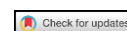





LINKING INFLATION DIFFERENTIAL ACROSS REGIONS TO UNEMPLOYMENT IN THE PHILIPPINES



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ABSTRACT

Article History

Received: 19 June 2018

Revised: 12 July 2018

Accepted: 19 July 2018

Published: 24 July 2018

Keywords

Inflation
Differential
Unemployment
Region
Union
Flexibility.

JEL Classification:

E020, J310, J680

We examine and econometrically test for the link between inflation differential across regions and unemployment in the Philippines from 2005 to 2017. Using optimal currency areas as a theoretical basis, this study sets up the Philippines as a currency union and regions as member countries which experience shocks idiosyncratically with the expectation that inflation differential across regions negatively correlates with national unemployment when wage flexibility acts as an adjustment mechanism. Using ordinary least squares estimation and the average of square differences in regional inflation from the mean as a measure for inflation differential across regions, we find that a unit increase in inflation differential across regions decreases the unemployment rate by 0.22 percentage points, indicating that wage flexibility acts as an adjustment mechanism against adverse idiosyncratic shocks in the Philippines. Interestingly, inflation is positively correlated with unemployment even when controlling for supply side shocks in the form of oil price inflation, suggesting that the Phillips curve was not present in the Philippines from 2005 to 2017. The study uses heteroscedasticity-and-autocorrelation-consistent standard errors and tests for unit roots and robustness to ensure the validity of its estimates.

Contribution/ Originality: This study contributes to the existing literature on inflation and unemployment by testing whether or not the spread in inflation rates between the Philippines' administrative regions has an effect on the national unemployment rate and by using optimal currency area theory to explain such a link if it exists.

1. INTRODUCTION

The unemployment rate in the Philippines has historically been high compared to its neighboring economies, reaching about twice as much of other ASEAN countries (e.g. Singapore, Myanmar, and Vietnam). While this could partly be due to adverse shocks experienced in the market, institutional constraints that impede adjustment mechanisms also play a significant role in its persistence (Montalvo, 2006).

Since Mundell's seminal work on optimal currency areas, there has been a growing consensus that wage and price flexibility can be effective instruments in addressing high unemployment rates in the context of a monetary union (Gali, 2012; Abbritti and Mueller, 2013; Arestis and Sawyer, 2013). Policy options consistent with this framework are already in place and have been empirically tested in other countries.

However, recent policy reforms in the Philippines seem to deviate from this direction (e.g. minimum wage, mandatory employment benefits). This trend is of particular concern when taking the context of the country into consideration: a geographically diverse nation consisting of 17 regions subject to distinct shocks and a single currency.

The Central Bank of the Philippines (CBP) functions as the Philippines' central bank and is conventionally tasked with the conduct of monetary policy that is binding to all regions. Therefore, the institution's policy direction has the potential to influence wage, price, and unemployment dynamics of both the entire nation and its subnational units.

Inflationary pressures brought about by a series of economic policy episodes have largely instigated the shifts in Philippine macroeconomic regimes that spanned five decades. From maintaining exchange rates in the 1950's and 1960's to the reorganization of the central bank before the new millennium, the issue remained relevant in the minds of lawmakers and economists alike, especially due to its strong link with economic growth and employment.

It was only in 2002 that the Central Bank of the Philippines (CBP) decided to adopt an inflation-targeting policy with the primary objective of promoting price stability in the country: a strategy which (Paderenga, 2013) considers "useful" as the explicit declaration of a policy regime helps reduce uncertainty in an economy. This reduction results from the provision of concrete targets for which the public's expectations can converge to as well as a scorecard that enables authorities to gain credibility.

According to the Central Bank of the Philippines (2017) price stability is a universal goal shared by monetary authorities across the globe as it allows both households and firms to plan ahead and arrive at sound consumption, investment, saving, and production decisions. This has been supported by substantive quantitative studies which reinforce the view that inflation adversely affects long-run economic growth (Yap, 1996).

As the poor often do not have real or financial assets, it is also seen as a way to address income inequality by protecting their purchasing power and allowing them to hedge against price increases (CBP, 2017). In fact, under Republic Act 7653, also known as the New Central Bank Act, price stability is identified as a key factor in achieving inclusive and sustainable economic growth, a goal that has long eluded the country's economic landscape. Therefore, although inflation targeting is the BSP's primary focus, it still maintains coordination with other government agencies to make sure that its actions are in accordance with other economic goals.

In a developing country like the Philippines, economic growth is sometimes seen as the holy grail of macroeconomics as it is thought to address the incessant concerns of poverty and unemployment which have plagued the country for a considerable amount of time now. Although both have generally been decreasing, they are still relatively high with poverty incidence and unemployment rate estimated at 21.6 % as of 2015 and 5.3% as of January 2018, respectively.

Poverty reduction has been in the mainstream of Philippine politics (and economics) since the signing of the Millennium Declaration in September 2000, prompting a myriad of public and private institutions to create strategies to aid in its realization. It is a conventional belief that economic growth affects poverty reduction as the former creates opportunities that can help the poor in improving their lot (Parel, 2014). Such opportunities include, but are not limited to, more favorable market conditions and improved public services (Todaro, 1997).

Evidence across and within countries, however, do not necessarily support this claim for all instances. This seems to suggest that economic growth per se is insufficient in combating poverty. An equal weight must also be given to the nature of growth: whether or not it allows redistribution and longevity of created opportunities. Perhaps this is the very reason why the BSP characterizes the type of desired economic growth as both "inclusive" and "sustainable".

Broad-based poverty reduction also appears in the BSP's set of objectives. This reflects the institution's commitment to cover all sectors, regions, and populations in delivering its mandate. This is of particular importance because a large percentage of the poor is engaged in agricultural activities such as farming, fishing, and swine

raising. Therefore, broad-based poverty reduction could entail investments in market research, infrastructure development, and value-added processing activities (McKay and Summer, 2008).

Like poverty, unemployment is also believed to be inversely related with economic growth. This tradeoff is commonly known in economics as “Okun’s law”, named after the economist Arthur Okun. As mentioned above, economic growth can create opportunities which allows more people to be employed and, intuitively, less unemployment.

Poverty and unemployment hinder economic development, making it imperative to implement sound economic policies that can address both effectively. This serves as a significant factor for the rationale behind the current inflation-targeting regime of the BSP. However, apart from assessing the effectiveness of a particular policy action, equal importance must be given to discovering the precise reasons behind these two major issues the country is facing.

From 2002 to 2008, economic disparities among the different regions of the Philippines have actually contributed to the persistence of increasing poverty even in periods of economic growth (Reyes and Tabuga, 2011). Population growth is also generally thought to exacerbate the issue. Being the 12th most populated country in the world with over a hundred million residents, there is often talk about how the Philippines has become overpopulated in recent times.

Such a claim needs to be further dissected as population densities vary across its regions, with “overcrowding” observed in more developed localities. This trend is also often attributed to how the agricultural sector, which remains to be the main source of income for rural dwellers, has lagged behind the industry and services sectors, thereby inducing migration from rural to urban areas (e.g. Metro Manila).

In line with these, there is a need to consider the geographic diversity and labor dynamics present in the Philippines in order to arrive at more nuanced assessments of policy impacts for several, equally important motivations. First, as mentioned above, the Philippines’ geographic context excites curiosity with regard to the desirability and idiosyncratic consequences of choosing an inflation-targeting direction. Second, after more than a decade since the macroeconomic policy regime change, increasing prices and lack of jobs still remain as two of the most pressing concerns of Filipinos (Pulse Asia, 2018). Third, labor market rigidities continue to persist despite considerable contention from various sectors. Lastly, relevant economic variables such as the average CPI inflation, and unemployment rates have historically been varied across regions.

Using optimal currency areas as a theoretical basis, we set up the Philippines as a currency union and its 17 regions as member countries similar to studies conducted by Nagayasu (2010) for Japan, Ramdhani (2015) and Ridhwan (2016) for Indonesia, and Tillman (2011) for Korea. We then econometrically test if unemployment in the Philippines is linked to inflation differential across regions. The level of flexibility in the labor market is interpreted as an adjustment mechanism that potentially determines the movement of both variables considered.

2. REVIEW OF RELATED LITERATURE

The relationship between inflation and unemployment came into the mainstream with the publication of A.W. Phillips’ paper in 1958 which examined the link between the rate of change of money wage rates and the level of unemployment in the United Kingdom. Phillips looked to form some quantitative estimate between the two variables by using indices on the average price of imports and hourly wages, as well as percentage unemployment figures calculated from trade union returns for three (3) time periods: 1861-1913, 1913-1948, and 1948-1957.

By performing least squares estimation, the results showed a clear tradeoff between the rate of change of money wage rates and unemployment, except in or immediately after such years in which a significant and rapid increase in import prices was observed. This can be explained by the tendency of employers to bid wage rates up in order to attract apt labor from other firms and industries during periods when demand for said factor of production is high and unemployment is low. On the flipside, there is less incentive for workers to offer their services at a rate lower

than what is established during periods of high unemployment and low demand for labor, and so wage rates only fall slowly.

Phillips also took note of how the rate of change of retail prices affect the rate of change of money wage rates, which operates through what he identified as the “cost of living adjustments” in wage rates. This cost will have a very marginal effect except when retail prices are driven up by a rapid increase in import prices, which subsequently triggers a wage-price spiral that persists until the rate of increase of import prices drops significantly below a certain critical value.

Phillips’ work gained much prominence in the field and was soon modified by economists to establish a relationship between inflation and unemployment, with results mirroring those of the original work (i.e. there exists an inverse relationship between inflation and unemployment). It is important to bear in mind that the inflation-unemployment tradeoff only exists in the short-run as price and wage adjustments are expected to occur in the long-run (Cacnio, 2012).

The applicability of the Phillips curve theory has been extensively tested in the context of the Philippines, which reflects a prolonged search for a tool that can be used for forecasting inflation and implementing monetary policy (Puzon, 2009). However, results seem to suggest some level of inconsistency in overall findings.

In reviewing literature related to the topic, Cacnio (2012) reported that some studies were able to obtain results that were robust enough to indicate a tradeoff between inflation and unemployment in the Philippines while others observed actual non-existence (e.g. Dua (2006)). Findings from recent literature also show that there has been a weakening of the link between the two variables of interest, which is referred to as the “flattening of the Phillips curve”. This is primarily caused by three factors: (i) implementation of inflation-targeting by the BSP, (ii) globalization, and (iii) the existence of a large pool of excess workers.

Cacnio (2012) clarified that the negative relationship between inflation and unemployment existed in the country in earlier periods, except when there were economic shocks, financial busts, and political crises. However, starting in the early 2000s, this began to weaken and was characterized by increasing/decreasing inflation with a relatively stable level of unemployment.

An investigation of the Phillips curve’s validity was also done by Puzon (2009) for the ASEAN-4 countries, namely Indonesia, Malaysia, the Philippines, and Thailand. Ordinary least squares (OLS), together with the instrumental variable approach, were performed to estimate the relationship between unemployment and inflation, while controlling for the effects of exchange rate and supply shocks.

Spanning from 1980 to 2005, the data included annual consumer price index, money market interest rate datasets supplied by the United Nations Statistical Database (UNSD), and exchange rate defined as “domestic currency per dollar”. In cases when a unit root problem was detected through the Phillips-Perron test, a modified “first-differenced” model was used by the author.

Puzon’s results indicated that there seems to be no stable one-to-one tradeoff between inflation and unemployment for the four countries considered. It was also discovered that variables that could control inflation differed across the four countries. For example, the interest rate and 1997 East Asian Financial Crisis dummy were significant for Indonesia while both were not in the case of Thailand (the inflation lag, unemployment dummy, and oil dummy were significant).

With regard to the Philippines, using OLS resulted in the significance of unemployment lag, interest rate, and exchange rate lag at the 10% level, which supports the Phillips curve theory. However, serial correlation was detected so an alternative method (Prais-Winstein) was employed, which then resulted in a positive coefficient for unemployment that supports the rational expectations theory (i.e. there exists no tradeoff between unemployment and inflation due to instantaneous adjustments/responses to changes in prices and wages by markets).

Brooks (2002) estimated two equations via the co-integration approach with the first specifying employment as a function of real GDP, minimum wage (adjusted through the price index), and seasonals, while the second specified

nominal wage as a function of consumer price index, productivity, unemployment rate, and seasonals. The main findings are: (i) Philippine employment growth is positively related with real GDP growth and negatively correlated with real minimum wage, (ii) unemployment is negatively related with real GDP growth and positively related with real minimum wage, and (iii) minimum wage is positively related with the consumer price index and negatively related with unemployment.

Reyes and Tabuga (2011) looked into the relationship between poverty, economic growth, and inequality by decomposing poverty changes into growth and redistribution effects for two periods (2003 to 2006 and 2006 to 2009). Interestingly, the regression resulted in growth taking a positive estimate, a poverty worsening effect. The implication is that, on average, real income fell with respect to the poverty line. Changes in income distribution, on the other hand, were instrumental in reducing the poverty gap and its severity.

The authors also tested if the observed economic growth from 2002 to 2008 was mirrored in the country's poorest regions, namely the Autonomous Region in Muslim Mindanao (ARMM) and Southwestern Tagalog Region. It was shown that no economic expansion took place in both regions, which suggested that significant growth did not happen where it was badly needed. Two highly-populated regions, Calabarzon and Central Luzon, also experienced economic deceleration.

It was also shown that economic growth favored both the industry and service sectors while leaving the agriculture sector behind by a considerable margin. Poverty even consistently rose during the time when the agriculture sector decelerated, and this affected the rural poor's ability to augment their income. In fact, about 50% of households that experienced decline in real income in 2003 were engaged in agricultural activities. Moreover, majority of households that became poor in 2006 were in the same sector.

Reyes and Tabuga (2011) concluded that, due to being a highly diverse archipelago, the poverty situation for the Philippines as whole is simply a reflection of the net effect of all the region-specific developments. The results of the study may hint that economic growth in the periods considered were neither broad-based nor beneficial to poverty reduction initiatives. Therefore, before an evaluator/researcher examines the relationship between growth and poverty, s/he must first understand where growth did or did not take place.

In a similar study, Parel (2014) tried to determine if household income and expenditure growth were affected by location, access to infrastructure, changes in prices, peace situation, and initial household endowments and saw that their impacts significantly vary across those belonging to different income groups. Other notable results were the following: (i) trickling down of growth was observed to some extent from 2003 to 2006, with the rich benefitting more significantly, (ii) vulnerability and severity of poverty is higher in rural areas as development is often resigned to urban areas, and (iii) there is a need for strong rural-urban linkages in order for rural households to be able to reap the benefits from urban development.

Naromal and Estrada (2013) studied the determinants of regional unemployment in the country from 2005-2011 and investigated if the regions were correlated across time and space using a spatial autoregressive approach. They were able to show that an inverse of Okun's law was present in the regional level at the 5% level significance. In addition, spatial dependence among regions was evident in their analysis. This implied that unemployment rate in one region affects that of its neighboring region.

This part briefly discusses the key policy implications mentioned by the authors (if any) in their respective works. According to Brooks (2002), reduction in unemployment for the Philippines would entail a play between higher economic growth and moderate increases in the real minimum wages. This will require sustained implementation of a comprehensive policy package that focuses on macroeconomic stability, poverty reduction, better governance, and structural reform.

Cacnio (2012) asserted that the flattening of the Phillips curve is a mixed blessing for monetary authorities. On one hand, it implies that higher unemployment won't result in large inflationary movements while, on the other, if

it remains above target then bringing it down to the desired level would require greater variability in employment and output.

Reyes and Tabuga (2011) suggested that future poverty reduction initiatives must have investments in the agriculture sector and should create an enabling environment that will create more and better job opportunities. Finally, Naromal and Estrada (2013) called for the need to understand the causes of regional unemployment and its spatial relationship.

Several recommendations were given by authors that looked into the unemployment-inflation interplay. Phillips (1958) acknowledged that his results were, of course, tentative and thus had the need for “much more detailed” research that delve into the relations between unemployment, wage rates, prices, and productivity. Puzon (2009) suggested having a bigger sample size ($n = 26$ in the study), inclusion of several other variables such as a lag for interest rates, stock prices, and energy/petroleum prices, and consideration of other functional forms (e.g. quadratic, logarithmic). Finally, Brooks (2002) warned that the use of minimum wage may result in weaker statistical results for the wage variable since it is possible that wage-related decisions by firms are not correlated with the given minimum wage.

While there is an abundance of literature on the inflation-unemployment tradeoff, the relationship between inflation differential across regions and unemployment is relatively unexplored. The usual applications of the Phillips Curve theory are generally done on a countrywide scale that can either be interpreted as (i) having an implicit assumption that the impact/s of such a dynamic are equally felt by regions dividing a nation-state or (ii) area-specific inflation differentials are considered to be insignificant or simply overlooked.

3. SEMINAL WORK AND THEORETICAL MODEL

The study's theoretical model for linking inflation differential across regions to unemployment in the Philippines is an adaptation of optimal currency area (OCA) theory, namely of Mundell (1961) suggestion that a country may rely on wage flexibility as an adjustment mechanism against idiosyncratic shocks when it cannot rely on monetary policy, fiscal policy, and labor mobility as adjustment mechanisms. If wage flexibility acts as an adjustment mechanism, the correlation between inflation differential across regions and unemployment is expected to be negative, and if not, there may be a positive correlation or zero correlation. The following graphs in this section are an adaptation of the graphs used in European Parliament (1998) to describe the effect of different adjustment mechanisms to idiosyncratic shocks described in Mundell (1961).

To illustrate, we start by assuming that the Philippines has only two regions, Region 1 (R1) and Region 2 (R2) initially at the same equilibrium price and output level. Suppose that an idiosyncratic shock occurs in the form of an adverse demand shock in R1 which is illustrated in Figure 1. Unemployment increases and the price level decreases in R1, and so the inflation differential between R1 and R2 increases. If the analysis stops here (i.e., the regions simply accept the new equilibrium under this shock), this shows that inflation differential across regions would have a positive correlation with unemployment in the Philippines.

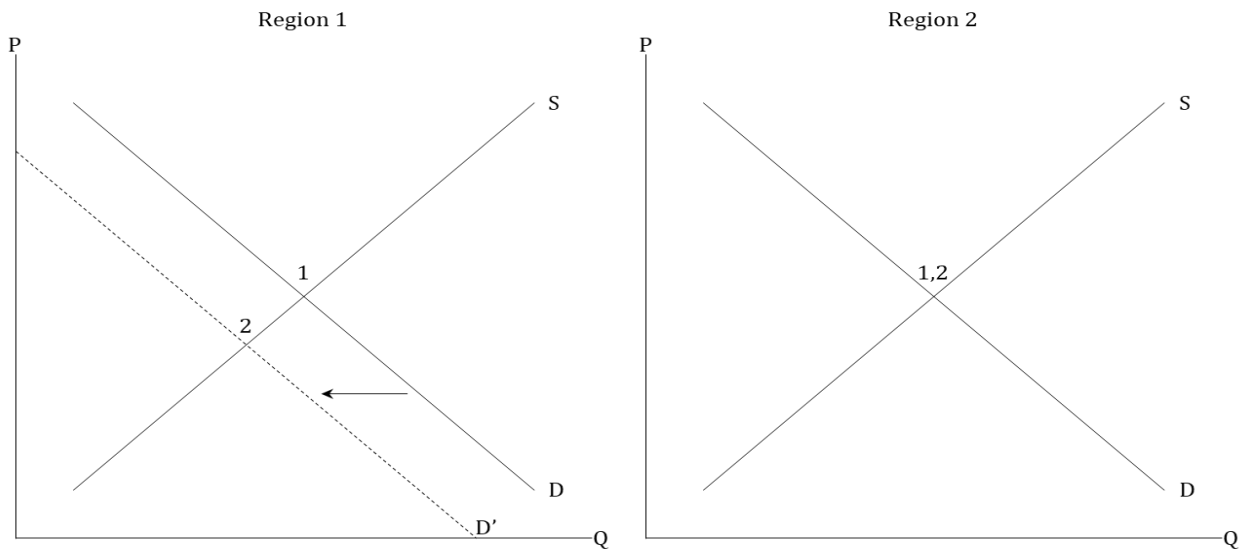


Figure-1. An idiosyncratic shock in the Philippines in form of an adverse demand shock in Region 1.

Suppose we are interested in returning unemployment back down to its pre-shock equilibrium. Expansionary monetary policy is not optimal here. While it brings unemployment back down in R1, it causes higher inflation in R2. Since the vertical distance in equilibrium prices between R1 and R2 remains the same, the inflation differential remains the same as in post-shock, pre-adjustment state, and so we observe zero correlation with national unemployment.

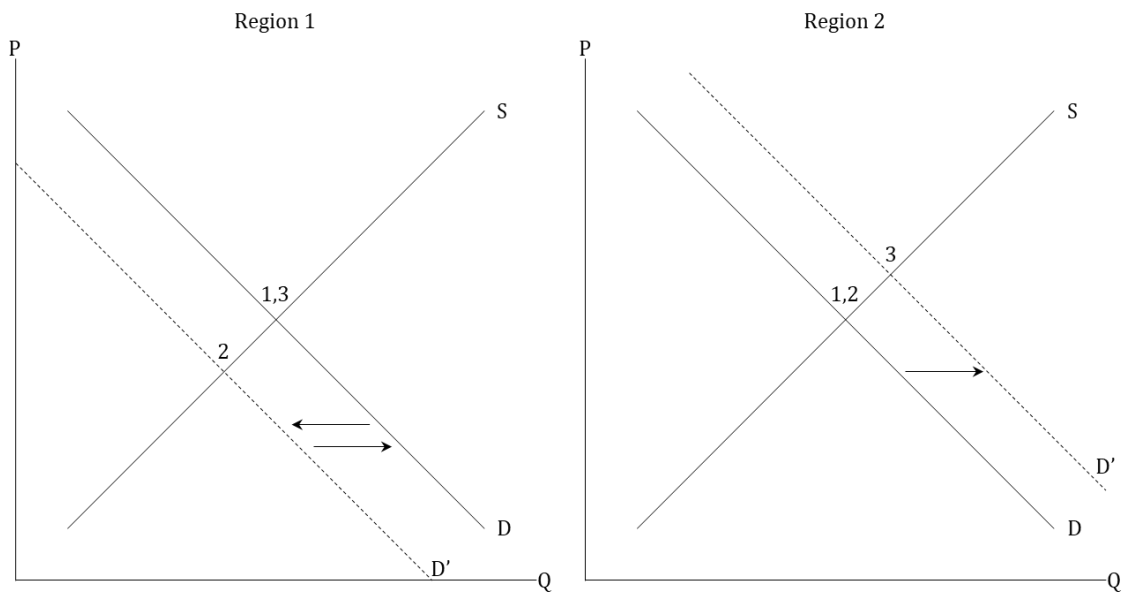


Figure-2. Effect of expansionary monetary on a currency union experiencing an idiosyncratic demand shock.

High labor mobility is an alternative mechanism by which R1 can return to its original unemployment equilibrium as shown in Figure 3. Unemployed laborers from R1 migrate to R2, and this acts as a negative supply shock in R1 and a positive supply shock in R2. In the new equilibrium, unemployment and prices return to pre-shock equilibrium in R1 and prices decline in R2. The inflation differential remains the same as in post-shock, pre-adjustment state, and again we observe zero correlation with national unemployment.

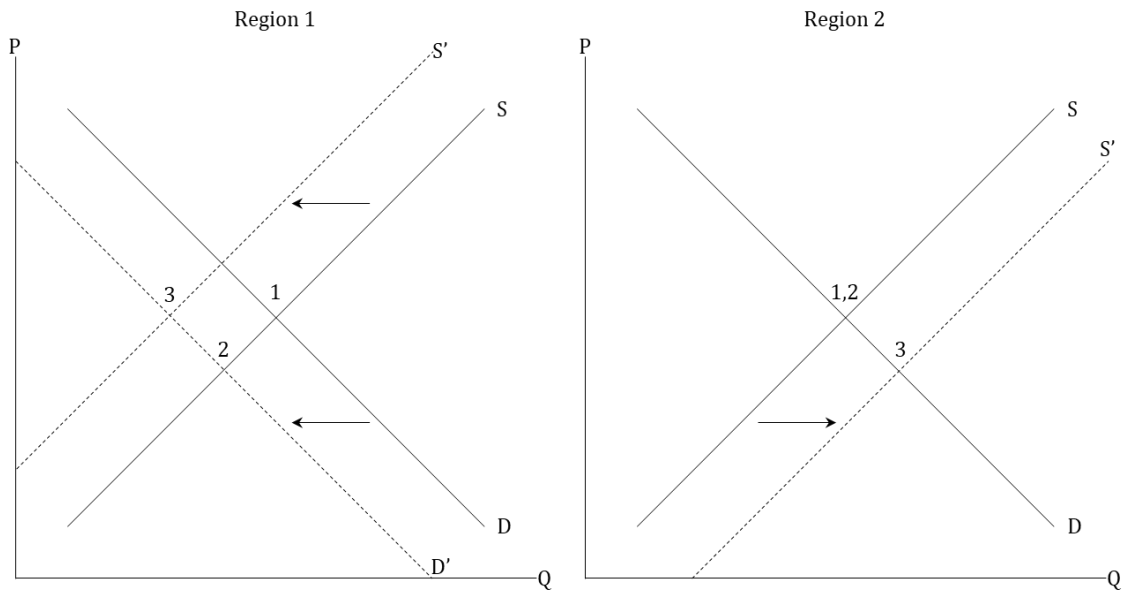


Figure-3. Effect of migration from Region 1 to Region 2 when Philippines experiences idiosyncratic shock.

High wage flexibility is another alternative mechanism by which R1 can return to its original unemployment equilibrium, and the one we are interested in as shown in Figure 4. Workers accept a fall in their nominal wages, and this acts as a positive supply shock. In the new equilibrium, unemployment falls back to its pre-shock level and prices decline even further in R1. This adjustment in R1 has no implications on R2.

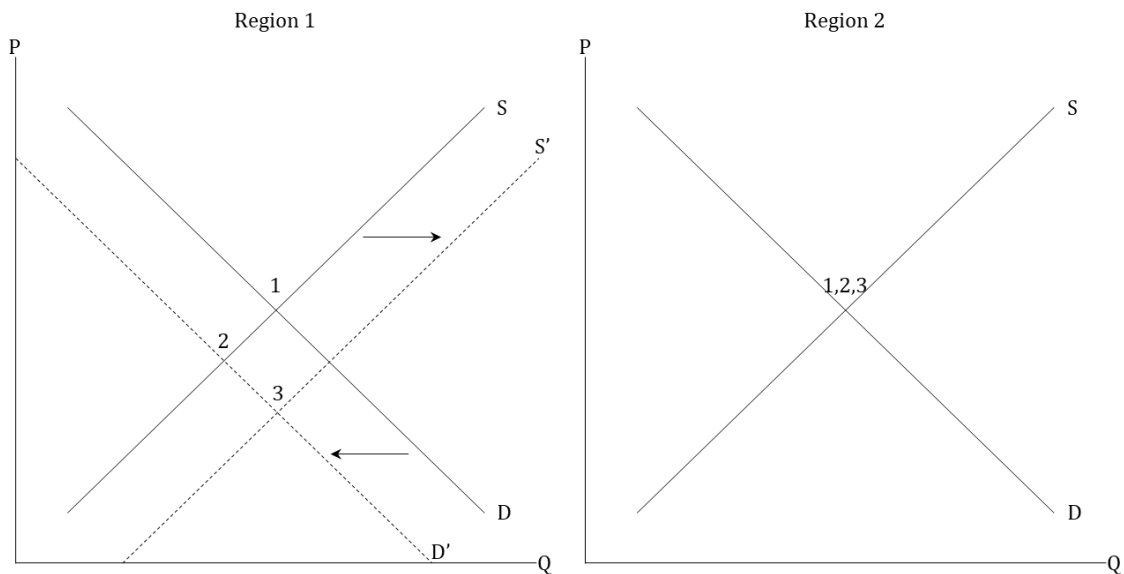


Figure-4. Effect of workers accepting lower nominal wages as Region 1 experiences an adverse demand shock.

In the case where wage flexibility acts as an adjustment mechanism to an adverse idiosyncratic shock, the inflation differential across regions in the Philippines has increased while unemployment has decreased compared to their post-shock, pre-adjustment states, and so the correlation between the two becomes negative. Therefore, if wage flexibility acts as an adjustment tool against adverse idiosyncratic shocks in the Philippines, high inflation differential across regions would be associated with low unemployment.

Figure 5 shows the unemployment rate and inflation differential across regions from 2005 quarter 2 to 2017 quarter 4 in the Philippines. If the theoretical model truly describes the nature of a negative correlation between the two, it may help explain why unemployment did not spike dramatically during Global Financial Crisis (GFC) while

the inflation differential across regions jumped significantly during the same period in that wage flexibility acted as a buffer, and it may also explain the seemingly opposite movements between the two leading up to the GFC and during the Aquino administration in 2010 onwards.

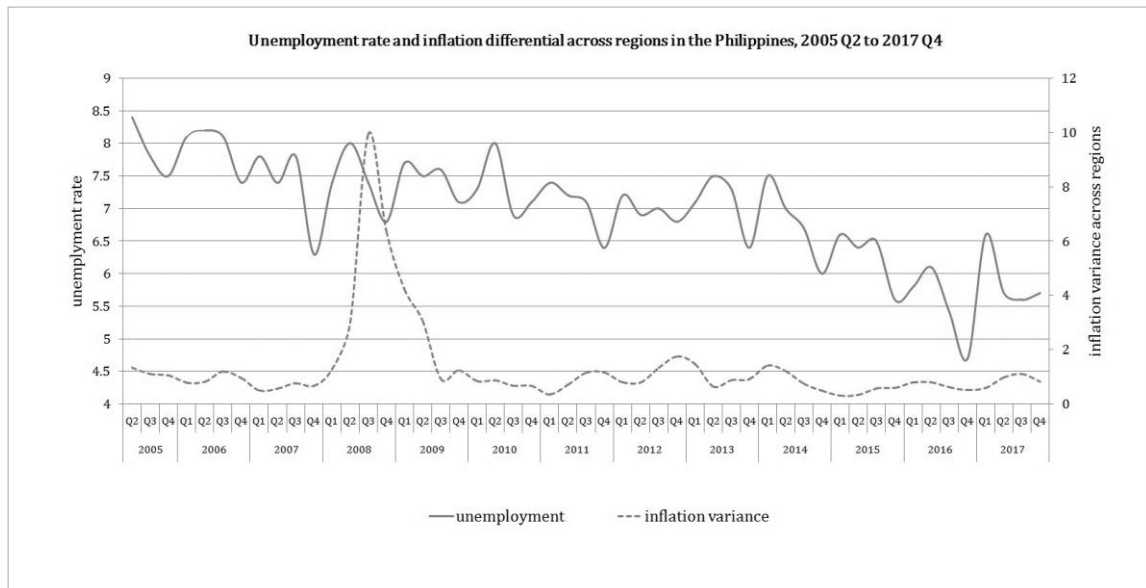


Figure-5. (Note: inflation differential/variance across regions is measured here as the average of squared differences in regional inflation rates from the mean for each quarter using data from the Philippine Statistics Authority)

The next section describes the empirical methodology we use to formally test for the relationship between inflation differential across regions and unemployment in the Philippines.

4. EMPIRICAL MODEL

Following past literature (such as Resurreccion (2014); and Puzon (2009)) on econometrically linking inflation and unemployment in the Philippines, the specified model for linking inflation differential across regions to national unemployment is:

$$unemp_t = \beta_0 + \beta_1 inf_t + \beta_2 infvar_t + \beta_3 pcgrowth_t + \beta_4 infoil_t + \beta_5 q2_t + \beta_6 q3_t + \beta_7 q4_t + \beta_8 gfc_t + u_t$$

Where, for quarter t ,

$unemp_t$ is the national unemployment rate

inf_t is the year-on-year national CPI inflation rate (with base year 2008 quarter 1)

$infvar_t$ is the inflation differential across regions calculated as the average of the squared differences of the regional CPI inflation rates from the mean inflation rate at quarter t , or formally:

$$infvar_t = (1/n) \sum_{i=1}^I (inf_{i,t} - \overline{inf_t})^2$$

Where $inf_{i,t}$ is the inflation rate of region i at quarter t and $i = 1, \dots, I$ regions.

$pcgrowth_t$ is the year-on-year real GDP per capita growth rate (with base year 2008 quarter 1) the effects of population and economic growth on unemployment

$infoil_t$ is the year-on-year inflation of Brent crude oil as a proxy for supply shocks

$q2_t$, $q3_t$, and $q4_t$ are the quarterly dummy variables controlling for seasonal changes in unemployment (e.g., $q2_t = 1$ if t is quarter 2 for its year, 0 otherwise), and

gfc_t is a dummy variable controlling for the effect of the Global Financial Crisis from 2007 to 2009.

4.1. Data

To link inflation differential across regions to national unemployment, this study uses national quarterly data from the Philippine Institute for Development Studies (PIDS) and Philippine Statistics Authority (PSA) for 2005 quarter 2 to 2017 quarter 4, with a total of 51 observations. This is done to expand the number of observations and to account for the new definition of unemployment implemented by the Philippine Statistics Authority (PSA) in April 2005 (PSA, 2012). For this reason, the study uses quarterly dummies in order to control for seasonal changes in national unemployment such as the holiday season in quarter 4 causing an increase in commercial activity or the entry of fresh graduates looking for employment in quarter 2.

Brent crude oil price inflation (calculated using data from the Federal Reserve Economic Data series) is used as a proxy controlling for supply side shocks. From the Phillips curve, the expectation is that inflation (from demand side shocks) follows a negative correlation with unemployment, but supply side shocks may result in a positive correlation as was the case during the 1973 oil crisis. Year-on-year Brent crude oil price inflation is used here, but the type of crude oil used matters little as the prices of different crude oil types tend to move together over time.

4.2. Estimation Method: Ordinary Least Squares

Given that the assumption of homoscedasticity rarely holds in economics (Stock and Watson, 2018) this study anticipates heteroscedasticity in the error term. Heteroscedasticity was also found in Resurreccion (2014) study on inflation and unemployment in the Philippines from 1980 to 2009. Moreover, this study anticipates the presence of serial correlation (autocorrelation), a common issue with time series data where the error term correlates with itself over time, often in adjacent periods (Williams, 2015). These two issues do not affect the unbiasedness or consistency of ordinary least squares (OLS) estimators, but they violate the assumption of constant variance in the error term necessary for efficient estimators in OLS, resulting in invalid tests for significance if they are present and not controlled for.

To confirm the presence of heteroscedasticity and serial correlation, this study first estimates the model using OLS and in post-estimation performs the Breusch-Pagan/Cook-Weisberg test for heteroscedasticity and the Breusch-Godfrey test for higher-order serial correlation up to four lags given the quarterly nature of the data and given that serial correlation is common in the form of the error term correlating with itself in adjacent periods in annual data.

Units roots may also be present. Given a discrete-time stochastic process $\{y_t, t = 1, \dots, \infty\}$ written as an autoregressive (AR) process of order p :

$$y_t = \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + \dots + \alpha_p y_{t-p} + \varepsilon_t$$

A unit root exists if the following condition is satisfied:

$$m^p - m^{p-1} \alpha_1 - m^{p-2} \alpha_2 - \dots - \alpha_p = 0 \quad m = 1$$

If the outcome variable and variables of interest contain unit roots, conducting OLS without controlling for this may produce invalid estimates known as “spurious regression results” (Granger and Newbold, 1974) characterized by high R^2 and high t -statistics. That is, the outcome and independent variables seem to have statistically significant relationships because they move in the same or opposite directions over time even if in reality they may not have a relationship with each other.

Therefore, this study runs modified augmented Dickey-Fuller (ADF) autoregressive (AR) unit-root tests proposed by Elliott *et al.* (1996) on the dependent variable and variables of interest. This test dominates other

existing unit root tests in terms of power by transforming and detrending the series through a generalized least squares (GLS) regression to efficiently estimate the deterministic parameters (i.e., $\alpha_1, \alpha_2, \dots, \alpha_p$) and then using the transformed data to perform the usual ADF unit root tests. Another advantage of using this procedure in Stata is that it calculates the optimal lag (p) for conducting each unit root test which minimizes the the loss function which represents the penalty or cost of forecasting one future outcome when another occurs. There are several ways by which the loss function is calculated. Here, the study uses the optimal lag calculated by Ng and Perron (2001) after testing up to ten period lags following the Schwert (2002) criterion for maximum lag selection. An advantage of Ng and Perron's method is that it allows for the possibility of a zero optimal lag which allows one to strongly reject the null hypothesis that a unit root is present.

To control for the presence of heteroscedasticity and serial correlation, the study uses OLS estimation with heteroscedasticity-and-autocorrelation-consistent (HAC) standard errors estimated using the Newey-West estimator with a four-period lag suggested in Wooldridge (2006) given the data's seasonality. In matrix form, the estimated coefficients and their variances (marked with suffix "-hat") are

$$\hat{\beta} = (X'X)^{-1} X'y$$

$$\text{Var-hat}(\hat{\beta}) = (X'X)^{-1} X'\hat{\Omega}X(X'X)^{-1}$$

where

X is an $n \times k$ matrix of observations on k independent variables for n observations

y is an $n \times 1$ vector of observations on the dependent variable

x_t is a $1 \times k$ vector of observations on k independent variables for $t = 1, \dots, n$

$X'\hat{\Omega}X = X'\hat{\Omega}X + [n/(n-k)] \sum_{t=1}^n [1-l/(m+1)] \sum_{i=1}^m e^{-hat}_t e^{-hat}_{t-i} (x_t' x_t + x_{t-i}' x_t)$

$X'\hat{\Omega}X = [n/(n-k)] \sum_{t=1}^n e^{-hat}_t x_t' x_t$ from White's estimator

$e^{-hat}_t = y_t - x_t \hat{\beta}$

k is the number of parameters estimated, and

m is the number of lags.

Lastly, the study tests the robustness of the estimated coefficients for inflation and inflation differential across regions, the "core" independent variables of interest in the model. The robustness check tells us how sensitive the estimated coefficients of the core variables are to the presence of control variables. This is done by estimating a set of regressions of the dependent variable (unemployment) on the core variables, which are included in all regressions, and all possible combinations of the control variables. For the model specified in this study, there are 6 control variables, and so $2^6 = 64$ test regressions are estimated. If the estimated coefficients are not of the same sign for all test regressions (i.e., positive for some, negative for others), then they are not considered robust.

All estimates are derived using Stata 13.

5. EMPIRICAL RESULTS

Table 1 shows the postestimation results for the heteroscedasticity and serial correlation tests as well as the modified unit root tests. For the heteroscedasticity test, the null hypothesis that the error term's variance is constant is rejected at $p < 0.01$, indicating the presence of heteroscedasticity. For the serial correlation test, the null hypothesis of no serial correlation is rejected at $p < 0.01$. For the unit root tests, we reject the null hypothesis that a unit root is present for unemployment, inflation, and inflation differential across regions, and so we rule out the risk

of spurious regression results. Overall, the results from Table 1 indicate that the study correctly controlled for heteroscedasticity and serial correlation by using HAC standard errors.

Table-1. Heteroscedasticity and serial correlation tests for time-series OLS

Test	Null hypothesis	Test statistic	Rejected null
Heteroscedasticity ^a	Constant variance	8.34***	Yes
Serial correlation ^b	No serial correlation	26.10***	Yes
Unit root ^c			
Unemployment ^d	Contains unit root	-3.590**	Yes
Inflation ^e	Contains unit root	-5.938***	Yes
Inflation differential across regions ^f	Contains unit root	zero optimal lag	Yes

Notes:

^aBreusch-Pagan/Cook-Weisberg LM test for heteroscedasticity using the N^*I^* version

^bBreusch-Godfrey test for higher-order serial correlation set at 4 lags due to periodicity of data (Wooldridge, 2006)

^cModified Dickey-Fuller test in which the series has been transformed by a OLS regression. The study first conducts unit root tests up to a maximum number of lags following the Schwert (2002) criterion and from there considers the test at the optimal lag calculated by Ng and Perron (2001).

^dOptimal lag of 6 periods.

^eOptimal lag of 5 periods.

^fOptimal lag of 0 periods, indicating that the null hypothesis of having a unit root present is strongly rejected.

*p<0.1

** p<0.05

*** p<0.01

Table 2 shows the OLS estimates. The estimated coefficient for inflation differential across regions indicates that a unit-increase in inflation differential across regions is associated with a 0.22 percentage point decrease in the national unemployment rate. This result is highly statistically significant at $p<0.01$. This indicates that wage flexibility acts as an adjustment tool in the Philippines against region-specific shocks. Interestingly, the coefficient for inflation is positive and highly statistically significant at $p<0.01$, suggesting that the Phillips curve does not hold in the Philippines from 2005 to 2017, even after controlling for supply side shocks in the form of oil price inflation. This is consistent with Puzon (2009) who suggests that this is due to rational expectations: markets adjust automatically to changes in prices, and so there may be no trade-off between inflation and unemployment.

Table-2. Impact estimates of inflation differential across regions on unemployment

	Coefficient ^a	Standard Error ^b
Inflation Rate	0.2395***	0.0729
Inflation differential across regions	-0.2195***	0.0807
Observations	51	

Notes:

^aOLS estimates

^bHeteroscedasticity-and-autocorrelation-consistent (HAC) standard errors

*p<0.1

** p<0.05

*** p<0.01

Table 3 shows the results of the robustness checks. Of the 64 regressions estimated using different combinations of the control variables, the sign of the estimated coefficient for inflation differential across regions is consistently negative for all of them. Moreover, the average t -statistic indicates that the variable tends to be highly statistically significant. For inflation's coefficient, the sign is consistently positive for all regressions, and the average t -statistic indicates that it also tends to be highly statistically significant. The results from Table 3 indicate that both estimated coefficients are robust.

Table-3. Robustness check for time-series OLS

Core variable	Mean	Average Standard Error	Percent + ^a	Percent - ^b	Average t-statistic	Observations
Inflation	0.2383	0.0679	100	0	3.6291	64
Inflation differential	-0.1918	0.0708	0	100	2.7247	64

Notes:

^aShare of regressions in which coefficient is positive in percentage form^bShare of regressions in which coefficient is negative in percentage form

6. CONCLUSION

In this paper, we adapt OCA theory to describe the mechanism by which inflation differential across regions links to unemployment in the Philippines. Empirical tests indicate that the national unemployment rate and inflation differential across regions move in opposite directions. From the theoretical framework, this negative relationship indicates that wage flexibility is an effective tool for reducing unemployment, especially when labor mobility is limited and monetary and fiscal policy cannot be relied upon as adjustment mechanisms against idiosyncratic shocks.

The following section explores the potential policy implications of this study as well as proposals for future studies, discussing the limitations encountered as well as possible expansions which can be made to the literature in this direction. The policy options discussed here hinge on the consensus in the literature on the role of wage flexibility and labor market institutions in addressing unemployment in the context of currency unions.

6.1. Policy Implications from Other Currency Unions

Four years after the Economic and Monetary Union (EMU) was established, [Viñals and Jimeno \(1996\)](#) discussed the possible impacts of currency unification on unemployment in Europe. Consistent with Mundell's framework, the authors suggest that in periods of economic real asymmetric shocks, the currency union can rely on labor mobility, fiscal policy, and wage flexibility as adjustment mechanisms to address unemployment. However, [Hancké \(2013\)](#) observes that while fiscal and monetary policies are important in a monetary union, these instruments are “the policy areas that are least well suited as adjustment mechanisms”. This echoes the position of [Micallef and Cyrus \(2013\)](#) suggesting that in currency unions, “asymmetric shocks cannot be corrected by changes in monetary or exchange rate policies.” In the absence of these policy options, the adverse consequences of asymmetric shocks are addressed “through structural policies and relative adjustments in prices and wages” among the members of the union.

For this reason, the European Central Bank advocates for more flexible labor markets and structural reforms among countries in the euro area. These calls “have been reflected in the nature of the policies being imposed on member countries” [Arestis and Sawyer \(2013\)](#), with structural reforms aligned in the direction of deregulation, liberalisation, the reduction of trade union rights, and diminished social protection and minimum wages, among others.

There are a number of views over how labor market institutions relate with unemployment, employment and wage determination. It is important to understand these interactions to shed some light on the operations of a currency union and to determine the appropriate policies to be adopted within the union ([Arestis and Sawyer, 2013](#)). Hence, it is also imperative among policymakers to know the nature and possible sources of rigidities in the labor market.

[Abbritti and Mueller \(2013\)](#) adopted a framework to analyze the functioning of a monetary union that is characterized by asymmetries in labor market rigidities among member countries. The authors considered two types of frictions in the labor market: (1) unemployment rigidities and (2) real wage rigidities. The former captures employment protection legislation as well as costs associated with hiring and matching technology which

collectively impedes the “flows in and out of unemployment”. Real wage rigidities, on the other hand, capture the institutional constraints that influence the flexibility of wages in response to changes in the economic landscape.

Abbritti and Mueller show that a high degree of unemployment rigidities leads to a steeper Phillips curve, while a high degree of real wage rigidity causes the Phillips curve to be flatter. Their findings indicate that greater unemployment rigidities lead to increased inflation differential volatility, while greater real wage rigidities have insignificant impact on the volatility of inflation differential. They conclude that “asymmetries in labor market structures worsen the adjustment mechanism of a currency union to symmetric and asymmetric shocks.”

Calmfors (2001) examined the relationship between structural unemployment and the presence of monetary union in Europe. Citing that unemployment in euro area is mainly driven by significant structural rigidities, they looked into the consensus that reforms in the labor market are necessary in light of the nature of unemployment within the union. Calmfors (2001) identifies these policy measures that have been proposed in the literature: (1) less generous unemployment insurance, (2) legislations supporting less stringent employment protection, (3) less regulations on minimum wage, (4) changes in legal framework for wage bargaining to increase the bargaining strength of employers, (5) larger scope for individual wage contracts relative to collective agreements, and (6) more effective labor market programs to facilitate competition for jobs.

Calmfors (2001) also analyzed the political economy question on how the monetary union influences the incentive for labor market reforms. He finds that “to the extent that countries would suffer from an inflation bias outside the EMU, membership tends to weaken the incentive for labor market reform”. In the absence of inflation bias, the incentive to institutionalize reforms in the labor market is stronger among the member countries compared to non-member countries.

Using New Keynesian Models, Gali (2012) explored the effects of wage flexibility on employment. His findings suggest that “wage adjustments do not play a direct role in the determination of employment”. Instead, the impact of wage adjustments on employment is seen through “the change in aggregate demand resulting from the endogenous monetary policy” in response to inflation variations caused by adjustment in wages. Therefore, policies that enhance wage flexibility can offer potentially effective solutions in addressing unemployment issues.

D’Adamo and Rovelli (2015) find that the differences in labor market institutions are associated with variations in inflation adjustment across economies. Their findings reveal that non-traded sectors generally experience greater inflation compared to the non-traded sectors. This cross-sectoral inflation differential also varies across countries, depending on labor market institutions. They also find that more rigid institutions reduce adjustment to unemployment – the impact of which is significantly more evident in the traded sector. D’Adamo and Rovelli (2015) conclude that differences in labor market institutions across member-countries in a currency union “may be at the root of some unfavourable patterns of price competitiveness, especially in the euro area.” In relation to this, these differences can determine the degree of asymmetry of monetary policy transmission effects across members of the euro area.

The literature on the experiences of the European Union indicates a general consensus on the important role of wage flexibility and labor market institutions in addressing unemployment in the context of currency union. The challenge among policymakers is to institute policies and reforms at the level of the currency union, taking into account the differences in labor market adjustments and varied economic landscapes among its member countries or regions.

6.2. Policy Implications for the Philippines

The negative relationship between inflation differential across regions and national unemployment suggests that the unemployment-reducing effect of wage flexibility may be capitalized upon by further reducing rigidities in the labor market to facilitate adjustments in times of asymmetric economic downturn in the Philippines.

The effectiveness of wage flexibility in reducing unemployment point to policy options that echo the structural reforms from the experience of the European Union. Therefore, structural reforms in the Philippine labor market must be aligned in the “direction of deregulation, liberalisation, the reduction of trade union rights, diminished social protection and minimum wages”, which was originally asserted by [Arestis and Sawyer \(2013\)](#) in the context of the European Union.

Policy options summarized by [Calmfors \(2001\)](#) may be considered by legislators in the Philippines in crafting policy reforms towards this direction. These include:

- 1.fewer policies supporting the protection of employees,
- 2.fewer regulations on minimum wage,
- 3.changes in the legal framework for wage bargaining to increase the bargaining strength of employers *vis-a-vis* labor unions,
- 4.larger scope for individual wage contracts relative to collective agreements, and
- 5.more effective labor market programs to facilitate competition for jobs.

Aside from the wage costs of labor, the institutionalized enforcement of non-wage costs of labor may contribute to rigidity in the labor market. Examples of non-wage costs of labor includes those employee benefits and working conditions mandated through the labor code. Policymakers seeking to rely on wage flexibility as an adjustment mechanism against idiosyncratic shocks causing unemployment may therefore have to rethink the losses and gains of different institutionalized non-wage labor costs. This, of course, entails ethical concerns.

Wage rigidity is also partly due to upward pressure on wages from labor unions. Where unions have strong bargaining power and in the face of adverse demand shocks, employers may not have the freedom to unilaterally reduce nominal wages because of the presence of such unions, which may result in layoffs for non-unionized workers rather than policies that decrease wages of all workers ([Friedman and Friedman, 1980](#)). Bargaining also occurs over employee benefits including job security and medical coverage, among others, thereby increasing the cost of labor. Legislative efforts to restrain excessive bargaining power among labor unions may relax this upward pressure on wage and non-wage costs, allowing some downward flexibility in the costs of labor to occur.

Another potential source of rigidity is the presence of firm-specific investments in human capital. Employers are incentivized to minimize voluntary turnover and maximize work effort and productivity among their employees. Decreases in nominal wage across all employees may lead to reduced effort and higher propensities to quit. Therefore, firms are likely to fire workers with whom the firm invested the least resources in developing human capital instead of pursuing policy that cuts wages across the board ([Ehrenberg and Smith, 2012](#)). In the absence of the option to reduce wage rates, policymakers may consider providing firms with greater flexibility in terms of working hours to enable them to choose how many workers to employ and to what degree.

Our empirical results, interpreted through the lens of OCA theory, suggest that wage flexibility is an effective instrument in reducing unemployment, yet some policy reforms in the Philippines diverge from the direction of labor market deregulation and liberalisation. Instituting policies that create stronger rigidities in the labor market may dampen the rate at which the market adjusts to adverse shocks. The unemployment rate is predicted to be persistent in the presence of region-specific shocks given an absence of wage flexibility and other viable alternative adjustment mechanisms. Hence, there is a need for policymakers to rethink how they legislate policies that may exacerbate rigidities in the labor market.

6.3. Moving Forward: Limitations and Future Studies

Several limitations were encountered in conducting this study. Firstly, the data used in the regression analysis was limited to only the Philippines from 2005 to 2017 in order to control for the new definition of unemployment adopted in April 2005. The results of this study, therefore, may not be generalizable to other time periods of the Philippine economy. For instance, the study found that, even after controlling for supply side shocks using oil price

inflation, the Philippines' inflation rate is positively correlated with unemployment contradicting (Resurreccion, 2014) findings of a negative correlation from 1980 to 2009 for the Philippines but consistent with Puzon (2009) findings of a positive correlation from 1980 to 2005; the difference between the two may be due to them using different control variables and their estimates' sensitivity to the presence of covariates.

Secondly, this study does not control for the impacts of different administrations due to the limitations of the data used. Since it only covers the Philippines from 2005 to 2017, the only administration fully represented in the dataset is President Aquino's from 2010 to 2016. President Arroyo's which started in 2001 and President Duterte's which started in 2016 and is still ongoing at the time of this writing are not fully covered in the dataset, and so using dummy variables to control for each presidency may not capture the true effect of each administration on unemployment in the Philippines. Furthermore, when including dummy variables for the presidencies in OLS estimation with HAC standard errors, both inflation and inflation differential across regions retain the same signs for their estimated coefficients but stop being statistically significant due to high standard errors whereas the dummy variables become highly statistically significant, suggesting a problem of multicollinearity with the dummy variables. It's likely, for example, that each administration is highly linked to changes in both inflation and inflation differential in those periods. For these reasons, presidential dummy variables were not used in estimating the empirical model of this paper.

Lastly, another limitation stems from the OCA-adapted theoretical framework. In the face of an idiosyncratic adverse demand shock to one region, wage flexibility's role as an adjustment mechanism is characterized by a decline in workers' nominal wages, but it is ambiguous as to whether or not real wages also decline given that the overall price level also declines in the adversely-shocked region. If so, inflation differential across regions may therefore relate not only to the unemployment rate but also the quality of employment, or underemployment rate. However, much of OCA theory focuses on the integration of developed economies such as those in Europe and North America whereas issues of underemployment and, more broadly, quality of employment are more commonly associated with developing economies.

While exploring the link between inflation, inflation differential across regions, and underemployment entails a whole other paper on its own, it's interesting to note that when using OLS with HAC standard errors to predict underemployment instead of unemployment using the same right-hand side variables as in our empirical model, a unit increase in inflation differential across regions is associated with a decrease of 0.62 percentage points in the underemployment rate at $p < 0.1$. This suggests that prices decline more than nominal wages do in response to an adverse idiosyncratic shock, and so real wages are not falling but in fact rising when wage flexibility acts an adjustment mechanism. This is not a conclusive empirical finding, but it's promising nevertheless and encourages further exploration.

To conclude, there is room for further research in the direction of inflation differential across regions' role in the labor market. Moreover, the question of generalizability hangs in the air, and it would be interesting to see if the study's findings for the Philippines from 2005 to 2017 may be replicated in other countries and currency unions for different time periods.

Funding: This study received no specific financial support.

Competing Interests: The authors declare that they have no competing interests.

Contributors/Acknowledgement: All authors contributed equally to the conception and design of the study.

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