Determining a Relationship Between Corruption & Inflation:

The Lebanese Banking Crisis

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Code Used in Analysis

https://github.com/knbeltz/cpi_inflation_research

The Lebanese Banking Crisis of 2019 is one of the worst economic crises in recorded history. With a recorded 38% drop in GDP and a currency devaluation of more than 98%, this crisis was unprecedented in the country's three-decade recovery from its civil war that ended in 1990 (Hausmann et al. 2023). The crisis could not have come at a worse time, as the country was ravaged by the once-in-a-century COVID pandemic as well as a massive explosion in Beirut's epicenter. Although Lebanon has made progress with its economic recovery, the recent Israel-Hezbollah conflict has caused significant financial damage of up to $5.1 billion, along with a 6.6% decline in real GDP growth, which currently presents a significant roadblock towards the Lebanese recovery (World Bank Group 2024).

The cause of the crisis is clear: a lack of long-term economic planning in favor of short-term economic gain. Since 1990, the post-war economic recovery has been facilitated primarily through borrowing external debt (Hausmann et al. 2023). During the recovery, the Lebanese Central Bank or Banque du Lebanon (BdL) offered generous interest rates in exchange for the Lebanese Pound (LBP) to attain foreign reserve currency. Although Lebanon was able to reduce its debt from 18.4% of GDP in 1992 to 10% of GDP in 1997, the interest payment on the debt increased from 5.5% to 14.6% of GDP respectively. BdL's solution to these high-interest payments was to peg the LBP to the dollar, at an exchange rate of approximately 1,507.50 LBP to 1 USD, as this will inspire confidence in the currency that will prompt investment, even with lower interest payments. However, this was not enough to deter a heightened fiscal deficit, as the lack of sustainable growth initiatives caused major economic sectors like exports, tourism, and remittances to peak in value between 2009 - 2011, yet government expenditures continued to increase.

The private sector borrowed immensely, with over $132 billion in liabilities to cover a $42 billion deficit between 2002 and 2018. This came primarily from the influx of foreign direct investment ($34.6 billion), borrowing by non-banks ($35.9 billion), and borrowing by banks ($65.7 billion). The government deficit was also financed through commercial banks ($13 billion), non-banking entities ($14.6 billion), and the BdL (which channeled resources from commercial banks) ($29.0 billion) from the period of 2002 – 2013. Post-2013, banks focused more on financing the BdL instead of the government, and the BdL financed the government deficit by issuing dollar liabilities to commercial banks. However, the amount of dollars that the BdL had in reserve was only $44.7 billion to cover $107.9 billion in liabilities in August of 2019. As a result, the scheme imploded, and the valuation of the Lebanese Pound decreased substantially to attempt to cover the liabilities from the scheme.

The cause of the crisis can be blamed directly on the lack of incentives for sustainable growth, in exchange for a Ponzi scheme to attempt to fund the national deficit. However, the crisis can be indirectly linked to a foundation of corruption and political instability. Corruption undermines economic growth because it undermines institutions that uphold the rule of law. Corrupt government officials who are swayed by scrupulous rewards do not have the incentive to prioritize sustainable economic growth, but instead, do what is necessary to enrich themselves either through embezzlement or bribery in exchange for advantages or favors (Guechati and Chami 2022). Since Lebanon has a history of corruption with embezzlement in particular, it is a plausible hypothesis that the root of the economic crisis can be traced back to Lebanon's problem with corruption and political instability.

Lebanon is not the only country in the region that is plagued by corruption. Across the Middle East & North Africa, corruption remains a systemic issue that is experienced from the

commoner paying a bribe or attaining a *wasta* favor, to the very top elite in government and industry (Transparency International 2019). Although some countries like the United Arab Emirates are among the least corrupt in the world, many countries in the Middle East, like Yemen, Somalia, Libya, and Syria, are among the most corrupt and least stable. Therefore, it can be argued that corruption can be a major contributor to economic crises and should be tested through a statistical experiment.

Corruption in Lebanon

Corruption in Lebanon is rampant. According to Transparency International's Corruption Perception Index (CPI), Lebanon scored 22/100, ranking 154/180, meaning that Lebanon is in the bottom 15% of countries for level of transparency in the year 2024 (Transparency International, n.d.). The International Foundation for Electoral Systems (IFES) assessed a series of Lebanese institutions on whether they are affected by corruption on a scale from 0-3 (Feghali and Dettner 2024). The reported scores are the following:

1. Political Corruption and Lack of Accountability (includes mismanagement of state affairs, misappropriation of funds, embezzlement, and 'excessive meddling' through misuse of power) - 2.88 / 3

2. Administration Corruption (includes Political Patronage, and bribery) 2.81/3

3. Justice and Security (includes appointment of judges by political patronage, and independence of judiciary) - 2.77/3

4. Media (includes media independence, news bias, and ability for the press to hold the government accountable) - 2.42/3

Given the nature of corruption, a trend emerges in which administrative corruption of political patronage gives way to political corruption, whereby government officials and judges are appointed through *wasta* (connections), political affiliation, or sectarianism. These appointed government officials reap the spoils that come with their positions, thus causing the political corruption of mismanagement, as well as the misappropriation of funds. It was this mismanagement that led to the banking crisis in the first place.

Lebanon can trace its systemic corruption through the inception of a modern government framework, which came about after the 1989 Taif agreement that ended its nearly 15-year civil war (Resimić 2025). The agreement stipulated that the President must be a Maronite Christian, the Prime Minister a Sunni Muslim, and the Speaker of Parliament a Shia Muslim. Although many argue that consociationalism is conducive for fostering stability by providing a legitimate channel to address group grievances, the current Lebanese system set up in the Taif agreement has been criticized for entrenching sectarianism through patronage networks and clientelism. This is especially true when circumventing gridlocks, in which informal agreements are made, oftentimes dividing up state institutions among political parties that represent respective demographics. This system has been responsible for a "political economy of sectarianism" in which economic surplus and government contracts are distributed along sectarian lines through a small, connected sectarian elite.

The issue of sectarianism is further compounded by the issue of Hezbollah, which is prominent amongst the Shia community of Lebanon. As both a paramilitary organization and a prominent political party of the Lebanese Parliament, Hezbollah has grown to be a powerful organization, so much so that it cannot be restrained by the Lebanese government. As a result, the organization is free to do as it pleases with immunity, and it engages in a variety of

corruption schemes, including embezzlement, illicit money laundering, and clientelism. The sectarian division created in part by Hezbollah has further turned away Economic aid to Lebanon from the Gulf States like Saudi Arabia (who were once considered reliable economic backers) due to the influence of Hezbollah, which is heavily backed by their major geopolitical rival Iran (Blair 2022).

OLS Regression and Results

Conducting a statistical experiment on the relationship between corruption and economic crisis requires a dependent variable to measure the level of economic instability, as well as a discrete quantitative variable to measure the level of corruption. The main detrimental outcome of the Lebanese Banking crisis is the hyperinflation that took place. The resulting collapse of the value of the Lebanese Pound caused an imminent collapse of the Lebanese economy as a whole. Since hyperinflation is the main symptom (and detriment) of the economic decline in Lebanon, inflation will be the dependent variable in this OLS regression. Accounting for corruption, Transparency International's Corruption Perceptions Index (CPI) is a leading indicator of levels of corruption, which scores a nation's level of corruption from 0 (most corrupt) to 100 (least corrupt) (Transparency International, n.d.). The indicator is scored by accounting for the following acts of corruption (Transparency International 2025):

- Bribery
- Diversion of public funds
- Officials using their public office for private gain without facing consequences
- Ability of governments to contain corruption in the public sector
- Excessive red tape in the public sector which may increase opportunities for corruption
- Nepotistic appointments in the civil service
- Laws ensuring that public officials must disclose their finances and potential conflicts of interest
- Legal protection for people who report cases of bribery and corruption

- State capture by narrow vested interests
- Access to information on public affairs/government activities

The following are the results from an exploratory analysis from 2018, 2019, 2020, and 2021 (right before and after the banking crisis) on the initial correlation between the corruption perception index (CPI) and inflation rate % taken from the International Monetary Fund (IMF) (International Monetary Fund, n.d.). Each blue dot represents a country that had both a CPI indicator and an inflation rate available for its respective year.
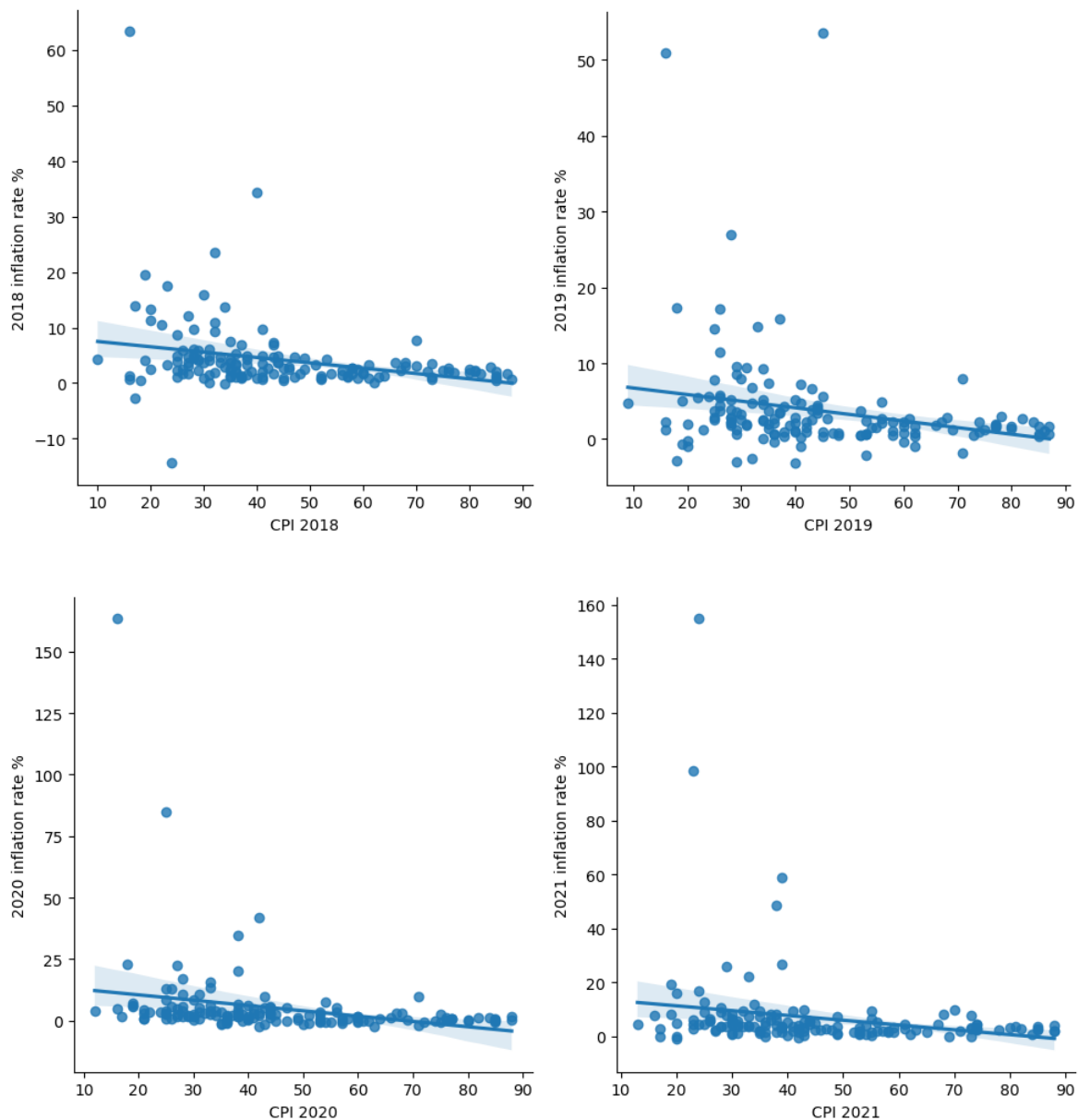
Year	Correlation Coefficient
2018	-0.2694107161769081
2019	-0.23763571925887605
2020	-0.25611311115718116
2021	-0.20574975086008812

Based on these results, it is clear that there is an initial negative correlation between levels of corruption and inflation, with countries that experience corruption more likely to experience more inflation. From the outset, this makes sense when considering hyperinflationary economic crises like the one in Lebanon. However, it is also true that there are more factors that contribute to inflation than corruption. Accounting for different variables that could affect the influence of inflation, a multiple Ordinary Least Squares (OLS) regression is used with the following variables.

$$INF_i = \beta_0 + \beta_1 CPI + \beta_2 M2 + \beta_3 \Delta GDP_i + \beta_4 DGDP_i + \beta_5 UNEMP_i + \epsilon_i$$

Where:

INF: Inflation rate %
CPI: Corruption Percentage Index score
$M2$: Broad money % of GDP
ΔGDP: GDP growth %
$DGDP$: Debt-to-GDP ratio
$UNEMP$: Unemployment rate %
ϵ: Error Term (assumed exogeneity)

In this regression, the corruption perceptions index (CPI) is used as the independent variable, while controlling for broad money (World Bank Group, n.d.), GDP growth (World

Bank Group, n.d.), debt-to-GDP ratio (International Monetary Fund, n.d.), and unemployment

rate (World Bank Group, n.d.). These controls were introduced due to their effect on the inflation

rate, separate from corruption. An error term is introduced, which is assumed to be exogenous,

represented by ϵ is also taken into consideration. The regression is run year by year, whereby

each regression corresponds to data from a single year between 2012 and 2023. Additionally, it

is assumed that the variances of the error term are consistent and thus homoskedastic. The

following are the results from the years 2012-2023, in which an F-test is also performed with

$\alpha = 0.05$.

Coefficients of independent variables						
Year	β_0	$\beta_1 CPI$	$\beta_2 M2$	$\beta_3 \Delta GDP$	$\beta_4 DGDP$	$\beta_5 UNEMP$
2012	13.3102	-0.1005	-0.0511	-0.4285	0.0514	-0.1038
2013	6.1095	-0.0655	-0.0400	0.0724	0.0627	0.0598
2014	7.1127	-0.0630	-0.0409	-0.1258	0.0563	0.0080
2015	8.3028	-0.0492	-0.0402	-0.6252	0.0365	-0.0228
2016	7.5187	-0.0552	-0.0390	-0.3082	0.0244	0.0840
2017	6.5599	-0.0633	-0.0553	-0.1225	0.0686	0.0921
2018	6.1542	-0.0437	-0.0892	-0.5642	0.1317	0.0579
2019	4.4759	-0.0118	-0.0972	-0.3473	0.1163	0.1028
2020	1.8310	-0.1121	-0.1536	0.4750	0.2999	0.2272
2021	8.7244	-0.0386	-0.1078	-0.0473	0.0931	0.1387
2022	13.5779	-0.0598	-0.2108	-0.4612	0.2628	0.2704

Coefficients of independent variables						
2023	12.4208	-0.0471	-0.1979	-1.2086	0.2669	0.310

Year	R^2	$Adj\ R^2$	Prob F-STAT
2012	0.194	0.150	0.00117
2013	0.230	0.189	0.000141
2014	0.174	0.130	0.00285
2015	0.275	0.236	1.22e-05
2016	0.189	0.147	0.00106
2017	0.241	0.203	4.65e-05
2018	0.430	0.400	1.96e-10
2019	0.348	0.313	1.27e-07
2020	0.488	0.459	6.99e-12
2021	0.127	0.077	0.0339
2022	0.155	0.100	0.0204
2023	0.303	0.250	0.000187

In order to determine if variables are significant, a hypothesis test is performed on each variable of each OLS regression.

$$H_0: \beta_i = 0$$
$$H_1: \beta_i \neq 0$$
$$\alpha = 0.05$$

A two-tailed t a test will be performed on each variable of the regression. The resulting test statistics will be the estimated coefficient divided by the standard error of the corresponding coefficient ($t = \frac{\hat{\beta}_i - 0}{SE(\hat{\beta}_i)}$) with $\alpha = 0.05$. The following are the results of the individual coefficient P-values, with each variable that rejected the null hypothesis highlighted in yellow.

Year	β_0	$\beta_1 CPI$	$\beta_2 M2$	$\beta_3 \Delta GDP$	$\beta_4 DGDP$	$\beta_5 UNEMP$
2012	0.000	0.024	0.032	0.023	0.065	0.399
2013	0.000	0.014	0.007	0.395	0.000	0.429
2014	0.000	0.039	0.014	0.554	0.004	0.924
2015	0.000	0.122	0.018	0.000	0.076	0.796
2016	0.000	0.066	0.010	0.050	0.175	0.310
2017	0.000	0.052	0.001	0.481	0.000	0.301
2018	0.005	0.277	0.000	0.014	0.000	0.583
2019	0.062	0.794	0.000	0.093	0.000	0.380
2020	0.654	0.205	0.000	0.039	0.000	0.315
2021	0.024	0.627	0.005	0.845	0.045	0.468
2022	0.069	0.688	0.005	0.400	0.003	0.501
2023	0.039	0.679	0.000	0.018	0.000	0.891

In all of the F-tests for variance, every single regression is determined to be statistically significant. This means that each regression explains at least part of the overall significance of

the independent variables, which cause inflation. Although the overall variance was statistically significant (outlined by all of the F-stat probabilities $> \alpha$), only a few individual variables were consistently statistically significant in affecting inflation, given that they rejected the null hypothesis. In order by the amount of rejected null hypotheses, these variables were $M2$ (12/12), $DGDP$ (9/12), ΔGDP, (6/12), and CPI (3/12). At the same time, there is not enough evidence to suggest a significant relationship between $UNEMP$ and inflation as no test was able to yield a result that rejects the null hypothesis. Looking at the results, it is obvious that there is a small negative correlation between the broad-based money supply ($M2$) and inflation. At the same time, there is an extremely probable positive relationship between debt-gdp-ratio and inflation, as well as a somewhat probable negative correlation between GDP growth and inflation (with exceptions in 2013 and 2020).

The most intriguing outcome of this experiment has to do with the slight negative correlation of broad money as a percent of GDP and inflation. Although this seems counterintuitive, it makes sense when considering that developed countries are likely to have a higher proportion of broad money, not only due to the sophistication of their financial system, but also due to having higher access to banking services for their respective populations. On top of this, it is plausible to assert that developed countries have more stability with their financial system and can be classified as "low-inflation regimes" where wages and prices are only loosely linked and thus inflation is more easily controlled (Boro, Hoffman, and Zakrajšek 2023). In addition, for many of the results (in particular between 2018 - 2023), there is a highly probable positive correlation between the debt-GDP ratio and inflation. This is also true due to the nature of debt as it affects inflation, in which excess government spending not only increases the demand for goods and services (which increases prices), but also fiscal shock, whereby

governments pressure the central bank to lower interest rates even during inflationary periods to keep the interest on the debt manageable (The Budget Lab 2025). This is especially true in countries that have limited restraints on the central bank from executive or legislative authority.

Problem with this methodology

Throughout the experiment, a direct relationship between corruption and inflation could not be proven, as out of the 12 years tested between 2012 and 2023, only three yielded results that could reject the null hypothesis. In those results (2012, 2013, and 2014), the coefficients were -0.1005, -0.0655, and -0.0630, respectively. This is an indication of a small negative correlation between corruption and inflation. Although these results are plausible for the impact of corruption on inflation, two issues may arise that could alter the results. One is that there is empirical evidence that one of the impacts of corruption is through a mismanaged government deficit (Benfratello, Del Monte, and Pennacchio 2015) (Note the study referenced is preliminary and incomplete as of 2015). Therefore, controlling debt-GDP along with corruption could take away from one of the impacts of corruption on inflation.

Another issue is the issue of multicollinearity through the variance identifying factor (VIF) of $\frac{1}{1-R_i^2}$ (where R_i^2 is the R^2 value obtained through regressing the i'th independent variable on other controls). A VIF value less than 5 is understood to not be significantly impactful, while a VIF greater than 10 is understood to be highly collinear, in which the variance has a major impact on the results of the experiment. The following are the VIF results for multiple regression:

Variance Identifying Factor (VIF) of independent variables					
Year	$\beta_1 CPI$	$\beta_2 M2$	$\beta_3 \Delta GDP$	$\beta_4 DGDP$	$\beta_5 UNEMP$
2012	5.696917	5.470367	1.593845	4.224248	2.269830
2013	5.035489	5.488204	1.376022	4.196251	2.298121
2014	5.827427	5.565049	2.176046	4.337625	2.204428
2015	5.161822	5.296278	1.501673	4.505355	2.214015
2016	5.481752	5.167037	1.832881	4.464096	2.269646
2017	5.329293	5.167244	2.013706	4.643101	2.272201
2018	6.730834	5.925437	2.117428	3.788357	2.227850
2019	6.737681	5.997297	1.649524	3.822283	2.219803
2020	5.974208	5.811321	1.621454	3.671134	2.463146
2021	6.570734	6.384383	2.528189	6.395963	2.341074
2022	5.529766	5.755903	2.138731	5.426676	2.063637
2023	5.312410	5.157099	1.575020	4.606650	2.071090

Based on these results, it is clear that there is at least some issue with multicollinearity among the results of the data. Although multicollinearity is not as prominent due to all the VIF values being less than 7, in every regression, both the CPI and $M2$ variables are all greater than 5. Therefore, there is some concern of overstatement primarily between the CPI and $M2$ variables.

To solve both of these problems, a new OLS regression is introduced, which removes the $DGDP$ variable from the regression. Doing so would allow us to determine the possibility of corruption affecting inflation through poor fiscal management, as well as reduce multicollinearity between variables by just enough to ensure that multicollinearity will be

omitted. The following are the results from this new regression holding constant the previous

hypothesis test used on the first OLS regression:

$$INF_i = \beta_0 + \beta_1 CPI + \beta_2 M2 + \beta_3 \Delta GDP_i + \beta_4 UNEMP_i + \epsilon_i$$

Coefficients of independent variables					
Year	β_0	$\beta_1 CPI$	$\beta_2 M2$	$\beta_3 \Delta GDP$	$\beta_5 UNEMP$
2012	11.6002	-0.1011	-0.0185	-0.1094	0.0129
2013	6.9661	-0.0649	-0.0102	0.0606	0.0773
2014	7.4952	-0.0580	-0.0155	-0.0457	0.0210
2015	9.2672	-0.0558	-0.0231	-0.6573	0.0041
2016	8.5044	-0.0857	-0.0173	-0.3531	0.1537
2017	7.0507	-0.0889	-0.0178	0.2669	0.1815
2018	11.2906	-0.0873	-0.0263	-0.7351	0.1466
2019	8.8476	-0.0117	-0.0613	-0.4846	0.1170
2020	13.1287	-0.1402	-0.0577	-0.0184	0.2693
2021	11.2603	-0.0340	-0.0704	0.0005	0.1325
2022	20.7847	-0.0845	-0.0961	-0.0722	0.2342
2023	22.0240	-0.0663	-0.0893	-0.9803	-0.0521

P-Values of independent variables					
Year	β_0	$\beta_1 CPI$	$\beta_2 M2$	$\beta_3 \Delta GDP$	$\beta_5 UNEMP$
2012	0.000	0.029	0.359	0.159	0.914
2013	0.000	0.019	0.421	0.467	0.327
2014	0.000	0.062	0.285	0.758	0.809
2015	0.000	0.076	0.108	0.000	0.962
2016	0.000	0.007	0.208	0.036	0.078
2017	0.000	0.012	0.236	0.051	0.057
2018	0.000	0.065	0.260	0.006	0.238
2019	0.000	0.816	0.015	0.026	0.379
2020	0.012	0.212	0.233	0.948	0.370
2021	0.003	0.667	0.032	0.998	0.488
2022	0.006	0.589	0.150	0.897	0.579
2023	0.001	0.606	0.102	0.084	0.882

Conclusion

The result of this experiment concludes that there is little direct cause of corruption in and of itself on inflation. Although there is a negative correlation between a country's corruption percentage index (CPI) and inflation, controlling for other variables yields little direct impact on its own. Even for not accounting for the debt-GDP ratio which was demonstrated to be a prominent relationship, corruption was only able to be demonstrated within four years (2012, 2013, 2016, and 2017) of the new OLS regression (omitting debt-GDP), compared to three years

(2012, 2013, and 2014) of the first OLS regression including debt-GDP as an independent variable. Therefore, it cannot be proven that there is a direct causal mechanism of fiscal mismanagement through corruption as a driving factor of inflation. The results in this experiment do not necessarily omit corruption as a factor of economic mismanagement or even instability, but rather, it does not conclude a direct relationship between corruption and inflation, holding constant the other controlling variables in both OLS regressions. Instead, it was tangible macroeconomic conditions that had the most direct relationship with inflation, whereby the broad-based money supply, GDP growth, and debt-GDP ratio had consistent, provable relationships.

In the case of Lebanon, the findings conclude that there are more shrouded circumstances as to what prompted the reckless mismanagement that caused its collapse, other than corruption. Although corruption is itself a key component to explain the mismanagement, it was not the only cause in the first place. The OLS regression only determined tangible macroeconomic metrics to be associated with higher inflation; however, to determine the underlying cause of a crisis with a similar magnitude as the Lebanese banking crisis, one must use a different methodology. Regardless, there are some hypotheses as to the conditions that led to the mismanagement of the Lebanese economy. Specifically, the unique circumstances of sectarianism coupled with corruption and a service-based economy had more consequences with an industry like banking, which is reliant on locations that thrive off of stability, something Lebanon lacks. Therefore, the resulting consequences of instability due to corruption are more detrimental to an economy like Lebanon's compared to other countries, which are reliant on more tangible sources of revenue like natural resources.

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