Square(6)	0.9702

	Value	df	Prob.
t-statistic	0.022259	76	0.9823
F-statistic	0.000495	(1,76)	0.9823
Likelihood ratio	0.000541	1	0.9814

force participation and unemployment rates.

Table 5 above shows that the variables are cointegrated. The results of the Johansen cointegration test revealed that the second difference of the Log of GDP per capita, actual values of male and female education, the first difference of male and female LFPR, and male and female UER are cointegrated. The Johansen trace and maximum eigenvalue tests rejected the null hypothesis of no cointegration for this specific series of variables. Based on the results, the LFPR depends on the independent variables of GDP per capita (constant 2018 prices) and education.

Baldini et al. (2014), Mork et al. (2020), Khitarishvili (2013), Kasa and Alpetekin (2015), Serrano et al. (2019), and Akyuz and Dogan (2017) established that a relationship exists between the labor force participation rate and gross domestic product per capita (constant 2018 prices). Baldini et al. (2014) concluded that when GDP per capita dropped during the great recession, which plagued employment opportunities, the labor force participation of Euro 17 plummeted and established that the decline was not harmonious across regions. Mork et al. (2020) and Khitarishvili (2013) supported the findings of Baldini in their respective areas of study. Meanwhile, Serrano et al. (2019) pointed out that female LFPR in Latin America demonstrated a positive relationship with GDP per capita and had seen an increase in GDP per capita while female labor force participation followed the upward trend. Kasa and Alpetekin (2015) and Akyuz and Dogan (2017) inferred that aggregate labor force participation had a substantial effect on Turkey's GDP pivoting the latter to attain economic growth. However, specific disparities in the area of labor participation proved that females are often placed in unpaid labor.

Meanwhile, the level of education has been exhibiting a relationship with the labor force participation of both cohorts, as proven by the studies of Baldini et al. (2014), Ayhan (2015), and Lizares and Bautista (2020). Baldini et al. (2014) elaborated that having higher educational attainment posted a higher chance of being part of the labor force, while Ayhan (2015) purported that low education attainment poses risks to labor participation for both cohorts. For the Philippines, Lizares and Bautista (2020) found a relationship between educational attainment and labor force participation, wherein increases in the former transformed into an increase in the likelihood of labor participation. Choudry and Elhorst (2018), on the other hand, pointed out that low-income countries such as the Philippines demonstrated a negative relationship between women with low educational attainment and labor participation, while high-income counterparts achieved the opposite.

Table 6 above shows that the female LFPR and male LFPR are positively significant at a 5% confidence level to the dependent variable D(LFPR).

The female LFPR was computed at 0.987028. According to the results, there is a significant positive relationship between the female LFPR and aggregate LFPR. Due to the direct relationship of the variables mentioned, as the female LFPR increases, aggregate LFPR will increase by 0.987028. This direct relationship can be drawn from the composition of the aggregate labor force participation rate, which consists of the female and male LFPR. Since the female LFPR is positively correlated, the independent variable will cause an increase in the aggregate LFPR, which is the dependent variable in this model. Meanwhile, male LFPR was pegged at 1.000741. In connection with the results, there is a significant positive relationship between the male LFPR and aggregate LFPR. The existing causal relationship between the variables tested causes a 1.000741 increase in the aggregate LFPR. As with the female LFPR, an increase in the male LFPR will posit an increase in the aggregate LFPR since the composition of the aggregate LFPR involves that of the male and female labor force participation rates. According to Hirsch et al. (2016), labor participants will naturally seek more labor participation if they feel that their main job is threatened by external factors such as but not limited to unemployment and unfavorable labor force participation conditions. This explains why increases in the female and male LFPR resulted in an aggregate increase in LFPR.

On the other hand, male and female UER had an insignificant negative effect on the dependent variable, LFPR since their p-value is more significant than the 5% confidence level. Female UER posted a value of -0.005975. Based on the findings, as female UER decreases, the aggregate LFPR decreases by 0.005975. Meanwhile, male UER was computed at -0.001937. This calculated result indicates that as the male UER decreases, the aggregate LFPR decreases by 0.001937. From this, we can infer that the negative relationship exhibited by male and female UER fails to conform with the behavior of the added worker effect. The added worker effect tells us that increases in the unemployment rate should increase the labor force participation rate. This positive dimension is caused by the additional workers that enter the labor force when others attain unemployment. Hence, the added worker effect views the unemployment and labor force participation rates positively related. However, the contrary was found based on the output.

In this regard, the male and female UER had a p-value greater than alpha. They found conclusive evidence of failure to reject the null hypothesis of the added worker effect in the Philippines. These findings put to rest the investigation of the presence of added worker effect in the Philippines and place forth that the added worker effect is not present for male and female cohorts of the Philippine labor force. Several findings of the added worker effect being not current were published. Specifically, Emerson (2011), Liu (2014), Nemore et al. (2021), and Gumata and Ndou (2017) rejected the presence of the added worker effect for both cohorts.

Moreover, Table 6 shows that the Durbin-Watson p-value is greater than alpha, indicating no autocorrelation. In White's test for heteroskedasticity, the p-values are greater than the alpha, concluding that there is no heteroskedasticity in the regression output. The normality of the residual had a p-value of 0.16, which is greater than the alpha. This supports that the data is normally distributed. This also coincides with Kim (2016), and Das and Imon (2016). For the Chow breakpoint test, the p-values are greater than the alpha, confirming that the series is stable. Lastly, the Ramsey RESET test's p-values are greater than the alpha. Hence no specification error was found in the

regression output.

Table 7
Variance inflation factors

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
Constant	0.001300	15.13913	NA
D(DLOG(GDP))	0.000287	2.495955	2.493817
D(MALE_LFPR)	0.000393	19.91073	19.91071
D(FEMALE_LFPR)	0.000387	2.836628	2.855088
EDUC_MALE	1.85E-05	15.36407	1.231972
EDUC_FEM	0.000450	20.865518	20.86491

Table 7 above shows that there is no multicollinearity in the regression output.

The results presented in Table 8 are consistent with Table 6, which showed that female LFPR and male LFPR are positively significant at a 5% confidence level to the dependent variable D(LFPR). Due to the direct relationship, as male LFPR and female LFPR increase, aggregate LFPR will increase by 1.017710 and 0.976278, respectively. From this, it can be said that Hirsch et al. (2016) support this result, as mentioned in the results of Table 6.

In contrast, log GDP per capita, male education, and female education are considered to have a contrasting relationship with the mentioned dependent variable. Moreover, the gender-specific education variables negatively correlate with the aggregated dependent variable, pegged at 0.557945 for males and 0.560029 for females. Log GDP per capita has computed results that indicate that as it decreases by 0.061125, the same goes for the aggregate LFPR. Moving forward, we can infer that the negative relationship demonstrated among the variables fails to confirm that they are aggregate labor force participation rate determinants. Education remained insignificant. This is in lieu of the study of Choudhry and Elhorst (2018), stating that education is insignificant to female labor participation in low-income countries like the Philippines. This is also supported by the study of Epetia (2019), stating that men are indifferent to educational attainment concerning their labor participation. In addition, Serrano et al. (2019) have proven that cyclical and trend components of GDP per capita negatively affect participation rate, especially in the case of female LFPR. To conclude, the overall results do not have a hypothesis to test as this is only supplementary to the study, investigating the determinants of the labor participation rate.

Table 8 also shows the absence of autocorrelation and heteroskedasticity, as seen in Durbin-Watson and White's test. With the Jarque-Bera result of 0.13, the data is concluded to be normally distributed, supported by the studies of Kim (2016) and Das and Imon (2016). Lastly, the series is considered stable with no specification error demonstrated by the Chow breakpoint test and Ramsey RESET test.

Table 9
Variance inflation factors

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
Constant	17565.48	2.17E+08	NA
D(DLOG(GDP))	0.003206	1.236420	1.236346
D(LFPR_MALE)	0.000368	2.795729	2.774464
D(LFPR_FEM)	0.000266	2.483677	2.480618
EDUC_MALE	1.756214	41949882	101935.2
EDUC_FEM	1.756899	68576078	101948.3

Table 9 also shows that there is no multicollinearity in the regression output.

Table 8
OLS results and diagnostic test results

Variable	Coefficient	Std. Error	t-statistic	Prob.
Constant	-55.90894	132.5348	-0.421843	0.6743
D(DLOG(GDP))	-0.061125	0.056618	-1.079601	0.2837
D(LFPR_MALE)	1.017710	0.019194	53.02114	0.0000
D(LFPR_FEM)	0.976278	0.016309	59.86055	0.0000
EDUC_MALE	0.557945	1.325222	0.421020	0.6749
EDUC_FEM	0.560029	1.325481	0.422510	0.6738

R-Squared	0.997375	Mean dependent var	-0.097561
Adjusted R-squared	0.997202	S.D dependent var	1.538813
S.E. of regression	0.081400	Akaike info criterion	-2.108524
Sum squared resid	0.503575	Schwarz criterion	-1.932422
Log likelihood	92.44948	Hannan-Quinn criter.	-2.037822
F-statistic	5774.235	Durbin-Watson stat	2.694783
Prob(F-statistic)	0.000000	Jarque-Bera	4.039130
		Prob(Jarque-Bera)	0.132713
F-statistic	0.780535	Prob. F(17,64)	0.7078
Obs*R-squared	14.08151	Prob. Chi-Square(17)	0.6613
Scaled explained SS	17.05705	Prob. Chi-Square(17)	0.4505
F-statistic	1.081534	Prob. F(6,70)	0.3820
Log likelihood ratio	7.269655	Prob. Chi-Square(6)	0.2966
Wald Statistic	6.489201	Prob. Chi-Square(6)	0.3707

	Value	df	Prob.
t-statistic	0.185473	75	0.8534
F-statistic	0.034400	(1,75)	0.8534
Likelihood ratio	0.037602	1	0.8462
t-statistic	-0.4211843	76	0.6743
F-statistic	0.177952	(1,76)	0.6743
Chi-square	0.177952	1	0.6731

5. Conclusion

The main objective of this research is to determine the relationship between the independent variable (unemployment rate) and dependent variable (labor force participation rate) at aggregate and gender-specific levels using quarterly data from 2000-2020 lifted from the Philippine Statistics Authority. With the assistance of Eviews and Gretl software, the study determined the relationship between the unemployment rate and labor force participation rate via the Johansen cointegration test. The ordinary least square result provided insight into the added worker effect in the Philippines. Furthermore, the researchers also aim to have a supplementary finding of the determinants of labor force participation using independent variables (education and GDP per capita).

Summarizing the tests' findings, this paper fails to reject the added worker effect null hypothesis. It proves the absence of added worker effect in the Philippine labor force. This means that increases in unemployment failed to translate to a rise in labor force participation. The results also corroborated the variance of labor force participation and unemployment after using the Johansen cointegration test. Thus, the unemployment invariance hypothesis does not apply in the Philippines, anchored to the rejection of the null hypothesis of the unemployment invariance hypothesis. Therefore, it implies that unemployment and labor force participation rates exhibit a relationship. Hence changes in the unemployment rate will merit a difference in the labor force participation rate. Moreover, it has been found that in this study, the variables that only determine aggregate LFPR are gender-specific labor participation, leaving educational attainment and GDP per capita insignificant and having no adverse effect on the dependent variable.

This study aimed to contribute to the Unemployment Invariance Hypothesis and Added Worker Effect literature which the researchers disproved in the Philippines. One of the major bottlenecks that the researchers stumbled upon is limited studies conducted to provide insights into the presence of UIH and AWE in non-OECD countries, particularly in the Philippines. For further related studies, the researchers suggest adding more independent variables to have heterogenous results instead of gender-based ones, as demonstrated in the findings. This would help them focus more on relevant hypotheses related to the current state of the labor market in the country.

This paper addresses the need to mitigate unemployment in the Philippines. As proven in the results of the UIH exhibiting a relationship, policies created to lower unemployment will translate into higher labor force participation in the country. Short-term solutions of the Department of Labor and Employment, such as the Special Program for the Employment of Students (SPES) and Community-Based Employment Program, should be continued to address the need for employment substantially. Since unemployment will not have a trickle-down effect on labor force participation, in the long run, policymakers are challenged to provide further jobs that will be sustainable in the long run, as the results indicate short-term shocks only. Long-term solutions are favored, such as expanding the services the Technical Education and Skills

Development Authority provides to infuse the labor force with the required skills to help them retain employment amidst economic shocks. The non-existence of the added worker effect in the country could also be exemplary for the policymakers as this also means that there are underlying factors as to which people eligible to work are discouraged from entering the labor force. Hence, policies should be focused on the encouragement of workers to enter the labor force permanently.

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