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THE NEXUS AMONG LIQUIDITY, LEVERAGE, AND FINANCIAL PERFORMANCE: EMPIRICAL EVIDENCE FROM PAKISTAN

Abstract

Operating liquidity and financial leverage are two critical aspects of a company's administration. This study investigates the relationship between financial leverage and varying functioning liquidity processes. Furthermore, the study also surveys the combined impact of economic leverage and functioning liquidity on organisational effectiveness. For this reason, the asset ratio can be used to evaluate firm sales and profits and companies in the concrete industry that are listed on the Karachi Stock Exchange were used as demography. Secondary records were obtained over a ten-year period from 2011 to 2020 via annual account findings of selected companies and the Company Recording device. To investigate the findings, an informal research method was used and STATA analysis was used to evaluate the data. For comparison purposes, accounting ratios and the frame data assessment model were used to reconstruct associations between the variables of the study and discover cross-sectional variability. Because the Hausman test detects the existence of cross-sectional diversity, the framework shifts towards linear regression. The main research finding suggests that there is a considerable relationship between financial leverage and various metrics of functioning liquidity. Moreover, the findings of this study indicate that economic liquidity and functioning cash flow have a significant impact on the company's concrete financial sector development. This study will inform not only the concrete industry but also companies in other industries listed on the Karachi Stock Exchange by providing a close look at the relationship between economic performance and organisational maintenance, as well as their effect on

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company success.

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1. Introduction

1.1 Background

An organisation's capital structure (CS) has been explained in various ways. Schlosser and Michel (1989) define CS as the centralisation of all loans and the company's fairness in "Fundamentals of Corporate Finance." According to Brealey (2012), CS is the proportion of loans to total company financing. In other statements, the CS is the sum of the finances used by the company to fund its total investments (including normal, preferred stock, and debt payments). Companies that are upfront are those that use an increased debt fraction in their CS, since loans are regarded to be a lower-priced financial services supply in financing choices, whereas companies that are unhedged are those that do not use loans in CS (Titman, Tompaidis, Tsyplakov, 2004). Companies that are more leveraged generate more financial gain (tax shelter) for current investors, but they also present a risk to equity investors because they may incur authority and insolvency expenses. In contrast, leverage can be classified into two types: 1) monetary leverage and 2) operational leverage.

According to Saksonova (2006), operating leverage (OL) is the ability of any company to use resolved working costs to amplify the impact of adjustments in purchases on the company's operating income, which is highly correlated and affiliated with investing operations (Pandey, 2004). Financial leverage (FL) refers to the relationship between the holder and the resources loaded in the company's capital structure, which primarily consists of prevalent favoured equity and debt that have been used to fund the net revenues of the company's processes and economic expansion (Goel et al., 2015). According to Mohohlo et al. (2018), there is a cost attached to both types of leverage, but their efficient application can result in major benefits.

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Financial leverage and operating liquidity are two critical aspects of general company administration.

Operating liquidity is used to assess a company's financial health in the short to medium term. Essentially, it depicts the debts and investments, or the stability between the profundities accessible in funds. If the company runs out of cash, then it may lose the benefits that the distributors have provided to it. Because each stockholder has a vested interest in the company, the institution needs to preserve adequate liquidity (Goel et al., 2015)

Ware (2015) states that determining the optimum CS could increase the assets of shareholders, which is an important decision of financial managers, because one-sidedness (debt or equity) would adversely affect the wealth of shareholders. For the smooth operations of the firm, leveraged decisions need to be continuously balanced because FL is an essential part of the fruitful operations of the business firm. This study is an attempt to experimentally the connection between operational liquidity and financial leverage and their control over the profitability of the company.

1.2 Problem Statement

A company's objective is to maximise its revenue and reduce its costs. However, maintaining the firm's liquidity is also a central objective (Gill et al., 2010). Nevertheless, enhancing earnings at the expense of liquidity leads to considerable issues for the company. As a result, there should be a dialogue between these two goals of companies. If the organisation does not highlight revenue, then the company's long-term preservation may be compromised. Furthermore, if leadership does not consider liquidity, then the firm will suffer bankruptcy and insolvency issues. For these reasons, planning for operating capital should be properly considered as it will influence the company's efficiency and success.

Most studies in Pakistan (Khidmat, Rehman, 2014; Amjad, 2007) have been performed on companies listed on the Karachi Stock Exchange. Return on equity has been used as a marker of earnings by researchers for investigating the outcome of leverage and on the businesses' profit margins. The current study focuses on listed concrete firms on the Pakistan Stock Exchange (PSX) and uses return on assets (ROA) as a measure of financial performance.

1.3 Research Questions

- What effect will financial leverage have on company productivity?
- What effect will operating liquidity have on a company's productivity?
- What are the collective effects of financial leverage and operating liquidity on company performance?

1.4 Objectives of this Study

The purpose of this research is to investigate the effects of:
- The impact of financial leverage on the financial performance of concrete companies that are listed on the Pakistan Stock Exchange.
- The impact of operating liquidity on the financial performance of concrete companies that are listed on the Pakistan Stock Exchange.

1.5 Significance of the study

All the concepts examined are commonly recognised. However, this study differs from preceding studies in the features of the PSX examined and in the sample, which consists of large firms in the cement industry. Hence, this study aims to assess the theoretical and empirical literature to address the hypothesis and study the association between profitability and liquidity.

This study can be beneficial to distributors, stockholders, workers, and creditors, among others. Vendors of products should be very careful to differentiate the liquidity of the organisations to which they are providing goods or services on loans. Therefore, a business would want to have sufficient liquidity to continue to move earnings, a portion of which is divided up to stockholders.

2. Literature Review and Hypothesis Development:

Margaritis and Psillaki (2010) addressed the considerable negative effect that debt-to-equity rates have on company sales and profits. Eriotis et al. (2002) and Frangouli and Neokosmides (2002) utilised the panel records technique to examine the relationship between both the equity ratio and loans in a company's financial performance. Companies that favour equity are much more profitable than companies that take into account debt finance (Eriotis et al., 2002). They used the data envelopment analysis (DEA) method to

investigate the relationship between capital structure and the performance of French producers, and found a positive relationship between liquidity and profit margins.

According to Hasan (2014), the study was conducted to determine the relationship between company achievement and leverage in companies in the sugarcane industry that are listed on the Karachi Stock Exchange (KSE). Utilising pool correlation panel data assessment, he discovered that sugar businesses mentioned on the KSE can enhance implementation while using leverage to achieve a certain scale because loans to capital proportion have a favourable impact on return on assets and increased sales, but earnings per share has an unfavourable connection with earnings per share and total profitability. Rehman et al. (2013) tested the 36 companies listed on the Dhaka Stock Exchange from 2007 to 2012 and found an extremely negative connection between leverage and ROA.

Patel (2014) compared the profit margins of highly leveraged retail outlets and distributors to those of organisations with lower amounts of debt. Explanatory and ratio analysis of all United States wholesalers and distributors in the Compu-stat database show that companies are hurting in aspects of both financial leverage and financial performance. Then, in his report "Effect of Liquidity on Earnings: A Research of Sabar Dairy," Kaya (2014) tested the sales and profits with power and influence of a separate dairy company over 30 years by utilising statistical assessment on profitability ratios such as investment returns utilised, profits per share, return on capital, and assets ratio, as well as the extent of operating performance and financial strength. Except for the correlation between return on assets and the extent of operating performance, all relationships were positive.

Akhtar et al. (2012) found a positive relationship between the economic leverage and financial performance of 20 companies in the energy and oil segment mentioned on the Karachi Stock Exchange, utilising the proportion leverage ratio and proportion debt-equity ratio as the predictor variables. The relying variable and economic leverage. The economic performance measures were assets and return on equity, return on equity, pay out current ratios, revenues as a fraction of overall investments, operating profit margin, and increased sales proportion.

How liquidity and solvency impact the chemical sector in Pakistan was tested by Khidmat and Rehman (2014), who took a sample of ten companies out of thirty-six listed businesses in the Karachi Stock Exchange over a nine-year period using explanatory, analytical, and descriptive methods. The

liquidity indicators were current ratio and quick ratio and the solvency indicators were debt ratio, debt to equity ratio, and coverage ratio for the indicators of performance were return on assets and return on equity. Cash flow and financial health were independent variables, while achievement was not. It was determined that the liquidity position has a positive impact on profit margins, while the solvency ratio has a direct effect on profit margins.

Based on a comprehensive review of the prior literature, we developed the following research hypotheses:

H1 = There is a strong link between OL and profitability.

H2 = FL and OL have a meaningful connection.

H3 = There is a link between financial leverage and financial gains.

Multiple studies have discovered in empirical evaluations that economic leverage and functioning liquidity have a significant impact on firm achievement (Khidmat, Rehman, 2014). In Pakistan, research teams have explored the effects of economic enables and functioning cash flow on firms in the pharmaceutical, energy, and biological industries (Goel et al. 2015; Ware, 2015; Eriotis et al., 2002). There are very few studies on the performance of firms in other industries, such as the textile industry (Amjed, 2007), the sugar industry (Rehman et al., 2013), and the concrete sector. This study investigates the effect of economic power and influence and functioning cash flow in the concrete industry by building on Goel et al.'s paper (2015). It is also noted that studies in this area have mostly focused on the KSE as all investigations were undertaken prior to the establishment of PSX, and no study has been undertaken on Pakistan's concrete industry yet.

3. Research Methodology

3.1 Data & Variables

The Pakistan Stock Exchange lists 22 concrete companies. We chose only from concrete companies that are also listed on PSX for precision. There are 22 concrete companies mentioned on the Pakistan Stock Exchange, of which we have chosen 18 companies whose economic data are accessible from 2011 to 2020. Our sample comprised 18 businesses randomly selected from a pool of 22 companies. Rehman (2014) chose ten listed synthetic companies from a total of 36 listed companies in research on the chemical compounds industry.

The independent variables in this research are FL and OL. To consider the impact of FL on the OL debt ratio, earlier studies utilised FL and the CCC,

OCF, and current ratio as mediating variables for the OL. The budget deficit to net assets (D/TA) ratio indicates FL. It explains the percentage of assets attributable to debt holders (Asad, Yousaf, 2014; Zeitun, Saleh, 2015). The debt ratio can be obtained by dividing company total liabilities over the total assets of a company. CCC is the measure to gauge the liquidity of how quickly a firm can change cash on hand into inventory and account payables through selling and A/R and then back into cash. Current ratio is the measure of the short-term solvency of the firms and how rapidly a company can change its current assets into cash for the settlement of short-term liabilities. An OCF margin is the computation of the cash a firm can produce from its fundamental operations per dollar of sales. A rising OCF margin can indicate that a company is efficient in converting sales into profit, but it can also be a sign of great income.

Control variables are those that are relevant factors that are unrelated to the research but which affect the dependent variable. We utilise four control variables in our assessment: 1) company maturity level (Dogan, 2013), 2) sales (Goel et al., 2015), 3) volume (Goel et al., 2015), and 4) operating income (Amjed, 2007; Dogan, 2013). The goal of such factors is to reduce the standard error.

Table 1. Details of the variables used in the study

Variables	Description
(CR)	The existing ratio is calculated by dividing current assets by current debts. CL/CA (Amjed, 2007)
(FL)	Total debt divided by total assets yields financial leverage. TD/TA (Asad, Yousaf, 2014; Zeitun, Saleh, (2015).
(OCFM)	The functioning cash flow margin is calculated by dividing the functioning cash flow by the purchases. Sales/OCF (Goel et al., 2015)
(CCC)	Introducing inventory to account holders' receivable and deducting expenses accounts payable yields the cash conversion cycle. Receivables + Inventory = Payables (AL IN DAYS) (Goel et al., 2015)
(ROA)	Divide total income by total assets to get return on investments. NP/TA (Kaya, 2014).
(OCF)	Net cash flow is calculated by adjusting net revenue for adjustments in all noncash accounts on the balance sheet (such as devaluation and amortization). Total Net Cash Flow from Processes (Goel et al., 2015).
Age	The company's age is computed by deducting the existing years from the years of inclusion. Year of Successful integration – Current Year (Goel et al., 2015)

Sales	Net sales are used to calculate sales. This is the total sale less the sales discount, reverts, and entitlements. Net Revenues (Dogan, 2013)
Size	The cash reserves describe the company's magnitude. Firms with a massive scale of investments will be regarded for large sales. Assets in total (Amjed, 2007; Dogan, 2013)

3.2 Theoretical framework:

Independent variable
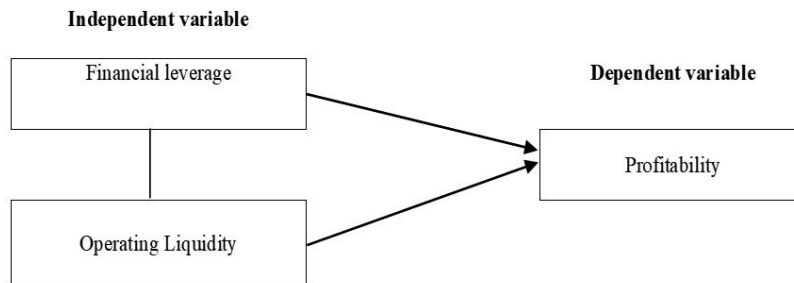
3.3 Estimation strategy:

The latest research examines the effect of financial leverage on cash flow and is predicated on statistical information, so a positivist approach is the best ideology for this type of research. Research techniques can either be deductive and inductive. Inductive study is grounded on research design (dummy reliant), whereas deductive work is focused on assumption and quantitative studies. As a result, the deductive method is thought to be more useful for this type of research, and previous studies by Rehman (2014) also used the deductive research approach. Since a quantitative method is used in this study, a quantifiable method is suitable. The multivariate regression model was used as described by Dogan (2013) and Goel et al. (2015) used in their studies. Therefore, Based off of Goel et al. (2015), these six models were developed to investigate the influence of FL and OL on firm performance.

Table 2. Models for investigating the effect of leverage on liquidity

Models	Equations
Model 1	$CCC = \alpha + \beta_1 FL + \beta_2 Sales + \beta_3 size + \beta_4 Age + \beta_5 CFO$
Model 2	$CR = \alpha + \beta_1 FL + \beta_2 Sales + \beta_3 size + \beta_4 Age + \beta_5 CFO$
Model 3	$OCFM = \alpha + \beta_1 FL + \beta_2 Size + \beta_3 Age$

The second focus of this study is to examine the mixed result of FL on OL on the company's financial performance and widen three more frameworks (Table 3), each of which has its own OL metrics. ROA was used as a dependent variable in all three of these concepts.

Table 3. (Models for investigating the effect of FL and OL on profitability)

Models	Equations
Model 4	$ROA = \alpha + \beta_1 FL + \beta_2 CCC + \beta_3 Sales + \beta_4 Size + \beta_5 Age$
Model 5	$ROA = \alpha + \beta_1 FL + \beta_2 CR + \beta_3 Sales + \beta_4 Size + \beta_5 Age$
Model 6	$ROA = \alpha + \beta_1 FL + \beta_2 OCFM + \beta_3 Sales + \beta_4 Size + \beta_5 Age$

These models are considered multivariate regression models. Multiple regression models have one dependent variable and two or more independent variables $[y = f(x_1, x_2, x_3....x_n)]$. In a multivariate regression model, there are multiple dependent variables and multiple independent variables $[(y_1, y_2, y_3......y_n) = f(x_1, x_2, x_3...... x_n)]$. In this analysis, there are multi-dependent variables and multi-independent variables. In other words, this analysis is established on multivariate analysis instead of multiple regression models. These are known as multiple regression analysis modelling techniques. Multiple regression analysis are those that have one dependent parameter and independent variables $[y = f(x_1, x_2, x_3....x_n)]$. However, there are numerous reliant variables and numerous independent factors in the multiple regression analysis model $[(y_1, y_2, y_3......y_n) = f(x_1, x_2, x_3...... x_n)]$. There are multi-dependent factors and multi-independent parameters in this assessment. That is why this assessment focuses on multivariate models rather than multiple linear regression modelling techniques.

Past studies such as Goel et al. and Amjed, (2007) established three models using this model with ROE as the predictor variable. Except for short-term loans, long-term loans, and overall debt, all three models have equivalent different factors.

4. Results and Discussion

4.1 Descriptive statistics

A descriptive statistic (table 4) is a concise summary of the 22 companies listed in the PSX data set. It tries to explain and disseminate the information's mean value and, potentially, the average. Mean, standard error, measurement items of CCC, OCFM, CR, sales, FL, age, size, and OCF are shown in the table below. The average value denotes the averages of the variables in a given set of data, while the standard error denotes the distance from the mean. Measured values, on the other hand, denote the minimum and maximum variables in the concrete industry over a specified time period.

Table 4. Descriptive statistic

Variable	Mean	S.D	Min	Max	Observations
CCC	1.24e+07	1.89e+07	-7.77e+08	1.12e+11	N = 180, n = 18, T = 10
CR	1.244026	1.473017	.000161	13.52019	N = 180, n = 18, T = 10
OCFM	.0849413	.5809420	-5.908976	1.0337	N = 180, n = 18, T = 10
FL	.2850214	.2150346	.01553	1.460634	N = 180, n = 18, T = 10
Sale	1.06e+11	1.08e+11	8.07e+08	1.460634	N = 180, n = 18, T = 10
Size	1.73e+11	1.78e+11	4.18e+08	9.84e+10	N = 180, n = 18, T = 10
Age	30.9486	10.99979	13	62	N = 180, n = 18, T = 10
OCF	2.52e+09	3.68e+09	-1.13e+00	1.91e+11	N = 180, n = 18, T = 10
ROA	.0561193	.0991117	-.1827331	.2367436	N = 180, n = 18, T = 10

As seen in Models 1, 2, and 3, the hypothesis is rejected from the Hausman test, indicating that the findings validate the significant affect prototype. As explained in the research methods, the first step is to assess the impact of FL on OL. For this reason, Models 1, 2, and 3 were established. The results of Models 1–3 demonstrate that FL has a massive effect on OL.

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Table 5. Results of Model 1

Dependent Variable: CCC

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FL	-71.717	0.000	7.25	0.000
Age	-3.02e	0.000	12.47	0.005
Sale	0.1079	0.005	3.77	0.012
Size	0.1224	0.000	3.99	0.000
CFO	-0.3232	0.007	3.01	0.004
Adj. R Sqr	.6845			
Hausman Test				
Chi Square Table	14.168		Prob.	0.002

Model 1 uses the cash conversion cycle as the dependent variable to investigate the effect of FL on OL. According to the table 5, the governed factors company size, maturity level, revenues, and chief operating officer are statically important. Furthermore, conversion cycle has a direct relationship with financial power and influence. The valuation demonstrates the model's appropriateness.

The results of Model 2 (table 6) demonstrate that FL has a substantial influence on contemporary proportion and has a positive relationship and that all other factors have a meaningful correlation. The results in Model 2 demonstrate an adapted R-squared value of 0.7847, indicating that the model seems to be fit.

Table 6. Results of Model 2

Dependent Variable: CR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FL	-3.27	0.000	3.79	0.001
Age	0.167	0.009	13.89	0.000
Sale	-2.762	0.000	4.77	0.002
Size	1.260	0.005	7.43	0.000
CFO	4.80	0.000	0.21	0.005
Adj. R Sqr	.7847			
Hausman Test				
Chi Square Table	42.437	Prob.		0.001

Excluding the CFO, all managed different factors are substantial as measured by adjusted R-squared, suggesting a positive and remarkable relationship between current proportions and financial strength.

The findings of Models 1, 2, and 3 are utilised to analyse the impact of FL on OL exhibition. As an institution becomes more highly leveraged, it also becomes more fluid. These findings should be interpreted as indicating that raising capital through debt can enable companies to fund their total assets while also paying off their current assets. Simply stated, as debt levels rise, so does a company's liquidity.

Table 7. Results of Model 3

Dependent Variable: OCFM				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
FL	0.33	0.000	-5.27	0.001
Age	-1.87	0.003	-2.47	0.000
Size	1.04	0.000	-3.88	0.009
Adj. R^2	0.6459			
Hausman Test				
Chi Square Table	87.022		Prob.	0.000

The table 7 shows that a company's debt position has a major impact on OCFM. Nevertheless, this model contradicts the preceding two models' findings that leverage placement has a negative correlation with liquid assets, with the adjusted R-squared indicates the model strength and conditioning. The outcomes of Models 1 and 2 show that as the company is becoming more leveraged, its liquidity increases. As a result, this study may conclude that companies that taken on more debt use it primarily to fund existing investments and pay off existing loans. This is consistent with the having to work capital's sensible approach, which is funding short-term investments with long-term lending. Based on the findings and interpretations presented above, it is evident that our first hypothesis, H1, is accepted because there is a substantial connection between monetary leverage and functioning cash flow, and the null hypothesis was rejected.

The second goal of this study was to investigate the impact of FL and OL on organisational value. For this purpose, three additional models were developed, namely, Models 4, 5, and 6. Various OL gauges were used as

independent factors, with time of life, dimensions, and revenues serving as control variables. In all three models, FL was eliminated as an independent factor, and return on assets was eliminated as a reliant parameter. The Hausman test results were repeated to aid the data over the period fixed effects technique. Moreover, the outcomes of these three variables demonstrate that there is a significant relationship between FL and OL and performance management.

Table 8. Results of Model 4

Dependent Variable: ROA

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FL	-0.28	0.000	17.37	0.002
CCC	-5.84	0.001	-4.57	0.000
Age	0.011	0.000	6.89	0.004
Size	-3.77	0.003	-10.37	0.000
Sale	6.363	0.000	-9.74	0.009
Adj. R^2	0.5267			

Hausman Test

Chi Square Table	62.227		Prob.	0.001

According to this framework (table 8), ROA has a negative relationship with CCC and a strong relationship with FL. The measured parameters were again statistically meaningful, and the framework had a high level of fitness. The results of Framework 4 show an adjusted R-squared of 0.5267, which would be an indication of this model's level of fitness. Foremost, the combined effect of leverage and the ability to operate liquidity on firms' performance needs to be investigated. Three approaches, Model 4, Model 5, and Model 6, were used for this reason. The company's current performance was significantly influenced by operating cash flow and financial strength. The response variable was ROA, and the study variables were leverage ratio and operations and maintenance liquidity.

Table 9. Results of Model 5

Dependent Variable: ROA				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
FL	-0.26	0.000	-17.34	0.000
CR	0.0104	0.009	-1.77	0.000
Age	0.203	0.000	6.35	0.004
Size	0.325	0.005	-5.89	0.000
Sale	-3.792	0.000	-9.73	0.000
Adj. R^2	0.5726			
Hausman Test				
Chi Square Table	58.4741	Prob.		0.002

It depicts a critical relationship between the existing ratio and a firm's specific success and a beneficial correlation between the existing proportion and leverage. The model fit well, and the manipulated variable was statically important. The outcomes of Model 5 (table 9) demonstrate adjusted R-squaredof 0.5726, which is an indication of this model's level of fitness.

Table 10. Results of Model 6

Dependent Variable: ROA				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
FL	0.1873	0.000	-17.30	0.000
CR	0.0904	0.001	9.39	0.005
Age	0.208	0.000	6.55	0.000
Size	1.307	0.004	-11.8	0.000
Sale	2.719	0.000	11.79	0.001
Adj. R Sqr	.6543			
Hausman Test				
Chi Square Table	.4678		Prob.	0.000

Financial leverage has a poor association with organizational earnings, whereas OCFM has a good association. The measured parameters were also statistically significant, and the framework had a great workout. Model 6's results (tab. 10) indicate an adjusted R-squared of 0.6543, which indicates the model's level of fitness.

According to the above modelling techniques 4, 5, and 6, H2 acknowledged that OL has a substantial effect on business achievement, whereas H0 is denied. The findings also revealed that H3 is acknowledged because there is a relationship between business achievement and FL, which is why H0 is rejected.

As stated in the introduction to this study, budgetary control and operations and maintenance management play a significant role in an organisation's achievement. Our research results from Models 4, 5, and 6 endorse this reasoning because they show that FL and OL are primary factors of any profitability of firms. Consequently, the results of Models 4, 5, and 6 show that both economic power and functioning cash flow have a significant effect on business performance. Financial leverage has a negative impact on firm achievement. The reason for this can be stated as an increase in economic costs.

4.2 Correlation

The correlation analysis (table 11), which handles the power and guidance of a linear connection between two factors, is shown in the table below. The correlation valuation is between +1 and –1. where +1 denotes a favourable one-to-one connection between the variables and -1 denotes a critical one-to-one connection. The coefficient value is always between +1 and -1. When compared to the other different factors in the table, OCF is strongly associated with FL, age, sales, CR, and ROA.

Table 11. Correlation analysis

	CCC	CR	OCFM	FL	SALE	SIZE	AGE	OCF	ROA
CCC	1.0000								
CR	0.1644	1.0000							
OCFM	0.0630	0.1345	1.0000						
FL	-0.2022	-0.3926	-0.1167	1.0000					
SALE	0.1245	0.4355	0.2456	-0.387	1.0000				
SIZE	0.2469	0.2091	0.1567	-0.377	0.7893	1.0000			
AGE	0.0598	0.0689	-0.0645	0.1387	-0.1586	-0.109	1.0000		
OCF	0.0828	0.5325	0.2499	-0.253	0.9256	0.7685	-0.127	1.0000	
ROA	0.3379	0.4943	0.2997	-0.738	0.4977	0.2099	-0.057	0.4879	1.000

5. Conclusion and recommendation

5.1 Conclusion and recommendations

Profitability is the primary goal of nearly every business. Leverage has been shown in previous studies to have both a positive and negative effect on profitability. Firms that are heavily leveraged use an increased debt fraction in their CS since debt is regarded as a lower priced source of financial services in investment decisions, whereas firms that are unhedged do not use liabilities in their CS. Companies that are more leveraged start generating more financial gain (tax shelter) for current investors, but they also start generating more danger for stockholders because they start generating agency problems as well as financial distress.

To evaluate whether high-profit businesses must use more leverage, preceding results indicate that the utilisation of leverage leads to an advancement in the financial position of the company by increasing the chances of growth in the division in which they work. Our findings also show that firm operating liquidity is improved. Previous research has found an inverse relationship between economic power and influence and dividend pay out, which explains why companies with good power and influence disseminate fewer earnings than companies with low leverage (Akhtar et al. 2012). Profitability is the dependent variable of the study. The ability of the business to generate a profit after paying all expenses is referred to as profitability. The profitability indicators are ROA, net profit margin and ROE. In this study, ROA will be used as a proxy variable of profitability to study the effect of FL and OL on the profitability of the company.

The independent variables in this research are FL and OL. To consider the effect of FL on OL, I will use proportion as a proxy for FL as well as CCC, OCF, and liquidity ratios as proxies for OL. The D/TA is an FL indication. It refers to the proportion of overall investments contributed by debt holders. The D/TA ratio is computed by taking a firm's revenue debts by its asset value. CCC is a cash flow metric that measures how effectively a business can convert money on hand into stock and payable accounts via sales and A/R and then return to money. The current ratio is an indicator of a corporation's brief financial health, indicating how quickly it can convert its attributes into cash for the payment of short-term debts.

Because this study examines the effect of leverage on cash flow and is predicated on statistical information, the positivist approach is the best

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philosophy for this research. The data collection method for this research is straightforward, so I will use secondary information from Pakistani concrete companies from 2011 to 2020. Financial information for these companies will be gathered from the financial statements of concrete listed companies on the PSX, as well as from the companies' formal internet sites and company recording device. I chose only concrete companies that are mentioned on PSX for the purpose of precision and data availability. There are 24 concrete companies mentioned on the Pakistan Stock Exchange, of which I have chosen 18 firms whose accounting information is accessible from 2008 to 2017. For the sake of results, this research first explores the effects of FL on OL and then explores the influence of both on the cash flow of Pakistani concrete companies. To this end, three approaches (Models 1, 2, and 3) were established to measure the influence of FL on OL, as well as three additional models to analyse the effect of FL and OL on corporate profitability.

The outcomes of Models 1 and 2 show that as the company becomes more leveraged, its cash flow increases. As a result, the company that elevates liabilities may use it primarily to funding existing assets to pay off outstanding loans, which is consistent with the operating capital's cautious approach, which is to fund short-term investments with long-term debts.

Furthermore, the merged impacts of power and influence and functioning cash flow on firms' performance need to be investigated. Three approaches, prototype 4, prototype 5, and prototype 6, were used for this intention, and the company's score was positively influenced by the ability to operate cash flow and leverage ratio. The response variable was ROA, and the independent variables were economic leverage and functioning liquidity. The Hausman results of the tests were also used to endorse the committee data fixed-effect strategy. As a result of this situation, it is possible to conclude that both economic power and functioning cash flow affect firm-specific success. Financial leverage has a negative impact on profitability. The reason for this can be stated as an increase in cash costs. Functioning liquidity has a positive impact on firm achievement because it assists in the need for large financing for machines and equipment and assistance with day-to-day company operations.

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INFLATION, EXCHANGE RATE, UNEMPLOYMENT AND ECONOMIC GROWTH IN PAKISTAN: AN EMPIRICAL ANALYSIS USING THE ARDL APPROACH

Abstract

The objective of this research study is to capture the relationship between unemployment, inflation, the exchange rate and economic growth in Pakistan. The study used unemployment, inflation, exchange rate and gross domestic product (GDP) variables. However, time series data for the period from 1990 to 2018 were employed through Augmented Dicky Fuller, and unit roots tests were applied to check the stationarity of the data. Autoregressive distributed lag (ARDL) and the error correction model (ECM) have been employed to investigate the long-run and short-run parameters between unemployment, inflation, exchange rate and economic growth. The ARDL model result shows that there is a long-run relationship between the variables. Furthermore, the difference test shows that there is no problem of heteroscedasticity, misspecification of the model or serial correlation. The autoregressive distributed lag (ARDL) model indicates a significant positive relationship between inflation, the exchange rate and economic growth and a significant negative relationship with unemployment in the long run at the 5% level. Furthermore, the results depict that the error correction model (ECM) coefficient is -1.03 and significant, suggesting a 103% adjustment in a year.

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1. Introduction

For the economic development of countries, one cannot rule out the importance of the gross domestic product (GDP) growth rate (Rehman et al., 2019). GDP is an indicator of the economic health of a country and a measure of a country's standard of living. It is the value of finished goods and services produced in a country in a specific time period and calculated on an annual basis. GDP is a measurement of average real income in a country, but that does not mean that it completely measures economic well-being. To measure complete economic well-being, real gross domestic product (GDP) is used, as well as to measure the particular types of economic activities within a country because it represents the value of all the productive activity within a country in a specific period (Akbar et al., 2011). Over the years, the unsustainable and downwards trend in economic growth in Pakistan has been worrisome for policy-maker's professionals and foreign aid donor agencies (Iqbal and Zahid, 2014). Inflation indicates an increase in domestic prices of commodities relatively more than an increase in commodity prices globally. This indicates the increase in the prices of goods and services over time, while the nominal interest rate refers to those interest rates that are considered before taking inflation into account or before adjusting the interest rate for inflation; nominal rates adjusted for inflation are called the real interest rate (Ayub et al., 2014).

Ayyoub, Chaudhry and Farooq (2011) examined the inflationary situation in Pakistan with a special focus on its impact on GDP growth. We also re-examined the existence of the relationship between inflation and growth in the economy of Pakistan. The analysis was performed on the basis of annual time-series data for the period from 1972 to 2009. The study revealed that inflation in Pakistan's economy is harmful to GDP growth. The study focuses on the basic question of whether the negative inflation-growth relationship exists in the economy or if the situation is something else. This statistically significant result indicates that a persistent increase in the general price level hurts economic growth. Mubarak (2005) estimated the threshold level of inflation in Pakistan using an annual dataset from 1973–2000. The estimated model suggested a 9% threshold level of inflation above which inflation is inimical to economic growth. Hussain and Malik (2011) explored the nexus between

inflation and economic growth in the context of the Pakistan economy. Annual data for the period 1960–2006 were used in the study. The results showed that inflation is positively correlated to the economic growth of Pakistan and vice versa. The concern of causality between these two variables was unidirected. Inflation causes growth but not vice versa. Ali (2014) explored the impact of inflation and income inequality in Pakistan. Annual time series data from 1972–2007 were taken for the analysis. Inflation is concluded to have a growth-stimulating impact on the economy, but higher levels of inflation adversely affect the poverty-alleviating impacts of growth.

The role of the real exchange rate is important in the adjustment process of the economy. Exchange rates are generally the relative prices of national currencies under a floating rate government; they may be determined by the interaction of supply and demand in the foreign exchange markets. This premise gives simply a beginning for comprehending the determination of the exchange rate and its ensuring relationship to various macroeconomic variables and to policy (Chishti and Hasan, 1993). Javeed and Farooq (2009) examined the impact of exchange rate volatility on macroeconomic variables in Pakistan using quarterly data from 1982-I to 2007-IV. The findings of this study showed a positive relationship between these two variables, which negates the theoretical model, but these values were insignificant. The manufacturing product (MP) and economic growth showed a positive relationship. This showed that a 1% rise in MP is related to a 32% growth in the economy. Aman et al. (2013) explored the relationship between the exchange rate and economic growth in Pakistan for the period 1976–2010. A simultaneous equation model employing two- and three-stage least square (2SLS and 3SLS) techniques was used and found that the exchange rate has a positive association with economic growth through the channel of export promotion incentives, increasing the volume of investment, enhancing FDI inflow and promoting import substitute industry. However, the exchange rate positively affects economic growth. Ali et al. (2020) studied the relationship between the exchange rate and the economic growth of Pakistan in the annual period of 1980–2017. Granger causality tests, cointegration tests and NARDL models were applied to check the relationship between these variables. The study showed that imports have no Granger causality effect, while the exchange rate has a bidirectional effect on economic growth. The asymmetric causality results have positive and negative shocks. Asymmetrically, the

positive shocks of export and economic growth have bidirectional effects, while import and exchange rates have unidirectional causality with economic growth.

When people are seeking employment but are unable to find a job, it is called unemployment. People look for the past four weeks, but they cannot find work (Shahid 2014). According to Akpakpan (1999), when the economy does not generate enough jobs to employ all those who are willing to work, valuable resources are lost. Potential goods and services that might have been enjoyed by consumers are lost indefinitely. This is the real economic cost of unemployment, and no insurance plan can eliminate it. Abbas (2014) investigated the long-term effects of economic growth on the unemployment level in Pakistan from 1990 to 2006 using the ARDL bounds testing approach to cointegration. The estimated results of the present study confirmed the existence of a stable, long-run negative effect, whereas, in the short run, no relationship was found. A one percent increase in economic growth is associated with a reduction in the unemployment level by 1.665 percent in the long run. The ECM indicates a high speed of adjustment of short-run fluctuation, as 83 percent of short disequilibrium adjusts in a year. Umair and Ullah (2013) examined the impact of inflation on GDP and the unemployment rate in Pakistan. They concluded that inflation insignificantly influences GDP and unemployment and that the correlation is negative. The correlation between GDP and the unemployment rate has also been found to be insignificant. Arsalan and Zaman (2014) found that gross domestic product has a negative relationship with unemployment. Population growth has a positive relationship with unemployment and contributes to unemployment. The results revealed that population growth is the key determinant of unemployment. In this study, the trade-off between inflation and unemployment in the Pakistani economy was also observed. Cheema and Atta (2015) concluded that economic uncertainty is an important determinant of unemployment in Pakistan and that it has a statistically significant positive relationship with unemployment both in the long and short run.

The objective of this paper is to determine the factors that affect economic growth in Pakistan. Therefore, the Autoregressive Distributed Lag (ARDL) model is used to investigate the relationship between inflation, the exchange rate, unemployment and economic growth in Pakistan. This research study uses time series data for the time period of 29 years from 1990 to 2018 to investigate the impact of inflation, the exchange rate, and unemployment on economic growth in Pakistan. Many economists posit that controlling

inflation, the exchange rate, and unemployment has a significant role in the economic development of various societies. However, the impact, effectiveness mechanism and short- and long-run effects of inflation, the exchange rate and unemployment on economic growth were not thoroughly examined. Therefore, it is essential to examine these factors and their economic effects from 1990 to 2018.

2. Literature review

Makaringe and Khobai (2018) investigated the effect of unemployment on economic growth in South Africa using data from the period 1994–2016. The autoregressive distribution lag (ARDL) bounds test approach is applied to determine the existence of the long-run linkage among the variables. The results of the study showed that the ARDL model indicates a long-run relationship between unemployment and economic growth. The empirical results obtained confirmed that there is a negative relationship between unemployment and economic growth both in the long run and short run.

Aqil et al. (2014) concluded that the impact of GDP growth, inflation, FDI and population growth on the unemployment rate of Pakistan is strong. The analysis revealed that GDP growth and inflation have no significant impact on unemployment. However, FDI and population growth have significant and negative impacts on unemployment. Thus, it is concluded that the higher the FDI and population growth, the lower the unemployment in the country.

Asad, Hashmi and Yousaf (2016) examined the relationship between workers' remittances and economic growth along with labour migration in Pakistan. The study also investigated the links between workers' remittances and unemployment and captured the interaction between unemployment and economic growth. Annual time series data from 1975 to 2010 were used for analysis.

Husain, Siddiqi and Iqbal (2010) investigated the relationship between growth and unemployment for the period 1972–2006. The ADF test showed that the variables have a unit root problem at the level, but these variables are significant at the first difference, and there are three cointegrating vectors. The

maximum eigenvalue statistics also show a long-run relationship between growth unemployment, capital, labour, openness of trade and human capital.

Gylfalson and Herbertsson (2001) examined the effect of inflation on economic growth. They used the theoretical model in which inflation potentially affected economic growth through the savings real interest rate, the velocity of money and efficiency in production. The study examined the effect of inflation on long-term economic growth based on the data obtained from 170 countries from 1960 to 1992. The result showed that inflation is detrimental to economic growth by more than 10 to 20 percent annually.

Khan and Chhapra (2016) suggested that the government should pay attention to the control of inflation through effective and efficient monetary policy and establish new industries to increase employment and the third advance infrastructure. Export decreases heavy import prices and always encourages foreign direct investments.

Shahid (2014) examined the effect of inflation and unemployment on the economic growth of Pakistan using time series data from the World Data Bank for the period of 1980 to 2010. The unit root ADF was used. The ARDL result showed that there is no problem of heteroscedasticity misspecification of the model and serial correlation; however, the study shows that inflation varies from economy to economy, and the relationship between inflation and economic growth was positive.

Rasheed and Ali (2016) inspected the effect of inflation on GDP and unemployment in Pakistan. Time series data taken from secondary sources from 2002 to 2014 were used. The existence of inflation varies across countries. The result showed that inflation has an insignificant impact on unemployment and GDP in Pakistan.

Rahman and Salahuddin (2009) analysed the relationship between economic growth and its determinants with a special focus on stock market development in Pakistan. The data used were from 1971 to 2006. The FMOLS and ARDL models were used for the long-run relationship, and ECM was used for the short-run dynamics. The findings showed a positive relationship between an efficient stock market and economic growth both in the short run and long run. Financial instability and inflation have a negative effect on growth.

Samiullah et al. (2013) investigated economic growth determinants in the case of Pakistan for the period 1980–2009. The (ARDL) model, error correction model (ECM) and ADF test were used. The ARDL results showed that there is cointegration between economic growth and the explanatory

variables of the real domestic investment, foreign investment, exports, remittances and the literacy rate. The estimated long-run elasticities of economic growth with respect to domestic investment, exports, remittances and the literacy rate were found to be 0.121, 0.026, 0.020, 0.065 and 0.224, respectively. Further results show that the error coefficient term is -0.67 and significant.

Rehman et al. (2019) explored the long-run relationship of the major macroeconomic variables of economic growth for Pakistan's economy during 1976–2016 using bound tests and the ARDL model. The study estimated the short-run and long-run relationship between GDP and labour force, rate of capital formation, money supply, inflation rate and trade rate. The results indicated a significant positive relationship between the labour force and economic growth and a significant negative relationship between FDI and unemployment in the long run at the 1% and 5% levels, respectively.

Jan, Ahmad, and Ullah (2019) found that export and economic growth have a positive relationship, meaning that an increase in exports increases economic growth. They concluded that exports have a positive impact on GDP growth in the long run and that the import variable is negative but insignificant. Tahir, Shah, Khan (2015) conducted research focused on establishing a relationship between external determinants and the economic growth of the Pakistani economy. The analysis was carried out with time series econometric techniques using data over the period 1977–2013. Foreign remittances and foreign direct investment have a significant positive role in the growth process of the Pakistani economy, while foreign imports have adversely influenced the economic growth of Pakistan.

Atique and Malik (2012) examined the determinants of economic growth for Pakistan and the impact of domestic debt and external debt on the economic growth of Pakistan separately over the period from 1980 to 2010. The ordinary least square (OLS) approach to cointegration, unit root testing, serial correlation testing, testing for checking heteroscedasticity and the CUSUM test of stability were used. The relationship between external debt and economic growth was found to be negative and significant. They concluded from the results that the external debt amount slows economic

growth more than domestic debt. The negative effect of external debt is stronger on economic growth in comparison to domestic debt.

3. Data and Methodology

Creating the right source of data and variables is important not only for experimental analysis but also for the accuracy of research. Numerous studies have been conducted over the past five decades to assess the effects of inflation and unemployment on growth. Most studies have used OLS and ARDL estimation techniques to analyse this relationship. The data sources were mainly based on secondary data. The methodology and variables of the present study have been selected on a theoretical and experimental basis, keeping in view their relative importance. It also seeks to include variables that largely determine the level and rate of growth in Pakistan's economy to examine the relationship between unemployment, inflation, exchange rate and economic growth in Pakistan. This investigation uses an annual time series dataset covering the period from 1990 to 2018. The time series data of economic indicators of Pakistan's economy were collected from the World Development Indicator (WDI). The linear natural logarithm equation is specified as follows:

$$Y_t = \beta_0 + \beta_1 Un_t + \beta_2 In_t + \beta_3 Ex_t + \mu_t \qquad (01)$$

where Y is economic growth (GDP current US$), Un is Unemployment, In is Inflation, Ex is the exchange rate to the US dollar and μ_t is an error term. Using time series data from 1990 to 2018 for GDP, unemployment, inflation and exchange rate data were obtained from the World Development Indicators (WDI) database.

Data Description

S.No.	Variable	Time Period	Data Type	Source of Data
1	GDP	1990–2018	Time Series	WDI
2	Inflation	1990–2018	Time Series	WDI
3	Exchange Rate	1990–2018	Time Series	WDI
4	Unemployment	1990–2018	Time Series	WDI

3.1 Econometric methodology

The research study will examine the relationship between economic growth, unemployment, inflation and exchange rate by applying the autoregressive distributed lag (ARDL) approach introduced by Pesaran and Smith (1998) and Pesaran et al. (2001). The ARDL model is chosen because it has certain advantages, one of which is that it can be applied irrespective of whether the time series variables are I (0), I (0) or frictionally integrated (Pesaran et al., 2001). The short- and long-run parameters can be estimated simultaneously, and the error correction model can integrate short-run adjustment and long-run equilibrium without fear of losing long-run information (Jalil and Mahmud, 2009). The equation of the ARDL model is as follows:

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Un_{t-1} + \beta_3 In_{t-1} + \beta_4 Ex_{t-1} + \sum_{i=1}^{\rho} \delta_i \Delta(Y)_{t-1} + \sum_{i=1}^{\rho} \delta_i \Delta(Un)_{t-1} + \sum_{i=1}^{\rho} \delta_i \Delta(In)_{t-1} + \sum_{i=1}^{\rho} \delta_i \Delta(Ex)_{t-1} + \alpha_t \tag{2}$$

where Δ is the first difference operator, Y_t is the dependent variable, Un_t, In_t and Ex are the explanatory variables, α_t is the error term and β_1, β_2, β_3 and β_4 correspond to the long-run parameters. The ARDL model starts first with investigating the unit root test to ensure that each variable is either I (0) or I (0) to satisfy the bound test assumption. The F test or Wald test is conducted to investigate the existence of a long-run relationship among the variables.

The null hypothesis of the nonexistence of cointegration, H0: $\beta_1=\beta_2=\beta_3=\beta_4=0$, is tested against the alternative hypothesis, H1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$, and the variables are said to be cointegrated if the null hypothesis is rejected, which establishes the existence of a long-run relationship. Third, if a long-run relationship is established between the variables, an error correction model is estimated from the following equation:

$$\Delta Y_t = \beta_0 + + \sum_{i=1}^{\rho} \delta_i \Delta(Y)_{t-1} + \sum_{i=1}^{\rho} \delta_i \Delta(Un)_{t-1} + \sum_{i=1}^{\rho} \delta_i \Delta(In)_{t-1} + \sum_{i=1}^{\rho} \delta_i \Delta(Ex)_{t-1} + \theta ECT_{t-1} + \alpha_t \qquad (3)$$

The results of the error correction term will indicate the speed of adjustment to reach equilibrium after a short-term shock. Stability and diagnostic tests will be employed to ensure goodness of fit for the chosen ARDL model, which will include serial correlation, heteroscedasticity, normality tests, and CUSUM tests.

We have also applied various tests, including the serial correlation LM test to check the autocorrelation, the Ramsey Reset test for model functional form, the Breusch pagan Godfrey test for heteroscedasticity, and the Jarque Berra test to check the normality of variables and CUSUM tests.

3.2 Unit Root Test

To check the order of integration of variables, the unit root test is applied. It is recognised that the strategies to find the unit root are complicated in the literature. We have employed the ADF test, which is used in place of correlation because ADF can handle more complex and larger models. The augmented Dickey-Fuller (ADF) statistic is a negative number. The requirement for the ADF test is as follows:

$$\Delta Y_t = \delta + \beta_t + \beta Y_{t-1} + \gamma_i \sum_{i=1}^{\rho} \Delta Y_{t-1} + \varepsilon_t \qquad (4)$$

The ADF test includes lagged a difference as a key component to oppose autocorrelation. This study also uses the ARDL approach to analyse the cointegration between unemployment, inflation, the exchange rate and economic growth in Pakistan.

4. Empirical results

To investigate the relationship between unemployment, inflation, the exchange rate and economic growth, we used different tests and techniques. First, a unit root test is conducted to ensure that none of the variables is I (2) and that the optimal lag is automatically selected by E-views 9 depending on the Schwarz Information Criterion. Previous studies show that gross domestic product (GDP) has a negative relationship with unemployment and a positive relationship with inflation (Gandelman & Murillo 2009). Inflation has a negative correlation with the gross domestic product and a negative correlation with unemployment in Pakistan (Umar & Razaullah 2013). Furthermore, this study used the autoregressive distributed lag (ARDL) model to determine the long-term relationship between unemployment, the exchange rate, inflation and economic growth.

4.1 Descriptive statistics of variables are given in Table 1.

Table 1 reveals the highest mean value of 64.10614 for the exchange rate and the lowest mean value of 4.023116 for unemployment. The exchange rate has a maximum standard deviation of 121.824, indicating volatility in the exchange rate, in contrast with the minimum standard deviation of 0.486651 for GDP. The unemployment, exchange rate, GDP and inflation data series positively reflect skewness in the data series. The higher values of Jarqa-Bera reflect the absence of normality in the data series of GDP, unemployment, the exchange rate and inflation.

Table 1. Descriptive Statistics of Variables

	GDP	Unemployment	Exchange Rate	INFLATION
Mean	6.600322	4.023116	64.10614	8.333305
Median	6.476672	4.260000	59.72378	7.921084
Maximum	7.344624	7.830000	121.8241	20.28612
Minimum	5.917744	0.397700	21.70738	2.529328
Std. Dev.	0.486651	2.442083	29.08011	4.194765
Skewness	0.226720	-0.103382	0.261394	0.626753
Kurtosis	1.450335	1.766147	1.937399	3.361385
Jarque-Bera	3.150207	1.891217	1.694601	2.056432
Probability	0.206986	0.388443	0.428570	0.357644
Sum	191.4093	116.6704	1859.078	241.6658
Sum Sq. Dev.	6.631226	166.9855	23678.28	492.6894
Observations	29	29	29	29

Source: Author's own estimation

4.2 Unit root test

An augmented Dickey-Fuller (ADF) test was applied to check the properties of the variables. According to the augmented Dickey-Fuller test analysis, all variables are stationary at the first difference, and all the variables are nonstationary at the level. Table 2 depicts the results of the augmented Dickey-Fuller unit root test.

Table 2. Results of the ADF unit root test

Variables	Level	Result	1st Difference	Result
GDP	0.9404	Nonstationary	0.0012	Stationary
Unemployment	0.3314	Nonstationary	0.0000	Stationary
Inflation	0.2283	Nonstationary	0.0000	Stationary
Exchange rate	0.4351	Nonstationary	0.0138	Stationary

Source: Author's own estimation

4.3 ARDL model for the short run

Table 3. Error correction model estimation for the selected ARDL-Model

Variable	Coefficient	Std. Error	t-statistic	Prob.
D(U_)	-0.030746	0.008831	-3.481596	0.0037
D(ER)	0.000129	0.002763	0.046860	0.9633
D(ER(-1))	-0.012156	0.004834	-2.514612	0.0248
D(ER(-2))	-0.003832	0.005200	-0.736880	0.4734
D(ER(-3))	-0.007632	0.003480	-2.193494	0.0457
D(INFLATION)	0.006651	0.003412	1.949247	0.0716
ECM(-1)	-1.030303	0.255925	-4.025796	0.0013

Cointeq=LNGDP-(-0.0499*U_+0.0161*ER+ 0.0138*INFLATION+5.8385)

Table 3 shows the results of short-run dynamics between unemployment, inflation, the exchange rate and economic growth. The coefficient of the error correction term (ECM) depicts the speed of adjustment for long-run equilibrium. The value of ECM defines how quick the adjustment process will be for the convergence of variables. A highly significant error correction term with a negative sign reflects a stable long-run relationship. The value of the ECM coefficient between 0 and -2 is a good enough value, depending upon the adjustment and flexibility capacity of the economy (Samargandi et al., 2013). The coefficient value of ECM -1.03 implies that the speed of convergence is 103% in the following year. The value of the error correction model (ECM) is -1.030303 between 0 and -2, showing a valid speed of adjustment/conversion to equilibrium.

Table 4. ARDL bound test

Bound Test		
F-statistic	5.407	
Critical Values		
Significance Level	**Lower Bound**	**Upper Bound**
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Table 4 shows the results of the ARDL bound test in which the F-statistic value is greater than the upper bound at the 5% level. Therefore, we concluded that there is a long-run relationship. It is a necessary condition that the F-statistic for the bound test must be greater than the critical values of the I (0) and I(I) bounds. The existence of cointegration between the variables as the value of F-Statistics 5.407 is greater than the upper bound at 5%.

4.4 ARDL model for the long run

The long-run association between unemployment, inflation, the exchange rate and economic growth is explored by the ARDL model. Table 5 shows the results of the ARDL in the long run. Here, the dependent variable is economic growth, and the independent variables are unemployment, inflation and the exchange rate. Unemployment has a negative and significant relationship with economic growth. According to (Mohseni & Jouzaryan, 2016), unemployment also has a significant and negative impact on gross domestic product. The inflation rate is 0.013833, which is also significant at the critical level of 5%. The effect of inflation on economic growth is positive in the long run. This result is consistent with the economic theory that growth and inflation are positively linked. The present study's findings are supported by Ahmed and Joya (2012), who found that inflation increases production and productivity. This result is consistent with Mubarak (2005), who found that the average consumer price index from 1972 to 2007 was 8.97% and that inflation in Pakistan falls below 9% and has a positive effect on growth (Malik and Chaudhry, 2001). Hussain (2011) also points out that there is a positive

and significant relationship between inflation and economic growth in Pakistan, which agrees with the present study.

Here, the exchange rate is positive and significantly related to economic growth, which means that a 1 percent increase in the exchange rate leads to increased economic growth. While unemployment is a negative relation, a 1 percent increase in unemployment leads to a 0.049 percent decrease in economic growth.

Table 5. Long-run coefficients

Variable	Coefficient	Std. Error	t-statistic	Prob.
Unemployment	-0.049919	0.007039	-7.091453	0.0000
Exchange Rate	0.016078	0.000604	26.617583	0.0000
Inflation	0.013833	0.004383	3.155870	0.0070
C	5.838514	0.091576	63.756264	0.0000
R-squared	0.995112	F-statistic	285.0237	
Adjusted R-squared	0.991621	Prob(F-statistic)	0.000000	
Durbin-Watson stat	2.037451			

Source: Author's own estimation

4.5 Diagnostic Tests

4.5.1 Checking Stability

A further step of estimating the model is checking the adequacy of the model before making a forecast. These review steps are divided into checking the model's stability and checking the diagnostic of the residuals' performance.

Figure 1. The CUSUM test
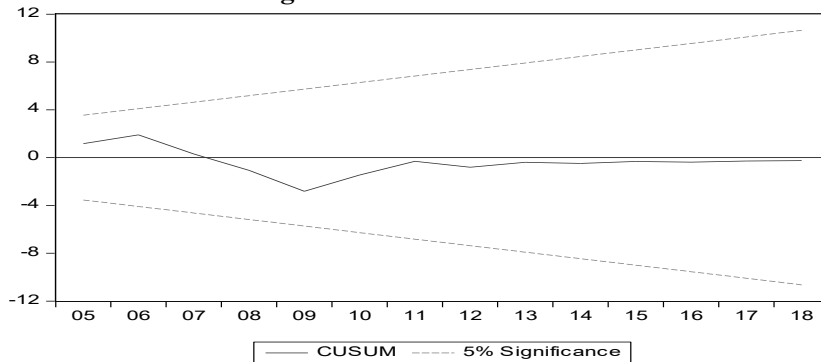
To check the stability and accuracy of the estimated model, CUSUM is used. The figure confirms that the estimated model satisfies the stability condition, as there is no root lying outside the significance level.

4.6 Checking Heteroscedasticity and Serial Correlation

We apply a number of diagnostic tests to the ECM, finding no evidence of serial correlation, heteroscedasticity, the CUSUM test, or effect on the disturbances. The model also passes the Jarque-Bera normality test, which suggests that the errors are normally distributed.

Table 6. Heteroscedasticity and Serial Correlation

Test	Chi-squared value	P value
LM test for Serial Correlation	0.1285	0.3410
Breusch–Pagan-Godfrey for Heteroskedasticity	0.2720	0.3023

Source: Author's own estimation

As it is widely used for checking the serial correlation of the residuals, the LM test is used, and it is confirmed that there is no longer a serial correlation between residuals. As shown in Table ----, the null hypothesis that there is no serial correlation is not rejected at level 0.05, which means that there is no evidence for serial correlation in the residuals term of the estimated model. Additionally, Table 6 shows that there is no heteroscedasticity (or the variance

is constant) in the residuals, since we do not reject the null hypothesis of no heteroscedasticity at the 0.05 significance level.

4.7 Checking Normality

The Jarque-Bera test is used for checking the normality of the residuals. The null hypothesis of the JB test is that the residuals are normally distributed. The probability (p value) highly recommends the normality of residuals as we can't reject the null hypothesis event at a very high level of significance.

Table 7. Checking Normality

Checking Normality	Value	Probability
Jarque-Bera test	1.8938	0.3879

Source: Author's own estimation

5. Conclusion and Policy Recommendations

This study is an attempt to investigate the long-run relationship between unemployment, inflation, the exchange rate and economic growth in the economy of Pakistan during the time period 1990 to 2018, where GDP is the dependent variable and unemployment, inflation and the exchange rate are independent variables. Prior to the ARDL test analysis, the ADF test was carried out to check for stationary and nonstationary levels of the variables. After finding at level, all the variables are nonstationary and become stationary at first difference. Autoregressive distributed lag (ARDL) and error correction models (ECM) with bounds have been applied to estimate the short-run and long-run relationship between unemployment, inflation, the exchange rate and GDP. The autoregressive distributed lag (ARDL) model indicates a significant negative relationship between unemployment and economic growth and a significant positive relationship with inflation and exchange rate in the long run at the 1% and 5% levels. Finally, the error correction model is estimated to capture the short-run effects of unemployment, inflation and the exchange rate on economic growth. The value of the error correction term (ECT) is between 0 and 2 and significant, endorsing cointegration among the

variables. Moreover, it indicates that deviation occurs in the short-run return to its long-run equilibrium with a speed of 103 percent. The bound test further confirms the cointegration among the variables.

The empirical results of this study provide policy-makers with a better understanding of the linkage between unemployment and economic growth to formulate investment policies in Pakistan. Unemployment and high-level poverty in Pakistan are due to many economic challenges. This sluggish economic performance has failed to create new job opportunities for their workforce. Therefore, steps should be taken to increase the productivity level of the economy by providing a conducive environment for local and foreign investors. Moreover, self-employment opportunities, government spending, education and training, and political stability can help to reduce unemployment. Self-employment/entrepreneurship is the backbone of any stable economy. It not only creates job opportunities but also provides versatile ideas for re-establishing what the economy needs.

All steps taken to benefit the economy are very important aspects for all nations. The government role in this aspect is fundamental. If the government spends more, then there will be more job opportunities and the building of a platform for recreating ideas and innovations. Political stability is also one of the factors that reduces unemployment and boosts economic growth. The fluctuations in politics greatly affect economic growth; therefore, political activities should be kept in the balance phase. Population growth is another factor. If the population is increasing at a higher rate, the economy would be burdened and there would be fewer job opportunities. Proper steps are needed to manage steep population growth. Another factor that greatly contributes to the economic growth rate is the education system. The systematic and organised education setup can produce more intellectual ideas that help encourage economic growth. The proper balance between these variables is to be maintained to obtain the desired results and to provide a booster to the economy.

The findings of the study show a positive relationship between inflation and economic growth. Inflation is concluded as having a growth-stimulating impact on the economy. However, higher levels of inflation adversely affect the poverty-alleviating impacts of growth. The inflation rate should be below the threshold level for the economy; inflation beyond the threshold level is harmful to economic growth. A stable price level is very important to stimulate sustainable growth, help generate employment and increase production.

The exchange rate has a positive and significant effect on economic growth in the present study; therefore, it is suggested that a country should have soft management of the exchange rate because persistent depreciation in the exchange rate over a period of time can lose the trust and confidence of investors in the economy. Moreover, other economic strategies, such as an increase in production by invention, innovation and advanced technology, can increase the share of exports, which can bring about appreciable economic growth. Considering the importance of exchange rate variables, especially the real term, these findings eventually suggest that a systematic exchange rate via monetary policy should be properly developed to promote the stability and sustainability of economic growth in Pakistan. Therefore, this paper recommends that the government encourage export promotion strategies and a conducive environment to maintain a surplus balance of trade. Additionally, adequate security, effective fiscal and monetary policies, and infrastructural facilities should be provided so that foreign investors will be attracted to investing in Pakistan.

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Paola Nardone* - Iacopo Odoardi†

THE EVOLUTION OF SEASIDE TOURISM ON THE ADRIATIC
COAST OF ABRUZZO: FROM THE MID-19TH CENTURY TO THE
MID-20TH CENTURY*

Abstract

Seaside tourism originated in the wealthiest and most advanced regions of
northern Europe in the 17th century, spreading to Mediterranean countries
approximately a century later. Both medical research on the benefits of the sea
and the progressive economic and infrastructural expansion allowed the
adoption of this type of tourism that has progressively passed from an elite
habit to a mass practice. In this framework, we examine the case of the
Abruzzo region in Italy on the central coast of the Adriatic Sea. We illustrate,
in particular, the evolution of four coastal municipalities whose economic
development encouraged the first public and private initiatives for tourism
purposes. In the historical reconstruction, important roles are played by the
events of the Unification of Italy (1861) and by the social and consumption
changes of Italians.

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1. Introduction

In this article, we propose the historical reconstruction of approximately one hundred years of development of seaside tourism in the Abruzzo region in Italy. Abruzzo is a region barely considered in historical and economic studies, yet nonetheless has played a decisive role in connecting the "two Italy's", North and South.

On the one hand, Abruzzo is geographically located in central Italy, on the Adriatic coast, historically belonging to the Kingdom of the Two Sicily's and since then culturally and socially linked to the southern area. On the other hand, Abruzzo's economic development has shown consistently different performances from the weak resilient south, differentiating in economic structure and society (Leonardi 1995; Andriani 2013), and even sharing some characteristics and socioeconomic paths with regions of the centre-north conventionally considered wealthy (e.g., Lagravinese 2015; Asso 2021).

In this article, we deepen one of the paths of economic development, namely, the creation and spread of seaside tourism, proposing the detailed historical reconstruction of four of the main coastal municipalities. Through consulting numerous unpublished archival documents, we reconstruct the history of tourism practices and the respective economic implications starting from the first wave of elite tourism, coinciding with the period of the unification of the country (1861), up to the rapid postwar economic development (1950s) and through to the expansion of mass consumption.

The original contribution of our research is the historical reconstruction of a relevant economic sector in what was once a backwards and isolated region, part of a vast "periphery" nearly isolated from the "central areas", such as the capital – Rome – and the wealthy north. Seaside tourism currently represents one of the most important forms of tourism in the area, and such an economic activity contributes to creating 3.99%[1] of the total regional added value (the Italian average is 3.95%, in 2018, on ISTAT data).

The remainder of this paper is organised as follows. In Section 2, we present a brief historical reconstruction of the beginning and early stages of the development of seaside tourism. Section 3 contains the introduction of the

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[1] Considering total tourism activities: accommodation and catering services.

case of Abruzzo and the extensive explanation of four case studies among the most important coastal municipalities. Section 4 concludes.

2. The evolution of seaside tourism: a brief historical reconstruction

The origin of seaside tourism dates back to the countries of northern Europe, particularly in the England of the eighteenth century, where thriving elite tourism had developed in some spas. These first experiences of services could not yet be considered tourism in all respects, and the first step towards the creation of seaside resorts took place when the beneficial properties of thermal water were added to those of bathing in the cold water of the sea. The development of this practice on the English coasts made it possible that one of the first and largest seaside resorts of the eighteenth century was created near a British spa town – Scarborough – a summer tourist destination for the aristocracy and nobility (Urry 2002, 36).

The nascent tourism sector has undergone changes and rapid evolution. Seaside tourism surpassed spa tourism at the end of the 18th century, when the benefits of sea air, rich in iodine, were added to those known from diving in salt water. Indeed, a new addiction was emerging in England, which focused on the charm of the cold seas (Battilani 2001, 104).

Medical science recognised brackish air as an important curative property against respiratory diseases that spread in those years due to the unhealthy environment created by the disorderly development of the new cities in the process of industrialisation. The tourist holiday in coastal towns was also recommended for the treatment of childhood diseases and, above all, to combat tuberculosis, which at the time was considered the disease of the century.

With the spread of consumption trends connected to these practices, at least for a privileged part of the population, the spread of seaside resorts was observed in maritime towns on the coasts of northern Europe. The practice of seaside tourism was initially regarded as an elite practice that used the coast for strolling, carefully avoiding exposure to the sun, wind and contact with the sand. In water, strict rules for diving were observed, away from the sight of other swimmers and tourists (Pierucci 2009a, 274-275). The same architecture of the beach resorts underscored their inaccessibility for the middle class: imposing and impressive stations, finely elegant, equipped to accommodate wealthy customers, with covered walkways for access to the bathing rooms, which could be done in special tubs or through the so-called "bathing

machines", i.e., small horse-drawn cabins with an opening on the back from which it was possible to dive without being seen (Berrino 2011, 119).

The advent of new means of steam transport facilitated the spread of the same model of tourism on the Mediterranean coasts as early as the end of the eighteenth century. It continued to be elitist winter tourism practised for the treatment of respiratory diseases, and the facilities built on the Côte d'Azur and in Italy first imitated the lush buildings typical of the Atlantic coasts.

The first seaside resort on the Adriatic Sea was built in Trieste – at the time part of Austrian territory – at the beginning of the twentieth century. It was the first floating beach resort, a model adopted almost immediately in the Venice lagoon and then on the Doric coast in the city of Ancona. Given the particular morphology of the coast, which is mostly flat and sandy, floating beach resorts were used and subsequently replaced with other types of more efficient structures. The latter were in particular known as the "Adriatic model": seasonal structures connected to the beach by walkways, consisting of platforms resting on stilts with cabins from which it was possible, via stairs, to descend into the water without being seen. They were modern and functional buildings, which did not need the protection of natural creeks (Pierucci 2009a, 281-282).

The change in the style of tourism from the winter to the summer season occurred slowly and only at the end of the nineteenth century, when the dictates of medical science began to enhance the therapeutic properties of the sun. The spread of sandblasting and thalassotherapy changed the tourist's relationship with the beach, which, in response to demand, began to be more frequented and better equipped. The habit of tourism on the warm coasts was facilitated by the development of the railways that allowed people to reach the bathing places in a short time. These transport changes favoured the frequenting of places previously considered remote and isolated, and regions such as Abruzzo in Italy observed an initial soft development of coastal resorts (Berrino 2011, 141).

The beach increasingly became the protagonist not only as a place of health but also for socialisation and entertainment. The normal attendance for tourism expanded to include most of the social classes. Magazines and newspapers of the time took an interest in the new phenomenon, disseminating information on seaside tourism and contributing to the development of coastal resorts (Taddei 1993, 257). In this framework, alongside the specialised treatment structures, the kursaals (intended as tourist facilities that offer a

variety of services and entertainment) were born, i.e., facilities dedicated to leisure.

With the new century, the relationship with the sea changed definitively; from quick dives away from the gaze of others, tourists switched to bathing in the sea. The hygienic culture and the habit of tanning made the relationship with the sea more uninhibited; bathing was no longer a moment of care but became above all a moment of leisure. The consequences for seaside tourism were huge, from the significant expansion of tourists to the modification of the model of beach resorts. The latter were no longer built on the sea from which bathers could immerse themselves without being seen but were built in concrete on the beach, equipped with cabins, toilets and often places for refreshments.

3. Development of seaside tourism in the municipalities of Abruzzo

In the postunification of Italy (1861), the development of tourism in the southern regions was faced with enormous difficulties due to the high heterogeneity of the territories that made up the new state. In addition, a high degree of hostility towards the new unification policy was present, especially from poor and less educated subjects, who were more widespread in the south (Di Nucci 2019).

In some southern regions, a major role in tourism expansion was played by the *Italian Touring Club*, which revealed the attraction scenarios of that area (Berrino 2011). In particular, some possible southern tourist destinations – at least in regions such as Abruzzo – often concerned with natural landscapes in a general context of insufficient transport infrastructures.

In this framework, seaside tourism in Italy developed substantially only in the mid-nineteenth century. As regards the Adriatic coast, it developed especially in the north where facilities dedicated to elite tourists were created even before unification. The central and southern beaches were mostly aimed at local day tourists, with no reception facilities. Only in the second half of the nineteenth century were appropriate improvements planned – such as the extensive reclaiming of the marshy areas and the construction of roads and railways – which allowed easier access to the coast from a tourist point of view. During these first signs of coastal transformation, large urbanisation

projects developed in many coastal municipalities, including the construction of parks for tourists, luxury hotels and holiday homes (Di Nucci 2019).

The new relationship between tourists and the sea discussed in Section 2 outlined a new geography of seaside tourism: the elite resorts, frequented by an international clientele, were mainly concentrated on the Ligurian coast, in Venice and Trieste; the high bourgeoisie and the Italian nobility preferred Versilia; and the Adriatic coast of Abruzzo was frequented by the middle class (Benegiamo and Nardone 2018). In Abruzzo, the natural landscape and the Mediterranean climate (Pierucci 2009b) have encouraged the dissimilar and particular development of the municipalities discussed in the following sections: Pescara, Francavilla al Mare, Vasto and Ortona.

Figure 1. Caption of the figure.
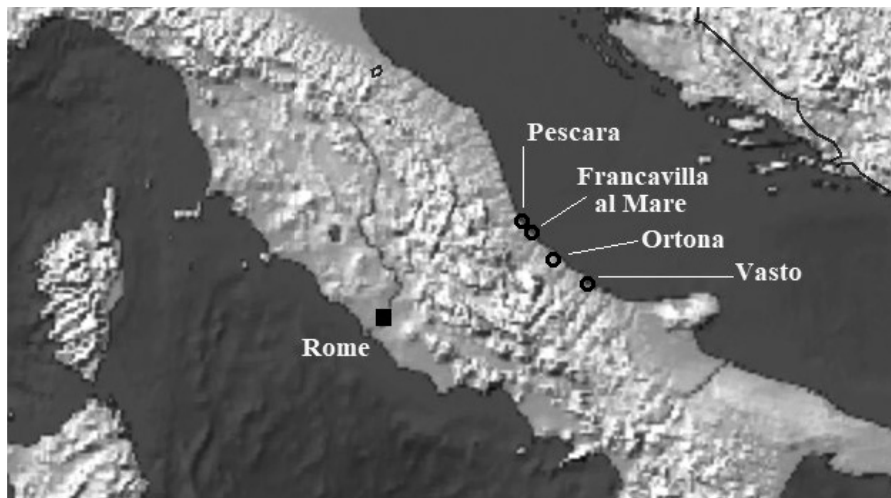
Source: Authors' elaboration on Eurostat map.

3.1. Seaside tourism in the municipality of Pescara

The bathing activity of the municipality of Castellammare Adriatico-Pescara (the two urban agglomerations that formed the municipality of Pescara) began at the end of the 1870s, when the local administration facilitated the construction, by private entrepreneurs, of the *Padiglione Marino* (*Marine Pavilion*), a beach resort used as ballroom, and some bathing huts. *Padiglione Marino*, inaugurated in August 1887, and *Caffè-Concerto*

represented the fulcrum of the tourism development project of the town (Alici 1993, 14, 20; Bianchetti 1997, 62)[2]. In the complex of activities implemented by the seaside town, in the same month, the "Censimento dei Bagnanti" ("Census of Bathers") was instituted, where 1,642 people with 195 companions were registered. It was mostly local tourism: the majority of the bathers came from the nearby towns of the Val Pescara (Valley of the Pescara River), with only 6% residing outside the region (from cities such as Bologna, Milan, Rome, Foggia, Naples). The presence of the nobility was negligible, accounting for less than 1% of tourists, compared with 50% of the upper-middle-class tourists and another half belonging to the less well-off classes.

The data of the census of the summer of 1887 highlighted seaside tourism still in an undeveloped phase, which was certainly not affected by the opening of the Adriatic railway line and the Rome-Pescara line, which took place in 1863 and 1883, respectively (Alici 1993, 12). Additionally, the short-sighted orientations of the entrepreneurial bourgeoisie played a negative role in tourism development. They aimed at stimulating industrial and commercial growth, leaving out the tourist-seaside sector. A sign of change occurred in May 1892, when the mayor Teofilo D'Annunzio – together with a group of local entrepreneurs – favoured the birth of the *Società per il Progresso Economico di Pescara* (*Society for the Economic Progress of Pescara*). The institution aimed to create a modern tourist district in the eastern part of the city. However, the achievement of the objective was subject to the implementation of reclaiming and urbanisation works, the cost of which was prohibitive for the municipal coffers, so the project was abandoned[3]. In the meantime, a residential building program along the beach was started, which involved the demolition of unhealthy urban neighbourhoods, thus giving the town a pleasant appearance from an architectural point of view. In 1893, the municipality obtained the availability of the beaches located north of the *Padiglione Marino* by the State Property (Demanio), and the entire area was divided into building lots to be sold by private negotiation.

Other transformations that took place together with the birth of the *Club Estivo* (*Summer Club*), set up on the model of the *Commissione Balneare di Rimini* (*Rimini Seaside Commission*) (Silvestrini 1965, p. 58)[4] made it

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[2] Archivio di Stato di Chieti (ASCh), Contenzioso (CON), Processi verbali, 1875-1885, *ad vocem;* Archivio Storico Comunale di Pescara (ASCPe), b. 124, f. 10, Luigi Olivieri to the municipality of Castellammare Adriatico, 12 october 1878, b. 2009, f. 23, private writing, 12 november 1883.

[3] ASCh, Tribunale Civile e Commerciale (TCC), Processi verbali, 1879, ad vocem.

[4] ASCPe, b. 9/CA, f. 88, b. 13339, f. 1, 6.

possible to register over 4,000 visitors in the summer of 1905. The latter figure was considered significant for the time and made it necessary to urgently proceed with the necessary structural interventions to adequately support the increase in tourist flow[5].

A second ambitious project was thus launched, entrusted to engineer Antonino Liberi, who directed the building interventions in the area bordering the municipality of Francavilla al Mare (a coastal municipality on the southern border of Pescara, see Section 3.2). This project took place through a master plan aimed at the subdivision of the beaches of the *Pineta* area (a pine forest located in the southern part of the city). However, even this development program was rejected due to the lack of buyers, so the engineer from Pescara opted for an alternative solution: the construction of a garden city following an urban model that was widespread in Europe at the time (Bianchetti 1997, 69)[6]. A kursaal and a series of homogeneous villas were then built, a project in which local entrepreneurs actively participated, supported by the incentives and tax breaks granted by the municipal government. The project was successful, and the new neighbourhood created obtained the nickname the "garden city" by journalists and writers (Alici 1993, 20-21)[7].

The original project of Liberi was resumed in the following years and included in the program of the *Kursaal Pineta* joint stock company, founded on 22 September 1911, with the aim of building a marine district at the *Pineta* of Pescara (De Antonis and Minore 1977, 34; Colapietra 1980)[8]. For this purpose, in 1912, the municipality of Pescara approved "The rehabilitation plan of the Contrada Pineta" ("Il Piano di risanamento della Contrada Pineta") and the "Building plan to transform the rehabilitated area into a seaside climate district" ("Piano edilizio per trasformare la plaga risanata in quartiere climatico balneare") for a cost of 600 thousand lire[9]. In 1913, work began on the construction of the Kursaal building: the structure immediately became one of the most active aggregation centres of the city's cultural and recreational life, later hosting an important beach resort (Bianchetti 1997, 64).

The significant development of tourism in the city forced the municipality to finance increasingly noteworthy public works during the period 1913–1916[10]. In February 1919, work was carried out again on the *Padiglione*

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[5] Ivi, b. 2430, f. 7, Zecca Cauli to the major of Castellamare Adriatico, 11 october 1910.
[6] ASCh, Prefettura (Pref.), I serie, VII versamento (vers.), categoria 22^, prefect of Chieti to mayor of Pescara, 12 september 1911.
[7] Ivi, b. 2009, resolution of the Municipality of Castellamare Adriatico, 23 march 1910.
[8] ASCh, TCC, Fallimenti (FALL), b. 52, registri di Società, n. 4, *ad vocem*.
[9] Ivi, Pref., II serie, IV vers., b. 141, f. 125.
[10] ASCPe, b. 24, f. 11, City Council resolution, 14 april 1913

Marino, with an upgrading project aimed at improving its functionality in the summer period for a cost of over 60 thousand lire[11]. The building housed the numerous leisure activities organised by the *Pro-Castellamare* association, mainly engaged in popular festivals. The premises of the *Padiglione* were also used as a stage for the creation of shows staged by theatrical entrepreneurs[12].

In the first postwar period, seaside tourism in the Mediterranean area recorded a significant development, and the bathing model that previously characterised the popular classes gradually spread to all the social classes (Battilani 2001, 120). The fleeting and intimate immersion in water was replaced by entertaining and social activities. In particular, during the Fascist period, holidays became a strong social activity, and in light of the myth of the "vigour of the breed", a decisive impulse was given to popular beaches (Pierucci 2009a, 290).

As a result of this transformation, the neighbouring towns of Castellamare and Pescara intensified the reclaiming of the coast and the construction of new houses along the shore and governed the entire urban development. The goal was to create a national-level seaside tourism along the coast between Montesilvano and Francavilla al Mare (municipalities north and south of Pescara, respectively) able to compete with the Romagna Riviera (a wealthy and highly developed coastal area of the north). The costs of the project were considerable: the municipalities involved – while waiting for the local entrepreneurs to finance the largest share of the works – started the most significant interventions; in particular, they strengthened public transport, entering into agreements with companies in the sector[13]. Despite the commitment of Castellamare and Pescara, in the summer of 1925, the gap with Rimini (the reference point for tourism in the Emilia-Romagna region in northern Italy) was still large, as evidenced by the data published by the *National Agency for the Increment of Tourism* (*Ente Nazionale per l'Incremento del Turismo*). The latter agency calculated approximately 70 thousand beds available in 26 hotels and 13 pensions for the city of Rimini, while Castellamare and Pescara could only count on 300 beds divided into 13 hotels (Enit 1925).

An important turning point in the seaside tourism sector was recorded in 1927, when the new province of Pescara was born from the union of the municipalities of Castellammare Adriatico and Pescara, and in October of the

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[11] Ivi, b. 1926, f. 2, report of the refurbishment works of the Padiglione Marino, 28 october 1919.
[12] ASCPe, b. 33, f. 9, President of the Club to the mayor, 20 june and 3 july 1908.
[13] ASCPe, b. 674, f. 2.

same year, the *Autonomous Tourist Board* (*Azienda Autonoma di Soggiorno e Turismo*) was officially recognised (Iacone 1993, 45; Di Biase 1998, 218). These two events brought rapid consequences: the flow of "foreign vacationers" had a significant increase in the summers of 1928 and 1929 – over 57,000 visitors – with obvious benefits for the coffers of the Province of Pescara (Consiglio Provinciale dell'Economia 1929, p. 117). At the end of the 1920s, the *Tourist Board* (*Azienda di Soggiorno*) took the place of the municipality of Pescara in the administrative and financial management of bathing activities. The program of interventions launched in the following decade, with the involvement of private entrepreneurs, produced positive effects: in 1931, 206,000 visitors were present, which rose to over 334,000 in 1934, of whom 3,000 were foreigners. However, these results were not yet sufficient to transform Pescara into a seaside resort of national importance because there was no significant increase in the second half of the 1930s. The weak receptivity of the hotel sector and the poor level of services offered to vacationers had a negative effect on the image of the city[14].

Figure 2. Shares of arrivals and daily presence of tourists in Pescara in 1938.
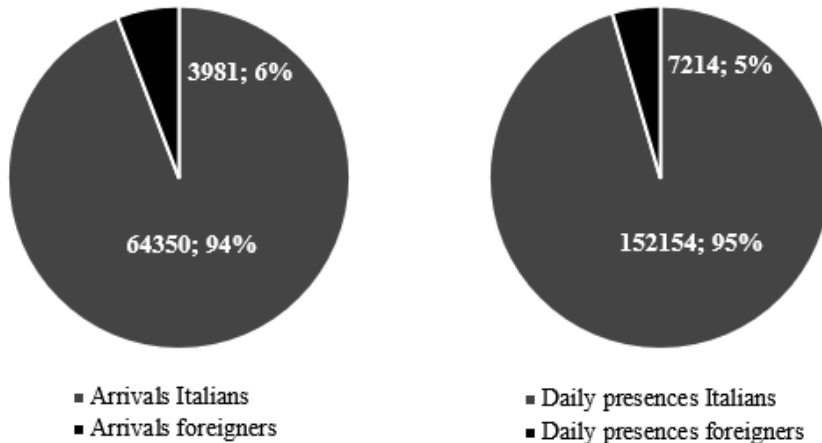
Source: *Authors' elaborations on data from Di Nucci (2019).*

The Second World War and the massive bombings by the Allies caused extensive damage to the hotels in Pescara. The reconstruction program

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[14] *I problemi turistici della provincia di Pescara*, in «L'Adriatico», 2 march 1935.

launched in October 1945, on the initiative of the *Provincial Tourism Board* (*Ente Provinciale per il Turismo* – EPT) and other public and private entities,[15] allowed 11 hotels to be in operation in July 1946, with 207 rooms and 316 beds. In 1948, 10 hotels were in operation, with a sufficient supply of single and double rooms and services[16]. Nevertheless, Pescara's accommodation capacity was still modest; public bodies were unable to strengthen the bathing industry, a goal that could only be achieved by drawing on the ERP (European Recovery Program) funds that were requested[17], or by contacting – as happened in 1950 – the *Cassa per il Mezzogiorno* (Casmez – *Southern Italy Development Fund*), which had planned to allocate approximately 30 billion lire to the development of the tourism industry in southern Italy[18]. The amount requested was 1,740 million lire to be invested in accommodation equipment, spas and sports facilities as well as in the road infrastructure sector. The sum granted was only 400 million lire, of which 295 million were tied to the seaside sector[19].

Figure 3. Arrivals and presence of tourists in Pescara from 1945-1954
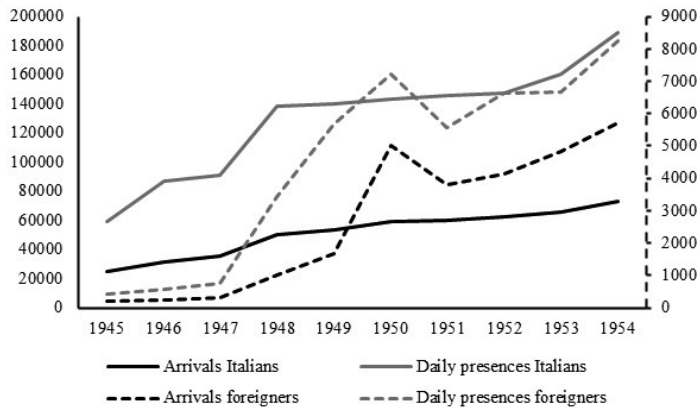
Source: *Authors' elaborations on data from Di Nucci (2019).*

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[15] ASPe, Ept, I serie, b. 19, f. 96, Enit to Ept of Pescara, 13 october 1945.

[16] Ivi, b. 11, f. 1, Ept to the Direzione Generale del Turismo, 13 july 1946; Ivi, b. 5, f. 14, denunciation of the hotel structure of the Ept of Pescara, 19 july 1948.

[17] ASCPe, b. 1250, 18 march 1949.

[18] *30 miliardi della Cassa per il turismo nel Sud*, in «Il Tempo», 13 march 1951.

[19] *Le esigenze turistiche regionali* in «Il Messaggero», 10 september 1951; ASPe, Ept, serie I, b. 24, f. 156, Ept of Abruzzo to the Casmez, 9 october 1951.

During the 1950s, Italy experienced significant industrial development; Abruzzo participated in the country's economic growth in several sectors, including tourism. The seaside industry in Pescara, thanks also to the presence of foreign tourists, was on the way to becoming a mass phenomenon. Positive effects were triggered by the law of 25 March 1950 (n. 228), which facilitated expropriations for public use projects carried out for the construction and modernisation of hotel complexes, followed by law no. 161, which provided subsidised loans for the construction of hotels and financed one billion lire a year.

Although public funding was not yet sufficient, it proved very useful, especially for the modernisation of some hotels in the Adriatic city[20]. At the end of the 1950s, seaside tourism in Pescara had grown considerably compared with the postwar period. However, the leading weakness, namely, the insufficiency of hotels and equipment, continued to negatively affect the definitive take-off of the tourism sector[21].

3.2. Seaside tourism in the municipality of Francavilla al Mare

The seaside development of Francavilla al Mare began at the end of the nineteenth century, when the natural expansion of the sandy strip at the foot of the hill where the city stands began to attract the first tourists for summer holidays, even from outside the region (Iacone 1993, 15-17). In this context, foreign tourism was attracted by the initiatives of public and private bodies that created bathing facilities and organised suggestive events in the late 1870s.

The first seaside resort was built in 1873 by private initiative, and a few years later, the municipality began the construction of the road destined to become the structural core of the future *Marina* district, i.e., the current *Viale Nettuno* (*Neptune Avenue*). In 1886, the construction of the *Palazzo della Sirena* (*Palace of the Mermaid*) began, with the aim of creating a building dedicated to the organisation of highly appealing summer events. A few years later, in 1888, the completion of the infrastructural network that led to the construction of the Rome-Pescara railway caused a strong increase in tourists from Rome.

After the First World War, the town's activity in the seaside sector resumed with moderate intensity. *Palazzo Sirena* became the hub of all summer

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[20] Ivi, f. 156, report 11 may 1959.
[21] Ibidem.

activities, giving rise to huge profits but also to disputes between local and foreign entrepreneurs, to whom the management was assigned with five-year contracts[22]. With the aim of obviating the tensions among entrepreneurs that were likely to affect the performance of the tourist season, the municipality authorised the establishment of the *Circolo della Sirena* (*Mermaid Club*), i.e., an association formed by local entrepreneurs and members of families who usually spent their holidays in the town of Francavilla. The solution did not work, however, so the municipality decided to dissolve the club in December 1920, having become a near total monopoly of a small group of entrepreneurs from Francavilla[23].

In the 1920s, important hotels were built, as well as meeting places and seaside resorts, which led to an increase in clientele from other regions. The tourism sector became the main economic and productive alternative to the crisis of agricultural and fishing activities. In January 1927, the municipality joined the *National Consortium of Seasons of Vacations spots* (*Consorzio Nazionale delle Stagioni di Soggiorno*), with the aim of including Francavilla in the national seaside circuit, and in March of the same year, the town obtained the coveted recognition of the establishment of the local Travel and Tourism board, one of the first in Italy (Benegiamo 2006, 46).

The same year, the municipality planned to build a kursaal on the model of the one in Pescara (see Section 3.1), with approximately 100 cabins and a wooden platform of 600 square metres with a canvas roof over the sea. The work was not completed, although the designer, Federico Cuneo of Rapallo, had undertaken to advance the sum necessary for the work (estimated at approximately 100,000 lire) upon a commitment by the municipality to return the funds within five years[24]. Various interventions were implemented by the Tourist Board to encourage the "foreign tourist industry", a choice deemed necessary to ensure a leading role in the tourism industry of the Adriatic belt (Rosito 1995, 92-94). The 1929 crisis was a factor that weighed negatively on this objective. A sharp decline in the number of bathers occurred, putting one of the most beautiful and important structures at risk of closure: the large *Hotel dei Bagni* (*Hotel of the Baths)*, with a capacity of 70 rooms and intended to accommodate an elite clientele. Measures to rescue the hotel were urged by the EPT, which called the city administration to pay greater attention to all

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[22] ASCh, Pref, II serie, V vers., b. 190, City Council resolution, 12 december 1910.
[23] Ivi, City Council resolution, 12 november 1925.
[24] Ivi, b. 192, resolution of the podestà, 2 june 1927 and agreement Municipality-Cuneo, same date.

accommodation facilities in crisis[25]. For this reason, the municipality designed a series of urban interventions aimed at strengthening the driving role of the coast during the 1930s, investing considerable sums that were partly financed by the Ministry of Public Works[26] and began the arrangement of the beach crossed by the Alento River with the aim of transforming it into one of the area's greatest tourist attractions. The project was also supported by two major companies from Rome, owners of extensive local land to be redeveloped[27]. In the same years, the city administration organised the beach located to the northeast of the urban belt in the direction of the pinewood of Pescara (*Pineta* area). The project involved the construction of an avenue parallel to the sea, *Viale Alcione* (*Alcyone Avenue*) at a total cost of over one million lire, which was completed in 1937[28]. In 1938, the project for the construction of the kursaal was resumed, and the total cost of 500 thousand lire would be paid by the Tourist Board with subsidised bank loans and with State contributions[29]. In 1939, the tourist tax was introduced, which affected both the rented apartments and the guests of the 7 public hotels, of which only one (*Albergo dei Bagni*) was in the higher category. It thus became possible to obtain funds for the municipal coffers and plan other works to improve the Francavilla accommodation infrastructure[30].

Despite the commitment and initiatives of the Tourist Board and the Municipality, the seaside industry was still struggling to take off sufficiently in the years 1940–1945. Several times, the two entities were forced to request the government to intervene and provide credit to institutions to deal with the financial crisis caused by a gradual decrease in the flow of tourists, which in turn was attributable to the general situation of the country engaged in the war effort[31]. The situation did not improve much at the end of the war, and in the early 1950s, when daytime tourism increasingly joined the long tourist stays due to the destruction suffered during the war. Francavilla al Mare, formerly known as the "Pearl of the Adriatic", was converted into a beach for mass tourism.

Only in the second half of the 1950s did a turnaround and a lively increase in attendance begin to take place, thanks to the continuous efforts made by the Municipality and the Tourist Board in rebuilding *Palazzo Sirena* and many of

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[25] Ivi, b. 187, Municipality of Francavilla to the Prefect, 19 june 1935; deliberation Ept, 3 april 1937.

[26] Ivi, b. 190 e 195, f. non num.

[27] Ivi, b. 195, f. non num.

[28] Ivi, b. 195, f. non num.

[29] Ivi, b. 190, f. non num., resolution of the Azienda di Soggiorno, 12 march 1938.

[30] Ivi, bb. 190-192, f. non num.

[31] Ivi, b. 190, f. non num., report of the Azienda di Soggiorno, 22 november 1951.

the lost hotel and bathing facilities. At the beginning of the summer of 1960, Francavilla had 4 hotels and 2 inns, with an accommodation capacity of 90 rooms and 150 beds, and the town could also count on approximately 300 apartments to rent.

Francavilla still had a modest reception and recreational structure (of both public and private origin), nevertheless characterised by a series of latent driving forces that quickly unfolded in the following years, transforming the town of Abruzzo into one of the most important seaside municipalities of the Adriatic Sea[32].

3.3. Seaside tourism in the municipality of Vasto

The Vasto seaside tourism sector developed a few years later than the other Abruzzo towns. The coast was devoid of urbanisation, except for a few houses of farmers and sailors, while the urban centre stood on a distant promontory and was poorly connected with the beach. Added to this particular territorial feature was the poor entrepreneurial mentality in the tourism sector; at the end of the nineteenth century, the concessions required for the use of the beach concerned only factories and warehouses.

The first seaside resort, *La Sirena* (*The Mermaid*), opened in 1890 and was developed from a shed for the shelter of fishing gear. This structure was built on a series of stilts in the sea; it housed 20 cabins from which it was possible to descend into the water away from prying eyes and was connected to the mainland by a jetty (Tagliente 1994, 26-28). For the time, it was an important structure that fully satisfied the still scarce local tourism and that increased with the activation of the Adriatic railway. The anthropisation of the beach took place only in the early decades of the twentieth century, when the beach and the sea of Vasto began to feed feelings of entertainment and worldliness, as evidenced by the construction of the first villas along the coast by private entrepreneurs[33].

During the Fascist period, the coast experienced real tourist development. In particular, the first hotel restaurant was inaugurated in 1929, *Nuova Italia* (*New Italy*). This accommodation facility was strongly requested by the municipal authority, which guaranteed the manager an exemption from paying

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[32] Ivi, Pref., I serie, V vers., categoria 7^, material pending order, Mayor of Francavilla to the prefect, 22 november 1951.
[33] Archivio Comunale di Vasto (ACV), Biblioteca Raffaele Mattioli (BRM), b. 77, f. 102, 103.

local taxes, free use of the drinking water service, and a monthly contribution of 250 lire for the first 5 years of activity[34].

The 1930s were characterised by the opening of several seaside resorts and the construction of the *Colonia Marina* (*Marine Colony*), consisting of a series of wooden shelters built on the beach with the contribution of private citizens and the "Pro Colonia Marina" city committee, of which the podestà was president[35]. The increase in the tourist flow that followed is evidenced by the number of beach concessions for bathing purposes, in addition to the safety, hygiene and beach rescue service set up by the municipality during the summer[36].

In the second half of the 1930s, the most important initiative to accelerate the tourist take-off of Vasto took place. In 1937, the engineer Attilio Giammaria planned the construction of a large bathhouse to also be used during the winter. The project concerned an area of 2,659 square metres, for an expected expenditure of over 800 thousand lire, which would be financed by the *Ministry of Popular Culture* (*Ministero della Cultura popolare*) and the *Autonomous Section of the Hotel Credit* (*Sezione Autonoma del Credito Alberghiero*). The three-story building, built on the beach and with immediate access to the seafront, hosted numerous entertainment and catering activities[37]. In fact, although Vasto had not yet been officially declared as a Health, Holiday and Tourism Resort, it had already eradicated all malarial areas in 1931. This substantially increased the number of vacationers, which forced the administration to organise adequate services. To finance these services, the managers of the seaside huts contributed a fee of 20 lire per structure for the whole summer season[38].

Among the last prewar initiatives, the entrepreneur Michele Molino opened the *Hotel Nettuno* (*Neptune Hotel*). Built with the contribution of EPT funds (2,500 lire), it became the flagship of Vasto seaside tourism for many years[39]. In addition, the municipality decided to buy 330 square metres of beach from the State Property in 1940 to be used for bathing activities. However, the sudden fall of the city council led to the termination of the agreement with the State Property.

The end of the war in Abruzzo in June 1944 triggered a vigorous resumption of activities in the seaside sector. In May 1945, the municipal

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[34] ASCh, Pref, II serie, V vers., b. 492.
[35] ACV, BRM, b. 77, f. 107.
[36] Ivi, f. 111.
[37] Ivi, f. 109, Giammaria project, 10 october 1937.
[38] ASCh, Pref, II serie, V vers., b. 439.
[39] Ivi, b. 142.

administration determined the shares of the beach to be paid by the owners of the bathing huts, in addition to the public price of the cabins for the entire summer season, classifying them by row[40]. Prices were initially rather modest; they were revised upwards in 1947 due to inflation and budgetary needs.

In 1948, when Vasto obtained recognition for a five-year term as a Health, Holiday and Tourism Station, three hotels were in operation (*Nuova Italia*, *Nettuno*, and *Ricci*) in addition to several inns for a total of approximately 800 beds[41]. However, these hotels and inns were old and inadequate for enhancing the infrastructure related to seaside tourism and for the town of Vasto to be included among the most renowned tourist destinations on the regional coast[42]. At a later time, the Tourist Board supported the construction of two hotels with approximately 40 rooms to be built on the coast and in the city centre[43].

In 1953, the activities organised by the city granted Vasto the definitive recognition as a Health, Holiday and Tourism Station, an event that made it possible to build additional structures that attracted 54,134 vacationers in 1958, of whom 5,897 were foreigners[44]. Vasto achieved a prestigious milestone with the construction of the *Autostello Hotel*, prevailing over neighbouring larger municipalities such as Pescara, Francavilla, Chieti and Lanciano, which were strongly interested in the project. *Autostello Hotel* was a hotel type linked to the road route and, in some cases, connected to the *Automobile Club of Italy* (ACI). The complex, which covers approximately 3,800 square metres, provided for an expense of 4 million lire, an important sum advanced entirely by the ACI to the municipality, that committed to repaying it in eight annual instalments starting in 1955[45]. Additionally, in 1955, the municipal administration convinced the Ciatsa Company of Valdagno di Vicenza to build the *Jolly Hotel* on one of the most attractive points of the coast, equipped to meet the needs of an elite clientele at any time of the year[46]. In the same year, the *Italian Tourist Hotel Society* (*Società Italiana Alberghi Turistici*) planned the construction of a hotel complex on an area of approximately 1,500 square metres. A few years later, the *Youth Hostel*

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[40] Ivi, b. 493.
[41] Ivi. b. 142.
[42] Ivi, b. 148.
[43] Ibidem.
[44] Ivi, b. 488, report of the Azienda di Soggiorno, 2 december 1958.
[45] Ibidem.
[46] Ivi, resolution of the Municipality of Vasto, 4 june 1955.

(*Ostello della Gioventù*), the first camping sites and guesthouses opened in Vasto[47].

At the end of the 1950s, the tourist activity of Vasto was ready to successfully face the development of mass tourism of the seaside industry that would take place in the 1960s, thanks to the opening of the A14 motorway and the new route of the old Adriatic state road. The contribution of the Tourist Board was particularly important in supporting the initiatives of the municipal administration and private citizens to improve services and facilities. It created notable hype, using national and foreign newspapers and magazines to establish direct contacts with official tourism bodies and travel agencies in Germany, France and Holland. Numerous publications were published, for example, of historical-artistic guides of Vasto and of the price lists of hotels with indications of holiday periods[48].

3.4. Seaside tourism in the municipality of Ortona

The town of Ortona has had a different development path compared with the seaside municipalities illustrated thus far. Although Ortona has a considerable coastline, it did not develop a real seaside tourism policy before the Second World War. Until then, the interests of the local government were entirely centred on the development of the cargo port rather than on bathing[49]. Nevertheless, the electric funicular, which connected the beach with the railway station (state railways and Sangritana railway) and the upper part of the city,[50] was active since 1926, suggesting that in the 1920s there was already some tourist activity on the beach. In particular, a tourist guide of the time mentions the *Dea Venere* (*Goddess Venus*) seaside resort, equipped with two rows of dressing rooms and a square for summer entertainment activities (Rapino 1928, 50-51).

At the beginning of the 1930s, a soft development of the seaside tourism sector was observed, particularly in the *Lido Riccio* and *Lido Saraceni* areas, frequented by swimmers for the healthy climate and for the moderate prices, above all in the *Bagni Marini* seaside resort[51].

In 1937, only three modest inns existed with just 16 rooms, a totally unsuitable infrastructure for tourism development. For this reason, the

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[47] Ivi, Etp to the Prefecture, 5 july 1958.
[48] Ivi, activity program of the Azienda Autonoma for the four-year period 1958-1962.
[49] Ivi, I serie, IV vers., b. 167, report of the local port commission, 20 october 1900.
[50] ASCh, TCC, Registro Società, n. 3, *ad vocem*.
[51] Ivi, Pref, I serie, VI vers., categoria 22^, material pending order, Prefectural Report, 12 september 1930.

administration began a series of beautification works in the city the same year, taking advantage of the financial plan launched by the national government to support and upgrade tourist facilities. The city administration entrusted the engineer Giovanni Nervegna with the drafting of the project for the construction of a large hotel with 41 rooms; the estimated cost of 570 thousand lire would have been partially covered with a loan contracted by the city with the *Hotel Credit Section of the Italian National Labour Bank* (*Sezione del Credito Alberghiero della Banca Nazionale del Lavoro*) and with the government. In 1939, the Ministry of Popular Culture accepted the request from Ortona; nevertheless, the delay in granting funding and the outbreak of the war resulted in the project's failure [52].

Fifteen days after Italy entered the war – on 25 June 1940 – the government issued the new lists of climatic and seaside municipalities of tourist interest, including Ortona. However, the war events saw the city among the most devastated on a national level, precluding any possibility of tourist development[53]. The devastating impact of the war affected the city for a long time, and forced it to give up the project to improve tourist facilities by exploiting the 35 million awarded in 1949 by the State, thanks to ERP funds. The Stem company, that had been awarded the contract, went bankrupt at the very beginning of the project [54].

In 1956, one year after the first request to the government for recognition of the status of Holiday and Tourism Station, the city had only four certified bathing resorts for marine heliotherapy and thalassotherapy treatments, two third- and fourth-category hotel complexes, and some guesthouses and inns for a total of approximately 100 beds[55]. For the take-off of the seaside tourism sector, the establishment of the Autonomous Board with its important financial advantages was of the utmost importance. For this reason, in 1957, the local administration reiterated the request, obtaining recognition linked to the quality of the tourist area in 1959. It was, therefore, possible for Ortona to access government conditions for the construction of tourist infrastructure and adjust the amounts of the tourist tax, passing from an average income of 28,000 lire in previous years to approximately 150,000 lire in 1960. The delay experienced by the city was considerable compared to the other Abruzzo

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[52] Ivi, II serie, V vers., b. 314, resolutions of the podestà, 1 august 1938 and 23 december 1939.
[53] Ivi, III vers., Ufficio di Gabinetto, b. 45, fasc. 12.
[54] Ivi, II serie, V vers., b. 352, resolution of the Municipality of Ortona, 9 july 1954.
[55] Ivi, b. 300, report of the Ufficiale Sanitario, 16 octboer 1956.

towns, and in the 1960s, Ortona remained in the lowest position among the seaside resorts of the region.

4. Conclusions

At the time of the unification of Italy, the coastal strip of Abruzzo was isolated from the internal territory, a situation determined by the application of centuries-old policies aimed at the defence of the territory, which favoured an uninhabited coast without connections with the hinterland. A wild and desolate coast suitable both for fighting but, above all, to discourage the landing of the enemy coming from the sea. For this reason, until the unification of Italy, the Abruzzo seaside was a deserted land where only a few shipments needed for maritime trade were present (Nardone 2008).

The unification process changed the fate of the region, which was affected by government actions aimed at creating the new state. The construction of road infrastructures – in particular the opening of the railway line, which runs along the coast – was a determining factor in revolutionizing the geography and economy of the maritime side. Many inhabited centres from the hill moved along the coast, and new urban centres were born.

At the end of the nineteenth century, the necessary conditions had been created for alternative use of the coastal strip from the usual fishing and recreational activities. The new heliotherapeutic medicine encouraged long walks along the coast that became a meeting and leisure place, while the first seaside resorts built on stilts were used for fleeting immersions.

It was only in the Fascist period that extensive malaria remediation programs were put in place and that residential neighbourhoods and seaside infrastructures began to be built to take advantage of a unique opportunity for the coast of Abruzzo. The opportunity to attract maritime tourism was born from the new fashion of bathing suits and tanning, which had been the discovery by medical science of the healing qualities of the sun.

Remediation programs and the development of tourism infrastructure allowed several coastal localities of Abruzzo to qualify as Health and Tourism Resorts and, consequently, to be able to create local Tourist Offices capable of attracting and driving state funding in the tourist seaside sector.

In 1927, Pescara and Francavilla al Mare were among the first centres in Italy to obtain this qualification together with other important towns such as Rapallo, Senigallia, Santa Margherita Ligure and Viareggio (all known tourist locations in the wealthy and more developed centre-north). The important occasion for Vasto took place in 1948 and in 1959 of Ortona, a time gap that led to the heterogeneous economic development of the coastal strip that has

not recovered in the following years and that sees the city of Pescara excel over the others for seaside tourist activities.

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THE INFLATION UNCERTAINTY AND OUTPUT UNCERTAINTY NEXUS: THE CASE OF PAKISTAN

Abstract

This study uses quarterly data from Pakistan from 1973 to 2018 and applies the GARCH-M specification and Granger causality test to empirically investigate the relationship between inflation, output growth, and their associated uncertainties. The results of the study negate the presence of the Cukierman-Meltzer effect; that is, inflation uncertainty does not harm inflation. The study supports the Friedman-Ball hypothesis, which states that higher inflation leads to higher inflation uncertainty. The Granger causality test further strengthens the results and suggests a unidirectional relationship between the two. The results from the study reject the presence of Devraux's hypothesis and Black's hypothesis and confirm the Friedman hypothesis that inflation uncertainty adversely affects economic growth in Pakistan. Our Granger causality test results further confirm our results obtained from the GARCH-M specification. We find no support that higher inflation uncertainty affects the inflation rate; however, the empirical finding supports the stance that higher output uncertainty increases the inflation rate, as suggested by both sets of results. Monitoring inflation and inflation uncertainty can boost the economy, as suggested by the results, if they remain stable.

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HYPOTHESIS; INFLATION UNCERTAINTY; GARCH; GRANGER CAUSALITY

1. Introduction

Inflation corrodes economic activity, causes severe damage to the credibility of the central bank, reduces purchasing power, and has a devastating effect on investors' investment decisions. Persistent inflation uncertainty adversely affects consumer savings and spending, interest rates, and business investments in many ways, and the combined effects, in turn, lower economic output (Pindyck, 1993).

Economic efficiency is adversely affected by inflation uncertainty for two broad reasons. First, increased inflation affects long-term contracts, and second, increased inflation volatility hampers the information passed through to market participants about future inflation and uncertainty (Friedman, 1977). Freidman (1977) and Okuns (1971) have argued that inflation uncertainty affects real economic activity. The literature suggests that unanticipated inflation affects real variables, while anticipated inflation has almost no effect on real economic activity (Okuns 1971; Friedman 1977;, Fischer and Modigliani 1978).

First, in his Nobel lecture, Friedman argued that inflation might negatively impact output growth, as it increases inflation uncertainty (Friedman, 1977). Ball (1992) advances the Friedman hypothesis and finds that inflation uncertainty increases with the rising inflation rate. Friedman was the first to analyse the relationship between unanticipated inflation and economic growth. Friedman was of the view that there is a positive relationship between inflation and unemployment. The Friedman hypothesis was empirically tested by employing the variance of the inflation rate and dispersion of forecasts, whereas the study accedes to the hypothesis that more inflation creates more inflation uncertainty (Fountas, 2001; Conrad & Karansoy, 2005).

The average inflation rate has also been affected by future uncertainty; however, the relationship is theoretically ambiguous. Fountas and Kim (2006) tested the direction of the relationship and stated that monetary authority responds affirmatively to greater inflation uncertainty behaviour, i.e., more inflation uncertainty creates more inflation. However, the relationship has been tested by (Holland, 1995) and claims to be negative. The study further elaborates that the central bank's response to greater inflation uncertainty

would be to contract the growth rate of the money supply, which will, in turn, reduce the rate of inflation. This effect is known as the Fed stabilising hypothesis, which declares a negative relationship between inflation and inflation uncertainty. To date, the relationship has not been identified as one-sided, and empirics show ambiguous results in different cases.

Inflation has not only been a concern for price stability, the central objective of the central bank, but inflation volatility also has a vulnerable effect on output growth. Theorists have long been arguing about the uncertainty of future inflation rates and their impact on real variables. Okun (1971) and Friedman (1977) both discussed the detrimental effects of inflation and output. Cukierman and Meltzer (1986) presented their model in a Barro-Gardon setup and stated that agents face uncertainty about the central banker's objective function and the rate of inflation. The monetary authority surprises the public by setting up a high money supply growth, where, in the presence of greater inflation uncertainty, the rate of inflation increases.

In Pakistan, many researchers have tried to determine the relationship between inflation and economic growth. Studies include (Ayyoub *et al.,* 2011; Hussain & Malik, 2011), where their results confirm the economic association between the two variables. The aforementioned studies did not try to test the Friedman-Ball hypothesis, Friedman hypothesis, Devraux hypothesis, or Black hypothesis. One recent study by Javed *et al. (*2012) empirically modelled inflation uncertainty for Pakistan and determined its relationship with the inflation rate. Furthermore, no support was found in favour of the Cukierman and Meltzer effect.

However, no such study has been conducted for Pakistan, to my knowledge, which has modelled the nominal inflation uncertainty to that of real (output growth) uncertainty. Modelling various uncertainties, including inflation uncertainty, and empirically assessing its impact on output variability may reveal useful insights for better policy-making.

The main objective of this study is to test the relationship between inflation uncertainty and output, and the inflation to the inflation uncertainty through output growth channel, i.e., an analysis of the Friedman hypothesis and the effect of the two uncertainties on each other. The GARCH-M methodology has been employed because it allows us to estimate the conditional variance equation and mean equations simultaneously. Thus, the use of the advanced technique would allow us to test the following important macroeconomic relationship: the Friedman hypothesis, the Friedman-Ball hypothesis, the Cukierman-Meltzer effect, Black's hypothesis, and Devraux's hypothesis.

The Granger causality test is employed to strengthen the results obtained from the GARCH-M specification.

2. Literature Review

There is a large amount of literature available both nationally and internationally to test the relationship and causality between inflation and economic growth. There are also many studies available on the macroeconomic modelling of inflation uncertainty and the causality between inflation and inflation uncertainty. The question of how economic growth affects inflation has always resulted in ambiguous answers. The results in most of the cases were found to be ambiguous and inconclusive in others.

2.1. International Studies.

According to the Phillips curve hypothesis, an increase in the rate of economic growth will raise inflation. However, an increase in the rate of inflation results in higher inflation uncertainty, according to Friedman's hypothesis. Therefore, by transitivity, an increase in the rate of economic growth hampers inflation uncertainty. This is one line of argument. The other line of reasoning states that an increase in the rate of inflation resulting from economic growth will reduce inflation uncertainty. This argument was made by Ungar and Zilberfarb (1993). They were of the view that an increase in the rate of inflation reduces inflation uncertainty. However, the available literature supports the idea that economic growth has either a weak or no impact on inflation uncertainty.

A negative and stable inverse relationship exists between inflation and the unemployment rate, as proposed by the Phillips Curve hypothesis, which was considered to be one of the earliest views on the inflation and economic growth relationship. The original Phillips Curve hypothesis states that "there exists a tradeoff between the inflation rate and the level of unemployment. This is where the debate gets started. Economists started to dig more into the relationship both theoretically and statistically. Abel and Bernanke (2005) reexamined the original Phillips curve hypothesis and stated that no systematic relationship exists between the inflation rate and unemployment rate for the U.S. economy even though it was considered earlier and the hypothesis has quite accurately estimated the relationship.

To examine the causality relationship between inflation uncertainties and economic growth, Fountas et al. (2009) outline several approaches. A univariate GARCH model is based on the view that a univariate GARCH framework may be set to test the causality relationship among the variables, which is the 1st step in estimating inflation uncertainty by estimating the GARCH process and estimating the conditional variance of the variable in hand and then estimating the causal relationship among the variables performing Granger tests. Another approach to capture the nexus between inflation uncertainty and output uncertainty is the simultaneous approach, which requires a GARCH in a mean model of inflation uncertainty. The GARCH in the mean process is internally embedded with the conditional variance equation and lags of the rate of inflation. According to Fountas *et al.* (2009), GARCH in the mean model has the speciality of estimating the bidirectional causality between inflation and inflation uncertainty. Many types of research are available that study the causality among inflation and economic growth as well as both their associated uncertainties, for example, Bredin and Fountas (2007), Bredin and Fountas (2009) and Fountas *et al.* (2006). Such studies have specified a bivariate GARCH in the model to estimate inflation and economic uncertainty. The results of the studies were quite in line; for instance, Fountas *et al.* (2006) studied the relationship between inflation uncertainty and economic growth uncertainty for G-7 countries. Their study reveals that inflation uncertainty has negative welfare effects, along with the conclusion that more economic growth uncertainty results from higher growth (Fountas *et al.* 2006). For instance, Fountas *et al.* (2006) reveal very little evidence of economic growth's impact on inflation uncertainty. Their study was based on G-7 countries, where their results show zero impact of economic growth on inflation uncertainty for four out of the seven countries. They further quote that their results are quite in line with economic intuition, which is why their results predict an ambiguous relationship between growth and inflation uncertainty. According to them, the reason might be the interaction of the Phillips curve hypothesis effect to that of Friedman's hypothesis or the Ungar and Zilberfarb's hypothesis.

The issue of how uncertainties affect both inflation and output growth has largely been taken after Friedman's stance that uncertainty in inflation lowers output growth. This informal statement was further tested many times by different researchers in different periods for different economies. Grier and Perry (2000) empirically investigated the issue of using GARCH-M modelling for the U.S. They employed different techniques in their study to provide a

concrete answer for the effects of uncertainties on each other. Their results reveal that either type of uncertainty bears no effect on average inflation. No statistical evidence has been found to support Black's hypothesis that output growth uncertainty is positively related to the average output growth rate and, last but not least, the proved that inflation uncertainty lowers output growth, as suggested by Friedman. (Grier and Perry; 2000).

Several empirical studies have been conducted to determine the causal relationship between the rate of inflation and inflation uncertainty. Empirical studies conducted by Holland (1995) and Grier and Perry (1998) found evidence of bilateral Granger causality between the rate of inflation and inflation uncertainty. Both Holland (1995) and Grier and Perry (1998) found that inflation raises inflation uncertainty in the U.S. and all G-7 countries, respectively.

Fountas and Karanasos (2006) investigated the causal effect of real and nominal macroeconomic uncertainty on output growth and inflation, as well as the impact of inflation on inflation uncertainty for the G7 countries from 1957–2000. Through this study, various economic theories by Cukierman-Meltzer and Friedman were also tested. The results propose inflation as a positive determinant of inflation uncertainty, and inflation uncertainty was found to have little impact on output growth. According to this paper, different countries are expected to respond differently to a change in the level of uncertainty surrounding the inflation rate. In the case of several countries, output growth was found to be a positive determinant of the growth rate. Last, the study postulates that output does not lead to a rise in inflation.

Berument and Yuksel (2007) estimated the temporal ordering of inflation and inflation uncertainty for the United Kingdom from the period of 1962:02–2002:09 using the classes of ARCH models to construct the measures of monthly inflation uncertainty. The findings suggest that inflation and inflation uncertainty cause each other in the Granger sense. This means that a rise in inflation causes inflation uncertainty to rise as well. Similarly, increased inflation uncertainty would also increase inflation.

2.2. National Studies.

Although inflation has been tested for much empirical analysis in Pakistan's case, we restrict the literature review to the effects of inflation, its associated uncertainties, and macroeconomic growth. The most basic

relationship between inflation and economic growth is that of the tradeoff between the two variables. Theoretically, it bears a negative relationship between economic growth and inflation, and this tradeoff has been tested empirically by Ayyoub *et al.* (2011) for Pakistan. Their findings support the negative relationship between inflation and economic growth, where they confirm the tradeoff and further conclude that the feasible threshold level of inflation in the case of Pakistan was found to be 7%. Any digit above this level severely hurts the economy and reduces the growth opportunities in the country. Their study recommends that the authorities keep the level of inflation below 7%. Keeping in my mind the above study, the figures for inflation in the country provide a different and threatening view. The average inflation rate from 80 to 96, as depicted by Khan and Qasim (1996), was 8.5% per annum during the two decades. They modelled different sets of equations for inflation and concluded that persistent double-digit inflation causes a potential threat to the overall health of the economy and that tackling the issue at hand requires a tighter fiscal policy, adjustments in the supply-side variables, and regulation of government-administered prices, which were found to be inflationary according to their results. They also recommended that the authorities reduce public borrowing, as it causes monetary expansion, thus accelerating inflation. Abbas (1992) studied the impact of the rate of inflation and inflation variability on output growth in ten different countries from the period of 1960–1990. The findings, however, show that there is no significant relationship between the inflation rate, its variability, and the variability of output growth. Another attempt has been made by Chaudhry *et al.* (2013) to estimate the threshold level of inflation for Pakistan. Their findings suggest the inflation threshold level is 9%, which causes different sectors of the economy to grow. Any level of inflation above the threshold will severely hurt economic growth. They also conclude that inflation in Pakistan has a positive impact on agriculture and service sector growth. Javed *et al.* (2012) empirically examined the relationship for Pakistan using monthly data from January 1957 to December 2007. They tested the Friedman-Ball hypothesis using the ARMA-GARCH setup and concluded that inflation positively affects inflation uncertainty; however, their results provide no support for the Cukierman-Meltzer effect, which states that inflation uncertainty affects the inflation rate. Their results confirm the unidirectional causality running from inflation to inflation uncertainty and not the opposite. Inflation in Pakistan is considered to be a monetary phenomenon, as stated by Qayyum (2006). A similar study was conducted earlier by Rizvi and Naqvi

(2009), where the results support the Friedman-Ball hypothesis in the case of Pakistan. The Granger causality test was employed using the GJR-GARCH and EGARCH setups and concluded that causality runs only from inflation to inflation uncertainty. Their study also negates the Cukierman-Meltzer effect in the case of Pakistan. Another study includes the work of Khalid (2005), who tried to find a linear association between inflation and economic growth. Qayum's (2006) results reveal that real GDP growth has been affected in the first round and inflation itself in the second as the money supply increases in the country. Khalid (2005) explains the reasons for inflation and quotes that it is openness, the printing of the new currency, and imported inflation from trading partners that cause inflation in Pakistan. Hussain (2005) found that for Pakistan, there is no threshold level of inflation. He considers that the range for inflation is 4%–6% using the dataset from 1973–2005. For estimation, he used ordinary least squares (OLS). Based on his results, it is favourable to keep inflation between 4% and 6% in Pakistan to accelerate economic growth. His results contrast those of Mubarik and Riazuddin (2005) and are similar to those of Singh, who suggested a 4%–7% inflation target for India.

Husain and Malik (2011), using annual data from 1960–2006, employed a cointegration and error correction model (ECM). His results suggest that inflation is positively related to economic growth in Pakistan. The interrelationship between inflation and economic growth is found to be unidirectional, i.e., inflation causes growth, but growth does not cause inflation. These results are justified by the Tobin portfolio shift effect. He also found that 9% is the threshold level for the economy of Pakistan; above this level, economic growth will be lower in Pakistan. This result is also consistent with that of Mubarik (2005).

2.3. Conclusion.

The above literature review can be summarised as follows. Most of the international studies have focused on the relationship between inflation, inflation uncertainty, output growth, and output growth uncertainty. Studies, such as those of Grier and Perry, Fountas *et al.,* Fountas and Bredin, Grier and Perry, and Heidari and Bashiri, have all investigated the relationship deeply and empirically tested all the possible economic relationships between the two variables, as suggested by macroeconomic theory, including the Friedman-Ball hypothesis, the Cukierman and Meltzer effect, Black's hypothesis, Devraux's hypothesis, and the Friedman hypothesis. While Pakistan lacks

such studies, studies on Pakistan are confined to finding only the relationship between inflation and economic growth, inflation and inflation uncertainty, the threshold level of inflation for the country, its possible relationship with money supply growth and trade openness and its determinants. Some of the studies that were discussed above and are of importance here are Amin *et al.,* Abbas *et al.,* Abbas and Naqvi, Mubarak, Hussain and Malik, and others, who have provided some of the basics for identifying the relationship between inflation and other macroeconomic variables.

3. Econometric methodology and data

The inflation and output growth rates can affect each other in one or many ways. The uncertainty part of inflation has multifaceted effects not only on the rate of inflation but also on economic growth. The hypothesis presented and discussed above provides enough arguments that the effects may vary in different country cases. Now, to test the abovementioned theories, one requires a better measure of uncertainty to capture the effects.

3.1 Using the GARCH Model as a Measure of Uncertainty

To estimate the uncertainty of a particular variable, economists use its time-varying variance as a proxy for uncertainty (Friedman, 1977). Earlier, the practice of using moving the standard deviation or variance of the time series remained popular as a proxy for the variable in consideration. The drawback of the use of the time-varying variance, according to (Bredin & Fountas, 2009), is that it cannot distinguish between anticipated and unanticipated changes, while uncertainty lies only in the unanticipated component.

The GARCH methodology overcomes the shortcomings of the earlier uncertainty models by considering the time-varying conditional variance. GARCH modelling provides an explicit test of whether the overtime movement of a variable's conditional variance is statistically significant. GARCH also provides a simultaneous estimation of both the mean and variance equation for the variables under consideration.

A bivariate GARCH-M model is used to estimate the conditional means, variances, and covariances of inflation and output growth. The inflation rate and real output growth are estimated from the following bivariate VAR model:

$$\pi_t = \emptyset_{\pi 0} + \sum_{i=1}^{n} \emptyset_{\pi\pi,i}\,\pi_{t-i} + \sum_{i=1}^{n} \emptyset_{\pi y,i}\,y_{t-i} + \varepsilon_{\pi t} \tag{1}$$

$$y_t = \emptyset_{y 0} + \sum_{i=1}^{n} \emptyset_{y\pi,i}\,\pi_{t-i} + \sum_{i=1}^{n} \emptyset_{yy,i}\,y_{t-i} + \varepsilon_{yt} \tag{2}$$

where π_t and y_t denote the inflation rate and real output growth, respectively. The residual vector $\varepsilon_t = (\varepsilon_{\pi t}, \varepsilon_{yt})\,'$ is assumed to be conditionally normal with mean 0 and covariance matrix H_t, i.e., $(\varepsilon_t / \Omega_{t-1}) \sim N(0, H_t)$, where Ω_{t-1} is the information set up to time t-1.

3.2 GARCH-M model of inflation uncertainty

Time series may exhibit time dependence even if there is no serial correlation, which is the basic idea behind ARCH models. ARCH models can take into account volatility clustering because of this dependence in the volatility process. In the ARCH (q) model as given by (Engle, 1982), the conditional variance of a variable can be presumed to be a linear function of the past q squared changes.

$$h_t = \omega + \sum_{i=1}^{q} \alpha_i e_{t-1}^2 \tag{3}$$

Where:

h_t is the time *t* conditional variance of inflation,
ω is a constant term and
α_i refers to the parameters to be estimated.

The conditional variance must be greater than 0 to make some sense. To ensure this, we impose restrictions on the parameters of the model. The restrictions are $\omega > 0$ and $\alpha_i \geq 0$.

We define $v_t \equiv e_t^2 - h_t$, and the ARCH(q) model in Equation (3) is specified as:

$$e_t^2 = \omega + \sum_{i=1}^{q} \alpha_i e_{t-1}^2 + v_t \tag{4}$$

If the sum of positive α_i's (autoregressive parameters) is less than 1, then the process in Equation (4) is stationary. A limitation of the ARCH(q) model is that to properly account for volatility persistence, q should often be large. As a remedy to this difficulty, (Bollerslev, 1986) introduced the GARCH (p, q) model. The mean equation remains unchanged, and the variance is as follows:

$$h_t = \omega + \sum_{i=1}^{q} \alpha_i e_{t-1}^2 + \sum_{j=1}^{p} \beta_j h_{t-j} \tag{5}$$

Where:
α_i and β_j show the ARCH and GARCH effects, respectively.

The level to which the volatility shock from the current period feeds to the future is measured by the ARCH effect. Similarly, the extent to which current inflation uncertainty is determined by the inflation uncertainty from the previous period is measured by the GARCH effect. Similar to ARCH models, some parameter restriction is imposed on the conditional variance of GARCH models to ensure its positive value. Particularly, $\alpha_0 > 0, \alpha_i \geq 0, \beta_j \geq 0$ is needed. Volatility persistence is measured by the sum of the ARCH and GARCH effects.

The conditional variance of inflation π_t is specified by the GARCH (p, q) model, and the conditional variance is defined as:

$$Var(\pi_t) = \frac{\omega}{1 - \sum_{i=1}^{q} \alpha_i - \sum_{j=1}^{p} \beta_j} \tag{6}$$

The most commonly applied GARCH is the GARCH (1, 1) model because of its simplicity and easy interpretation. The conditional variance equation is given by:

$$h_t = \omega + \alpha e_{t-1}^2 + \beta h_{t-1} \tag{7}$$

We need to estimate only three parameters, i.e., ω, α and β. Compared to other GARCH specifications, GARCH (1, 1) is commonly adopted in the literature because of its straightforwardness in estimation and interpretation.

GARCH-M (1, 1) is an extension of the standard GARCH (1, 1) process. The GARCH-M model originates from the ARCH-M model, which was developed by Lilien *et al. (*1987). The GARCH-M specification is utilisled when the value of the mean is explained by conditional variance. The conditional variance equation is not different from Equation (7), and the mean equation is given by:

$$\pi_t \; = \; \sum_{i=1}^{m} \tau_i \, \pi_{t-i} \; + \; e_t \; + \; \sum_{j=1}^{n} \theta_j e_{t-j} \; + \; \delta h_t \tag{8}$$

The impact of inflation uncertainty on inflation is measured by the in-mean coefficient δ. In support of (Okun's, 1971) argument, when the value of δ is positive, it indicates that higher inflation uncertainty leads to higher inflation. If the value of δ is negative, it indicates that higher inflation uncertainty decreases average inflation according to the hypothesis of (Holland, 1995).

This study follows an approach similar to (Fountas *et al.* 2010). Fountas *et al.* (2010) analysed the causality relationship between economic growth, inflation, and inflation uncertainty for 21 industrial countries. He estimated the GARCH-M model of inflation uncertainty. The conditional variance (inflation uncertainty) is included in the GARCH-M model as an explanatory variable by definition. Therefore, a simultaneous estimation of the bidirectional relationship between inflation and inflation uncertainty is allowed by the model. The conditional variance of the estimated model is as follows:

$$h_t = \omega + \sum_{i=1}^{q} \alpha_i e_{t-1}^2 + \sum_{j=1}^{p} \beta_j h_{t-j} \; + \; \sigma \pi_{t-1} \tag{9}$$

The impact of lagged inflation on inflation uncertainty is represented by the coefficient σ. A positive value of σ indicates that high inflation will lead to higher inflation uncertainty according to the hypothesis of (Friedman, 1977). A negative value of σ indicates that higher inflation decreases inflation uncertainty, consistent with (Ungar & Zilberfarb, 1993).

GARCH (1, 1) in the mean model for inflation and output growth is as follows: π_t represents inflation in period t, and Y_t represents the output growth in period t.

$$\pi_t = \beta_o + \sum_{i=1}^{4} \beta_o \, \pi_{t-i} + \beta_5 \sigma_{\varepsilon_t}^2 + \beta_6 \sigma_{v_t}^2 + \beta_7 \sigma_{\varepsilon_{t-12}}^2 + \varepsilon_t \tag{10}$$

$$\sigma_{\varepsilon_t}^2 = \sigma_o + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{\varepsilon_{t-1}}^2 \tag{11}$$

$$Y_t = \theta_o + \theta_1 Y_{t-1} + \theta_2 \pi_{t-1} + \theta_3 \sigma_{\varepsilon_t}^2 + \theta_4 \sigma_{v_t}^2 + \theta_5 v_{t-12} + v_t \tag{12}$$

$$\sigma_{v_t}^2 = \alpha_3 + \alpha_4 v_{t-1}^2 + \alpha_5 \sigma_{v_{t-1}}^2 \tag{13}$$

$$COV_t = \rho_{\varepsilon v} \, \sigma_{\varepsilon_t} \sigma_{v_t} \tag{14}$$

where Eq. (10) is the mean inflation rate, which is a function of the lags of the inflation rate, a fourth-order MA process, and the conditional variance of inflation and output.

Here, the coefficient of inflation uncertainty would confirm or negate the Cukierman-Meltzer effect in the case of Pakistan. Cukierman and Meltzer's effect state that greater inflation uncertainty increases the rate of inflation. If the coefficient was found to be positive and significant, the presence of the Cukierman and Meltzer effect is verified. Similarly, the positive and significant coefficient of output uncertainty in the mean inflation equation suggests the presence of Deurax's hypothesis, which states that an increase in output growth uncertainty increases the inflation rate.

Eq. (11) gives us estimates of the conditional variance of the inflation rate, while Eq. (12) is the conditional mean of output growth. Here, the coefficient of the conditional variance of the inflation rate term directly tests the Friedman hypothesis. The coefficient will be negative and statistically significant if inflation uncertainty adversely affects the output growth rate. For Black's hypothesis, the coefficient must be positive and significant. The hypotheses state a positive relationship between output growth uncertainty and the output growth rate. Eq. (13) is the conditional variance of the output growth equation, and finally, Eq. (14) is the constant conditional correlation model of the covariance between the residuals of inflation and the output growth equation.

We further assume that the error terms ε_t and v_t are conditionally normal with zero means. The system through 1 to 5 has been estimated using the (Berndt et al., 1974) numerical optimisation algorithm to calculate the maximum likelihood estimate of the parameter in the system.

After estimating the proxy for inflation uncertainty, the next step is to use this proxy in Granger causality tests to evaluate the direction and magnitude

of causal relationships between economic growth, inflation, and inflation uncertainty.

3.3 Granger Causality Tests

To verify the results of the GARCH-M model, the study also assesses the causality relationship between inflation, inflation uncertainty, and output growth through Granger causality tests. Granger (1969) causality testing requires that the variables under consideration must be stationary. To test the effects of inflation uncertainty on inflation, we run the following regression (Fountas et al., 2010).

$$\pi_t = \varphi_0 + \sum_{i=1}^{k} \varphi_i \pi_{t-i} + \sum_{j=1}^{k} \tau_j h_{t-j} + e_t \qquad (15)$$

where
h_{t-j} is the lagged inflation uncertainty,

π_{t-i} are the past values of inflation and

e_t is the error term.

If the null hypothesis $\tau_j=0$ is rejected, it indicates that inflation is statistically impacted by inflation uncertainty. The positive value of τ_j agrees with the argument of (Cukierman & Meltzer, 1986), and the negative values of the coefficients follow the hypothesis of (Holland, 1995).

The study also regresses inflation uncertainty on its own lagged values, as well as on lagged inflation terms, to evaluate the impact of inflation on inflation uncertainty. It is specified as follows:

$$h_t = \rho_0 + \sum_{i=1}^{k} \rho_i h_{t-i} + \sum_{j=1}^{k} \gamma_j \pi_{t-j} + e_t \qquad (16)$$

If the values of γ_j are positive, then the results are consistent with (Friedman, 1977), while negative values are consistent with the hypothesis of (Ungar & Zilberfarb, 1993). To test the effects of inflation uncertainty on economic growth Y_t, the following equation is used for estimation:

$$Y_t = \vartheta_0 + \sum_{i=1}^{k} \vartheta_i Y_{t-i} + \sum_{j=1}^{k} \varsigma_j h_{t-j} + e_t \tag{17}$$

If the value of the coefficient ς_j is positive, then the argument of (Dotsey & Sarte, 2000) is supported, while negative coefficient values are in line with (Friedman's 1977) claim. To evaluate the influence of economic growth on inflation uncertainty, the ic study specifies the following regression:

$$h_t = \lambda_0 + \sum_{i=1}^{k} \lambda_i h_{t-i} + \sum_{j=1}^{k} \eta_j Y_{t-j} + e_t \tag{18}$$

If the values of η_j are positive, then it supports the hypothesis of (Briault, 1995), and if the values are negative, then it supports the argument of (Ungar Zilberfarb, 1993). The equation for examining the effect of inflation on economic growth is as follows:

$$Y_t = \varpi_0 + \sum_{i=1}^{k} \varpi_i Y_{t-i} + \sum_{j=1}^{k} \psi_j \pi_{t-j} + e_t \tag{19}$$

If the values of the ψ_j coefficient are negative, then it supports the hypothesis of (Friedman, 1977). Finally, to examine the effects of economic growth on inflation, the following equation is used:

$$\pi_t = \varrho_0 + \sum_{i=1}^{k} \varrho_i \pi_{t-i} + \sum_{j=1}^{k} \kappa_j Y_{t-j} + e_t \tag{20}$$

If the estimates of the κ_j coefficient are positive, then the result supports the hypothesis of (Briault, 1995) and is called the Phillip's curve effect.

3.4 Data Description

The present study uses quarterly time-series data of inflation and output growth ranging from the first quarter of 1973 to the third quarter of 2018. GDP data were quartered using the (Chow & Lin, 1971) procedure. The data for the consumer price index (CPI) and industrial production index (IPI) were taken from International Financial Statistics, the State Bank of Pakistan, and various issues of the Economic Survey of Pakistan.

4. Results and Discussion

4.1. Diagnostic Test

To determine the stationarity of both variables, various unit root tests were employed, and the results are shown in the table below. Almost every unit root test suggests that both series are stationary at their levels.

Table 1. ADF, PP, KPSS, and NP Test Results for Pakistan Inflation and Growth

	Include in test equation	Inflation	Growth rate of output	Critical values 1% level	Critical values 5% level	Critical values 10% level
ADF	Intercept	-4.641**	-4.879**	-3.470	-2.879	-2.576
	Trend and intercept	-4.582**	-4.96**	-4.015	-4.437	-3.413
	None	-2.498*	-3.491**	-2.579	-1.942	-1.615
PP	Intercept	-9.202***	-27.514***	-3.469	-2.878	-2.576
	Trend and intercept	-9.304***	-28.173***	-4.014	-3.437	-3.142
	None	-5.430**	-17.223***	-2.578	-1.942	-1.615
KPSS	Intercept	0.193***	0.124***	0.739	0.463	0.347
	Trend and intercept	0.146***	0.121***	0.216	0.146	0.119
Ng-Perron	MZa	-2.232	0.112	-13.8	-8.1	-5.7
	MZt	-0.987	0.227	-2.58	-1.98	-1.62

Notes: * denotes significance at the 10% level, ** denotes significance at the 10% and 5% levels, and *** denotes significance at the 10%, 5% and 1% levels.

Table 2 below shows the summary statistics of the inflation and output growth series. The high value of the Jarque-Bera test suggests that the inflation series is not normally distributed. The lower value of the Jarque-Bera test and P value of greater than 10 percent of the growth series shows that the series is normally distributed.

Table 2. Descriptive Statistics

Variables	Mean (μ)	Std.Dev. (σ)	σ/μ (C.V)	Skewness	Kurtosis	Jarque-Bera	Prob.
Inflation	0.02245	0.01933	0.86102	2.234	12.04	702.02	0.00
Output growth	0.0121	0.1501	12.4	-0.0775	2.247	4.1033	0.128

To verify whether the residuals are serially correlated and to test whether there is any ARCH effect remaining in the residuals, the Brush-Godfery Lagrange multiplier test and the LM test for ARCH in the residuals have been employed. The results of the test show that there is no serial correlation (see Table 3 below) in the residuals. The results of the LM test for ARCH reject the null hypothesis of no ARCH effect in the residuals. All these results fulfil the criteria of employing the GARCH procedure to estimate our model and obtain the results.

Table 3. Brush-Godfrey Serial Correlation LM Test and ARCH-LM Test

	LM test	Probability
Inflation	31.77	0.1012
Growth	2.9221	0.2320

ARCH-LM Test

	F-Stat	Obs*R^2	Probability
Inflation	13.24	12.38	0.0000
Output Growth	31.61	26.70	0.0000

Null hypotheses of LM test: There is no serial correlation of any order up top.

Null hypotheses of ARCH-LM Test: There is no ARCH effect, i.e., the coefficients in the regression are zero.

The results of the OLS regression are given in Table 4. Similarly, the output equation has been regressed by its lag term, the lag of the inflation rate, and a further order moving average term. The reason behind the inclusion of the inflation term in the output equation is to differentiate between the effects of

inflation from inflation uncertainty on output as inflation is considered to be associated with inflation uncertainty (Grier & Perry, 2000). Here, the Q statistics indicate that there is no serial correlation; however, the squared residuals show the correlation, thus indicating the ARCH process. The results of OLS are consistent with the GARCH (1, 1) specification (see Table 5). By adding all the lagged terms of the inflation coefficients of the OLS and GARCH-M specifications, the results are 0.58 and 0.69, respectively. The parameters of the GARCH (1, 1) specification in the variance equation are statistically significant, and the value of the coefficients is large in magnitude at 0.555, which shows that inflation shocks create persistent inflation uncertainty in the model. Similarly, the lag term of the output growth rate in the OLS and GARCH-M specifications is 0.23 and 0.27, respectively, and both are significant at a 1% level of significance.

Table 4. OLS Regression for Inflation and Output Growth

GARCH (1, 1)-M system	constant conditional correlations

A: inflation

$$inf_t = 0.008 + 0.237inf_{t-1} - 0.1237inf_{t-2} + 0.025inf_{t-3} + 0.441inf_{t-4} - 0.170\varepsilon_{t-4} + \varepsilon_t$$
$(0.018)^5$ (0.003) (0.113) (0.745) (0.000) (0.216)

$R^2 = 0.232$
Log likelihood function = 460
Ljung-Box Q (1) = 2.04

Ljung-Box Q (1) = 12.47

Ljung-Box Q^2(4) = 21.06

Ljung-Box Q^2(4) = 62.24

B: Output growth

$$GDP_t = 0.015 + 0.234GDP_{t-1} + 0.293inf_{t-1} - 0.0107v_{t-4} + v_t$$
(0.0000) (0.0029) (0.0048) (0.8840)

$R^2 = 0.1332$
Log Likelihood function = 400.0312
Ljung-Box Q (4) = 0.1198

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5 P-values are given in Parenthesis.

Ljung-Box Q (12) = 89.21

Ljung-Box$Q^2(4)$ = 0.0029

Ljung-Box$Q^2(12)$ = 73.62

The results of the GARCH-in-Mean model have been tabulated as follows.

Table 5. Inflation and Output Growth

GARCH (1, 1)-M system   constant conditional correlations

INF_t = 0.0041+0.363INF_{t-1}-0.4207INF_{t-2}+0.1433INF_{t-3}+0.6044INF_{t-4} $-0.4569\varepsilon_{t-4}$
(0.3483)[6]   (0.001)   (0.2949)   (0.1696)   (0.00)
(0.0007)
$-6.1988\sigma^2_{\varepsilon_t}$ $-0.0091\sigma^2_{v_t}$ + ϵ_t
(0.3919)   (0.2282)
h_{INFt} = 0.000052+0.347$inf_{t-1}{}^2$+0.555$\sigma^2_{\varepsilon_{t-1}}$
(0.000)   (0.000)   (0.000)
GDP_t = 0.0200+0.2787GDP_{t-1} +0.1712INF_{t-1}+0.1053v_{t-4} $-8.8473\sigma^2_{\varepsilon_t}$ $-0.0169\sigma^2_{v_t}$+v_t
(0.0003)   (0.000)   (0.0254)   (0.0664)   (0.0205)   (0.0047)

h_{GDPt} = 0.00058+0.635$GDP_{t-1}{}^2$+0.616$\sigma^2_{v_{t-1}}$
(0.000)   (0.000)   (0.0562)
Cov_t = 0.068$\sigma_{\varepsilon_t}\sigma_{v_t}$
(0.2130)

Table 6. Q-Statistics

Q-Stat	Inflation equation	Output equation
Q (2)	1.4876 (0.4750)	0.5133 (0.7740)
Q (4)	1.8634 (0.7610)	0.6149 (0.9260)
$Q^2(2)$	0.7207 (0.6970)	0.2178 (0.6410)
$Q^2(4)$	1.01014 (0.9080)	3.3213 (0.5061)

Our results of the GARCH-M specification show no sign of the Cukierman-Meltzer effect in Pakistan's case. The GARCH in mean variables in the inflation equation is statistically insignificant, which negates the presence of Deveraux's hypothesis and Cukierman and Meltzer's effect. The GARCH in the mean specification fails to provide any statistical support in favour of both the abovementioned hypotheses. Our results in this case are similar to those

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6 P-values are given in the Parenthesis.

of (Amin *et al.,* 2012), where they also failed to provide any support for the Cukierman and Meltzer effect in the case of Pakistan. The lagged term of the inflation rate included in the output equation is positive and statistically significant both in the OLS and GARCH-M specifications, which shows that previous episodes of inflation do have a significant impact on output growth specifically in the short run. The lagged residual variance coefficients of both the inflation and output equations are similar, suggesting that shocks both in output growth and inflation have a persistent effect on output growth and inflation, respectively. Friedman's hypothesis can be verified by looking at the coefficient of the conditional variance of inflation in the output equation. The results confirm Friedman's hypothesis that inflation uncertainty can lower output growth. Our results do not provide any support for Black's hypothesis, as the output uncertainty coefficient must be statistically significant and positive; in our case, the coefficient is statistically significant, but the sign is negative instead of positive.

The GARCH-M estimation results were further tested for correlation by taking a look again at the residuals and squared residuals obtained after the GARCH-M estimation. The Q-statistics and the squared residuals Q^2-statistics at different lags satisfy the null hypothesis of no serial correlation. No sign of any correlation has been found in the residuals, thus strengthening our GARCH-M estimates.

Table 7. Residuals Diagnostic

	Inflation	Output Growth
Q-stat (2)	1.4876 (0.4750)	0.5133 (0.7740)
Q-stat (4)	1.8634 (0.7610)	0.6149 (0.9260)
Q^2-stat (2)	0.7207 (0.6970)	0.2178 (0.6410)
Q^2-stat (4)	1.01014 (0.9080)	3.3213 (0.5061)

ARCH-LM tests at different lags have been employed to check for any ARCH effect if remaining in the residuals. The results show no sign of any ARCH effect left in the residuals. The results below also confirm the validity

of our GARCH (1, 1) in the mean, which adequately captured all such effects.

Table 8. ARCH-LM Test

		INFLATION	P value	GDP		P value
1 Lag	F-stat	0.6763	0.4121	F-stat	0.0055	0.9406
	Obs R^2	0.6821	0.4088	Obs R^2	0.0056	0.9401
2 Lag	F-stat	0.6586	0.5190	F-stat	0.3968	0.6731
	Obs R^2	1.3317	0.5138	Obs R^2	0.8049	0.6687
3 Lag	F-stat	0.3393	0.8511	F-stat	0.1761	0.9504
	Obs R^2	1.3907	0.8458	Obs R^2	0.7245	0.9483

3.2. Granger Causality Test

3.2.1. The Causal Relationship between Inflation and Economic Growth

The estimation output of the relationship between inflation and economic growth is shown in Table 9. Since the value of the coefficients of the lagged inflation terms is -0.3542, the results here support the Friedman hypothesis. We also regress inflation on lagged terms of economic growth and its own lagged terms. If the coefficient of the output lag terms remains positive, then it supports the (Briault, 1995) hypothesis, which is true in our case, as the coefficient sum is collectively 0.4900. The lags of both inflation and economic growth are statistically significant, which shows that there must be some meaningful influence of economic growth on the inflation rate.

Table 9. Regression of Economic Growth on Lagged Inflation

$$GDP_t = \alpha_0 + \sum_{i=1}^{k} \beta_i \, GDP_{t-i} + \sum_{j=1}^{k} \gamma_j \, INF_{t-j} + e_t$$

	Coefficient	Standard Error
α_0	0.010733	0.003457
β_1	0.121213	0.077152
β_2	0.018414	0.076341
β_3	-0.146389	0.096083
β_4	-0.224601**	0.096151
γ_1	-0.210935	0.138316
γ_2	-0.50961**	0.144259
γ_3	-0.020621	0.099264
γ_4	0.375861***	0.097507
Adj. R-Square	0.242443	
S.E of Regression	0.018919	

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 10. Regression of Inflation on Lagged Economic Growth

$$INF_t = \partial_0 + \sum_{i=1}^{k} \varphi_i \, GDP_{t-i} + \sum_{j=1}^{k} \omega_j \, INF_{t-j} + e_t$$

	Coefficient	Standard Error
∂_0	0.004063	0.001891
φ_1	0.473810***	0.075806
φ_2	-0.30572***	0.079062
φ_3	0.157276***	0.054411
φ_4	0.174102***	0.053446
ω_1	0.001102	0.042276
ω_2	0.412255***	0.041843
ω_3	-0.30054***	0.052659
ω_4	0.108449**	0.052686
Adj. R-Square	0.597690	
S.E of Regression	0.010370	

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 11. Granger Causality Tests: Inflation and Economic Growth

Direction of Causality	No. of Lags	F-Stat	Decision
$GDP \rightarrow INF$	4	29.3972***	Reject
$INF \rightarrow GDP$	4	8.8608***	Reject

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. The optimal number of lags in each case was chosen based on the Akaike information criterion (AIC).

The results from the Granger causality test confirm a bidirectional causal relationship between inflation and economic growth.

3.2.2 The Relationship between Inflation and Inflation Uncertainty

From the GARCH-M modelling result above, we see that the coefficients were positive but insignificant, thus negating the Cukierman and Meltzer effect. The same hypotheses have been reassessed using the Granger causality test of inflation's impact on inflation uncertainty and vice versa. For the analysis, first, we regressed inflation on its lag terms and the lagged inflation uncertainty terms. Here, the rule is that if the sum of the coefficients of inflation uncertainty in the inflation equation becomes positive, then it supports the Cukierman-Meltzer effect, and if they remain negative collectively, then the results support Holland's view. Our regression results reveal that the lagged inflation terms indicate a meaningful influence on the inflation rate. The coefficient value is calculated to be -2.32455, which strictly negates the Cukierman-Meltzer effect and supports Holland's view. To further assess the effects of inflation on inflation uncertainty, we have regressed inflation uncertainty on inflation. If the value of the sum of the coefficient of the lagged inflation terms remains negative, then it supports Ungar and Zilberfarb; if it is positive, it supports Friedman's view. Since the value in our case is 0.1070, this supports the Friedman hypothesis. We found no evidence in support of the Cukierman and Meltzer effect in Pakistan's case in either model. The Granger results show that inflation uncertainty does not Granger cause inflation. For inflation and inflation uncertainty, the Granger test shows that inflation Granger causes inflation uncertainty, thus proving Freidman's stance.

Table 12. Regression of Inflation on Lagged Inflation Uncertainty

$$INF_t = \alpha_0 + \sum_{i=1}^{k} \beta_i\, INF_{t-i} + \sum_{j=1}^{k} \gamma_j\, CVINF_{t-j} + e_t$$

	Coefficient	Standard Error
α_0	0.008717	0.002595
β_1	0.275860***	0.076699
β_2	-0.15269***	0.034017
β_3	0.064425	0.086329
β_4	0.343179***	0.084084
γ_1	0.635450	5.445287
γ_2	-1.211042	4.704173
γ_3	-1.114036	3.171827
γ_4	-0.647033	2.196345
Adj. R-Square	0.298896	
S.E of Regression	0.013690	

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 13. Regression of Inflation Uncertainty on Lagged Inflation

$$CVINF_t = \partial_0 + \sum_{i=1}^{k} \varphi_i\, CVINF_{t-i} + \sum_{j=1}^{k} \omega_j\, INF_{t-j} + e_t$$

	Coefficient	Standard Error
∂_0	-3.80E-05	3.82E-05
φ_1	0.676047***	0.080114
φ_2	-0.053132	0.069211
φ_3	0.055151	0.046666
φ_4	0.040659	0.032314
ω_1	0.00917***	0.001128
ω_2	-0.000718	0.001383
ω_3	0.100454	0.001270
ω_4	-0.001883	0.001237
Adj. R-Square	0.843578	
S.E of Regression	0.000201	

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 14. Granger Causality Tests: Inflation and Inflation Uncertainty

Direction of Causality	No. of Lags	F-Stat	Decision
$CVI \rightarrow INF$	4	0.5714	Do not Reject
$INF \rightarrow CVI$	4	18.7379***	Reject

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. The optimal number of lags in each case was chosen based on the Akaike information criterion (AIC).

3.2.3 The Relationship between Inflation Uncertainty and Economic Growth

In the regression of economic growth on inflation uncertainty, only the first lag of the output growth and the third lag of inflation uncertainty term remain statistically significant. If the sum of the coefficients values of the lagged inflation uncertainty term remained positive, the (Dotsey & Sarte, 2000) view is supported, which claims that an increase in inflation uncertainty exerts a positive impact on output growth, although the impact may be very small. Our regression results support the above statement, as the sum value of the coefficient is 11.37, which is positive, thus confirming (Dotsey & Sarte, 2000). Furthermore, if the summation of the coefficient (values) of output growth in inflation uncertainty equation becomes negative, then it supports the (Ungar & Zilberfarb, 1993) stance, which states that if an increase in economic growth increases the inflation rate then this increase in the rate of inflation will reduce inflation uncertainty. Our results show that the coefficient value is -0.000208, which is negative, thus supporting the (Ungar & Zilberfarb, 1993) stance. The Granger causality test shown in Table 15 below reports that there exists a bidirectional causal relationship between inflation uncertainty and economic growth. Both variables Granger cause each other; thus, our estimates of GARCH-M modelling are verified.

Table 15. Regression of Economic Growth on Lagged Inflation Uncertainty

$$GDP_t = \alpha_0 + \sum_{i=1}^{k} \beta_i \, GDP_{t-i} + \sum_{j=1}^{k} \gamma_j \, CVINF_{t-j} + e_t$$

	Coefficient	Standard Error
α_0	0.019268	0.003628
β_1	0.186784**	0.081982
β_2	0.048414	0.079595
β_3	-0.020670	0.081574
β_4	-0.052302	0.079372
γ_1	11.39943	7.066240
γ_2	-8.315004	5.918810
γ_3	10.84711***	3.805119
γ_4	-2.629445	3.102966
Adj. R-Square	0.160088	
S.E of Regression	0.019921	

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 16. Regression of Inflation Uncertainty on Lagged Economic Growth

$$CVINF_t = \partial_0 + \sum_{i=1}^{k} \varphi_i \, GDP_{t-i} + \sum_{j=1}^{k} \omega_j \, CVINF_{t-j} + e_t$$

	Coefficient	Standard Error
∂_0	6.22E-05	4.04E-05
φ_1	0.000927***	0.078869
φ_2	-0.002525**	0.000888
φ_3	0.004301*	0.000910
φ_4	-0.002911	0.000886
ω_1	0.000927	0.000915
ω_2	-0.00252***	0.000888
ω_3	0.004301***	0.000910
ω_4	-0.00291***	0.000886
Adj. R-Square	0.809359	
S.E of Regression	0.000222	

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 17. Granger Causality Tests: Inflation Uncertainty and Economic Growth

Direction of Causality	No. of Lags	F-Stat	Decision
$CVI \rightarrow GDP$	4	4.2415***	Reject
$GDP \rightarrow CVI$	4	8.4209***	Reject

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. The optimal number of lags in each case was chosen based on the Akaike information criterion (AIC).

3.2.4 The Relationship between Economic Growth Uncertainty and Inflation

The Granger causality test for the relationship between economic growth uncertainty and inflation is reported in the table below. As is evident from the table, real uncertainty causes inflation and, thus, supports Deurax's hypothesis. However, the Granger results also show that there is bidirectional causality running from real uncertainty to inflation and vice versa. Regression results from real uncertainty being dependent and lagged terms of real uncertainty and inflation being independent show a very good statistical output. In the second equation, since the first and fourth lag terms of output growth bear a positive sign, they have a positive value in magnitude, thus supporting Deurax's hypothesis. The results are in line with those of the GARCH model in the mean model and the Granger causality specification.

Table 18. Regression of Output Growth Uncertainty on Lagged Inflation

$$CVGDP_t = \alpha_0 + \sum_{i=1}^{k} \beta_i \, CVGDP_{t-i} + \sum_{j=1}^{k} \gamma_j \, INF_{t-j} + e_t$$

	Coefficient	Standard Error
α_0	0.0090***	0.0031
β_1	1.559***	0.0756
β_2	-0.8492***	0.1370
β_3	0.5491***	0.1340
β_4	-0.2739***	0.724
γ_1	-0.2388***	0.0555
γ_2	0.2701***	0.5809
γ_3	-0.1952***	0.5444
γ_4	0.0590	0.0516
Adj. R-Square	0.9957	
S.E of Regression	0.0101	

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

**Table 19. Regression of Inflation on Lagged Economic
Growth Uncertainty**

$$INF_t = \partial_0 + \sum_{i=1}^{k} \varphi_i \, CVGDP_{t-i} + \sum_{j=1}^{k} \omega_j \, INF_{t-j} + e_t$$

	Coefficient	Standard Error
∂_0	0.0049	0.0040
φ_1	0.1800*	0.0998
φ_2	0.0135	0.1786
φ_3	-0.4090**	0.1747
φ_4	0.2198**	0.0968
ω_1	0.2615***	0.0724
ω_2	-0.0306	0.0757
ω_3	0.1181	0.0710
ω_4	0.3027***	0.0673
Adj. R-Square	0.3798	
S.E of Regression	0.0132	

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 20. Granger Causality Tests: Output Growth Uncertainty and Inflation

Direction of Causality	No. of Lags	F-Stat	Decision
$INF \rightarrow CVGDP$	4	8.5899***	Reject
$CVGDP \rightarrow INF$	4	3.4513***	Reject

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. The optimal number of lags in each case was chosen based on the Akaike information criterion (AIC).

3.2.5 The Relationship between Inflation Uncertainty and Output Growth Uncertainty

Now, we test whether nominal uncertainty bears any impact on the real uncertainty. We regressed output growth uncertainty on the lagged terms of inflation uncertainty and output growth uncertainty. The first lag of real uncertainty is highly significant and bears a positive sign, indicating that real uncertainty also has a sound impact on nominal uncertainty. For the combined effect of both variables on each other, the Granger test reveals that there is a statistically sound bidirectional causality between the two variables. Thus, the nominal (inflation) uncertainty granger causes real (output growth) uncertainty, and any uncertainty in part of the inflation will increase the output growth uncertainty.

Table 21. Regression of Inflation Uncertainty on Lagged Output Growth Uncertainty

$$CVINF_t = \alpha_0 + \sum_{i=1}^{k} \beta_i \, CVGDP_{t-i} + \sum_{j=1}^{k} \gamma_j \, CVINF_{t-j} + e_t$$

	Coefficient	Standard Error
α_0	3.54E-05	6.44E-05
β_1	0.555212***	0.072857
β_2	-0.009772	0.065125
β_3	0.054353	0.041614
β_4	0.111026***	0.033432
γ_1	-0.001624	0.001536
γ_2	0.004707*	0.002682
γ_3	0.004454	0.002723
γ_4	-0.007505***	0.001548
Adj. R-Square	0.818207	
S.E of Regression	0.000218	

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 22. Regression of Output Growth Uncertainty on Lagged Inflation Uncertainty

$$CVGDP_t = \partial_0 + \sum_{i=1}^{k} \varphi_i \, CVGDP_{t-i} + \sum_{j=1}^{k} \omega_j \, CVINF_{t-j} + e_t$$

	Coefficient	Standard Error
∂_0	0.010479	0.003062
φ_1	1.465630***	0.073056
φ_2	-0.727224***	0.127554
φ_3	0.428863***	0.129473
φ_4	-0.189520**	0.073589
ω_1	15.38396***	3.464812
ω_2	-15.20084***	3.096953
ω_3	4.782535**	1.978797
ω_4	-4.474337***	1.589741
Adj. R-Square	0.995396	
S.E of Regression	0.010345	

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

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Table 23. Granger Causality Tests: Inflation Uncertainty and Output Growth Uncertainty

Direction of Causality	No. of Lags	F-Stat	Decision
$CVI \rightarrow CVGDP$	4	6.9169***	Reject
$CVGDP \rightarrow CVI$	4	10.7131***	Reject

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. The optimal number of lags in each case was chosen based on the Akaike information criterion (AIC).

3.2.6 The Causal Relationship between Output Growth and Output Growth Uncertainty

Finally, we employed the Granger causality test to statistically test the relationship between output growth and output growth uncertainty. The results of the test have been provided below, which shows that at a 5% level of significance, output uncertainty growth does not Granger cause output growth in Pakistan. The Granger causality test reconfirms the results of the GARCH-M specification and, thus, supports Black's hypothesis. However, our Granger test reveals that it is output growth that Granger causes output growth uncertainty.

Table 24. Granger Causality Tests: Output Growth and Output Growth Uncertainty

Direction of Causality	No. of Lags	F-Stat	Decision
$GDP \rightarrow CVGDP$	4	4.4204***	Reject
$CVGDP \rightarrow GDP$	4	1.9497*	Do not Reject

Note: ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. The optimal number of lags in each case was chosen based on the Akaike information criterion (AIC).

4. Conclusion and policy recommendation

The main objective of this study is to identify the empirical relationship between inflation, inflation uncertainty, and output growth uncertainty. This empirical relationship was tested using a set of hypotheses, including the Friedman hypothesis, the Cukierman and Meltzer effect, the Friedman-Ball

hypothesis, Devraux's hypothesis and Black's hypothesis. Each hypothesis has many sound economic implications, as suggested by renowned scholars[7]. The Bi-Variate GARCH-M model has been used to test the relationship between inflation, economic growth, and the relationship between their associated uncertainties in Pakistan using quarterly data from the first quarter of 1973 until the third quarter of 2018.

The results from this study show that, first, strong evidence has been found in favour of the Friedman-Ball hypothesis that an increase in the rate of inflation leads to an increase in inflation uncertainty. However, our results do not provide any support for the Cukierman and Meltzer effect. Both the results from the GARCH-M and Granger causality tests reject the Cukierman and Meltzer effect. The GARCH-M estimation also provides no support for Black's hypothesis. The study also confirms the Friedman-Ball hypothesis that inflation uncertainty lowers output growth. The results from both the Granger causality test and the GARCH-M specification are consistent with the existence of the Friedman-Ball hypothesis in the case of Pakistan. Last, our results from the Granger causality test reveal that both the real and nominal uncertainty Granger cause each other; thus, we conclude that the uncertainties bear a significant effect on each other and the overall macroeconomic performance of the country.

The abovementioned results might help the monetary authority and policy-makers formulate policies that minimise uncertainty in inflation to filter out the adverse effects of inflation on the country's macroeconomic activity. However, it is also evident from the study findings that stable inflation would encourage economic growth in Pakistan. Therefore, authorities should opt for such a stable inflation rate.

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ILLICIT FINANCIAL FLOWS AND INTERNATIONAL TRADE NEXUS UNDER INADEQUATE GOVERNANCE STRUCTURES: THE CASE OF SUB-SAHARAN AFRICA

Abstract

The primary objective of this research is to investigate the association between illicit financial flows and international trade. This study used the feasible generalized least squares and system GMM methods for empirical analysis. Growth and development targets are challenging in Sub-Saharan Africa due to a larger amount of illicit financial outflows towards developed countries. These illicit financial outflows are surprisingly greater than the amount of foreign aid provided to these countries. This scenario urgently requires determining the key global and governance factors that enhance illicit financial flows (IFFs) so that this region can finance its development agenda without foreign assistance. Empirical outcomes show significantly higher illicit financial flows with increasing levels of imports and exports, as individuals and companies misrepresent the invoicing instruments to externalise funds. The empirical estimates of political stability, voice and accountability, government effectiveness and corruption control rate are overwhelmingly negative. These outcomes suggest that the full implementation of all the Financial Action Task Force's anti-money laundering recommendations by the government authorities is needed. Furthermore, there should be easy access to the most recently available

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commodity-level world market pricing information to help overcome both illicit financial flows and trade misinvoicing as it happens.

JEL CLASSIFICATION: C50; D74; F23; N40

KEYWORDS: ILLICIT FINANCIAL FLOWS; SUB-SAHARAN AFRICA; IMPORTS; EXPORTS

1. Introduction

Sub-Saharan Africa (SSA) is composed of 48 countries that predominantly face serious developmental challenges including poverty, hunger, poor health and education, corruption and low economic growth rates. Although most countries in the region have some of the most sought-after minerals and oil reserves, almost all of them depend on aid and grants. Boyce & Ndikumana (2012) identified a lack of funding as the major constraint on SSA's growth and development. However, the inflows of aid and grants to these countries are far fewer compared to the amount of outflowing funds to mostly developing countries (Baker, 2007; OECD, 2014). Unfortunately, this fund outflowing is usually illegal or at minimum immoral. Therefore, these funds are called illicit financial flows (IFFs).

There have been significant debates on what exactly amounts to IFFs, as different researchers have proffered several definitions. The main issue of contention in properly defining IFFs is the legal status associated with the flow of funds. Confusion comes from the word 'illicit,' which does not necessarily mean illegal, but is defined by the Oxford Dictionary as "forbidden by law, rules or custom." Several researchers have agreed that IFFs go beyond legality to include the morality of cross-border transactions. IFFs, whether legal or illegal, are generally immoral since they subvert a country's objective to generate funds domestically that can be used for the provision of public services and the improvement of its citizens' livelihoods. IFFs have been defined as the "methods, practices and crimes aimed to transfer financial capital out of a country in contravention of national or international laws." The widely accepted definition of IFFs is money that is acquired, transferred or used illegally (OECD, 2014).

The primary objective of this research is to investigate the association between illicit financial flows and international trade. International trade takes

place through either exports or imports and creates room for funds, i.e., those acquired both legally and illegally, to be formally moved across borders. As the volume of trade increases and financial transactions become more complex, the manipulation of trade data becomes more attractive as a means of facilitating IFFs. According to Kar & Cartwright-Smith (2009), international trade often provides an 'excellent conduit' for IFFs. Exports and imports are mostly manipulated through misinvoicing, which accounts for more than 60% of IFFs (Baker, 2007; Forstater, 2018; Mevel, Ofa, & Karingi, 2013). Empirical evidence shows that there is an upwards trend of persistently large volumes of trade. Large volumes of trade reduce the probability of detecting manipulation of invoices; this is because on average, less than five percent of all cargo shipments are inspected, and there is limited exchange of data or statistical analysis by various customs agencies.

To move funds out of a country, an exporter underinvoices his or her exports. When exports are underinvoiced, the exporter will be using the transaction to retain funds that should have been earned from the export out of the country. The exported goods are valued more than what is indicated on the invoice. Therefore, the central bank expects less foreign currency from the transaction compared to the actual amount earned. The exporter retains the difference between the actual value and the invoiced value out of the country. In addition to the retained amount, such a transaction results in a thin base from which taxation is supposed to take place domestically. In both cases, the government is prejudiced of both foreign and local currency, thus reducing its capacity to effectively provide public services (Kar & Freitas, 2012).

Importers use overinvoicing to move funds out of the country. By overinvoicing, the importer declares his or her import to be more valued than it actually is. As a result, the importer is allowed to move more funds than the value of the goods to be received in the country, thus prejudicing the country of foreign currency. The amount over and above the actual amount of goods to be imported then becomes unaccounted for and remains in the foreign country for the benefit of the importer. Just as in exports, such a transaction not only moves funds out of the country but also increases costs in the books of the importer. Thus, the transaction reduces the profitability from which the government receives taxes. The effect is a smaller share of tax for the government, thus crippling its ability to effectively provide public services.

According to De Grauwe et al. (2012), governance plays a crucial role in African trade. The six governance dimensions have a critical influence on the occurrence of IFFs. Good governance is when a country ensures a multilateral

approach towards forming policies and procedures for the government to implement. When the government does so for both the public and private sectors in accordance with the laws of the land, it is called good governance. Good governance results in a decline in IFFs as it becomes difficult to commit criminal acts without getting caught and successfully prosecuted. It also becomes difficult to move funds across countries' borders. Hence, there is a potential gap in investigating the impact of trade and governance on IFFs in SSA countries. Therefore, this research answers the question of how trade and governance indicators affect IFFs in SSA countries and how suitable policy measures can control IFFs.

The rest of the paper is structured as follows. After the introduction is presented in the first section, the literature is reviewed in Section 2. Section 3 describes the model specification, potential variables, and data. The next section presents the empirical findings. Finally, we conclude the paper and suggest policy stances for local and international stakeholders.

2. Survey of Literature

The origin of the terms related to the illicit financial flow of funds is traceable to the pioneering works of the World Bank in the 1900s. It was at this time that regular capital flight was observed for the first time with keen concentration (Kituyi 2020). As globalization gathered pace alongside the rapid movement of private capital, the phenomenon became a matter of increased concern. The Global Financial Integrity Group (GFI, 2013) has defined illicit financial flow of funds (IFFs) as "cross border transfers of funds that are illegally earned, transferred, or utilized." In their combined report from 2016, the United Nations (UN) and the Organization for Economic Co-Operation and Development (OECD) define illicit financial flow of funds (IFFs) broadly as "all cross-border financial transfers, which contravene national or international laws. This wide category encompasses several different types of financial transfers, made for different reasons, including funds with criminal origin, such as the proceeds of crime (for example tax evasion, money laundering, fraud and corruption); funds with a criminal destination, such as bribery, terrorist financing or conflict financing; transfers to, by, or for, entities subject to financial sanctions under UN Security Council Resolutions and its successor resolutions (e.g., terrorist organizations); and transfers that seek to evade antimoney laundering/counterterrorist financing

measures or other legal requirements (such as transparency or capital controls)".

In essence, activities relating to IFFs are secretive and most of them, such as money laundering, tax evasion, corruption, bribery and terrorist financing, are illegal. The illegal component of the total global IFFs is estimated at 35%, while 60% is estimated to be IFFs generated through legal commercial activities such as transfer pricing within multinational companies and mispricing among independent companies (Baker, 2007). The rest of the IFFs are estimated from different levels of corruption in financial matters in concerned countries.

IFFs negatively impact the economic growth of a country. The funds that are supposed to finance local production and services are channelled out of the country, leaving a financing gap for both the financial sector and the government. While most activities associated with IFFs are hidden, the impact of some is conspicuous and devastating, particularly in the Sub-Saharan African countries. SSA countries are already burdened with a plethora of development challenges. According to the World Bank (2016), SSA has more countries affected by conflict than any other region in the world, and 400 million people in the region are living in extreme poverty. While the gross amounts of IFFs from countries such as China, Russia, Mexico, Malaysia and India are greater than those experienced in SSA, the severity of IFFs in the latter is exposed through the rankings of the ratios of IFFs and some development indicators (Spanjers & Foss, 2015). Sixty-four percent of the top 25 countries with the highest IFFs-to-GDP ratio are from SSA, with Togo and Liberia having ratios of 76% and 61.6%, respectively. Fifty-six percent of the top 25 countries with the highest IFFs-to-trade ratio are from SSA, while 64% of the top 25 countries with the highest IFF-to-FDI ratio come from SSA. The highest IFF-to-FDI ratio was 13 564%, with the lowest being 243%. Boyce & Ndikumana (2012) and De Grauwe *et al.* (2012) also indicated that Sub-Saharan African countries have the largest representation in the IFFs-to-education spending and IFFs-to-health spending ratios, with at least 116% in both cases. These ratios indicate that each country's IFFs are over and above what the country is spending on education and health, respectively.

Some of the public services impacted by IFFs include public health care, security, education, disaster management and social services. Since all the countries in Sub-Saharan Africa are not industrialized and are still developing, they have a thin base from which they source domestic funding. If anything, the region requires the most funding to ensure reasonable economic growth

and poverty alleviation programs. The continued leakage of billions of dollars through IFFs from SSA to mostly developed countries is affecting the region's economic development agenda. Research has proven that SSA is a net payer in global transactions. Without IFFs, the region could finance its own development agenda without any need for outside assistance. A reduction in IFFs would therefore lead to an expansion of domestic revenue and reduce reliance on foreign funding. This change could be instrumental for African countries to regain control of extracting and marketing their own minerals, thereby creating more value from their own resources in the long term (Liu, Burridge, & Sinclair, 2002).

Research on IFFs is critical since it will lead to solutions on how to arrest the flow of illicit funds from countries in SSA to other countries. Such solutions will mean an increased financial base from which the countries in SSA will invest or fund their own developmental projects. Increased investment leads to creating jobs and alleviating poverty through boosted sustainable economic growth and industrialisation. An increased level of economic development will ensure the progression of these Sub-Saharan African countries towards attaining the United Nations' Sustainable Development Goals (SDGs). Adopted in 2015, the SDGs are a global development framework that succeeded the set of Millennium Development Goals (MDGs). The MDGs' agenda was to ensure the reduction of extreme poverty and hunger, among other goals. There are 17 SDGs that aim to carry the momentum beyond what the MDGs achieved minimally. The SDGs' agenda includes ending extreme poverty and ensuring shared prosperity. IFFs are some of the major impediments that may seriously negatively affect the ability of countries in SSA to achieve the SDGs by 2030 (UNODC and OECD, 2016).

IFFs are indicative of the structural challenges of governance in countries where they occur. Kar & Freitas (2012) went further to indicate that governance is the main driver of IFFs and the underground world. Essentially, governance is defined as the decision-making process and the subsequent processes involved in the implementation of such decisions. The Commission on Global Governance defines governance as 'the sum of many ways individuals and institutions, public and private, manage their common affairs' (Weiss, 2000). The decision-making and implementation processes mainly involve governments and both formal and informal actors in military and civil society. After recognizing certain characteristics of governance that allow for the social and economic development of a country, the term good governance

was created (Chiappini and Viaud, 2020). Good governance has eight characteristics; i.e., 'It is participatory, consensus-oriented, accountable, transparent, responsive, effective and efficient, equitable and inclusive and follows the rule of law.'[5] There are six governance indicators that show the perceptions of governance from a wide variety of sources, both public and private, and cover 200 countries and territories. The six dimensions are control of corruption, regulatory authority, government effectiveness, political stability and lack of violence, vice and accountability, and rule of law. This is an on-going project that has been in operation since 1996, and the data is updated annually.

SSA is impacted more by IFFs because of its vulnerability to a number of challenges that affect it. Yet, IFFs are a global challenge that affects almost all countries in the world, including developed countries. The difference is different countries' capacities to deal with the factors that promote IFFs. The understanding of these factors and how they contribute to the proliferation of IFFs is critical for policy-makers to help them develop the right frameworks to curtail IFFs. Since IFFs are cross-border transactions, they are driven by numerous activities that allow for the illicit movement of either goods or funds across countries. The main activities involved in the creation of IFFs are the generation of funds, their movement across borders, and their usage. Any illicit activity along this chain results in the creation of IFFs. This research is concerned with the movement of funds across borders through trade. The extent to which this channel succeeds as a conduit for IFFs is dependent on the country's governance structures. Thus, it is worth exploring the trade and governance indicators affecting IFFs in SSA countries.

3. Data and Econometric Approach

This research examines the international trade, institutional factors and IFFs nexus for the Sub-Saharan African region. Following the literature, a comprehensive crime model is implemented in this section (Draca & Machin, 2015; Machin & Meghir, 2004; Rickman & Witt, 2008). This model postulates an association between the annually reported crime in the given panel and a set of explanatory factors that are derived from deterrence, socioeconomic, economic and crime-related elements. However, this research modifies the crime model in such a way that it will estimate the amount of influence exports

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[5] https://www.unescap.org/sites/default/files/good-governance.pdf

and imports have on the crime rate (IFFs) (controlling for institutional factors). In making this estimation, the research makes use of a multiple linear regression model. The following equation is used in the estimation:

$$IFFs_{it} = \propto_{it} + \beta_1 X_{it} + \beta_2 M_{it} + \beta_3 RegQty_{it} + \qquad\qquad (1)$$
$$\beta_4 Control.Corr_{it} + \beta_5 MGvt.Eff_{it} + \beta_6 PS_{it} + \beta_7 RL_{it} +$$
$$\beta_8 VA_{it} + \varepsilon_{it}$$

where the subscripts t and i show the time period and region, respectively. The dependent variable is the illicit financial outflows, while all economic and institutional variables in the model are described and defined in Table 2. In this study, IFF outflows, imports and exports are measured in millions of dollars and are presented in log form to compare means and alleviate the problem arising from the skewed distributions of these variables. α is the intercept, ε is the error or disturbance term, and β_1 to β_8 are the respective coefficients. (litre.)

3.1 Data

For empirical analysis, the available data only range from 2004 to 2014. The data used in the estimation are taken from three main reliable sources, which are given below.

Table 1. Variable Data Sources and Status

Variables	Data Source	Status
IFFs	*GFI*	Dependent Variable
X	*IMFs' DOTS*	
M	*IMFs' DOTS*	
Reg. Qty[1]	*WGI*	
Control. Curr.	*WGI*	Independent Variables
Govt. Eff.	*WGI*	
RL	*WGI*	
PS	*WGI*	
VA	*WGI*	

[1] All quality indices range from approximately -2.5 (weak) to 2.5 (strong), showing their performance.

- **Regulatory Authority**   - Regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote the private sector

- **Control of Corruption**   - Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption and the "capture" of the state by elites and private interests. Each estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5.

- **Government Effectiveness**   - Government effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Each estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5.

- **Political Stability and Lack of Violence**   - Political stability and lack of violence measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism.

- **Voice and Accountability**   - Voice and accountability captures perceptions of the extent to which a country's citizens can participate in selecting their government, as well as freedom of expression, freedom of association and press freedom

- **Rule of Law**   - Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, particularly the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. The estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5.

IFFs are secretive and mostly hidden; therefore, their quantification is based on estimations. These estimations are also made difficult by the various definitions given to IFFs. Some definitions focus on the illegality of transfer rather than the source, while others focus on the source[6]. The differences clearly come out in the broader definitions of IFF as discussed by (Forstater, 2018). The European Parliament Report (2015) on tax avoidance and tax evasion highlighted in the description of illicit financial flows that they "typically originate from tax evasion and avoidance activities, such as abusive transfer pricing, against the principle that taxes should be paid where profits have been generated." Picciotto (2018) discussed illicit financial flows and the tax haven and offshore secrecy system as follows: "Offshore is a murky world which facilitates a range of criminal, illegal, illegitimate and undesirable practices covered by the broad term illicit. They range from facilitating serious crime to behaviour that is unethical or undesirable, such as concealing assets from family members or business associates. It is sometimes said that many of these activities are 'perfectly legal', and hence legitimate."

3.1.1 IFFs and their Quantification

According to Mevel et al. (2013), there are four main methods used in the quantification of IFFs, namely, the World Bank's residual model, the Dooley method, the hot money method and the trade misinvoicing method. These different methods produce different results, which casts doubt on their perfection. Similarly, most researchers agree that the methods are not 100% correct in their estimations.

3.1.1.1 The World Bank's residual model

This model was formulated in 1985 and uses a broad measure that uses balance of payment amounts by taking into consideration the remainder of the source of funds over recorded use of funds, which reflects unrecorded outflows. This unrecorded outward flow of funds is assumed to be an IFF when the source of funds is more than the use of funds. There are mainly two sources of funds: 1) an increase in external debt and 2) net flows of foreign direct investments. The two main uses of the funds are the finance of the

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[6] Terms used in defining IFFs provide the source of conflict; for example, GFI refers to movement of 'funds or money', while OECD refers to movement of 'financial capital'.

current account deficit (shortfall of exports over imports) and the foreign exchange reserves.

Source of funds   minus   Use of Funds

K = [Δ External debt + FDI(Net)] - [CA Deficit + Δ Reserves (Net)] (Kar and Cartwright-Smith 2008).

3.1.1.2 The Dooley method

This method was formulated in 1986 and calculates IFFs by making three major adjustments to those privately held foreign assets recorded in the balance of payments by domestic authorities but not generating any investment income. This method assumes that interest income from legal capital would naturally be reported and recorded in the balance of payments; however, interest income from illicit capital flows would go unreported in the BOP. The IFFs are estimated by initially calculating the cumulative identified capital outflows in the BOP and adding the errors and omissions. The second adjustment is to add the difference in the changes in external debt as recorded to the World Bank, calculated by netting the stock of foreign debt reported to the World Bank with reported BOP liabilities. The figure acquired at this stage represents the foreign assets acquired by the private sector. Last, an addition of foreign stock needed to give the BOP investment income, which is acquired by using an international market rate, is made.

$$IFFs \ = \ A \ + \ B \ + \ C \ - \ D$$

where: A: Cumulative recorded nonequity BOP assets
        B: Cumulative errors and omissions
        C: Adjustment for unrecorded claims
       = Stock of external debt as reported to the World Bank - Cumulative recorded BOP liabilities.
        D: Capitalised reported non FDI income (Claessens and Naude 1993).

3.1.1.3 Hot Money Method

This is a method of estimating IFFs by assuming that the line item of net errors and omissions in the BoP does, in fact, represent capital outflows. The argument is that since the BoP measures a country's income surplus and net

assets against other countries, it therefore follows that changes in the net wealth of a country should be more or less equal to the increase in the income surplus. If the income surplus is more than the change in the net wealth of a country, then the difference is the capital outflow. Three different hot money measures have been developed depending on what is being included under the recorded private sector capital outflows:

$$Hot\ Money\ 1 \ = \ -(G \ + \ C1)$$

$$Hot\ Money\ 2 \ = \ -(G \ + \ C)$$

$$Hot\ Money\ 3 \ = \ -(G \ + \ C \ + \ D1 \ + \ D2)$$

where G: Net errors and omissions, C: Other short-term capital of other sectors, C1: Other assets, D1: Portfolio Investments: other bonds, and D2: Portfolio Investments: corporate equities (Claessens and Naude 1993).

3.1.1.4 Trade Mis-Pricing model

This model is also known as the trade misinvoicing model. It estimates IFFs by comparing the difference between statistics on bilateral export and import figures as separately recorded on custom documents of two trading countries. The IFFs take place when imports are overinvoiced and exports are underinvoiced. This practice allows for some funds to remain out of a country in contravention of national or international laws. There are three main types of trade misinvoicing models depending on the source of data and the nature of calculations affecting the export and import data to come up with IFFs. These different types are the IMF DOTS-based mis-pricing model, the IPPS-based mis-pricing model and the UN COMTRADE-based mispricing model.

3.1.1.5 IMF DOTS-based model

The Direction of Trade Statistics (DOTS) is an International Monetary Fund (IMF) dataset that provides partner country trading data to the IMF. Ordinarily and ceteris paribus, exports from one country to another are supposed to match the imports made by that other country from the former, inclusive of insurance and shipping (cif: cost, insurance and freight). If records of exports from country A to country B are different from import records from country B to country A, then that difference is assumed to be due to underinvoicing by the exporting country or overinvoicing by the importing country. In general, exports are expressed as cif, while imports are expressed

as fob (freight on board). To ensure consistency, a comparison of exports and imports is made after dividing the imports with a fixed coefficient to bring them to the import fob.

This research primarily relies on the IMF DOTS-based mispricing model due to the ready availability of data. The data for import and export are acquired from IMF's DOTS database. The main advantage of using the IMF's DOTS database is that GFI has calculated the IFF outflows by using the same database. Thus, consistency and clarity of the data is guaranteed. The data on institutional variables are retrieved from the World Governance Index (WGI) database.

Since the current research focuses on international trade, it is directed towards the export and import variables. Institutional control variables, such as regulatory quality, control of corruption, rule of law, political stability, voice and accountability, and government effectiveness, ensure the correct estimation of exports and imports for illicit financial flows. These institutional factors are included in the model because they are governance indicators that affect governmental institutions' ability to collect taxes (Reuter, 2017). Table 2 contains the descriptive summary for all study variables.

3.2 Econometric Approach

To estimate Equation (1), the GLS estimation method is the most suitable since all the variables are integrated at the same level. The robustness of the GLS results is assured by dynamic system panel-data regression (dynamic system GMM), which was first described by Arellano-Bover/Blundell-Bond (Arellano & Bover, 1995). The dynamic system regresses a linear dynamic panel-data model where the unnoticed panel-level impacts are associated with the lags of the response factors. It accommodates outsized autoregressive coefficients and a large ratio of the variance of the panel-level impact to the variance of idiosyncratic errors. This method supports the possibility of criminal inertia (Fajnzylber, Lederman, & Loayza, 2002), as it incorporates the lag of the response factor as a regressor in the estimation process. A collection of literature on economic crime has identified that a higher current crime rate is related to a higher crime rate tomorrow (Case & Katz, 1991). This estimation is also desirable for datasets with few periods and many countries (A. Asongua,c, 2018). Furthermore, it is more reliable with panel

data analysis, as it overcomes endogeneity problems (Arellano & Bover, 1995).

4. Results and Discussion

The motivation behind the empirical analysis is to examine whether IFFs were sensitive to international trade and the quality of institutional factors during the 2002-2014 period.

Table 2. Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
lnIFFS	216	6.62	1.64	2.24	10.19
lnExports	220	7.96	1.52	4.23	11.69
lnImports	220	7.54	2.07	2.11	11.89
Political Stability	220	-0.45	0.88	-2.21	1.10
Government Effectiveness	220	-0.71	0.57	-1.55	0.64
Control of Corruption	220	-0.54	0.60	-1.45	1.03
Regulatory Quality	220	-0.59	0.51	-1.47	0.67
Voice and Accountability	220	-0.55	0.64	-1.45	0.65
Rule of Law	220	-0.66	0.55	-1.55	0.67

Table 3. Trade and Institutional Determinants of IFFs

lnIFFS	B	S.E	z	P>z	C.I at 95%	
Imports	0.43	0.05	7.76	0.00	0.32	0.53
Exports	0.35	0.07	5.08	0.00	0.22	0.49
Rule of Law Estimate	1.41	0.33	4.21	0.00	0.75	2.06
Voice and Accountability	-0.42	0.14	-3.07	0.00	-0.69	-0.15
Regulatory Quality	-0.21	0.27	-0.77	0.44	-0.74	0.32
Control of Corruption	-0.06	0.27	-0.23	0.82	-0.59	0.46
Government Effectiveness	-0.50	0.28	-1.10	0.01	-0.85	0.24
Political Stability	-0.52	0.11	-4.80	0.00	-0.73	-0.31

Table 3. Trade and Institutional Determinants of IFFs (continued)

lnIFFS	B	S.E	z	P>z	C.I at 95%	
2002	Ref.					
2003	0.11	0.29	0.38	0.70	-0.45	0.67
2004	0.68	0.29	2.36	0.02	0.11	1.25
2005	0.49	0.29	1.70	0.09	-0.07	1.05
2006	0.82	0.28	2.89	0.00	0.27	1.38
2007	0.68	0.29	2.37	0.02	0.12	1.24
2008	0.67	0.29	2.28	0.02	0.09	1.24
2009	0.74	0.29	2.59	0.01	0.18	1.31
2010	0.23	0.29	0.78	0.44	-0.34	0.79
2011	0.28	0.29	0.95	0.34	-0.30	0.85
2012	0.56	0.29	1.90	0.06	-0.02	1.13
2013	0.47	0.29	1.60	0.10	-0.11	1.04
2014	0.17	0.29	0.57	0.57	-0.41	0.75
2015	-0.04	0.30	-0.14	0.89	-0.63	0.55
Constant	0.14	0.37	0.37	0.71	-0.58	0.85

This study has explored a nexus between trade activities and IFFs, controlling for other significant institutional confounders by employing the GLS estimation method in the case of Sub-Saharan African countries. Both exports and imports have significant positive relationships with IFFs, which was the expected outcome. The results show that a 1% rise in imports and exports results in 0.43% and 0.33% higher IFFs outflows, respectively. This outcome is due to trade-related over- or underinvoicing. Over-or underinvoicing occurs during either exporting or importing. Thus, it becomes normal for exports and imports to have a positive relationship with IFF outflows. Therefore, past studies have usually used trade data (i.e., imports and exports) to study trade mispricing (Forstater, 2018). The interesting point is that the estimate of imports is greater than that of exports. This finding can be explained by the ability of a government to properly monitor the data generated from the two trading processes. Exports can be more easily monitored under strict rules and regulations than imports by the home government as they are produced within the country. However, import data is

more open to manipulation for several reasons. These reasons include several other costs that can be added to the original cost of the imports and that the imports may come from a country with a different language from the home country. These gaps create room for errors (Manucha et al., 2006). The coefficient of exports is unexpectedly negative and not robust in the system GMM estimation.

Among institutional variables, regulatory quality has a negative but inconsistent relationship with IFFs. These outcomes contradict the results of Abotsi (2018). However, the association of government effectiveness with IFFs is negative and consistent ($p<0.01$). This result implies that the government's ability to design and implement robust policies certifies and endorses economic development while also curbing IFFs outflows. The government is thus able to curb IFFs because institutional factor help formulate effective policy measures and implement them, even in the tax system (Jalilian, Kirkpatrick, & Parker, 2007). Thus, higher government effectiveness means an efficient tax system in the country. An efficient tax system leads to increasingly difficult opportunities to commit tax-related crimes. Ultimately, this system leads to lower IFFs. A negative relationship is thus expected to occur (Mnguu, 2013; Togler and Schneider, 2007). The positive and highly significant ($p<0.01$) association of rule of law with IFFs is surprising and contradicts past studies that have pointed out a negative impact of rule of law on IFFS (Baker, 2007). The impact of political stability is significant ($p<0.01$) and negative. This result implies that an unstable political system allows rent seeking and corruption from unrestricted officials and leaders, especially in extractive political institutes (Acemoglu, Johnson, Robinson, & Thaicharoen, 2003). Among the empirical results, the estimate of the voice and accountability index is significantly ($p<0.01$) negative. This result implies that media freedom plays a vital role in overcoming IFFs. This study estimates an inconsistent nexus between the control of corruption and IFFs because it is noted that corruption accounts for only 5% of the total global IFFs (Kar, 2002). Moreover, Reed & Fontana (2011) noted that as corruption proceeds are very difficult to measure, their impact is insignificant. The year fixed effect significantly confirms the increasing trend of IFFs except for a few years, showing higher IFFS over this time period in SSA countries.

Table 4. Robustness with Dynamic System GMM Estimation

lnIFFS	B	S.E	z	P>z	C.I at 95%	
LnIFFS $_{(t-1)}$	0.08	0.06	1.18	0.24	-0.05	0.20
Imports	0.83	0.15	5.43	0.00	0.53	1.13
Exports	-0.21	0.12	-1.73	0.08	-0.46	0.03
Rule of Law Estimate	2.01	0.58	3.45	0.00	0.87	3.15
Voice and Accountability	-0.62	0.42	-1.47	0.14	-1.44	0.21
Regulatory Quality	0.19	0.61	0.30	0.76	-1.01	1.38
Control of Corruption	-1.08	0.56	-1.93	0.05	-2.18	0.02
Government Effectiveness	0.61	0.65	0.95	0.34	-0.65	1.88
Political Stability	-0.65	0.22	-2.96	0.00	-1.09	-0.22
Constant	2.11	0.88	2.41	0.02	0.40	3.83

Robustness is checked using dynamic system GMM estimation. The dynamic system confirms the outcomes of FGLS, except that IFFs are estimated to be higher in this region with a lower rate of control over corruption at $p<0.05$, holding other factors constant. This finding suggests that the states with lower scores for control of corruption face a relatively higher rate of corruption and will ultimately experience more IFFs. Furthermore, corruption is fundamentally linked to IFFs. Corruption produces undue benefits that need to be transferred illicitly and illegally to the developed world, which provides secrecy protection to their money (Filippo and Reganati, 2017). A previous study has also estimated a significant relationship between corruption and capital flight (Le & Rishi, 2006). Thus, corruption is found to have a positive impact on IFFs in the current research.

Chaikin and Sharman (2009) noticed that corruption is often the main source of funds being transferred illegally in developing territories. Developing territories normally have less organized crime and much smaller financial institutions (Chaikin & Sharman, 2009). This outcome is in line with Abotsi (2018), Desbordes & Verardi (2017) and other past studies that have indicated that an increased level of corruption raises the rate of trade

misinvoicing (Wardlaw, Blanc, Zupan, & Ahman, 2004). However, the coefficient of exports surprisingly becomes negative in this estimation.

5. Conclusion and Suggestions

This research investigates international trade, governance factors and IFF relationships for SSA countries using the FGLS. Additionally, system GMM regression analysis is employed for robustness. The empirical results reveal higher IFFs with increasing levels of imports and exports. Individuals and companies misrepresent the invoicing instruments to externalise funds or pay lower duty taxes, among other suspicious activities (Reed & Fontana, 2011). The empirical estimates of political stability, voice and accountability, government effectiveness and corruption control rate are significantly negative. In developing countries, poor governance and a (poor) lower rate of corruption control help enhance the occurrence of IFFs when multinational companies in the extractive industry negotiate the desired tax conditions against informal payments made to government representatives. Moreover, an unstable political system not only permits corrupt politicians to safely conceal their earnings from corruption but also holds the institutions accountable for sensing IFFs. This is aligned with the argument that corruption explains a far greater portion of IFFs from poor states than from rich states because disentangling corruption from the other sources of funds available for laundering is very difficult in these countries (Kar & Cartwright-Smith, 2009). This unequal effect on developing countries requires IFFs to be on the development agenda. Furthermore, it is also argued that the mispricing of exports and imports may help corrupt officers transfer money abroad in a way that cannot be observed. For example, an official in a developing state may found a facade import/export business to transfer money abroad, or he or she may privately buy goods from a multinational company at an artificially inflated price, thereby shifting the illegal earnings of corruption out of state (Forstater, 2018).

5.1 Suggestions

Curbing IFFs requires strong international cooperation and concerted action by developed and developing countries in partnership with both the private sector and civil society. Countries in which corruption is endemic should not abdicate responsibility for fighting it. This clearly indicates that a

share of the fighting must take place abroad. Further, those responsible for regulating the jurisdictions in which corrupt persons shift their profits carry a portion of the blame. Suggestions to solve this problem must come not only from the countries where illicit financial flows originate, but also from the recipient countries, i.e., offshore financial centres with a high level of financial secrecy. Corruption cannot be fought effectively in developing countries without developed countries playing their part to stop the flow of the proceeds of such corruption. Government authorities should adopt and fully implement all the Financial Action Task Force's (FATF) anti-money laundering recommendations. Laws already in place should be strongly enforced. The positive association of government effectiveness with IFFs recommends enhancing its intensity in terms of policy formation and implementation to overcome IFFs. Governments should significantly boost customs enforcement by providing appropriate training and equipment to better detect the intentional misinvoicing of trade transactions. One particularly important tool for stopping trade misinvoicing as it happens is giving access to the most recently available, commodity-level world market pricing information. This would allow customs officials to tell whether a particular good may be significantly mispriced relative to the prevailing world trade pricing for that good. This variance could then trigger further review for the transaction in some form, such as an audit. GF Trade™, a product of GFI, is a proprietary risk assessment tool that is designed to allow customs departments to do just that. Customs agencies should treat trade transactions involving a tax haven with the highest level of scrutiny. Moreover, governments should significantly boost their customs enforcement by equipping and training officers to better detect the intentional misinvoicing of trade transactions, particularly through giving them access to the most recently available world market pricing information at the detailed commodity level (Global Financial Integrity, 2019). It is suggested that researchers investigate the same IFF-related issues in different countries, regions, and continents to increase the betterment of poor people in line with the SDGs of the UN.

Declaration of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. No funding was received for this research work. The

datasets used during the current study are available from the website and are available on request.

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BETTER FINANCIAL RISK MANAGEMENT VIA A BETA EVALUATION MODEL - CASE OF FOUR BANKS IN VIETNAM DURING POST - LOW INFLATION

Abstract

Because of the vital roles that commercial banks play in Vietnam, we conducted this study to evaluate the macro impacts of low inflation, the US-China trade war, and the COVID-19 pandemic on market risk (Beta CAPM) of four large listed banks in Vietnam that are part of a group of joint stock commercial banks: Eximbank (EIB), Sacombank (STB), Navibank (NVB), and Asia Commercial Bank (ACB), before and after being listed on a stock exchange.

We use both qualitative analysis and an OLS regression model to evaluate the effects of internal and external macro factors on the beta CAPM of these four large banks. Our findings show that the risk-free rate has a positive correlation with beta CAPM in all four bank cases. Last, the lending rate also has a positive correlation with beta CAPM in three cases and a negative correlation in one case (NVB). Hence, because market risk will increase if the lending rate increases, we would suggest the State Bank of Vietnam (SBV) and bank system control lending rates to not raise rates too much.

From this fact, the authors propose risk management plans and recommend macro policies. Research results can be applied to other emerging markets.

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KEYWORDS: COMMERCIAL BANK; MACRO VARIABLE EFFECTS; VIETNAM; MARKET RISK; RISK MANAGEMENT; POLICIES.

ABBREVIATION: CPI: inflation; G: GDP growth; R: lending rate; Rf: risk-free rate; IM: industrial manufacturing.

1. Introduction

While banks in Vietnam are very profitable, they also face risks and challenges. After M&As, many banks need new risk management and corporate governance models. It is important to construct an effective risk model for banks as they are deeply connected with most industries in the market economy.

Risk management policies can be affected by internal factors and external factors, which include internal macro effects such as GDP growth, CPI, and interest rates and external macro effects such as the US–China trade war, crises, global economic conditions, and the COVID-19 pandemic.

Dinh Tran et al. (2021) find that macro indicators affect risks in the real estate and banking sectors (Huy, D. T. N., Loan, B. T., & Anh, P. T., 2020). While there are many models to estimate risks, and we contribute a risk model under macro effects within the scope of this study.

Therefore, we can build an econometric model using software Eviews to measure and evaluate the effects of the macro environment and other factors that impact bank market risk. Then, we can expand our quantitative model for risk estimation in the banking sector to other industries. We can use the traditional beta CAPM formula to calculate market risk, however for future research, we can develop a modern beta formula that is a weighted index that considers market value and stock prices compared to the traditional formula.

Risks in banking business are a broad concept and include market risk, liquidity risk, credit risk, and operational risk. Because of the vital role of commercial banks and their domino effects throughout the banking system and economy, it is important to evaluate the market risk of the big four joint stock commercial banks in Vietnam (ACB, STB, EIB, and NVB) during the post-low (L) inflation period of 2015-2020 until the US-China trade war and the COVID-19 pandemic.

The paper is organized by the introduction, research issues, literature review, methodology and data, main results, discussion, conclusion, and policy implications.

Research questions:
Question 1: What are the quantitative results of macro effects on bank risk?
Question 2: What are recommendations for bank risk policies?

2. Previous studies

Dimitrov (2006) documented a significantly negative association between changes in financial leverage and contemporaneous risk-adjusted stock returns.

Umar (2011) found that firms that maintain good governance structures have higher leverage ratios (47 percent) than firms with poor governance mechanisms per unit of profit. Chen et al. (2013) supported regulators' suspicions that overreliance on short-term funding and insufficient collateral compounded the effects of dangerously high leverage and resulted in undercapitalization and excessive risk exposure for Lehman Brothers. The model reinforces the importance of the relationship between capital structure and risk management. Gunaratha (2013) revealed that the degree of financial leverage across industries in Sri Lanka has a significant positive correlation with financial risk.

Mohamad et al. (2014) showed that financial risk is vital by using both return on asset and return on equity in the performance equation. This result also implied that we cannot avoid the inverse relation of financial risk and performance; therefore, a bank system must make a trade-off between risk and performance.

The table below summarizes previous studies relating to the topic of risk management under macro impacts:

Table 1. Summary of previous studies

Domestic studies	Authors name	Results, contents
1. Systemic risk and the problem of determining Beta coefficient in Vietnam	Vương Đức Hoàng Quân (2012)	Generally, in the first stage, the information from the Vietnam stock market is not sufficient in quantity and quality to estimate the beta coefficient using regression analysis of stock returns volatility compared to indices, which is the traditional method. VN-Index to value the listed companies and stocks.
2. Fama-French 3-Factor Model: The empirical evidence from the Ho Chi Minh City Stock Exchange	Trương Đông Lộc and Dương Thị Hoàng Trang (2014)	The research results show that stock earnings are positively correlated with market risk, firm size, and the book value to market value (BE/ME) ratio. In other words, the Fama - French 3-factor model is suitable in explaining the change in profits of stocks listed on HOSE.
3. The econometric model for stock prices in the period 2008-2011 - Case of stock prices ACB, VNIndex, risk free rate and S&P500	Đinh Trần Ngọc Huy (2015)	Analyse the impact of VNIndex and internal and external macro variables on the stock price of ACB.
4.The theory of average return of K. Marx and model of capital asset pricing	Nguyễn Thị Hường (2017)	The lack of beta in stock analysis is one limitation of Vietnam's stock market. However, as the market portfolio matures, beta will also keep pace with the development of the market.

Table 1. Summary of previous studies (continued)

Domestic studies	Authors name	Results, contents
5. Book chapter by Dinh Tran Ngoc Huy (2021, Springer Verlag book chapter) "Impacts of Internal and External Macro Factors on Firm Stock Price in An Econometric Model – A Case in Viet Nam Real Estate Industry"	Đinh Trần Ngọc Huy (2021)	Presenting a regression model analysing the impact of internal macro variables (inflation in Vietnam, lending rate, risk-free rate) and external (US inflation, exchange rate, S&P 500) on stock prices Vingroup is as follows: Stock price_VIC = -245.13 * Inflation_CPI + Lendingrate - 815.06*Rf_rate USD_VND_rate+0.07*SP500- 372.08*Inflation_US, R2 = 0.84, SER = 19.7
6. Systemic risks in banking business - periods of crisis	Nguyễn Thanh Bé, Bùi Quang Hưng (2019)	The risk management system of commercial banks in Vietnam has received some attention in the past few years, but due to its structural and technical limitations, this system cannot meet the complex requirements of a modern commercial bank operating in the current risky environment.
7. Factors affecting the return rate of listed stocks from the Fama French 5-factor model	Trịnh Minh Quang et al. (2019)	Factors of market change strongly affect the share prices of large companies.

Table 1. Summary of previous studies (continued)

International studies	Authors name	Results
1. The Impact of Macroeconomic and Financial Variables on Market Risk: Evidence from International Equity Returns	Patro et al. (2002)	A number of variables including imports, exports, inflation, market capitalization, dividend yield, and a book-to-book price ratio significantly influence a person's world market risk at a national level.
2. Do economic factors influence stock returns? A firm and industry level analysis	Butt et al. (2010)	The results revealed that market returns are primarily changes in stock returns, but macroeconomic variables and industry-related variables add explanatory power in describing volatility of stock returns.
3. Macroeconomic factors and micro-level bank risk	Claudia et al. (2010)	The risk of about a third of US banks increases in response to monetary easing.
4. Impact of Macroeconomic Factors on Banking Index in Pakistan	Saeed và Akhter (2012)	Regression results show that exchange rate and short-term interest rate in the Karachi stock market have a significant impact on the banking index. Macroeconomic variables such as money supply, exchange rates, industrial production, and short-term interest rates and exchange rates have a negative effect on the banking index while oil prices have a positive effect on the banking index.

Table 1. Summary of previous studies (continued)

International studies	Authors name	Results
5. Impact of Macroeconomic Indicators on Stock Market Performance: The Case of The Istanbul Stock Exchange	Arnes (2014)	Their analysis indicated that investors interested in Turkey should not assume that past relationships will continue to exist in the future. The effects of changes in macroeconomic variables will also differ by sector. For policy makers and lawmakers, however, the findings indicate that keeping interest rates low has been a good policy for the past 20 years.
6. Bank Leverage Ratios and Financial Stability: A Micro- and Macroprudential Perspective	Emilios (2015)	The leverage cycle can cause financial instability and limited leverage on bank governance performance.
7. Effect of Macroeconomic Variables on Stock Market Returns for Four Emerging Economies: Brazil, Russia, India, and China	Gay (2016)	This study hypothesised that the relationship between the exchange rate and the security's price should be in the same direction.
8. The Impact of Macroeconomic Factors on the German Stock Market: Evidence for the Crisis, Pre- and PostCrisis Periods	Celebi and Honig (2019)	In Germany, the aggregate index (OECD), the Economic Research Institute's Export Expectations index, the climate index, exports, CPI, as well as the three-year German government bond yield has a delayed effect on stock returns.
9. Impacts of macro variables on Starbucks Corp.	Kumaresan (2019)	Compared to internal corporate factors, macroeconomic factors (e.g., exchange rate) have a greater effect on firm performance.

3. Methodology and data

3.1 Data:

We used data available online from reliable sources. Interest rates and exchange rate data were obtained from commercial banks. The risk free rate (Rf), GDP growth, and CPI were obtained from the Bureau of Statistics. Stock price and S&P 500 data were obtained from stock exchanges.

3.2 Method

First, we applied qualitative methods. We used analytical, synthesis, inductive, and explanatory methods, combined with the dialectical materialism method. We analysed the effects of variables in a changing macro context.

Second, we applied quantitative methods. Next, this study also used a regression model to measure macro effects on beta CAPM during the pre-L inflation period from 2011 to 2015.

We analysed the effects of nine macro variables on the market risk of listed commercial banks. Weekly stock price data from 2011-2015 for the four commercial banks from reliable sources were obtained to measure Beta and other macro data.

Beta CAPM is a function with nine macro variables as follows:

$$Y = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9) = ax_1 + bx_2 + cx_3 + dx_4 + ex_5 + fx_6 + gx_7 + hx_8 + ix_9 + k$$

where (x_1: GDP growth rate (g), x_2: Risk-free rate Rf (i), x_3: Loan interest rate (r), x_4: Exchange rate (ex_rate), x_5: S&P 500, x_6: VNIndex, x_7: trade balance, x_8: industrial production index, and x_9: CPI). We used Eviews software to run OLS regression.

4. Main findings

First, we examined the correlation of macro factors in the case of case NVB during the 2015-2020 period. We found that GDP growth and industrial production have a positive correlation with beta, whereas the S&P 500 and trade balance have a negative correlation with market risk.

Figure 1. Correlation matrix of macro variables, case NVB

Correlation Matrix									
	BETA	CPI	EX_RATE	G	IM	R	RF	SP500	TRADEBA...	VNINDEX
BETA	1.000000	0.276498	-0.023089	0.108546	0.461634	0.019923	0.164197	-0.090031	-0.138181	0.045633
CPI	0.276498	1.000000	0.355839	0.084484	0.413563	-0.414518	-0.181729	0.255209	-0.220190	0.414535
EX_RATE	-0.023089	0.355839	1.000000	-0.085689	-0.083666	-0.775791	-0.724295	0.686922	0.531030	0.767832
G	0.108546	0.084484	-0.085689	1.000000	0.183953	-0.269621	0.461428	-0.451641	-0.519363	-0.057490
IM	0.461634	0.413563	-0.083666	0.183953	1.000000	0.092188	0.151470	-0.215029	-0.381226	0.008190
R	0.019923	-0.414518	-0.775791	-0.269621	0.092188	1.000000	0.639799	-0.670855	-0.392445	-0.877965
RF	0.164197	-0.181729	-0.724295	0.461428	0.151470	0.639799	1.000000	-0.834478	-0.664650	-0.821145
SP500	-0.090031	0.255209	0.686922	-0.451641	-0.215029	-0.670855	-0.834478	1.000000	0.841285	0.865637
TRADEBA...	-0.138181	-0.220190	0.531030	-0.519363	-0.381226	-0.392445	-0.664650	0.841285	1.000000	0.604758
VNINDEX	0.045633	0.414535	0.767832	-0.057490	0.008190	-0.877965	-0.821145	0.865637	0.604758	1.000000

Second, we examined the correlation of macro factors in the case of EIB during the 2015-2020 period. The S&P 500 and CPI have a positive correlation with beta, whereas Rf and lending rate have a negative correlation with market risk.

Figure 2. Correlation matrix of macro variables, case EIB

Correlation Matrix									
	BETA	CPI	G	IM	R	RF	VNINDEX	EX_RATE	SP500	TRADEBA...
BETA	1.000000	0.154523	0.397123	0.508339	-0.321127	-0.084472	0.363124	0.158882	0.055543	-0.055641
CPI	0.154523	1.000000	0.084484	0.413563	-0.414518	-0.181729	0.414535	0.355839	0.255209	-0.220190
G	0.397123	0.084484	1.000000	0.183953	-0.269621	0.461428	-0.057490	-0.085689	-0.451641	-0.519363
IM	0.508339	0.413563	0.183953	1.000000	0.092188	0.151470	0.008190	-0.083666	-0.215029	-0.381226
R	-0.321127	-0.414518	-0.269621	0.092188	1.000000	0.639799	-0.877965	-0.775791	-0.670855	-0.392445
RF	-0.084472	-0.181729	0.461428	0.151470	0.639799	1.000000	-0.821145	-0.724295	-0.834478	-0.664650
VNINDEX	0.363124	0.414535	-0.057490	0.008190	-0.877965	-0.821145	1.000000	0.767832	0.865637	0.604758
EX_RATE	0.158882	0.355839	-0.085689	-0.083666	-0.775791	-0.724295	0.767832	1.000000	0.686922	0.531030
SP500	0.055543	0.255209	-0.451641	-0.215029	-0.670855	-0.834478	0.865637	0.686922	1.000000	0.841285
TRADEBA...	-0.055641	-0.220190	-0.519363	-0.381226	-0.392445	-0.664650	0.604758	0.531030	0.841285	1.000000

Third, we examined the correlation of macro factors in the case of the ACB during the 2015-2020 period. We see that GDP growth and CPI have a positive correlation with beta, whereas S&P 500 and trade balance have a negative correlation with market risk.

Figure 3. Correlation matrix of macro variables, case ACB

Correlation Matrix									
	BETA	CPI	EX_RATE	G	IM	R	RF	SP500	TRADEBA...	VNINDEX
BETA	1.000000	0.303298	0.012087	0.014934	0.401882	0.011619	0.041136	-0.041440	-0.165660	0.050501
CPI	0.303298	1.000000	0.355839	0.084484	0.413563	-0.414518	-0.181729	0.255209	-0.220190	0.414535
EX_RATE	0.012087	0.355839	1.000000	-0.085689	-0.083666	-0.775791	-0.724295	0.686922	0.531030	0.767832
G	0.014934	0.084484	-0.085689	1.000000	0.183953	-0.269621	0.461428	-0.451641	-0.519363	-0.057490
IM	0.401882	0.413563	-0.083666	0.183953	1.000000	0.092188	0.151470	-0.215029	-0.381226	0.008190
R	0.011619	-0.414518	-0.775791	-0.269621	0.092188	1.000000	0.639799	-0.670855	-0.392445	-0.877965
RF	0.041136	-0.181729	-0.724295	0.461428	0.151470	0.639799	1.000000	-0.834478	-0.664650	-0.821145
SP500	-0.041440	0.255209	0.686922	-0.451641	-0.215029	-0.670855	-0.834478	1.000000	0.841285	0.865637
TRADEBA...	-0.165660	-0.220190	0.531030	-0.519363	-0.381226	-0.392445	-0.664650	0.841285	1.000000	0.604758
VNINDEX	0.050501	0.414535	0.767832	-0.057490	0.008190	-0.877965	-0.821145	0.865637	0.604758	1.000000

Fourth, we examined the correlation of macro factors in the case of the STB during the 2015-2020 period. We recognize that GDP growth and SP500 have a positive correlation with beta, whereas the risk free rate and trade balance have a negative correlation with market risk.

Figure 4. Correlation matrix of macro variables, case STB

Correlation Matrix									
	BETA	CPI	EX_RATE	G	IM	R	RF	SP500	TRADEBA...	VNINDEX
BETA	1.000000	0.353970	0.076729	0.022481	0.407735	-0.074980	-0.059826	0.043162	-0.089834	0.182394
CPI	0.353970	1.000000	0.355839	0.084484	0.413563	-0.414518	-0.181729	0.255209	-0.220190	0.414535
EX_RATE	0.076729	0.355839	1.000000	-0.085689	-0.083666	-0.775791	-0.724295	0.686922	0.531030	0.767832
G	0.022481	0.084484	-0.085689	1.000000	0.183953	-0.269621	0.461428	-0.451641	-0.519363	-0.057490
IM	0.407735	0.413563	-0.083666	0.183953	1.000000	0.092188	0.151470	-0.215029	-0.381226	0.008190
R	-0.074980	-0.414518	-0.775791	-0.269621	0.092188	1.000000	0.639799	-0.670855	-0.392445	-0.877965
RF	-0.059826	-0.181729	-0.724295	0.461428	0.151470	0.639799	1.000000	-0.834478	-0.664650	-0.821145
SP500	0.043162	0.255209	0.686922	-0.451641	-0.215029	-0.670855	-0.834478	1.000000	0.841285	0.865637
TRADEBA...	-0.089834	-0.220190	0.531030	-0.519363	-0.381226	-0.392445	-0.664650	0.841285	1.000000	0.604758
VNINDEX	0.182394	0.414535	0.767832	-0.057490	0.008190	-0.877965	-0.821145	0.865637	0.604758	1.000000

Next, we run the regression:

For NVB external factors:

The figure below tells us that trade balance has a negative correlation with beta, while exchange rate and S&P 500 have a positive correlation with market risk.

Table 2. External macro effects on NVB beta CAPM

Variables	Coefficient	Std. Error
Ex rate	0.0001	0.0001
Trade balance	-0.0006	0.0002
SP500	8.62E	0.0001
C	-2.5	23.9
R-squared	0.02	
SER	1.15	
Akaike info criteria	3.38	

Source: author estimation and stock exchange

For NVB internal factors:

The figure below shows that Rf and industrial production have a positive correlation with beta, while CPI, lending rate, and GDP growth have a negative correlation with market risk.

Table 3. Internal macro effects on NVB beta CAPM

Variables	Coefficient	Std. Error
CPI	-1.02	43.2
G	-19.9	50.1
IM	0.009	0.01
R	-9.4	130.5
Rf	51.5	68.3
VNIndex	0.003	0.007
C	-3.9	17.3
R-squared	0.31	
SER	1.2	
Akaike info criteria	3.5	

Source: author estimation and stock exchange

For EIB – external factors:

The figure below shows that exchange rate and S&P 500 have a positive correlation with beta, while trade balance has a negative correlation with market risk of EIB.

Table 4. External macro effects on EIB beta CAPM

Variables	Coefficient	Std. Error
Ex_rate	0.00026	0.0006
Trade balance	-0.0005	0.001
SP500	0.0002	0.0008
C	-5.2	13.4
R-squared	0.05	
SER	0.6	
Akaike info criteria	2.2	

Source: author estimation and stock exchange)

For EIB – internal factors:

The figure below shows that GDP growth, lending rate and Rf have a positive correlation with beta, while CPI has a negative correlation with market risk of EIB.

Table 5. Internal macro effects on EIB beta CAPM

Variables	Coefficient	Std. Error
CPI	-13.9	19.2
G	14.1	22.3
IM	0.006	0.005
R	18.5	58.1
Rf	3.5	30.4
VNIndex	0.002	0.003
C	-4.4	7.7
R-squared	0.5	
SER	0.5	
Akaike info criteria	1.9	

Source: author estimation and stock exchange

For STB – external factors

The figure below shows that the exchange rate and SP 500 have a positive correlation with beta, while trade balance has a negative correlation with the market risk of STB.

Table 6. External macro effects on STB beta CAPM

Variables	Coefficient	Std. Error
Ex_rate	6.39E	0.0005
Trade balance	-0.0007	0.001
SP500	0.0003	0.0007
C	-1.3	12.4
R-squared	0.05	
SER	0.6	
Akaike info criteria	2.08	

Source: author estimation and stock exchange

For STB- internal factors

The figure below shows that all factors, namely, Rf, VNIndex, GDP growth, lending rate and Rf, have a positive correlation with the beta of STB.

Table 7. Internal macro effects on STB beta CAPM

Variables	Coefficient	Std. Error
CPI	9.7	24.1
G	2.7	27.9
IM	0.003	0.006
R	23.1	72.8
Rf	1.5	38.1
VNIndex	0.001	0.003
C	-3.4	9.6
R-squared	0.24	
SER	0.6	
Akaike info criteria	2.3	

Source: author estimation and stock exchange

For ACB – external factor

We see from the figure below that trade balance also has a negative correlation with beta, while the other two factors have a positive correlation with it.

Table 8. External macro effects on ACB beta CAPM

Variables	Coefficient	Std. Error
Ex_rate	6.92E	0.0008
Trade balance	-0.001	0.001
SP500	0.0004	0.0016
C	-1.8	18.5
R-squared	0.06	
SER	0.8	
Akaike info criteria	2.8	

Source: author estimation and stock exchange

For ACB – internal factors

We find from the figure below that GDP growth has a negative correlation with beta, while most of the other factors have a positive correlation with it.

Table 9. Internal macro effects on ACB beta CAPM

Variables	Coefficient	Std. Error
CPI	10.4	36.9
G	-6.1	42.8
IM	0.006	0.01
R	1.32	111.5
Rf	9.2	58.4
VNIndex	0.0006	0.005
C	-1	14.8
R-squared	0.19	
SER	1.04	
Akaike info criteria	3.2	

Source: author estimation and stock exchange

5. Discussion and conclusion

Comparing the above data, we see that GDP growth has a positive correlation with market risk in two cases and a negative correlation with market risk in two cases (NVB, ACB). CPI also has a positive correlation with market risk in two cases and a negative correlation in two cases (EIB, NVB). The risk-free rate has a positive correlation with beta CAPM in all four bank cases. Last but not least, the lending rate also has a positive correlation with beta CAPM in three cases and a negative correlation in one case (NVB). (see above tables)

Because market risk will increase if the lending rate increases, we would suggest that the State Bank of Vietnam and the bank system control lending rates, esp. not increasing too much.

Additionally, the Ministry of Finance and relevant government agencies also need to control inflation properly.

Management implications

The bank system might consider building a suitable risk management model to estimate the impacts of macro variables on market risk and other bank risks.

It is necessary to enhance the role of risk supervision and control according to the risk management process.

Practical scientific values of research

Market risk (beta CAPM) is a type of systematic risk that will be affected by many macroeconomic fluctuations both domestically, such as inflation, lending interest rates, and VNIndex, and abroad, such as import and export, trade trade balance, and exchange rate. Therefore, risk determination is meaningful as one of the important health indicators in terms of risk for both commercial banks and securities companies, comparing this index over time and compared with other industry groups in the economy such as banking and other sectors: real estate, construction, and trade will contribute to identifying increased risks to have appropriate risk management policies and plans.

Because the banking market is an important market of the financial market and the Vietnamese economy, the risk measurement for the two groups of commercial banks and listed securities companies is important for both management at the corporate level and macroeconomic management at the state level.

Research limitation

We can add more factors, such as FDI and public debt, to our regression model to measure macro effects.

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