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Does Inflation and Economic Growth Affect Unemployment? Evidence From SAARC Countries

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ABSTRACT

Several studies have tested the relationship between inflation, economic growth, and unemployment. However, most studies investigate these linkages using data on single/individual countries involving two of these variables in most cases, thereby impeding a broader investigation. This paper analyzes the relationship between inflation, economic growth, and unemployment in a sample comprising SAARC countries. This is accomplished by analyzing panel data on these countries from 1990 to 2015 using fixed effects. Results indicate that economic growth and inflation on their own negatively affect unemployment in SAARC countries. Conversely, the combined impact of economic growth and inflation on unemployment is positive and statistically significant. The study further finds that certain control variables, such as human capital, trade, and foreign direct investment, negatively impact unemployment in SAARC countries.

1 Introduction

The nature of the relationship between inflation, economic growth, and unemployment is at the center of scholarly debates in economics. The existence of relationships among these variables was first conceptualized by Okun (1963) and Phillips (1958), termed as 'Okun's law' and 'Phillip's curve', respectively. Okun's law postulates that an inverse relationship exists between economic growth and unemployment. Specifically, it states that an increase in economic growth leads to a decline in unemployment. Likewise, 'Phillip's curve' hypothesize that a rise in inflation reduces the unemployment rate (Tenzin, 2019).

For governments and societies, inflation, economic growth, and unemployment are variables of considerable importance. Governments strive to maintain price stability, achieve a high rate of employment, and attain rapid and sustained economic growth. Failure to achieve these macroeconomic objectives can have serious social consequences (Wajid & Kalim, 2013). Given this, it is necessary to decipher how the aforementioned variables are related to each other.

Several studies have tested the relationship between inflation, economic growth, and unemployment. For instance, Sir (2014) explored the potential impact of inflation and economic growth on unemployment in the case of Sri Lanka. Likewise, Wajid & Kalim (2013) investigated these linkages in the case of Pakistan. In addition, Leasiwal (2021) assessed the impact of wages, growth, and inflation on unemployment in the case of Indonesia. Moreover, Chand et al. (2017) and Nikolli (2014) studied the nature of the relationship between economic growth and unemployment using the cases of Indian and Albanian economies, respectively. Although these studies provide important insights, they impede a broader investigation of the potential relationship between unemployment, economic

growth, and inflation for two reasons. First, most studies investigate these linkages using data on single/individual countries. Second, fewer studies undertake an empirical analysis that jointly tests the relationship among all three variables of interest. To fill this void, this paper investigates the existence and nature of the relationship between inflation, growth, and unemployment in a sample of SAARC[1] countries.

The SAARC region houses a population of 1.88 billion people, produces an economic output equal to $4,084.13 billion, and represents about 4.2% of the global economy (World Data, 2022). Most SAARC countries are developing economies that face high inflation coupled with staggering unemployment and a low growth rate. To mitigate these, it is crucial to understand the nature of the relationship among these factors. This paper accomplishes this by estimating fixed effects using the panel data of SAARC countries from 1990 to 2015. The paper finds that inflation and economic growth exert a negative impact on unemployment in SAARC countries.

2 Literature Review

2.1 The Inflation-Unemployment Relationship

Several scholars have explored the potential relationship that exists between inflation and unemployment. For instance, Furuoka (2007) studied the inflation-unemployment relationship in the Malaysian economy and found a causal and trade-off relationship between inflation and unemployment in the long-run. In an earlier study, Islam et al. (2003) tested the salience of the purported negative relationship between inflation and unemployment in the U.S. They found a weak co-integration and long-run causality between the two variables. Likewise, Furuoka & Munir (2014) tested the validity of the Phillips Curve in Malaysia and found an equilibrium relationship between unemployment and inflation rates.

Several scholars have also explored the long and short-run nature of the inflation-unemployment association-ship. One such study is undertaken by Vermeulen (2015), who quantified the impact of inflation on employment in the case of South African economy. The study found that a positive relationship exists between inflation and employment in the long-run. Conversely, no statistically significant relationship was detected between the said variables in the short run. Similarly, Wajid & Kalim (2013) found a statistically significant positive long-run inflation-unemployment relationship in Pakistan.

2.2 The Unemployment-Growth Relationship

Several scholars have tested the salience of the unemployment-growth relationship. Prominent among these is Banda et al. (2016), who tested the said relationship in the case of the South African economy and found a long-run unemployment-growth association-ship. In another study, Mihaela & Mihaela (2013) found an inverse ratio connection between unemployment and gross domestic product in Romania. Moreover, Michael et al. (2016) also explored the unemployment-growth relationship in Nigeria and found these related in the long run. In a related study, Abdul-Khaliq et al. (2014) assessed the unemployment-growth relationship in nine Arab countries. They found a statistically significant negative relationship between the two. Khrais and Al-Wadi (2016) also examined these linkages in MENA countries and observed the lack of any statistically significant unemployment-growth relationship. Conversely, Kalu (2021) found that in the long-turn, there is statistically significant unemployment-growth relationship existing in the Nigerian case.

2.3 The Inflation-Growth Relationship

Studies on the inflation-growth relationship are published in a considerably large number. For instance, Gillman et al. (2004) assessed the inflation-growth relationship in a sample of OECD and

[1] South Asian Association for Regional Cooperation

OPEC member countries. These scholars observed that there exists an inverse inflation-growth relationship in both sets of economies. Similarly, Idalu (2015) investigated the inflation-growth relationship in the Nigerian economy and found a long-run convergence between the two variables. In another study, Ayyoub et al. (2011) tested the salience of the inflation-economic growth relationship in Pakistan. They found an inverse relationship between these variables. Earlier, Gokal & Hanif (2004) also detected an inverse inflation-growth association in the case of Fiji.

2.4 The Unemployment, Growth, and Inflation Relationship

Several scholars have put the alleged association-ship between unemployment, inflation, and growth under empirical scrutiny. For instance, Ademola and Badiru (2016) examined the effects of unemployment and inflation on growth rates in the Nigerian economy and found a long-run association-ship among these variables. Across similar lines, Mohseni & Jouzaryan (2016) studied the impact of unemployment and inflation on growth in Nigeria. They found that in the long-run, inflation and unemployment exert a reductive impact on growth. Similarly, Shahid (2014) found that in the Pakistani economy, inflation, growth, and unemployment are associated in the long-run. In another study on the Iraqi economy, Anning et al. (2017) found that there is an equilibrium relationship existing between growth, inflation, and unemployment.

3 Methodology

3.1 The Data

This study utilizes panel data on the variables of interest for SAARC countries ranging from 1990 to 2015. The required data is extracted from several databases, including WDI[2], Pakistan Economic Survey, IFS[3], and Penn World Tables.

3.2 Empirical Model

The primary aim of the present paper is to estimate the impact that economic growth and inflation may potentially exert on unemployment in SAARC economies. For this purpose, the following baseline model is estimated as the starting point in the empirical strategy.

$$UE_{it} = \beta_0 + \beta_1 Inf_{it} + \beta_2 EG_{it} + \beta_3 (Inf_{it} * EG_{it}) + \beta_4 X_{it} + \varepsilon_{it} \ldots\ldots\ldots (1)$$

where UE_{it} represent unemployment, Inf_{it} depict inflation, EG_{it} stands for economic growth and ε_{it} is the random error component. Likewise, the interaction term $Inf_{it} * EG_{it}$ involving the product of inflation and growth is added in the model to decipher their combined effect on unemployment. Moreover, X_{it} represents the control variables which include trade openness, human capital, and foreign direct investment (FDI). Finally, "i" stands for cross-section, while "t" stands for the time period,

3.3 Description and Data Sources of the Variables

The variables employed in this study are described in Table-1. The data source for each variable is also given in the said table.

[2] World Development Indicators

[3] International Financial Statistics

Table 1

Variables

Variable Name	Description of the Variable	Source of the Variable
Unemployment rate (unm_{it})	This is obtained by dividing the number of unemployed people by total individuals in the labor force	World Development Indicators (WDI)
Economic Growth (GDP_{it})	Annual growth in GDP per capita ($GDPC_{it}$) in US $ and the annual growth rate of GDP in percentage ($GDPG_{it}$) and ($INGDP_{it}$) investment to GDP	World Development Indicators (WDI)
Inflation (inf_{it})	Consumer Price Index (CPI) ($INFC_{it}$) and GDP deflator ($INFd_{it}$)	International Monetary Fund (IMF) & the International Financial Statistics (IFS)
Human Capital (HC_{it})	Secondary School Enrollment ($SSEG_{it}$) and Human capital index (HC_{it})	Penn World Tables
Trade openness (Tra_{it})	Exports combined with imports and divided by GDP denoted by (Tro_{it}) and (Tra_{it})	World Development Indicators (WDI).
Foreign direct investment (FDI_{it})	FDI's Net outflows (FDO_{it}) and net inflows (FDI_{it}) as percentages of GDP	World Development Indicators (WDI)

3.4 Empirical Strategy and Analytical Techniques

The study utilizes panel data on the variables of interest. Therefore, the first step in the empirical strategy involves the use of the Breusch-Pagan test so as to know the best fit between the random effects and the pooled OLS tests. Afterward, the study uses Hausman to decide whether to employ the fixed effect or random effect specifications. Finally, the study makes use of the Serial Correlation (LM) test to find out whether to use GMM estimation or otherwise.

3.4.1 The Fixed Effect Specification

In its general form, the fixed effect model assumes the following specification:

$Y_{it} = D\alpha + \beta X_{it} + U_{it}$

where Y_{it} is the vector of the endogenous variables and X_{it} represents the independent variables of the study. Moreover, α stands for the country-specific effects, and D represents the country dummy, which is the respective section-wise fixed effect. Alternative names for the aforementioned model include the individual dummy variable model or the LS-Dummy model.

3.4.2 The Random Effect Specification

An alternative name for the random effect model is the error component model. This model is written as follows in the general form.

$Y_{it} = \alpha + \beta X_{it} + U_{it} + \varepsilon_{it}$

In the above model, the intercept term α doesn't change the way it does in the fixed effect model.

3.4.3 The Hausman Specification Test

This study uses the Hausman specification test to identify the appropriate analytical technique. The significance of this test stems from the simplicity associated with its use. This test allows us to decide whether a fixed or random effect fits the dataset in question.

For analyzing panel data, pooled OLS is generally used. The pooled model assumes that all variables and cross-sections are the same and that there are no inherent differences. However, this assumption is less likely to hold in the real world since data differs, for instance, across countries. Further, the H_0 in the case of the Brush-Pagan test ($\delta_{\boldsymbol{u}}^2$=0) is rendered unacceptable in the case of all the underlying model forms/specifications, showing that the intercept does not remain constant within the cross-sections. This leads the study to the fixed and random effect models.

The Hausman test helps to decide between the random effects and fixed random effect models, leading towards the following form of the H_0.

H_0 = *fixed effect model yield inefficient estimates*

A rejection of the null hypothesis renders the fixed effects model an appropriate choice. Next, the redundant fixed effect test is applied to choose among the period/cross-section or both. Irrespective of the case under consideration, the following H_0 is made.

H_0= *A fixed effects do not exist*

Since the above hypothesis is rejected in all specifications, it is deduced that a fixed effect exists. Finally, the Serial Correlation LM Test is applied against the following null hypothesis.

H_0= *There is no serial correlation*

A rejection of the above hypothesis rendered fixed effects as the sole choice.

4 Results

This study uses the fixed effect – the most consistent and widely used technique in the case of panel data. This study has six specifications/models consisting of various proxies of explanatory and control variables. For results, please refer to Table-2.

Table 2

Fixed Effects Results. The dependent variable is unemployment ($\boldsymbol{unm_{it}}$)

Variables of the Study	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6
$\boldsymbol{INGDP_{it}}$	-.9929***	-4.0284*	……..	……..	……	……..
	(-1.07)	(-3.45)				
$\boldsymbol{GDPC_{it}}$	…….	…….	……...	……..	……	.2648***
						(1.29)
$\boldsymbol{GDPG_{it}}$	……..	…….	-.19508***	-.1837***	-.09959***	……..
			(-0.92)	(-0.79)	(-0.95)	
$\boldsymbol{INFC_{it}}$	2.777*	1.4059**	-.4461*	-.6392*.	…….	…….
	(2.028)	(1.53)	(-4.04)	(-3.86)		
$\boldsymbol{INFd_{it}}$	…….	…….	……..	……	-.1201***	-.1062***
					(-1.52)	(-1.12)
$\boldsymbol{INGDP_{it}}$*$\boldsymbol{INFC_{it}}$	-.10343*	.05434**	……..	…….	……	……..
	(-2.32)	(-1.59)				
$\boldsymbol{GDPG_{it}}$*$\boldsymbol{INFC_{it}}$	……	……..	……..	…….	……	……..
$\boldsymbol{GDPG_{it}}$*$\boldsymbol{INFC_{it}}$	……..	……..	- .0970*	- .0984*	- .0194*	……

			(4.04)	(3.69)	(1.50)	
$GDPG_{it}$*$INFD_{it}$	…….	…….	…….	……	…….	……
$GDPC_{it}$*$INFD_{it}$	…….	……	……	……	……	.0092* (0.46)
TRA_{it}	.1383*	.0897*	……	…….	.0407*	……
	(7.19)	(5.04)			(2.34)	
TRO_{it}	…….	……	.5457*	.56379*	……..	.31097*
			(5.27)	(4.80)		(3.29)
$SSEG_{it}$	-.0624**	……	-.1457*	-56379*	…….	-.1387*
	(-1.65)		(-7.05)	(-6.62)		(-5.91)
HC_{it}	……...	5.447*	……..	……	-2.1786***	……..
		(1.95)			(-0.121)	
FDI_{it}	…….	…….	……...	……	-.5064*	……..
					(-2.64)	
FDO_{it}	-.824**	-.2708	-.74554***	-.6858***		.11760***
	(-1.51)	(0.690)	(-1.10)	(-0.97)		(0.16)
No of observation	1191	1188	1185	1188	1189	1188
BP test	12.74	22.93	10.46	9.82	19.51	13.75
P-value	0.003	0.052	0.052	0.001	0.050	0.005
Hausman test	12.252	52.1451	0.0004	10.81	25.09	24.707596
P-value	0.056	0.0004	0.0000	0.0006	0.0002	0.0000

t-statistic in parenthesis

*** p<0.01, ** p<0.05, * p<0.1

Model-1 demonstrates that inflation ($INFC_{it}$), trade openness (TRA_{it}), human capital ($SSEG_{it}$), foreign direct investment (FDI_{it}), and the interaction term involving growth and inflation ($INGDP_{it} * INFC_{it}$) are statistically significant. Among these variables, inflation and trade openness positively affect unemployment (unm_{it}), while the interaction term of inflation and economic growth exerts a negative effect.

Model 2 shows that growth ($INGDP_{it}$) has a statistically significant negative association-ship with unemployment (unm_{it}). Conversely, inflation ($INFC_{it}$), trade openness (TRA_{it}), human capital (HC_{it}), and the interaction term of economic growth and inflation ($INGDP_{it} * INFC_{it}$) have a statistically significant positive relationship with the dependent variable, i.e., unemployment (unm_{it}).

In Model 3, it is depicted that economic growth ($GDPG_{it}$), the interaction term of growth and inflation ($INGDP_{it} * INFC_{it}$), inflation ($INFC_{it}$), human capital ($SSEG_{it}$), and foreign direct investment (FDO_{it}) exhibits statistically significant negative relationships with unemployment. On the other hand, trade openness (TRO_{it}) demonstrates a statistically significant positive relationship with unemployment.

In Table 2, Model 4 shows that economic growth ($GDPG_{it}$), inflation ($INFC_{it}$), the interaction term of economic growth and inflation ($INGDP_{it} * INFC_{it}$), human capital ($SSEG_{it}$), and foreign direct investment (FDO_{it}) negatively affects unemployment. Moreover, trade openness (TRO_{it}) has a statistically significant positive impact on unemployment in SAARC countries.

In Model 5, economic growth ($GDPG_{it}$), inflation ($INFC_{it}$), the interaction term of economic growth and inflation ($INGDP_{it} * INFC_{it}$), human capital (HC_{it}), and foreign direct investment (FDI_{it}) have a statistically significant negative associationship with the rate of unemployment. Conversely, trade openness (TRA_{it}) exerts a positive impact on unemployment.

In the final model (Model 6), economic growth ($GDPC_{it}$), the interaction term of economic growth and inflation ($GDPC_{it} * INFD_{it}$), trade openness (TRO_{it}) and foreign direct investment (FDO_{it}) positively influences unemployment. On the contrary, inflation ($INFD_{it}$), and human capital ($SSEG_{it}$) negatively influences unemployment.

The findings of the aforementioned models show that the interaction term involving the combination of growth and unemployment has a strong negative relationship with unemployment, except for Model 2. This suggests that countries should focus more on job creation as a way to curtail the rise in the rate of unemployment and reap the benefits of economic growth.

5 Discussion and Conclusion

This study estimates the impact of inflation on unemployment through the growth channel in SAARC countries. This is accomplished by analyzing panel data on these countries from 1990 to 2015 using fixed effects. The study finds a negative impact of inflation and economic growth on unemployment in SAARC countries. An important aspect of the findings is the distinct effects of inflation and growth on unemployment in isolation and in combination with each other (i.e., the interaction term). Specifically, economic growth and inflation on their own negatively affect unemployment in SAARC countries. Conversely, the combined effect of inflation and economic growth on unemployment is positive and statistically significant. The study further finds that certain control variables, such as human capital, trade, and foreign direct investment, have negative effects on unemployment in SAARC countries.

6 Policy Implications

Based on findings/results, this study suggests that governments should strive to remove structural rigidities from economics to provide a conducive investment environment that favors job creation. Specifically, governments may focus on providing an uninterrupted power supply, better transportation infrastructure, functional legal systems, and adequate security. These ingredients would boost employment, making it possible for the populace to afford goods and services. This will result in industrial expansion, improvement in growth rates, an increase in employment opportunities, and helps check inflation. Moreover, governments should make unemployment reduction their primary target instead of price stability. The unemployment rate can be greatly reduced by encouraging self-employment and lowering the cost of doing business so as to achieve high, rapid, and sustained economic growth.

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Appendices

Appendix 1: Pooled OLS Estimation

Table 3

Pooled OLS Estimation Results

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$INGDP_{it}$	1.3282* (3.10)	.5371** (1.41)	…….	……	…….	……
$GDPC_{it}$	……	…….	-.08141*** (-0.27)	……	……	.4117*** (1.41)
$GDPG_{it}$	..…….	…….	…….	.0004*** (0.01)	-.0783*** (-0.64)	…….
$INFC_{it}$	6.0576* (4.26)	2.5954* (2.32)	-.5872* (3.94)	-.93449* (-4.36)	…….	……..
$INFd_{it}$	……	…….	…….	……	.0109*** (0.12)	-.1465*** (-1.13)
$INGDP_{it}$* $INFC_{it}$	-.2211* (-4.27)	-.09688* (-2.32)	…….	…….	……..	……

$GDPC_{it}$*$INFC_{it}$	…….	…….	.1324* (4.08)	…….	……	…….
$GDPG_{it}$*$INFC_{it}$	……..	…….	…….	.14352* (4.10)	……..	…….
$GDPG_{it}$*$INFD_{it}$	……..	…….	…….	……..	.0096*** (0.64)	……
$GDPC_{it}$*$INFD_{it}$	……	……	…….	……..……..		.04178*** (1.51)
TRA_{it}	.1517* (6.85)	.1232* (5.81)	…….	……..	0.0241* 2.18	……
TRo_{it}	……..	……..	.86841* (6.73)	-.9594* (7.03)	……	.6182* (5.27)
$SSEG_{it}$	-.0550* (-4,27)	……	-.06558* (-3.05)	-.05295* (-2.84)	…….	-.042* (-1.81)
HC_{it}	…….	-1.67134* (-2.33)	……	……..	2.542* (5.42)	…….
FDI_{it}	……..	……..	…….	…….	-.3752* (-2.23)	…….
FDO_{it}	-1.592* (2.25)	-2.0314* (-2.57)	-3.00* (-4.12)	-3.1410* (-4.35)	……	-2.375* (-2.87)

*Note that *, **, *** shows the level of significance at 1%, 5%, and 10% respectively. The t-statistic values are in parenthesis.*

Appendix 2 Random Effects

Table 4

Random Effects Estimation Results

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$INGDP_{it}$	1.328* (3.10)	.53712** (1.41)	……..	……..	…….	……
$GDPC_{it}$	……	…….	……	…….	…….	.4117*** (1.41)
$GDPG_{it}$	……	…….	-.08141*** (-0.27)	-.1837*** (-0.79)	-.0783*** (-0.64)	……
$INFC_{it}$	6.057* (4.26)	2.5954* (2.32)	-.5872* (-3,94)	-.6392* (-4.36)	…….	……
$INFd_{it}$	……	……..	……	……..	.0109*** (0.12)	-.1465*** (-1.13)
$INGDP_{it}$*$INFC_{it}$	-.2211* (-4.27)	-.09688* (-2.32)	……	……	……	……..
$GDPC_{it}$*$INFC_{it}$	……	……	……	……	……	……..
$GDPG_{it}$*$INFC_{it}$	…….	……...	.13246* (4.08)	.0984* (4.10)	……	……
$GDPG_{it}$*$INFD_{it}$	…….	……..	……..	……	.0096*** (0.64)	……
$GDPC_{it}$*$INFD_{it}$	……	……	……..	…….	……..	.0417*** (1.51)

TRA_{it}	.15175* (6.85)	.1232* (5.81)	……	…….	.0241* (2.18)	……
TRo_{it}	…….	…….	.8683* (6.73)	.5637* (7.03)	……..	.61828* (5.27)
$SSEG_{it}$	-.05507* (-3.80)	……	-.06558* (-3.05)	-.136* (-2.84)	……	-.0422* (-1.81)
HC_{it}	…….	-.1.6713* (-2.33)	……	……	2.542* (5.42)	……
FDI_{it}	…….	…….	……..	…….	-.3752* (-2.23)	……
FDO_{it}	-1.5929* (-2.25)	-2.031* (-2.57)	-3.0039* (-4.12)	-.6858*** (-4.35)	……	-2.376* (-2.87)
No of observation	1191	1188	1185	1188	1189	1188
BP test	12.74	22.93	10.46	9.82	19.51	13.75
P- value	0.003	0.052	0.052	0.001	0.050	0.005
Hausman test	6	52.1451	0.0004	10.81	25.09	24.707596
P- value	0.0056	0.0004	0.0000	0.0006	0.0002	0.0000

*Note that *, **, *** shows the level of significance at 1%, 5%, and 10% respectively. The t-statistic values are in parenthesis.*

Appendix 3 Descriptive Statistics

Table 5

Descriptive Statistics

Variables	Observation	Mean	Std. Div.	Min	Max
UNM_{it}	176	14.486	2.653	.79	14.7
$INGDP_{it}$	171	25.28	2.40	20.94	29.64
$GDPC_{it}$	170	3.78	2.94	-10.70	15.56
$GDPG_{it}$	170	5.5402	3.0741	-8.1247	19.8880
$INFC_{it}$	182	7.7203	4.64933	-18.108	22.564
$INFd_{it}$	170	7.7203	4.3053	.000299	24.8911
$INGDP_{it}$*$INFC_{it}$	171	60.9700	37.212	-151.777	202.994
$GDPC_{it}$*$INFC_{it}$	170	27.836	26.317	-53.0746	116.2747
$GDPG_{it}$*$INFD_{it}$	170	41.106	30.3161	-40.4087	195.81
$GDPC_{it}$*$INFD_{it}$	170	27.9357	126.27357	-36.4164	164.27

TRA_{it}	182	66.096	45.052	15.239	203.585
TRo_{it}	170	11.9138	34.0085	-177.213	2384.401
$SSEG_{it}$	113	51.598	16.7793	20.40052	99.724
HC_{it}	150	1.8331	.46822	1.31003	2.89964
FDI_{it}	175	1.5832	2.36788	-.1912	17.2889
FDO_{it}	104	.14102	.29975	-.038944	1.6224

Appendix 4 Breusch-Pagan Test

Table 6

Breusch-Pagan Test Results

H_0: Constant variance

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Chi²	12.74	22.93	10.46	9.82	19.51	13.75
Probability	0.003	0.052	0.02269	0.001	0.050	0.005

Appendix 5 Hausman Test

Table 7

Hausman Test Results

H_0: Fixed-effects are not effective estimates

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Chi² values	6	52.1451	30.33787	10.81	25.09	24.707596
Probability	0.0056	0.0004	0.0000	0.0006	0.0002	0.0000

Appendix 6 Redundant Cross-Section Fixed Effects Test

Table 8

Redundant Cross-Section Fixed Effects Test Results

H_0: No Fixed-effects

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
F-values	1.1011	0.5734	1.6699	1.65951	1.23909	2.0185
P-values	0.395	0.9347	0.0876	0.0903	0.2288	0.0322

Appendix 7 Redundant Period Fixed Effects Test

Table 9

Redundant Period Fixed Effects Test Results

H_0: No Fixed-effects

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
F-values	15.770	17.938	21.4707	21.57688	11.8881	20.51809
P-values	0.0000	0.000	0.000	0.0000	0.0000	0.0000

Appendix 8 Serial Correlation LM Test

Table 10

Serial Correlation LM Test Results

H_0: No serial-correlation

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
F-values	34.763	58.362	51.73	22.28	39.27	27.259
P-values	0.321	0.152	0.0912	0.174	0.1023	0.1352