ANALYSING LONG-TERM FEASIBILITY OF THE PHILLIPS CURVE THROUGH ITS FACTORS

COMPUTATIONAL ECONOMICS

BSC ECONOMICS YEAR 3 SEMESTER 2 - 2025

Introduction

The Phillips Curve's main theoretical framework centres itself around the idea of an inverse relationship between inflation rates and unemployment rates (Foy, 2019). The framework, which was published in 1958 by A. W. Phillips, showed how wages at the time had an inverse relationship with unemployment rates (Dorn, 2020). At the time of its inception, Phillips was able to assess economic indicators from years 1861-1913 in United Kingdom. Through this study, Phillips was able to discover that inflation's rate of change and unemployment rates had opposite effects on each other; he found that higher inflation led to lower unemployment and the reverse held true. The framework was backed by the concept that economic developments result in increased demand for labour, and thus employers must grant higher wages to incentivise labour (The Investopedia Team, 2024). This assumption was said to hold true in the short term. However, the long run estimates of the Phillips curve state how macroeconomic changes in the aggregate demand would only lead to changes in the price level whilst maintaining a natural state of unemployment. This analysis was performed to test how the Phillips Curve's fundamental ideas, made in the mid-20th century, have held until the early 21st century across different countries.

Research Question

Observing the credibility of the Phillips Curve in modern times requires understanding the main economic indicators upon which it was built. The two main premises of the Phillips Curve are the levels of inflation and unemployment rate in a country. Eventually, it also notes how changes in aggregate demand affect only the inflation rate. Assessing these variables' relationships will lead to a refined understanding of the effectiveness of the Phillips curve.

Hypothesis:

$$Inflation_i = \beta_0 + \beta_1 M3_i + \beta_2 interest_i + \beta_3 Unemployment_i + \beta_4 Income_i + \beta_5 Growth_i + \beta_6 classification_i + \varepsilon_i$$

For each Independent Variable β_j:

$$H_0: \beta_j = 0$$

$$H_A: \beta_j \neq 0$$

Where:

$Inflation_i$=Inflation Rate that year for the Country

$\beta_0 =$ intercept

$\beta_1 M3_i =$ the Broad Money Supply changes (%) that year for the Country

$\beta_2 interest_i$= Real Interest Rates (%) that year for the Country

$\beta_3 Unemployment_i =$ Unemployment Rates (%) that year for the Country

$\beta_4 Income_i =$ Gross National Income per Capita changes (%) that year for the country

$\beta_5 Growth_i =$ GDP growth (%) that year for the Country

$\beta_6 classification_i$ = Binary variable that shows whether that country classifies as a Low-Income (0) or High-Income (1) that year

ε_i = Error Term

Methodology

The initial assumption from the Phillips Curve is an inverse relationship between the inflation rate and unemployment rate. Thus, the Ordinary Least Squares Regression based on the Linear Regression was used to evaluate the data as it is standardised from the World Bank (n.d.). The regression was initially assessed with the independent variables to evaluate that there were no multicollinearities as it was an important assumption for the regression model. Avoiding multicollinearity was also important for evaluating the relationship as the individual effects of each variable such as unemployment were the focus. Any variables that exhibited this issue in the initial testing was then removed from the list of variables, then the test was run again.

Countries were categorised by their income level, then run through each data to see which low-income and high-income countries had complete data for the years 1991-2021. This 31-year period had the most data available for most countries. Once the list of countries was prepared, the regression was initially run to see the relationship between the variables on a global scale. The regression model was applied to each country during the period. A final shortlist of countries was made to see which countries had a positive and negative relationship of inflation and unemployment at a statistically significant level of α=0.05.

Results

Figure 1

OLS Regression Results

Dep. Variable:	inflation	R-squared:	0.241
Model:	OLS	Adj. R-squared:	0.225
Method:	Least Squares	F-statistic:	15.11
Date:	Wed, 14 May 2025	Prob (F-statistic):	5.13e-15
Time:	12:54:29	Log-Likelihood:	-780.68
No. Observations:	292	AIC:	1575.
Df Residuals:	285	BIC:	1601.
Df Model:	6		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	4.4687	0.631	7.077	0.000	3.226	5.712
unemployment	0.1858	0.066	2.805	0.005	0.055	0.316
interest	0.0093	0.017	0.557	0.578	-0.024	0.042
growth	0.0757	0.101	0.749	0.454	-0.123	0.275
classification	-3.2882	0.575	-5.719	0.000	-4.420	-2.156
m3	0.1224	0.024	5.037	0.000	0.075	0.170
income	-0.1168	0.085	-1.369	0.172	-0.285	0.051

Omnibus:	23.904	Durbin-Watson:	1.192
Prob(Omnibus):	0.000	Jarque-Bera (JB):	29.428
Skew:	0.633	Prob(JB):	4.07e-07
Kurtosis:	3.904	Cond. No.	66.2

Figure 1 focused on variables of the hypothesis presented previously. Initial findings showed that early suspicions were confirmed; there were issues with multicollinearity. Economic theory, specifically the Fisher effect, states that interest rates and inflation have an inverse relationship. However, not only did the data show a positive relationship, but it also showed a statistically insignificant (P=0.578) relationship. Theory also suggests that GDP growth and income have a role in inflation, however, all were shown as insignificant. This suggests that these variables may share relationships with each other when it comes to explaining inflationary changes. These variables were then omitted, and a second regression was done.

Figure 2

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                            OLS Regression Results
==============================================================================
Dep. Variable:              inflation   R-squared:                       0.179
Model:                            OLS   Adj. R-squared:                  0.177
Method:                 Least Squares   F-statistic:                     101.9
Date:                Wed, 14 May 2025   Prob (F-statistic):           1.13e-59
Time:                        13:25:41   Log-Likelihood:                -3873.3
No. Observations:                1407   AIC:                             7755.
Df Residuals:                    1403   BIC:                             7776.
Df Model:                           3
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          3.2395      0.223     14.539      0.000       2.802       3.677
unemployment   0.0919      0.026      3.540      0.000       0.041       0.143
m3             0.1270      0.009     13.844      0.000       0.109       0.145
classification -1.6748     0.217     -7.710      0.000      -2.101      -1.249
==============================================================================
Omnibus:                       65.595   Durbin-Watson:                   1.052
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               77.756
Skew:                           0.497   Prob(JB):                     1.30e-17
Kurtosis:                       3.583   Cond. No.                         42.6
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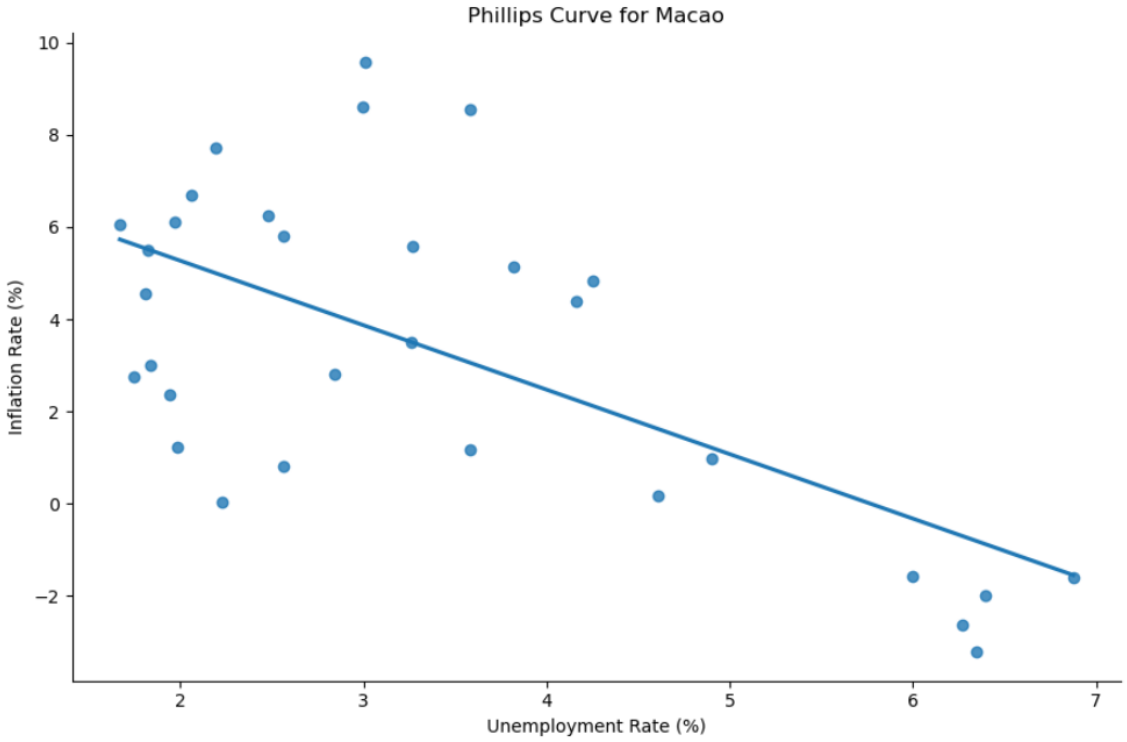
Figure 2 brought more clarity to any lapses in the results of figure 1. More countries had complete data, resulting in a larger sample size. Apart from this, all the p-values have become 0. This means that we reject the null hypothesis and find that these three variables are statistically significant to deciding changes in inflation.

The key takeaways are that unemployment and money supply are directly proportional albeit having weak relationships. Classifications on the other hand showed a strong negative relationship; lower income countries were more likely to have higher inflation. With an R-Squared value of 0.179, only 17.9% of the changes in inflation were accounted for by the model. This meant that apart from any omitted variable bias, there were other potential variables that were hard to quantify that must be accounted for.

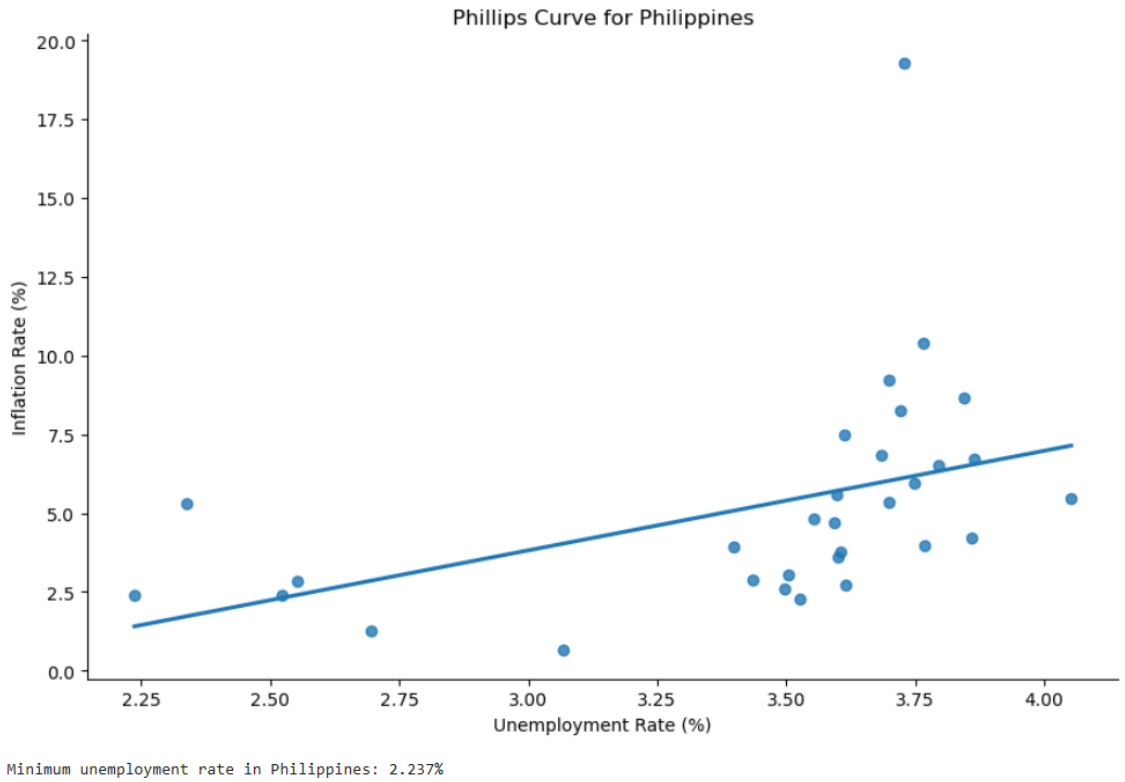
Conclusion

Figure 3



Minimum unemployment rate in Macao: 1.67%

Figure 4



Tackling individual countries showed how individual countries' Phillips curve looked over time. Two of these countries, namely Macao SAR, and Philippines, showed negative relationship and positive relationship respectively for inflation and unemployment. There were cases in both countries with low unemployment at around 2%, but one country experienced low inflation during that time, whilst the opposite in the other. This means that the main factors of the Phillips Curve were inconsistent. However, through the pooled regression, we saw a weak relationship between inflation and unemployment. This may result in the long-run scenario of the Phillips Curve to occur. In conclusion, the Phillips Curve may serve well as a basis for policymaking. However, due to the variables not explaining most of the variance, it must be combined with other economic instruments such as monetary and fiscal policies to achieve inflationary targets.

WORD COUNT: 980

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