

The Economist Diwan

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About the Journal	2
Message from the Dean	3
Message from the Head of Department of Economics	4
Message from the Editors	5
Oil prices and the macroeconomy: An analysis of African countries	6
<i>Michela Francisco</i>	
Demand Analysis for Private Villas in Dubai	24
<i>Faycal Al Alami, El-Cheikh Fadi Kais, Saud Al Zarooni</i>	
Youth Unemployment and Violent Crime: The Case of Latin America	38
<i>Samin Shahid</i>	
Happiness in the Making: The Determinants of Welfare	62
<i>Haya AlShamsi</i>	

About the Journal

The Economist Diwan is be a student-run academic journal that provides an opportunity to publish the best research done in economics and related fields at the American University of Sharjah (AUS). Starting its first publication in Spring 2017, this journal operates under the AUS Department of Economics in the School of Business Administration (SBA). Our aim is to publish research carried out by students in the American University of Sharjah (AUS) and potentially extending our reach to publishing undergraduate research from other universities in the region as well. Through this journal, the AUS Department of Economics intends to promote the diverse application of economics related concepts amongst its current and prospective students. For any other inquiries or if you wish to contribute, feel free to contact us via sea@aus.edu

Message from the Dean

It is with great pleasure and pride that I write this message to welcome you readers to this “Diwan” that features student-based knowledge creation in the Department of Economics of the School of Business Administration.

This research journal that is written and managed by our economics students, addresses in an analytical, robust way, a variety of economic issues that confront us. This journal however, is not addressed exclusively to fellow economics students who may find the will, motivation and incentive to follow suit and engage in research after they read this Diwan. Indeed, this journal is more inclusive, and should be of interest to our faculty and to other readers across campus and beyond. This Journal is witness of the high caliber of our students, and shows how excellent research can be achieved at an undergraduate level, if the education program provides the students with the required tools, self-confidence and knowledge to push the boundaries of knowledge. I hope that you will enjoy reading the articles in this journal as much as I did.

I would like to take this opportunity to thank our students for taking the initiative of sharing and disseminating knowledge, and to congratulate them on the quality of work they are showcasing here.

Excellent work!

N. Boubakri

Message from the Head of the Department of Economics

Economics has a profound impact on all our lives. Developments in the labor market affects our expectation of the current and future employment opportunities. Our spending behavior, our educational decisions, our wellbeing and our retirement plans are influenced by public policies. Globalization brings prosperity to many individuals and firms, while some others find it hard to stand up to the intense foreign competition. Monetary policy and changes in financial markets can influence our economic fortunes. All these decisions at the individual, firm and government levels entail opportunity cost. Thus, it takes serious economic analysis to understand the complexities of the forces that continue to shape our lives.

It is becoming increasingly clear that there is no full educational experience unless students can use what they learn in the classroom. At the Department of Economics, we teach our students to be curious about the fundamental issues and find out their creative solutions.

The journal Economist Diwan provides our students with first-hand experience in managing and publishing their best research work which they undertake in their upper-level courses. I am delighted to see four rigorous articles in this issue of the journal. I invite you to read the intellectual work of our bright students.

We the faculty congratulate them for publishing such insightful papers. With this journal, we hope to transform knowledge learnt in the classrooms into permanent public records for the benefits for all in the future.

Congratulations young scholars and thank you all for making us proud!

Javed Younas

Professor and Interim Head of the Economics Department

Message from the Editors

The Economist Diwan is a journal comprised of original works from graduate and undergraduate students in the field of Economics. Through the process of reviewing articles and presenting it in the journal, we aim to encourage economic research and the application of economic theory to real world situations. The articles of this issue discuss themes such as oil prices, crime and inequality, housing demand and even determinants of happiness, a sign of the variety of our student research and the important issues it tackles. Our goal is to show how econometric tools can be applied in real life policymaking to describe, analyze, or even provide solutions to socio-economic problems. We hope to provide the journal as a platform for aspiring young economists to apply the knowledge they acquired and take these tools beyond the classroom environment.



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Oil prices and the macroeconomy: An analysis of African countries

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Abstract

The relationship between oil price shocks and the macroeconomy is one that has been extensively explored since the end of World War II. The main contribution of this paper is our focus on African oil net-exporting countries (Algeria, Egypt, and Nigeria), which has received very little attention. In particular, we want to see whether oil price shocks Granger-cause the major macroeconomic variables of these countries for 1969-2017 by controlling for the 2008 global financial crisis. Following the literature, the macroeconomic variables include consumer price inflation (CPI), real GDP growth rate (RGDP), GDP deflator inflation (PGDP), growth in industry value added (VA), and growth in real gross fixed capital formation (INV). Our results indicate that oil price shocks do Granger-cause the macroeconomic performance of these countries. The Granger-causality test results are generally stronger when controlling for the global financial crisis. In the case of Algeria, policymakers should implement policies to ease the adverse effects of oil prices on RGDP, VA, and INV. For Egypt, policymakers should implement policies to ease the adverse effects of oil price shocks on PGDP and VA. Lastly, in the case of Nigeria, policymakers should implement policies to ease the adverse effects of oil price shocks on all five macroeconomic variables (CPI, RGDP, PGDP, VA, and INV).

Keywords: African countries; Macroeconomy; Oil price shocks; Granger causality; Global financial crisis

1. Introduction

Crude oil is one of the most valuable commodities in the global economy (Hubbard, 1998). Thus, the relationship between crude oil prices and nations macroeconomic indicators is one that has been addressed by economists since the 1970s. However, most empirical studies have been centered around advanced economies which until the 2011 shale revolution were mostly net-importers of crude oil such as the United States and Great Britain. Although there is a significant amount of literature on this topic there is a limited amount of literature focused on uncovering the effects of oil prices on emerging and developing economies.

The objective of this paper is to analyze the impact of changes in oil prices on the macroeconomies of three of the largest oil exporting countries in Africa: Algeria, Egypt, and Nigeria. To the best of our knowledge, these countries have not been analyzed in the literature, and out of the three, only Egypt is a non-OPEC member. Since these nations are net-exporters and their economies are significantly dependent on oil revenues, we hope to uncover the effect of fluctuations in global oil prices on their major economic indicators. Another contribution we intend to make is accounting for the 2008 Global Financial Crisis (GFC); in order to better identify which macroeconomic indicators are most vulnerable to oil price shocks.

The format of this paper is as follows: Section 2 reviews the literature. Section 3 discusses the oil sectors in Algeria, Egypt, and Nigeria. Section 4 presents the empirical results. Finally, section 5 concludes.

2. Literature review

The analysis of the effect of oil prices on economic growth was initially identified as being negative. Rasche and Tatom (1981) published the earliest study that analyzed the impact of oil

price shocks on aggregates supply and monetary policy. They show that there is a negative relationship between oil prices and real economic activity using data from six developed countries. More specifically, their findings show that an increase in oil prices results in a decline in output and a rise in both unemployment and inflation. That is, firms would reduce the pace of investment in business plants and equipment, thereby adjusting to a lower desired capital-labor ratio. Thus, output growth would adversely be affected beyond the period of the initial shock.

In a seminal paper, Hamilton (1983) analyzes the impact of oil price shocks on the US economy post World War II. He finds that there is a cyclical tendency for oil price spikes to be followed by economic recessions, and as a result he tried to explain why this pattern was occurring. To do so he proposed three hypotheses. The first is that the relationship between oil prices and economic growth is just historically coincidental. The second hypothesis is that there is another endogenous explanatory variable that is influenced by both oil prices and recessions that is causing this pattern, and lastly that prior to 1973 some of the recession was influenced by an exogenous increase in the price of crude oil. Using a vector autoregressive model (VAR) with six-variable GNP equations, including real GNP, unemployment, import prices, inflation, hourly compensation per worker, and M1 (variable that captures the financial sector). Hamilton (1983), finds that there is no empirical evidence to support the first and second hypotheses (p. 240)

Darby (1982) analyzed how the increase in real oil prices affected the US economy between 1973-74. In his view, the cause of the inflation and recession was that the large increase in oil prices caused a left-ward shift in the aggregate supply curve; thus, leading to lower output and higher prices. Likewise, Bruno and Sachs (1982) analyze the effect of input price shocks on the slowing down of the UK economy in the 1970's. The authors cite input price shocks as one of the reasons for the recession. That is higher raw material prices (like oil) would have been a significant

contributor to the problem. Using a production function, Bruno and Sachs further find that when oil prices increase there is a drop-in profitability and return on capital by about 9.5 and 5 percent respectively between 1960 and 1976. When estimating the output supply function, it was found that input prices are responsible for more than half of the slowdown in output.

Following Hamilton (1983), other researchers have tried to generalize the linear impact model to non-linear cases. One of the earliest and most cited publications is Mork (1989). His criticism of Hamilton's study is that it covers a period when oil prices were increasing, so it was not clear whether his conclusions would hold when prices were in decline. Mork adds real oil prices to Hamilton's model in order to test the stability of coefficients estimates prior and post falls in oil price. His results showed that the behavior of GNP was actually correlated with the oil market. When accounting for asymmetric effects of oil price increases, he found that there is a significantly large negative effect of oil price increases on the economy. However, when accounting for asymmetric effects of oil price declines there is no significant effect of price declines on the economy. Thus, the effect of an increase or decrease in oil price affects the economy differently (Mork 1989, p. 180)

Focusing on the OECD economies Barsky and Kilian (2002) show that there is a bidirectional causation from macroeconomic aggregates to oil prices, meaning that cause and effect are no longer well defined when relating changes in the real price of oil to macroeconomic outcomes. Barsky and Kilian arrive at these results by focusing on the stagflation of the 1970's using an input-output VAR model. Similarly, Lee et al. (1995) investigated the causal relationship between oil price shocks and real output in the US and found that the stability of the real price of oil prior to an innovation positively impacts US real output. In addition, their evidence indicates

the existence of a sectoral shift (mainly through reallocation of resources) when oil prices are both high and volatile.

To contest this view, other scholars doubt the existence of a relationship between oil price shocks and the macroeconomy. Hooker (1996) found that oil prices failed to Granger cause most macroeconomic variables between 1973 and 1995. Using the VAR model, they tried to identify three mismeasurement explanations as to why previous literature came to the conclusion that oil prices determine macroeconomic activity. Firstly, failing to account for structural breaks overestimates the importance of oil prices. Secondly, prior to 1973 oil prices were exogenous, but this no longer holds. Thus, the Granger causality assigns a smaller role to oil once oil prices are exogenous. Lastly, there are asymmetries between the effects of upward and downward shocks in oil prices, and prior to the OPEC creation most oil price shocks were downward. Hooker's estimations show that the structural breaks around 1973 were not due to oil price interactions, and thus accounting for these breaks does not affect the Granger causality results. He also found that oil prices are not more endogenous than they used to be in the US economy.

Furthermore, other scholars have attributed the relationship between oil prices and macroeconomic variables to monetary policies implemented by the central banks. Barsky and Kilian (2001, 2004) analyze the effect of rising oil prices on the worsening of the 1970's stagflation in the US. They concluded that the impact of rising oil prices on the performance of macroeconomic indicators is due to monetary policies. Thus, they rejected a one-way causal link from oil prices to the macroeconomic variables and stressed that oil prices can also be affected by macroeconomic performance. This is due to oil prices containing an endogenous component such as real interest rates and real GDP in the US. Thus, oil prices are unlikely to cause stagflation if the Federal Reserve refrains from excessive expansionary monetary policies. Similarly, Bernanke

et al. (1997) analyzed the role of monetary policy in postwar US business cycles. Their results suggest that the effect of oil price shocks on the economy are not due to changes in oil prices, but mostly attributed to tightening of monetary policies. From these findings, they debunk the large effect of oil price shocks on the US macroeconomy found by Hamilton (1983).

Other studies have looked at the effect of oil prices on the allocation of resources and shifts in industrial sectors in the economy. Keane and Prasad (1996) first looked into this effect and proposed the dispersion hypothesis in which they tried to explain the asymmetric relationship between oil prices and the macroeconomy. According to this hypothesis, changes in oil prices alter the equilibrium allocation across various sectors. The author found that increases in oil prices result in contractions in sectors that make use of oil in their production process. In the short run (due to high cost of reallocation between energy efficient and intensive sectors) there would be a loss in output (p. 390).

There are also studies on the effect of movements of natural resource prices during periods of economic boom or bust that span a decade or two. Most of these studies have tried to analyze the effect of different states of the economy on employment or wages, both in the energy and non-energy sectors. Marchand's (2012) study analyzed the effects of oil, coal, and gas extraction in Western Canada on employment and earnings in the energy sector. He found that energy sector employment and earnings rose in boom periods but declined during bust periods. He also found that there are positive employment and earnings effects, which spill over into non-energy industries such as construction, retail trade, and service sectors during the boom, though some of the spillover gains are lost during the bust. Similarly, Black et al. (2005) found that wages and employment in the energy sector did indeed grow faster in coal-producing counties than non-coal

producing countries during the boom; however, few positive spillovers into the non-traded sector or negative spillovers into the traded sectors were found.

Narayan et al. (2013) examined whether oil prices predict economic growth, their study included data from 45 countries developing and developed nations. They used an in-sample and out-of-sample predictability analysis using bias-adjusted OLS and GLS models. They found evidence that nominal oil price predicted economic growth for 37 out of the 45 countries (16 developing and 21 developed). Overall for all 45 countries there was greater evidence for in-sample predictability. When the authors conducted robustness tests for economic growth predictability by using real oil prices, they found that in-sample predictability was aligned with the findings using nominal oil prices. They recommended that due to the non-linearity of oil prices and output, future research should adopt non-linear models when examining the predictive power of oil prices for economic growth.

3. Overview of the oil sector in selected countries

According to the World Energy council, prior to 2002, Algeria, Egypt, and Nigeria accounted for about 50 per cent of crude oil reserves in Africa (WEC Africa, 2019). However, data from The Organization of Oil exporting Countries (OPEC) found that, post-2002 their share of proved oil reserves dropped to about 45 per cent due to discoveries of oil reserves in Equatorial Guinea and Sudan. In terms of production and exports, these countries contribute about 6 per cent of global production with their main export destinations being North America, Western Europe, and Asia (OPEC, 2017).

According to The Ministry of Energy and Mines, the Algerian economy is significantly dependent on crude oil exports since these exports account for about 95 percent of their foreign

exchange earnings. As of 2018 crude oil exports contributed to about 85 per cent of their GDP. Their main export destinations are North America and Eastern Europe. Oil production is primarily conducted by Sonatrach which is a state-owned oil company that is in control of 90% of oil production in Algeria. In terms of the five macroeconomic variables based on figure 1, we can see that real GDP has been relatively stable and when oil prices increased significantly between 1976-1982 and 1986-2006. There was also an increase in real GDP. In terms of inflation we see that when oil prices increase, Algeria registers a period of low inflation. Furthermore, both investment and value-added increase with spikes in oil prices.

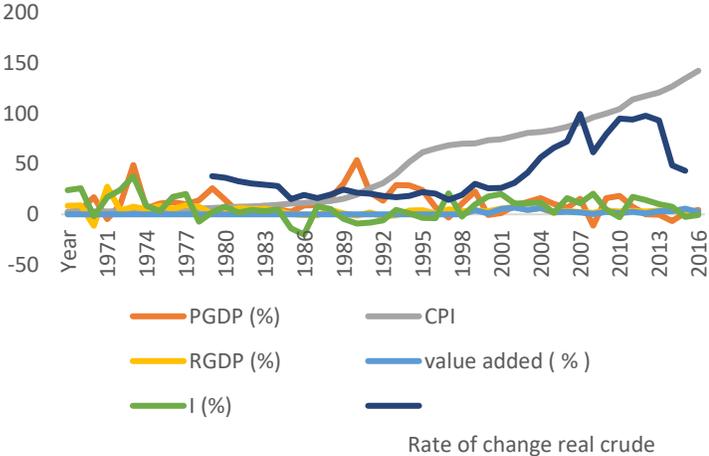


Figure 1. Algeria

For Egypt, crude oil production has been declining since its peak in 1993, and conjointly the country has witnessed an increase in domestic crude oil consumption; thus, since 2005, they have become a net importer of oil. According to OPEC data, in 2017 hydrocarbon production accounted for about 26 per cent of Egypt’s real GDP and about 30 per cent of the country’s foreign direct investment. The oil industry is managed by the Ministry of Petroleum and they run five government agencies that control oil production: The Egyptian General Petroleum Corporation (EGPC), Ganoub El-Wadi Holding Company, Egyptian Natural Gas Holding Company, Egyptian

Geological Survey and Mining Authority, and Egyptian Petrochemicals Holding Company. As shown in Figure 2, in terms of macroeconomic variables, real GDP has been growing at a relatively constant rate; however, the fall in oil prices has been coupled with an extreme increase in inflation.

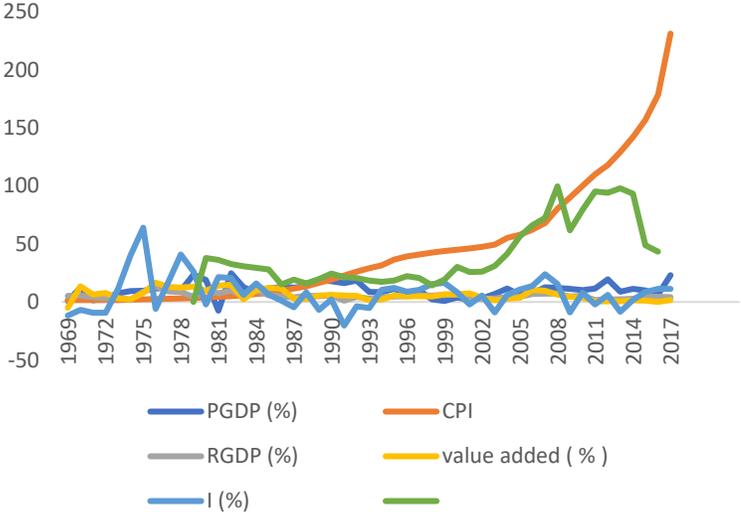


Figure 2. Egypt

According to OPEC, Nigeria is ranked as the largest crude oil producer in Africa with production levels of about 1.94 million barrels per day. Its economy is also highly dependent on oil revenues with 95 per cent of its FDI and 65 per cent of its GDP arising from oil revenues (2017). The oil sector is controlled by the federal government which entered into joint ventures between multinational oil companies (such as Nexxen, Inc. and Exxon Mobil) and the government-owned Nigerian National Petroleum Corporation (NNPC). Due to military instability, oil production has gradually been declining since 2005. The Nigerian macroeconomy is one that is significantly volatile in comparison with Algeria and Egypt. From figure 3, it is evident that there is little relation between oil prices and GDP growth, since this variable has varied significantly throughout the years. However, inflation after the 1980’s has increased whenever oil prices are on the rise.

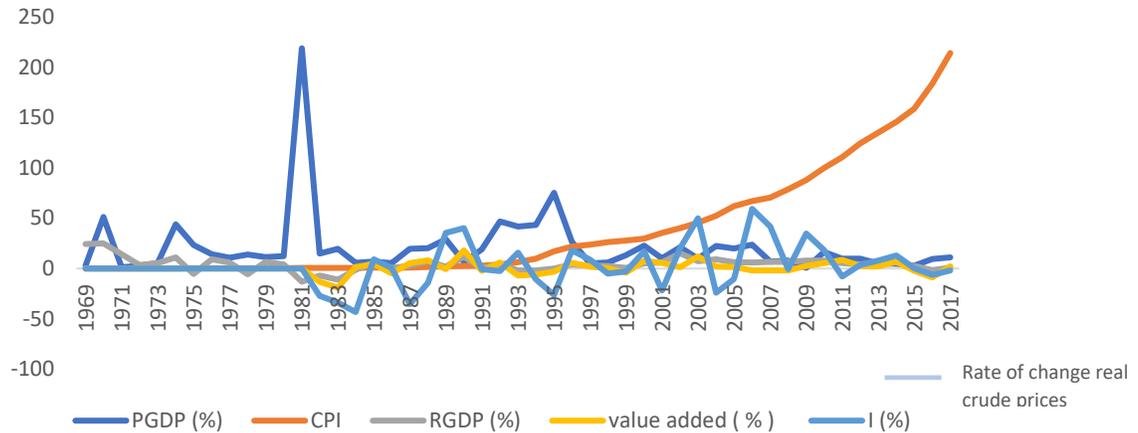


Figure 3. Nigeria

4. Empirical results

In this paper we focus on examining the effect of oil price shocks on five macroeconomic variables of Algeria, Egypt, and Nigeria. The choice of variables was based on the literature (Hamilton 1989; Mork 1989; Lee et al. 1995). We apply the Granger-causality test for consumer price inflation (CPI), real GDP growth rate (RGDP), GDP deflator inflation (PGDP), growth in industry value added (VA), and growth in real gross fixed capital formation (INV). The annual data on these variables for Algeria, Egypt, and Nigeria come from the World Bank database. The data on the rate of change in Brent oil prices (P) come from the Federal Reserve Bank of St. Louis database. The estimation period is 1969-2017.

When trying to determine which variable in a model has a statistically significant effect on future values of other variables, the Granger-causality test is able to do so. This test makes two assumptions. Firstly, that cause is followed by an effect. Secondly, a causal series needs to contain useful information beyond the historical information in the other variable. For example, let $Y_t \sim I(0)$ and $P_t \sim I(0)$. Then, the test equations are:

$$\left\{ \begin{array}{l} Y_t = a_0 + a_1 Y_{t-1} + a_2 Y_{t-2} + b_1 P_{t-1} + b_2 P_{t-2} + u_t \\ P_t = a_0' + a_1' P_{t-1} + a_2' P_{t-2} + b_1' Y_{t-1} + b_2' Y_{t-2} + u_t' \end{array} \right.$$

where P represents the rate of change in real crude oil prices, and Y represents the macroeconomic variables (CPI, RGDP, PGDP, VA, and INV). The rejection of the null hypothesis that $H_0: b_1 = b_2 = 0$ means that P Granger-causes Y. Similarly, the rejection of the null means that $H_0: b_1' = b_2' = 0$ means that Y Granger-causes P. Like the above model, both the AIS and SIC suggest the inclusion of two lags of Y and P. To control for the 2008 financial crisis, we created a dummy variable (= 0 for 1969-2007 and = 1 for 2008-2017). This dummy variable is included in the above Granger-causality test equations.

We start with the results for Algeria reported in Table 1. As can be seen, the Granger causality test results for Algeria show that without controlling for the GFC the only variable that is significantly Granger-caused by oil price shocks is investment. However, once controlling for the GFC, growth in real GDP, growth in value added, and growth in investment are all Granger-caused by changes in oil prices. As expected in the case of a small economy, Algerian macroeconomic variables do not Granger-cause oil prices.

Table 1. Granger-causality test results: Algeria

Without controlling for GFC				
Variable	Null hypothesis	F-value	P-value	Conclusion
CPI Inflation	P does not Granger Cause CPI inflation	2.572	0.093	Reject Ho
	CPI inflation does not Granger Cause P	0.615	0.547	Cannot reject Ho
GDP	P does not Granger Cause GDP	0.927	0.407	Cannot reject Ho
	GDP does not Granger Cause P	1.033	0.368	Cannot reject Ho
PGDP	P does not Granger Cause PGDP	0.214	0.809	Cannot reject Ho
	PGDP does not Granger Cause P	0.194	0.825	Cannot reject Ho
VA	P does not Granger Cause VA	1.081	0.352	Cannot reject Ho
	VA does not Granger Cause P	0.523	0.598	Cannot reject Ho
INV	P does not Granger Cause INV	0.461	0.635	Cannot reject Ho
	INV does not Granger Cause P	0.101	0.904	Cannot reject Ho

Controlling for GFC				
Variable	Null hypothesis	F-value	P-value	Conclusion
CPI Inflation	P does not Granger Cause CPI inflation	0.296	0.746	Cannot reject Ho
	CPI inflation does not Granger Cause P	0.615	0.547	Cannot reject Ho
GDP	P does not Granger Cause GDP	1.144	0.332	Cannot reject Ho
	GDP does not Granger Cause P	1.033	0.368	Cannot reject Ho
PGDP	RGDP does not Granger Cause P	3.064	0.062	Reject Ho
	P does not Granger Cause RGDP	0.194	0.825	Cannot reject Ho
VA	VA does not Granger Cause P	11.341	0.0002	Reject Ho
	P does not Granger Cause VA	0.523	0.598	Cannot reject Ho
INV	INV does not Granger Cause P	6.013	0.007	Reject Ho
	P does not Granger Cause INV	0.101	0.904	Cannot reject Ho

The results for Egypt are reported in Table 2. In contrast to results found in Algeria, in Egypt when not controlling for the GFC the only variable that is significantly affected by oil price shocks is the CPI inflation rate. However, when we control for the GFC, GDP deflator inflation and growth in value added, instead, are Granger-caused by changes in oil prices. As expected in the case of a small economy, Egyptian macroeconomic variables do not Granger-cause oil prices

Table 2. Granger-causality test results: Egypt

Without controlling for GFC				
Variable	Null hypothesis	F-value	P-value	Conclusion
CPI	P does not Granger Cause CPI	0.023	0.977	Cannot reject Ho
	CPI does not Granger Cause P	0.130	0.879	Cannot reject Ho
PGDP	P does not Granger Cause PGDP	0.711	0.499	Cannot reject Ho
	PGDP does not Granger Cause P	0.472	0.629	Cannot reject Ho
RGDP	P does not Granger Cause RGDP	1.348	0.275	Cannot reject Ho
	RGDP does not Granger Cause P	1.465	0.247	Cannot reject Ho
VA	P does not Granger Cause VA	1.617	0.701	Cannot reject Ho
	VA does not Granger Cause P	0.701	0.517	Cannot reject Ho
INV	P does not Granger Cause INV	0.517	0.013	Reject Ho
	INV does not Granger Cause P	1.002	0.379	Cannot reject Ho

Controlling for GFC				
Variable	Null hypothesis	F-value	P-value	Conclusion
CPI	P does not Granger Cause CPI	2.279	0.120	Cannot reject Ho
	CPI does not Granger Cause P	0.130	0.879	Cannot reject Ho
PGDP	P does not Granger Cause PGDP	12.761	<0.001	Reject Ho
	PGDP does not Granger Cause P	0.472	0.629	Cannot reject Ho
RGDP	RGDP does not Granger Cause P	2.271	0.121	Cannot reject Ho
	P does not Granger Cause RGDP	1.465	0.247	Cannot reject Ho
VA	VA does not Granger Cause P	10.223	0.001	Reject Ho
	P does not Granger Cause VA	0.701	0.517	Cannot reject Ho
INV	INV does not Granger Cause P	2.376	0.111	Cannot reject Ho
	P does not Granger Cause INV	1.002	0.379	Cannot reject Ho

Finally, the results for Nigeria are reported in Table 3. When not controlling for the GFC, CPI inflation, growth in value added, and growth in investment are significantly Granger-caused by oil price shocks. However, when we control for the GFC all five variables are Granger-caused

by changes in oil price shocks. Again, as expected in the case of a small economy, Nigerian macroeconomic variables do not Granger-cause oil prices.

Table 3. Granger-causality test results: Nigeria

Without controlling for GFC				
Variable	Null hypothesis	F-value	P-value	Conclusion
CPI	P does not Granger Cause CPI	2.916	0.067	Reject Ho
	CPI does not Granger Cause P	1.399	0.263	Cannot reject Ho
PGDP	P does not Granger Cause PGDP	1.590	0.221	Cannot reject Ho
	PGDP does not Granger Cause P	0.505	0.609	Cannot reject Ho
RGDP	P does not Granger Cause RGDP	0.609	0.253	Cannot reject Ho
	RGDP does not Granger Cause P	0.693	0.508	Cannot reject Ho
VA	P does not Granger Cause VA	3.319	0.050	Reject Ho
	VA does not Granger Cause P	0.830	0.446	Cannot reject Ho
INV	P does not Granger Cause INV	5.023	0.013	Reject Ho
	INV does not Granger Cause P	1.002	0.379	Cannot reject Ho

Controlling for GFC				
Variable	Null hypothesis	F-value	P-value	Conclusion
CPI	P does not Granger Cause CPI	2.814	0.076	Reject Ho
	CPI does not Granger Cause P	1.399	0.263	Cannot reject Ho
PGDP	P does not Granger Cause PGDP	119.845	< 0.001	Reject Ho
	PGDP does not Granger Cause P	0.505	0.609	Cannot reject Ho
RGDP	P does not Granger Cause RGDP	12.390	< 0.001	Reject Ho
	RGDP does not Granger Cause P	0.693	0.508	Cannot reject Ho
VA	P does not Granger Cause VA	3.298	0.051	Reject Ho
	VA does not Granger Cause P	0.830	0.446	Cannot reject Ho
INV	P does not Granger Cause INV	2.532	0.097	Reject Ho
	INV does not Granger Cause P	1.002	0.379	Cannot reject Ho

5. Conclusions

The aim of this paper is to analyze the effect of oil price shocks on the future values of macroeconomic variables in Algeria, Egypt, and Nigeria using the Granger-causality test. As a noteworthy aspect, we focus on African oil net-exporting countries and control for the 2008 global financial crisis. Our findings indicate that both with and without controlling for the global financial crisis, oil price shocks do Granger-cause some of the macroeconomic indicators. However, the results are much stronger when controlling for the global financial crisis. More specifically, when controlling for the 2008 global financial crisis, oil price shocks Granger-cause RGDP, VA, and INV in Algeria, and Granger-cause PGDP and VA in Egypt. In the case of Nigeria, however, oil price shocks Granger-cause all five macroeconomic variables (CPI, RGDP, PGDP, VA, and INV).

In our view, the strong evidence of Granger-causality could be attributed to the plummeting of oil prices after the 2008 global financial crisis. All three of these nations used oil revenues to provide subsidies, especially for petroleum products. Due to the low oil prices, a significant amount of these subsidies was lifted. This resulted in the effects of oil price shocks negatively transmitted through the economy.

In addition, in recent years, Algeria and Egypt have loosened their monetary policies as a response to oil price declines. For Algeria, the worry is that the country has resorted to using monetary financing through the World Bank, and this might lead the economy into an inflationary spiral. Similarly, Egypt has loosened its monetary policy as an attempt to lower government spending on subsidy provision and to attract foreign direct investment. In our view, such a monetary position is reasonable since for both countries oil prices Granger-cause growth in investment and growth in value added, and thus loosening monetary policy would help grow their industrial sectors and lower unemployment. A precaution both countries need to consider is that

as a result of such expansionary policies, the Central Banks of Algeria and Egypt might be creating conditions for periods of high inflation in coming years.

On the other hand, Nigeria still plans on maintaining a relatively tight monetary policy and tries to address high inflation and unemployment by providing loans to the agriculture sector through the central bank. This approach is adequate since based on our test results oil price shocks Granger-cause inflation. Thus, with a relatively tight monetary policy in place they are able to avoid worsening the current high rate of inflation. Additionally, since oil price shocks also Granger-cause investment and value added, the Nigerian Central Bank's effort of providing loans to the agriculture sector will help promote growth in investment, productivity, and output.

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Demand Analysis for Private Villas in Dubai

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Abstract

The real estate market is a very important sector for Dubai's economy. The market contributed to 13.6% of the emirate's GDP in 2018, up from 6.9% in 2017, which consisted of 53,000 transactions representing a total worth of Dh233 billion (Nasrallah, 2019). Therefore, it has become increasingly important to analyse the main contributors to the demand of real estate in Dubai. In this paper, we conduct an analysis of the demand for real estate in Dubai, specifically the demand for private villas by incorporating a set of variables that we deem can have an intuitive and economic impact on demand. We choose to study the market for private villas as previous literature have analysed demand with regards to the market for high-rise buildings in Dubai (apartments) (Dahan, 2018). We find that the coefficients of the variables obtained through a regression are indeed economically intuitive and significant to a certain extent.

1. Introduction

Since the early 2000s, Dubai has witnessed substantial growth in the real estate and construction sectors. Dubai is considered one of the most attractive destinations around the globe with regards to real estate investment, mostly by virtue of the laws and regulations which permit foreigners to own freehold property. Furthermore, in the attempt to attract further foreign investment and to elevate the rates of real estate ownership, the Government of Dubai has issued new laws that permit certain residents 5-year and 10-year residence visas.

According to the latest Economic Report published by the Government of Dubai, real estate and construction are the 5th and 6th largest contributors to Dubai's GDP respectively, and new laws and projects are looking to increase the strength of these sectors as Expo 2020 is approaching (Government of Dubai, 2018). These sectors are collectively employing about 27.6% of the working population in Dubai. Moreover, real estate transactions have increased in value from AED 268 billion in 2016 to AED 284 billion in 2017 and are projected to represent steady year-on-year growth. This has led the Government of Dubai to allocate over 70% of its AED 33 billion budget on infrastructure projects in time for Expo 2020. All-in-all, in a diversified economy such as Dubai, the real estate market represents a vital and dynamic driving force in overall growth and well-being of its economy. For instance, the chart below shows how the correlation coefficient between the Dubai Real Estate share prices and the price of crude oil are slowly approaching negligible values (Winkler, 2018).

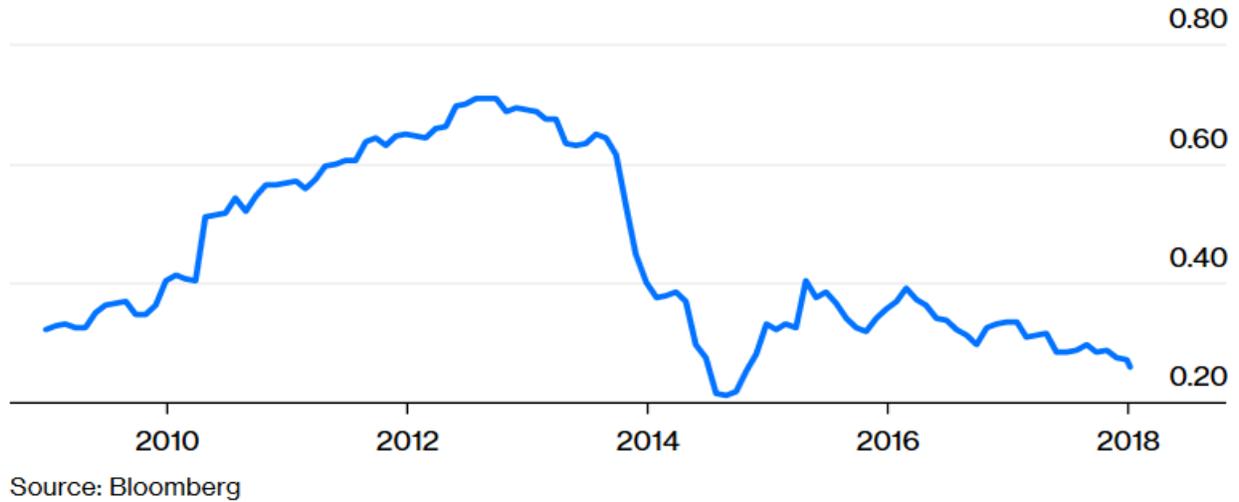


Figure 1. Real Estate Prices and Crude oil

Comprehensive studies in relation to the demand of real estate in Dubai are somewhat limited. This can be partly attributed to the significant limitation in obtaining data. There is only one study, discussed further in the next section, that conducts a study and forecasts future trends for the demand of buildings (apartments/high-rise buildings) in Dubai. Therefore, this paper aims to render a contribution to the study of real estate demand analysis in Dubai and to hopefully narrow this gap. In particular, this paper discusses and analyses the demand for private villas in the Emirate of Dubai. Several variables which are deemed to have an impact on the demand are studied and consequent conclusions are made by running a log-log regression in order to obtain the elasticity of demand in relation to the selected variables.

The paper is formatted as follows: A literature review of previous studies in the area real estate demand analysis is provided, followed by a full body section that provides description of data, economic intuition, the data analysis, and the final results of the study.

2. Literature Review

The real estate market can be defined as “the interaction of individuals who exchange real property rights for other assets, such as money” (Dubai Chamber, Data Management and Research Department [DCDMRD], 2007, p.3). During the mid-1990s until the beginning of the great recession, real estate markets suffered from significant increase in prices, in both developed and developing economies (Arrazola, et al., 2015). Countries that had been affected the most by the significant increase in house pricing were Ireland, where real housing prices almost tripled and the United Kingdom, and Spain, where prices doubled. The financial crisis of 2007 had corrected housing prices. “For example, in Ireland and Spain prices have been decreasing since the end of 2007 for 19 consecutive quarters, reaching falls of 50.1% and 32.0% respectively” (Arrazola et al., 2015, p.3).

Some characteristics that distinguish real estate from other economic goods are Immobility, Uniqueness, and long development period. Real estate is immobile in a sense that it cannot be separated from its location. Its value is directly related to the present and future economic prospects in the community in which the property is located. Each real property is unique in its way, which makes it difficult to compare with other real properties. Since it requires long development period to complete real estate projects, supply is slow to adjust to change in demand. When demand increases it results in a rapid price increase during the short run. On the other hand, a significant decrease in demand would result in price decrease (DCDMRD, 2007). The determinants of real estate demand are income, buyer’s taste and preferences, the buyer’s expectations about the future, the cost and availability of financing, population, and change in price of other goods. Although all these determinants are important, but the major determinants of demand are population, income, and availability of financing (DCDMRD, 2007). As stated in the

Dubai Chamber report, increases or decreases in population strongly influence real estate values. Changes in population is mostly related to employment opportunities which makes population move or migrate. Population is not only about the size, but also about demographic trends such as ethnicity, age distribution, size of households, and educational status.

An increase in the level of income will increase the demand for real estate, while a decrease in the level of income will decrease the demand for real estate. An increase in the income level of households will result in an increase of demand in residential real estate.

According to the report, in addition to demand determinants, the determinants of real estate supply can also affect real estate value. The key determinants of real estate supply are costs of production input, technological advancement, cost of financing, and the expectation of future demand. Advances in technological know-how would decrease the costs and lead to increase in the quantity supplied. Real estate production inputs consist of labour, land, and materials. Increases in the cost of production inputs results in decreasing real estate quantity supplied at a given price (DCDMRD, 2007). The most important determinant of supply is the expectation of developers regarding future demand. When developers are optimistic about future demand, quantity supplied tends to increase. On the other hand, when developers are not optimistic about future demand, quantity supplied tends to decrease. In Dubai, real estate is provided by the government and the private sector. The government was the sole provider of the real estate, but later it had passed the development to the private sector (DCDMRD, 2007). According to the results of the research conducted by Dahan (2018), the demand of real estate, specifically buildings/apartments, in Dubai grew very rapidly in the past seventeen years and this growth is expected to grow farther in the coming years. Dubai's real estate boom had a significant impact on living cost within the city of Dubai and nearby Emirates for several years, "For example, residential rents rose between 20 and

40 per cent in the first half of 2005 and again by up to 50 per cent in some parts of the city ” (Bagaeeen, 2007, p.180). The total number of completed villas and residential complexes increased by 30.4 % between 2000 and 2006 but decreased by 6% in 2006 compared to 2005.

In 2006, there were 17,342 villas and residential complexes under construction and control of Dubai Municipality (DCDMRD, 2007). However, due to the global financial crisis between 2008 and 2010, Dubai real estate market remained quiet. At the beginning of the recovery in 2011, the prices of the residential real estate had begun to recover (Falade-Obalad, & Dubey, 2014). The decision to allow non-Gulf citizens to own real estate properties in freehold areas had increased demand and supply (DCDMRD, 2007).

In 2012, there was a significant demand for luxury real estate assets which resulted in a significant increase in the volume of transactions during this year. Villa prices in excellent locations rose around 20% in 2012 (Falade-Obalad, & Dubey, 2014). There were many factors that lead to the increase in Dubai’s real estate development costs, such factors are land prices, construction materials, technology and innovation, and other factors. Two main reasons that were the causes of the increase in land prices are land location and infrastructure provided. Some critical construction materials as steel, cement, aluminium, and wood witnessed price fluctuations (DCDMRD, 2007). Because supply is fixed in the short run, changes in real estate value during the short run is the result of change in demand. An increase in demand will decrease the available real estate vacancies and when this happens more people will bid on the fixed supply of real estate units, which results in increase in prices and rent. When this increase reaches a certain level, developers and contractors are motivated by the profit potential to start new projects (DCDMRD, 2007). When construction starts, the supply of real estate largely increases which results in increases in supply overtaking increases in demand then more real estate vacancies are available

and as more vacancies appear, prices and rents start to drop. After that, profits will decline or vanish due to the increase in construction costs and decline in real estate prices. When this happens, buyers and renters can buy a property or rent at a less cost (DCDMRD, 2007).

3. Data Description

The sample used in this paper comes corresponds to several variables covering the periods from 2000-2018 (annual data). Given the small sample size readily available, it is ideal to incorporate 6-7 variables in order to get some sense out of the data. In our dataset, the demand would take the left-hand side of the equation (dependent variable) and a set of six independent variables were chosen to conduct the study. Namely, the six variables are: Price, Income, Recession, Tension, Number of Days to Register a Property (NDRP), and Capital Investment as a Percent of GDP (Infrastructure). The following table shows a detailed explanation of the variables used and their respective sources:

- Demand: Measured as the number of completed private villas in Dubai (in number of units).
Source: Dubai Statistics Centre (DSC).
- Price: Measured as the average price (in AED) of a villa: $\frac{\text{total value of completed villas}}{\text{number of completed villas}}$. **Source: Dubai Statistics Centre (DSC).**
- Income: Measured as the income per capita in AED. **Source: World Bank Worldwide Development Indicators.**
- Recession: Dummy variable taking the value of 1 from 2007-2009 and 0 otherwise. **Source: User created variable.**
- Tension: Dummy variable taking the value of 1 on 2003 and from 2015-2018, and 0 otherwise. This measures the high impact tensions occurring in the MENA region. 2003

for the American Invasion of Iraq, and 2015-2018 for the Yemen War. **Source: User created variable.**

- Number of Days to register a Property (NDRP): This represents the number of days it would take to register a property. **Source: World Bank Worldwide Development Indicators.**
- Capital Investment as a percent of GDP (Infrastructure): This is a measure of infrastructure expenditure. Includes construction of roads, railways, schools, and hospitals. **Source: World Bank Worldwide Development Indicators.**

The following figures show some the variables plotted against demand for a more visual representation followed by a correlation matrix.



Note that the following correlation matrix does not include the dummy variables since standard correlation methods (such as Pearson correlation coefficient) is used on continuous variables rather than dichotomous (binary) variables.

Demand	Price	Income	NDRP	Infrastructure	
1.0000	-0.0769	0.3861	-0.5736	0.2875	Demand
	1.0000	0.1120	0.1056	0.5531	Price
		1.0000	-0.4270	-0.1891	Income
			1.0000	0.0018	NDRP
				1.0000	Infrastructure

4. Economic Intuition

In the following section, we shall provide an economic intuition as to why the selected independent variables should have the expected relationship with respect to the dependent variable. We will start off with first trivial variables which we incorporated in this paper: price and income per capita. We should expect that the relationship of the price vis-à-vis the demand is as expected, a negative relationship (as price increases demand decreases and vice versa). On the other hand, we expect that income per capita to have a positive relationship with demand. Naturally, as the income of people increases the demand for buying real estate increases. Next, we thought of integrating several other variables which would be interesting to observe, as discussed in the previous section (Data Description). For the recession variable, we sought to observe interaction of the financial crises with the demand for villas in Dubai. For this variable, we expect a negative

relationship to be observed since a financial crisis will typically lead to reduced consumer sentiment and spending. Next, for the “Tensions” variables, we were to observe the interaction between political tensions in the Middle East during the period 2000-2018. We would expect that the relationship to be negative since the occurrence of political tensions will also lead to decreased consumer sentiment in the region and may result in capital outflow. As for the infrastructure variable (“Capex” as of percent GDP), our thesis here is that the more the government spends on infrastructure, the more people would build houses which would, thus, be a positive relationship. Lastly, for the time required to register a property variable (NDRP), we assume that a negative relationship would occur since the less amount of time it takes to register a property, the more people would be inclined to build a property since less nuisances would be present in terms of governmental procedures. Summing up, the following would be the demand function:

$$Q_D = f(P^{(-)}, Y^{(+)}, \textit{Recession}^{(-)}, \textit{Tension}^{(-)}, \textit{Infrastructure}^{(+)}, \textit{NDRP}^{(-)})$$

5. Data Analysis

In this section, we run a regression of the above listed variables against demand using an econometric software called Gretl. In our paper, we are specifically seeking to observe the elasticity of demand with respect to the independent variables, that is, what effect would a 1% change in an independent variable have on the change in demand for private villas in Dubai. Therefore, we run a log-log OLS regression to obtain the necessary coefficients. All variables are log-transformed, for the exception of the Infrastructure variable since it is already expressed in percentage terms (no logs for dummy variables as well). After carrying out the above, the regression was implemented, and the following results were obtained:

Table 1.

OLS, using observations 2000-2018 (T = 19) (Dependent variable: Log Demand)

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	2.01583	2.34991	0.8578	0.4078	
Log Price	-0.455251	0.184907	-2.462	0.0299	**
Log NDRP	-0.177509	0.0694853	-2.555	0.0253	**
Recession	-0.235434	0.130649	-1.802	0.0967	*
Tensions	-0.337313	0.0766245	-4.402	0.0009	***
Log Income	0.898719	0.232493	3.866	0.0022	***
Infrastructure	0.0772370	0.0233147	3.313	0.0062	***
* p < 0.1; ** p < 0.05; *** p < 0.01					
Mean dependent var	7.489596	S.D. dependent var		0.283712	
Sum squared residual	0.322708	S.E. of regression		0.163989	
R-squared	0.777268	Adjusted R-squared		0.665902	
F (6, 12)	28.55051	P-value(F)		1.96e-06	
Log-likelihood	11.75690	Akaike criterion		-9.513799	
Schwarz criterion	-2.902727	Hannan-Quinn		-8.394943	
rho	-0.350270	Durbin-Watson		2.687803	

As shown in the above table, all the coefficients of the independent variables are statistically significant at a 10% confidence interval (some at 5% and 1%). Moreover, the R² and adjusted R² are 0.777268 and 0.665902, which implies that the variation in these variables explain about 70% of the variation in demand. As for the signs of the coefficients, all of the signs adhere to the economic intuition detailed in the previous section. In the consecutive paragraph we shall look into the elasticities in more detail.

In general, all of the elasticities are more towards the inelastic region. According to the results, the price elasticity of demand is negative and inelastic. This shows that for a 1%

increase in prices, demand decreases by 0.455%. Moreover, as expected as the number of days required to register a property increases by 1%, the demand decreases by 0.177% (albeit not a large amount). The presence of a recession leads to a decrease in demand by 0.235%. The presence of tensions in the region lead to a decrease in demand by 0.337%. One interpretation of the above inelasticity is that Dubai (UAE) is relatively the safest city in the region and is therefore not really affected by a large (elastic) amount to the presence of recessions or tensions. When it comes to the infrastructure, a 1% increase in infrastructure expenditure (as a percent of GDP) leads to a 0.077% increase in demand. Although the economic intuition holds in the case of infrastructure, the magnitude of change is not that significant. Lastly, we observed that the income has the largest and most significant effect on the demand. The income elasticity of demand for villas in Dubai is 0.899 which almost represent a unit elastic demand. This shows that for a 1% increase in income, demand increases by 0.899%. This seems to show that income is the most important factor people take into consideration before choosing to build a villa, followed by price (by comparing magnitudes of elasticities).

6. Conclusion

This paper has analysed the demand for private villas in Dubai. The research has shown that the demand for private villas in Dubai most positively affected by the income levels in the country. Results have also shown that the income variable is almost elastic in its effect on the demand. On the other hand, followed by income, price has shown to have the most negative effect on demand, as shown by its elasticity (though it is inelastic). Effects of variables such as number of days to register a property and infrastructure expenditure are indeed representing the assumed economic intuition, however, the magnitude of their elasticities are not that significant. Variables such as recession and tensions also had the expected relationship with respect to demand

(negative). However, their elasticities are also inelastic. We would expect that such variables should have a large effect on the demand. One way to interpret this inelasticity is that on a macro scale of the region, Dubai is the safest city and is therefore not affected by a large amount of recessions or tensions which occur since most people/investors consider it as a safe haven, especially in times of war in other countries in the region. All-in-all based on our results, income and price levels can be considered as the primary factors that have a significant effect on the demand for private villas in Dubai.

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Youth Unemployment and Violent Crime: The Case of Latin America

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Abstract

Latin America is known as one of the most violent regions of the world and dominates global homicide rankings. This paper provides a comprehensive review of the potential factors that may result in this designation. We use panel data for 16 Latin American countries for the period 1995 to 2016 in order to analyze the relationship between violent crime (as captured by the intentional homicide rate) and the youth unemployment rate. Other factors affecting violent crime (including the availability of firearms, living standards, alcohol consumption, urbanization and young male population) are also studied. We find that the youth unemployment rate has a positive and significant impact on violent crime in Argentina, Belize, Costa Rica, El Salvador, Guyana, Honduras, Nicaragua and Uruguay. However, we find no relationship between youth unemployment rate and violent crime in Brazil, Colombia, Ecuador, Guatemala, Mexico, Panama, Paraguay and Venezuela. We conclude by discussing the limitations of our study and recommending public policies to overcome high crime rates.

Keywords: Violent Crime, Intentional Homicide, Youth Unemployment, Latin America, Availability of firearms, Living Standards, Alcohol Consumption, Urbanization, Male Population

1. Introduction

According to a report published by the Inter-American Development Bank, unlike the other regions of the world, where criminal violence rates have been stable or declining, many countries in Latin America have experienced growing homicide rates since the end of the Cold War. The region is prone to sudden escalations in violence where homicide rates begin spiralling out of control – a phenomenon rarely observed elsewhere. Combatting this extremely high rate of violence produces immense costs for the affected countries, including the loss of productive life years, the break-up of families, the loss of social capital, the undermining of public trust, the deferment of investment, brain drain, capital flight, internal displacement, and a general loss of confidence in democracy (Jaitman et al. 2017). The United Nations Office on Drugs and Crimes (UNODC) statistics and Igarape Institute Homicide Monitor show that Latin America accounts for approximately a third of global murders although it is home to only 8% of the world's population. In fact, just four countries in the region — Brazil, Colombia, Mexico and Venezuela — account for a quarter of all the murders on the planet. Out of 20 countries with the highest murder rates in the world, 17 are Latin American, as are 43 of the top 50 cities.

The overall effects of homicidal violence on society are far greater than individual consequences and pose considerable costs for the country's economy and its development. According to data from the United Nations Development Program (UNDP), homicidal violence has a direct impact on healthcare costs, institutional costs, private insurance costs, and material losses, among other categories. The costs of violence as a proportion of the gross domestic product (GDP) vary by country. Estimates suggest that for Peru and Brazil it is 1.4% of the GDP, for Mexico 3.6%, for El Salvador 4.9%, for Colombia 6.4%, for Venezuela 6.6%, and for Guatemala 6.7% (Briceño-León et al., 2008).

This violence translates to widespread fear among citizens. More than a third of all Latin Americans reported being a victim of violent crime in 2016, according to a report published by the Igarape Institute, a Brazilian-based think tank that focuses on emerging security and development issues. In some countries like Venezuela and Mexico, nearly half of the population suffered a violent crime in the last year. In 2017, around 140,000 people were victims of homicides, more than have been lost in wars around the world in almost all of the years this century. In the late 1980s and the 1990s the civil wars and military dictatorships were giving way to democracies. Tens of millions flocked to the cities, a willing workforce for the rapid industrialisation that governments hoped to bring about. But the economic growth that followed did not match this influx, nor did government services such as schools and hospitals and the demographic “youth bulge” exacerbated its effects. People crowded into slums, shantytowns and *favelas* from where they could not get to work. Poverty and lack of jobs pushed the youth to join gangs which were prone to violent crime ("Shining light on Latin America's homicide epidemic - Instituto Igarapé", 2019).

Until this violence is addressed, however, it will continue to undermine development and progress in the region. Surveys conducted by the Latin America Public Opinion Project (LAPOP), reveal that many citizens are willing to trade their civil rights for security, and some are even beginning to doubt that democracy is the best form of government for their countries (Zechmeister, 2014).

This paper is organised as follows. Section 2 is the literature review where we look at the relevant papers that discuss the sources of violent crime in Latin America and other parts of the world. In Section 3, we describe the data set, specify the quantitative variables, and present the models and estimation methods. The results are reported and discussed in Section 4, and in

Section 5, we conclude the paper by discussing the limitations of the study and implications for future research as well as policy recommendations to diminish high violent crime rates.

2. Literature Review

Research on the relationship between violent crime and youth unemployment has failed to provide a clear set of findings. Studies using both cross-sectional and time series data from various countries have found both a positive relationship (Allan and Steffensmeier 1989; Phillips et al. 1972; Smith et al. 1992) and a negative relationship (Gibbs 1966; Smith et al. 1992) between crime and unemployment among youth.

According to Cantor and Land (1985), there are two main views regarding the relationship between economic conditions and crime. One view is the motivational perspective which expects a positive relationship between crime and poor economic conditions. There are two sources of motivation. One may be the frustration that results from people being unable to obtain or to maintain employment, while at the same time they want to maintain or enhance their living standards (Greenberg 1985). Thus, if economic conditions worsen over time, the share of the population feeling frustrated should probably increase. The overall effect of an increased level of frustration in the population could be an increased rate of crime.

This conclusion implies that unemployed individuals may become frustrated due to inability to obtain jobs or due to a drop in their living standards and thus resort to crime. A second source of motivation may be the outcome of a rational choice process, where individuals weigh the costs and benefits of criminal behavior against legitimate behavior (Becker 1968; Block and Heineke 1975). According to this view, the unemployed are more likely to commit crime, since the total cost of crime may be perceived as low, relative to the total gains from

crime, and imprisonment would not involve the loss of income from employment. In either case, poor economic conditions could be responsible for higher rates of crime by increasing the proportion of the population prone to commit criminal acts (Britt 1994).

On the other hand, the opportunity perspective sees crime as a function of the supply of potential offenders and suitable targets for victimization. In contrast to the motivational perspective, this view assumes that the crime rate falls as economic conditions deteriorate. As a society experiences an economic downturn, the circulation of persons and new property are reduced. During a recession, as the unemployment rate rises, many more people remain in their homes and/or neighborhoods. Since many property crimes occur while people are absent from their homes, unemployed persons at or near their home provide an additional level of protection for their personal property, and they should experience lower risks of property crime. Similarly, most personal violence victimizations occur outside the home. The opportunity perspective suggests that when the unemployment rate among youth is high, youth would be more likely to remain at or near home, since they will probably be unable to support all their desired leisure activities and thus have lower risks of violent victimization due to decreased exposure to potential offenders. In addition, there will likely be greater direct supervision of youth by other unemployed family members or neighbors in periods of high unemployment. Conversely, as youth are more involved in the labor market, they have a greater opportunity to commit crimes, since the level of direct supervision of their behavior is reduced with the increased time spent away from home involved in both employment activities and leisure activities, possibly funded from income earned from that employment (Britt 1994).

Raphael and Winter-Ebmer (2001) and Edmark (2005) find that unemployment is an important determinant of property crime rates, but the effects of unemployment on both murder

and rape are zero. Carmichael and Ward (2001) find that youth unemployment and adult unemployment are both significantly and positively related to total crime rates. Fougere, Kramarz, and Pouget (2009) suggest that an increase in the level of youth unemployment causes an increase in property crime, but other types of violent crimes (such as rapes or homicides) appear to be unrelated to labor market conditions. Crutchfield (1989) finds that violent crime is more frequent in neighborhoods with a larger percentage of the population below the poverty level, and violent crimes are least frequent where the percentage of residents working full time is highest. Ahmed, Doyle, and Horn (1999) find strong evidence that favourable labor market conditions have a significant negative effect on property crime. Raphael and Winter-Ebmer (2001) find that unemployment among males is weakly related to the violent crime of rape.

Britt (1994) used unemployment and arrest time series data for persons aged 16 to 19 years in the United States to show crime among youth to be associated with both the current level of youth unemployment and the annual change in the rate of youth unemployment. For violent offenses (homicide, rape, and aggravated assault), as well as for property offenses (robbery, burglary, and larceny), higher rates of youth unemployment are negatively associated with annual changes in the arrest rates of youth. Gould, Weinberg, and Mustard (2002) find that both wages and unemployment are significantly related to crime. Entorf and Spengler (2000) find that being young and unemployed increases the probability of committing crimes. Papps and Winkelmann (2000) provide evidence for significant effects of unemployment on New Zealand crime, both for total crime and for some subcategories of crime. Schuller (1986) also finds support for the positive relation between unemployment and crime using time-series data from Sweden. Witte and Tauchen (1994) use American panel data on young men and find that employed individuals tend to commit fewer crimes than those who are unemployed.

Edmark (2005) finds that the urbanization rate is negatively related to aggregate violent crimes. On the contrary, Briceño-León, Villaveces, and Concha-Eastman (2008) find that countries with the highest rate of homicide tend to be countries with high proportions of urban population and high rates of poverty.

Loureiro et al. (2012) find that development indicators are negatively related to intentional homicide rate. According to a number of studies, homicide levels tend to be low in nations with higher levels of socioeconomic development which is commonly measured using GDP or GNP per capita (Krohn and Wellford 1977; Messner and Rosenfeld 1997; Neapolitan 1994).

The role of alcohol in violent incidents and crimes has been subject to a large number of empirical studies. Lenke (1990) studied the relationship between aggregate alcohol consumption and violent crime in Sweden through time series analysis and found a positive relationship between alcohol consumption and both homicide and assault rates in Sweden. In addition, occasional drinking was connected to less serious forms of violence, while heavy drinking was connected to more serious forms of violence.

A growing body of research has demonstrated that an increase in the overall amount of drinking in a society tends to be accompanied by a significant increase in violent crimes. This was shown by Skog and Bjørk (1988) who found that a rise in total alcohol sales was followed by a significant increase in violent crime rates. Analyses of alcohol sales and homicide rates in 14 European countries also showed that homicide rates tend to increase when alcohol sales increase, and so more in the northern European countries where intoxication is more prominent than in southern European countries (Rossow 2001).

Rossow (2004) uses time series data from 1950 to 1999 to study the association between alcohol consumption and homicide in Canada. His findings support the hypothesis that alcohol sales tend to have an impact on homicide rates, and there is a statistically significant association between alcohol sales and homicide rates for Canada. Pridemore (2002) carried out cross-national research in order to examine the relationship between alcohol consumption and homicide in 89 regions of Russia where the rate of alcohol consumption and homicide are among the highest in the world. The results show a positive and significant relationship between alcohol consumption and homicide, with a 1% increase in regional consumption of alcohol associated with an approximately 0.25% increase in homicide rates.

Villaveces, Cummings, Espitia and Koepsell (2000) use time series data to evaluate the effect of an intermittent police-enforced ban on carrying firearms on the incidence of homicide in urban Colombia where homicide is the leading cause of death. The incidence of homicide was lower during periods when the firearm-carrying ban was in effect compared with other periods. Hoskin (2001) finds that lethal violence is likely to be high in countries with greater supplies of privately owned guns. Their results reveal a statistically significant positive effect of firearm availability on national homicide rates. Most of the macro-level research examining the relationship between gun availability and crime rates has been based on American data, and overall these studies have found that measures of firearm availability are related positively to rates of overall homicide (Brill 1977; Fisher 1976; Kleck 1979; Lester 1988; Magadino and Medoff 1984). A number of studies have investigated the relationship between gun availability across a sample of nations, and most of these have reported a positive association (Killias 1990, 1993; Kleck 1997; Lester 1991, 1996).

The accumulated evidence to date suggests that violent crime should be negatively related to the economic growth rate and development indicators such as real GDP per capita and positively related to the availability of firearms, consumption of alcohol, and urbanization rate. However, the relationship between youth unemployment and violent crime appears to be somewhat ambiguous.

Only a handful of studies have looked at sources of violent crime in Latin America using data from the 1950s up until 2005. The majority of the studies use time series analysis or panel data involving a maximum of five countries. We contribute to this research by extending the time period to 2016 and by using a panel of 16 Latin American countries.

3. Data and Methodology

A panel covering a sample of 16 Latin American countries (Argentina, Belize, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Uruguay and Venezuela) for 22 years (from 1995 to 2016) has been employed. The dependent variable is violent crime which is measured by the intentional homicide rate. The paper uses youth unemployment rate as the main independent variable, while using availability of firearms, living standards, alcohol consumption, young male population, and urbanization rate as control variables.

Violent crimes according to the FBI's Uniform Crime Reporting (UCR) Program, are defined as those offenses that involve force or threat of force: murder, rape, robbery and aggravated assault ("Violent Crime", 2019).

We use intentional homicides per 100,000 people as a proxy for violent crime. There are two reasons for this. Firstly, there is insufficient data for other violent crimes, namely rape and

robbery. Some countries, particularly developing countries, do not have proper records of such crimes. Secondly, intentional homicide statistics are least likely to suffer from underreporting because corpses are more difficult to ignore than losses of property or assaults. The issues of mismeasurement associated with aggregate variables are quite severe for most types of crime data. Underreporting is widespread in countries with low quality police and judicial systems and with poorly educated populations. In fact, Soares (1999) finds that the extent of underreporting is negatively correlated with the level of development. Underreporting is most pronounced for low-value property crime (e.g., common theft) and for crimes carrying a social stigma for the victim (e.g., rape or sexual assault.)

The quantitative variables of interest in this paper are: (i) intentional homicides per 100,000 people; (ii) youth unemployment rate; (iii) deaths from alcohol use disorders; (iv) urbanization rate (the fraction of the total population that resides in urban areas); (v) GDP per capita; (vi) percentage of young male population (aged 25 to 29) and (vii) number of deaths caused by firearms.

The data set used in this study was obtained from five sources: (i) UN Office on Drugs and Crimes International Homicide Statistics database; (ii) International Labour Organization, ILOSTAT database; (iii) United Nations Population Division, World Urbanization Prospects: 2018 Revision; (iv) World Bank national accounts data; and (v) Global Burden of Disease Study 2016 published by the Institute for Health Metrics and Evaluation (IHME).

We perform ordinary least squares (OLS) regression analysis on the panel data, since it allows for a greater number of observations, while also allowing us to fix the effects across countries and across time, thereby controlling for the effect of unobserved variables. Moreover, panel data allows us to compare across countries and across time simultaneously.

Several possible models can be created to study the impact of youth unemployment rate on homicidal violence. We present five such models. We use five models to see which fixed effects are appropriate for our study.

We start our analysis with Model 1 as follows,

$$HOM_{it} = \beta_1 + \beta_2 U_{it} + \beta_3 F_{it} + \beta_4 G_{it} + \beta_5 URB_{it} + \beta_6 A_{it} + \beta_7 M_{it} + \text{error term}$$

where HOM is intentional homicide rate (measured per 100,000 people), U is the youth unemployment rate (%), F is the number of deaths caused by firearms (measured per 100,000 people), G is GDP per capita (\$), URB is the urbanization rate (% of population living in urban areas), A is the number of deaths caused by alcohol use disorder (measured per 100,000 people) and M is the young male population (% of total population). Model 1 assumes that all parameters ($\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ and β_7) are constant over time and countries.

Model 2 allows the intercept (β_1) to vary across time, while the slope parameters are constant as follows,

$$HOM_{it} = \gamma_1 t_1 + \gamma_2 t_2 + \dots + \gamma_{22} t_{22} + \beta_2 U_{it} + \beta_3 F_{it} + \beta_4 G_{it} + \beta_5 URB_{it} + \beta_6 A_{it} + \beta_7 M_{it} + \text{error term}$$

where t_1, t_2, \dots, t_{34} are the period dummy variables. This is referred to as the “period fixed effect (intercept)” model.

Model 3 uses country fixed effects which allows for the intercept to vary over countries, but the slope parameters are constant across countries as follows,

$$HOM_{it} = \beta_{1i} + \beta_2 U_{it} + \beta_3 F_{it} + \beta_4 G_{it} + \beta_5 URB_{it} + \beta_6 A_{it} + \beta_7 M_{it} + \text{error term}$$

Where the subscript “i” on the intercept indicates that the intercepts of the sixteen countries are allowed to vary.

Model 4 re-estimates model 2 by replacing U with sixteen country interaction variables as follows,

$$\begin{aligned}
Hom_{it} = & \gamma_1 t_1 + \gamma_2 t_2 + \dots + \gamma_{22} t_{22} + \delta_1 D_1 U_1 + \delta_2 D_2 U_2 + \delta_3 D_3 U_3 + \delta_4 D_4 U_4 + \\
& \delta_5 D_5 U_5 + \delta_6 D_6 U_6 + \delta_7 D_7 U_7 + \delta_8 D_8 U_8 + \delta_9 D_9 U_9 + \delta_{10} D_{10} U_{10} + \delta_{11} D_{11} U_{11} + \\
& \delta_{12} D_{12} U_{12} + \delta_{13} D_{13} U_{13} + \delta_{14} D_{14} U_{14} + \delta_{15} D_{15} U_{15} + \delta_{16} D_{16} U_{16} + \beta_2 U_{it} + \beta_3 F_{it} + \\
& \beta_4 G_{it} + \beta_5 URB_{it} + \beta_6 A_{it} + \beta_7 M_{it} + error\ term
\end{aligned}$$

where $\delta_1, \delta_2, \delta_3, \delta_4, \delta_5, \delta_6, \delta_7, \delta_8, \delta_9, \delta_{10}, \delta_{11}, \delta_{12}, \delta_{13}, \delta_{14}, \delta_{15}$ and δ_{16} , measure the effect of youth unemployment rate on the intentional homicide rates of the sixteen countries (Argentina, Belize, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Uruguay and Venezuela) respectively.

Model 5 re-estimates Model 4 by ignoring countries with insignificant values.

4. Empirical Results

Table 1 below reports the estimation results of Model 1, Model 2 and Model 3 while Table 2 reports the estimation results of Model 4 and Model 5. We use the White procedure in order to correct for heteroscedasticity, if any, and thus obtain robust standard errors. The numbers in brackets in the table are the absolute t-values obtained using standard errors corrected for heteroscedasticity.

Column 1 of Table 1 reports the estimates of Model 1, where the intercept and slope parameters do not vary across time, nor across countries. Here, we see an inverse relationship between youth unemployment rate and intentional homicide rate in the immediate quarter. A 1% increase in the youth unemployment rate decreases homicidal violence by 0.06% in the immediate quarter. Furthermore, there is a positive relationship between firearm availability and homicide rate, and urbanization rate and homicide rate, as seen in literature, and a negative

relationship between GDP per capita, alcohol consumption and young male population. However, the R^2 of the model is quite low.

Column 2 of Table 1 reports the empirical results of the period fixed effects (intercept) model. We see that this model has a higher R^2 than Model 1. Again, we see that an inverse relationship exists between youth unemployment and intentional homicide in the immediate quarter for the pooled regression; a 1% increase in U leads to a 0.013% decline in the homicide rate. Similarly, we find the same relationships for each of the control variables (availability of firearms, GDP per capita, alcohol consumption and young males) with homicidal violence except for urbanization rate which becomes negative.

Column 3 of Table 1 reports the empirical results of the country fixed effects model, which allows for the intercept to vary across countries, and the slope parameters are held constant. Here we see a positive relationship between youth unemployment and homicidal violence; a 1% increase in the youth unemployment rate results in a 0.096% increase in the homicide rate in the immediate quarter. The signs of all control variables remain the same except for young male population which becomes positive. The adjusted R^2 of this model is 0.943. This is significantly higher than the other two models.

Table 1
Estimates for Model 1, Model 2 and Model 3.

	Model 1	Model 2	Model 3
Constant	28.507 (7.26)		
U	-0.060(2.10)	-0.013 (0.42)	0.096 (2.29)
Control Variables			

F	0.901(49.1)	0.902 (49.5)	1.043 (16.8)
G	-0.142 (6.96)	-0.203 (7.74)	-0.006 (0.20)
URB	0.149 (5.52)	-0.203 (7.74)	0.150 (1.54)
A	-0.085 (9.28)	-0.0780 (8.33)	-0.116 (1.63)
M	-6.799 (6.81)	-6.595 (6.64)	2.873 (1.01)
Country Fixed Effects	No	No	Yes
Period Fixed Effects	No	Yes	No
Adjusted R ²	0.89	0.892	0.943
Observations	352	352	352

Note: Values in brackets are absolute t-values

Column 1 of Table 2 reports the empirical results of Model 4 which re-estimate the model in column 2 of Table 1 by replacing U with 16 country interaction terms. The estimates of Model 4 produce both significant and insignificant coefficient estimates of country interaction terms. The adjusted R squared is 0.89. The results indicate a significant positive relationship between youth unemployment rate and homicide for Argentina, Belize, Costa Rica, El Salvador, Guyana, Honduras, Nicaragua and Uruguay. These results are supported by the motivational perspective cited in the literature, which expects a positive relationship between crime and poor economic conditions. Unemployed individuals become frustrated and desperate over time due to their inability to find jobs and thus may take out their frustration and by resorting to violence. Additionally, the unemployed are more likely to commit crimes as the total cost of crime may be perceived as low relative to the total gains from crime (Cantor and Land, 1985).

As for Brazil, Colombia, Ecuador, Guatemala, Mexico, Panama, Paraguay and Venezuela, there is no relationship between youth unemployment rate and homicidal violence. As for control variables, we find that F, G and URB become highly significant and have the

expected signs. However, the signs of A and M are contrary to what is in the literature, but this should not matter as they are quite insignificant.

As a final step, we re-estimate model 4 by getting rid of countries with insignificant values. The results for this are shown in column 2 of Table 2. The adjusted R^2 is 0.94 thus, this model has significantly greater explanatory power, and so we choose this as our best model. The youth unemployment coefficients are positive and significant for the selected countries. A 1% increase in the youth unemployment rate leads to an increase in the homicide rate of Argentina by 0.006%, Belize by 0.035%, Costa Rica by 0.013%, El Salvador by 0.028%, Guyana by 0.011%, Honduras by 0.079%, Nicaragua by 0.018% and Uruguay by 0.013% in the respective immediate quarters. The coefficients for homicide rates from firearms and urbanization rate are positive and significant. This implies that a 1% increase in the homicide rate from firearms and urbanization rate causes the intentional homicide rate to increase by 0.93% and 0.13% in the immediate quarter respectively. The coefficient for GDP per capita is negative and significant. This means that a 1% increase in the urbanization rate leads to a 0.05% decrease in the intentional homicide rate in the immediate quarter.

Also, we find that alcohol consumption (A) and young male population (M) are again insignificant in the immediate quarter in this model. However, removing these variables is ill-advised as it leads to a reduction in the explanatory power of the model. The positive relationship between firearm availability and homicide rate is supported by numerous studies indicating that countries with higher gun ownership are more prone to have a high murder rate. The positive relationship between urbanization rate and homicide rate is also supported by literature which says that countries with the highest rate of homicide tend to be countries with high proportions of urban population (Briceño-León et al. 2008).

The alcohol consumption coefficient is negative and insignificant, contrary to the literature. This may be due to the limiting power of the proxy. We use the number of deaths caused by alcohol use disorder as a proxy for alcohol consumption. Alcohol consumption per capita or alcohol sales might have been a more appropriate proxy but that was not possible due to lack of data. The young male population coefficient is insignificant. Why does the intentional homicide rate seem to be unaffected by M? Again, the proxy used for young male population considers only the 25 to 29 age category. This also indicates that it is indeed unemployment among young men, and not the mere presence of young men in the population, that causes violent crime. Also, it is important to note that the unemployment rate is not the only possible measure of the labor market conditions. Ahmed et al. (1999) utilize broader measures of labor-market conditions in order to study their impact on crime; in addition to unemployment rates, it also includes wage levels and unemployment benefits. Such a measure might be more appropriate for the economics of crime-related applications. Future research could thus be devoted to developing a method for measuring overall labor-market conditions and their effects on crime in Latin America.

Table 2

Estimates for Model 4 and Model 5

	Model 4	Model 5
Constant	1.266 (2.26)	0.566 (1.75)
U Argentina	0.008 (3.21)	0.006 (4.74)
U Belize	0.036 (6.15)	0.035 (11.0)
U Brazil	-0.002 (0.28)	
U Colombia	0.001 (0.29)	
U Costa Rica	0.015 (3.63)	0.013 (5.14)
U Ecuador	0.000 (0.06)	
U El Salvador	0.028 (2.87)	0.028 (4.41)
U Guatemala	-0.009 (0.52)	

U Guyana	0.008 (2.12)	0.011 (4.37)
U Honduras	0.063 (6.16)	0.079 (10.2)
U Mexico	0.003 (0.22)	
U Nicaragua	0.010 (2.76)	0.018 (5.53)
U Panama	0.002 (0.57)	
U Paraguay	-0.002 (0.35)	
U Uruguay	0.016 (5.42)	0.013 (6.73)
U Venezuela	0.002 (0.88)	
Control Variables		
F	0.932 (27.8)	
G	-0.156 (4.06)	0.050 (2.23)
URB	0.171 (3.43)	0.127 (3.95)
A	-0.002 (0.08)	
M	-0.053 (0.29)	0.039 (0.28)
Country Fixed Effects	Yes	Yes
Period Fixed Effects	No	No
Adjusted R ²	0.89	0.94
Observations	352	352

Note: Values in brackets are absolute t-values

5. Conclusion

Issues left unresolved in this paper are the combined effects of gender, race and level of educational attainment on the relationship between youth unemployment and violent crime. Unfortunately, a major obstacle to successfully achieving these analyses is the availability of sufficient relevant data. Due to the lack of availability of these statistics for Latin America, the exact nature of the youth unemployment-violent crime relationship cannot be further clarified. We hope that this information will be made available to researchers in the future, thereby permitting a more comprehensive analysis of the relationship between youth unemployment and violent crime. In addition, inequality is a crucial variable in the analysis of crime rates however, very few research papers have employed the variable of inequality due to the difficulty of

obtaining data on inequality. In this paper, we study the connection between youth unemployment and violent crime using a panel data set on 16 countries in Latin America between 1995 and 2016. Our results suggest potential public policies against violent crime. Fighting youth unemployment should indeed help reduce violent crimes such as homicides. However, for some countries, violent crime appears to be unrelated to labor market conditions as measured by the rate of unemployment.

There are a number of potential routes to turn the young away from getting involved in violent crime including employment, gun control policies, and tighter controls on the consumption of alcohol. The results of this study place the cost of unemployment in a broader perspective. It seems that higher unemployment does not solely lead to expenses directly related to unemployment, but may also have indirect effects in the form of higher crime rates.

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Happiness in the Making: The Determinants of Welfare

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Abstract

My research's focus is on testing the validity of whether our happiness is really within our control. This idea leads us to question whether the actual source of happiness is our control itself. I relied on data extracted from The World Happiness Report to test my hypothesis. The main variables I relied on were GDP per capita”, “social support”, “healthy life expectancy at birth”, “generosity”, “perception of corruption”, and “confidence in national government”. From my study, we can conclude that there is a significant positive relationship between the two. However, whether one causes the other is more difficult to prove.

1. Introduction

“Happiness depends on ourselves” (Aristotle Quotes, n.d.). Around 2300 years ago, Aristotle philosophized on the sources of happiness. He believed that the joy or satisfaction we derive in our lives is wholly dependent on ourselves, and while that might be an acceptable answer to a philosophical question, it is not enough when we try to answer a more quantitative one. In this paper, I am interested in answering that mathematical question. More specifically, I am interested in testing the validity of whether our happiness is really within our control. This idea leads us to question whether the actual source of happiness is our control itself. As such, I will be studying the effects of possessing the freedom of making life choices on happiness levels.

2. Literature Review

In this modern age, everything has a set measurement: a standard rate to compare two entities with each other. In this way, we have relied upon the Gross Domestic Product to measure how well off a country is. Essentially, GDP measures the condition of a nation and its economy, but one of the significant issues it does not take into account is quality- the quality of products, quality of life, quality of welfare (Weijers & Jarden, 2013). Because of this limitation, different institutions have established new indicators to bridge this gap. These indicators ultimately measure the same thing: welfare, life satisfaction, and ultimately, happiness. Some of the most prominent happiness measures are the Gross National Happiness, the Happy Planet Index, and the Cantril Ladder (Iorgulescu, 2014). These indicators ultimately measure the same thing: welfare, life satisfaction, and ultimately, happiness. Moreover, this absence in coverage birthed a new dimension of literature, which focuses on establishing and analyzing the relationship of various socio-economic variables on happiness on a personal and national level.

The papers I have found fall into two main categories: the first relates to the theoretical discussion of what actually constitutes the determinants of happiness, and the second encompasses distinct empirical studies that focus on a specific aspect of happiness.

The first category of articles delves into establishing some dialogue on the important determinants of happiness. Iourgulescu (2014) summarizes the different modelling techniques employed by different happiness-based economics papers. It first introduced the concept of happiness in general, then it zeroed in on the different approaches present in the available literature. The paper accomplishes this by listing different papers and their specific focuses and techniques.

The second category of papers deals with distinct studies that examine the different factors that affect our level of happiness. Further, these papers have focused mainly on studying happiness in relation to freedom of choice, income, and governance.

Brule and Veenhoven (2014) attempted to determine the effect of freedom on happiness. The authors have done so by relying on cross sectional data set of forty-nine countries. Moreover, the authors utilized various socio-economic variables to conduct their study. These variables include quality of government, social security, and inequality in income among others. The results of their study showed that among countries with similar GDPs, countries with higher levels of perceived and actual freedom were found to be happier.

Okulicz-Kozaryn (2015) appraises the effect of freedom on life satisfaction, with a specific focus on Eastern Europe after their governmental transition. The author employed the OLS model with standard errors corrected for heteroskedasticity. He also grouped his data by country. The regression analysis illustrated that East European citizens feel less free and less happy than other nationals. However, if their perceived feelings of liberty were increased, then their happiness would increase at an increased rate compared to the other countries.

Cooper et al. (2011) is also a paper that divulges insight into the empirical relationship between economic freedom and happiness. The authors have used three different measures of happiness: happiness measured by the World Value Survey, the Happy Planet Index, and the Happy Life Years measure. Further, for their independent variable, they have chosen to use the EFW index, which measures economic freedom. Other than this determinant, they have found it appropriate to include GDP per capita as well as an interaction term between the two determinants in their regression. From their analysis, the article concluded that happiness and economic freedom are indeed positively correlated, as was conjectured.

Graffland and Compen (2014) complements Cooper et al. (2011) by delving deeper into studying the subcomponents of economic freedom on happiness. In addition, the authors were interested in testing whether income and trust had some indirect effects on those relationships. From their multiple regression analysis, the authors determined that the quality of the judiciary system positively affects happiness while small government size negatively affects happiness. They have also discovered that income and trust do impact the effects of those various economic indicators on happiness; however, the statistical significance of that impact depends on the specific indicator in question.

Debnath and Shankar (2013) investigated the association of a country's governance and its subsequent effect on happiness. The authors approached their study by adopting the data envelopment analysis (DEA) as their method. The analysis clarified that while improving governance might lead some to think that this change will increase happiness, the authors have come to the conclusion that due to the different modes of regulatory approaches employed by different governments, it cannot maximize happiness.

3. Data

The data I relied on to conduct my study originated from The World Happiness Report, which in turn amalgamated the different variables from The Gallup World Poll surveys across the years (Helliwell, Huang, & Wang, Changing World Happiness, 2019). Moreover, the dataset comprises of an unbalanced panel of 157 countries and 13 years.

After reviewing the literature, I have ascertained that some variables are critical to adequately study the effect of freedom to make life choices on happiness. These variables are “GDP per capita”, “social support”, “healthy life expectancy at birth”, “generosity”, “perception of corruption”, and “confidence in national government”. Further, all these variables are in the form of national averages of the participating countries.

Before presenting the summary statistics, we have to define the variables to fully understand what exactly we are looking at. First, let’s consider “GDP per capita”. The figures of this variable have been measured at constant 2011 international dollar prices. Furthermore, it will be more appropriate to rely on percentage increases, so I’ve used the log of the variable in my regressions. “Social support” is a binary variable that measures whether an individual has someone to depend on in troubled times. “Healthy life expectancy at birth”, as its name implies, reports the number of years people are expected to live. As the World Happiness Report defined, “generosity” is the residual of regressing the national average responses to the question “Have you donated money to charity in the past month?” on GDP per capita. “Perception of corruption” is a straightforward variable that details the attitude of the people towards their respective governments and their corruption levels. Another determinant that studies the government and its impact on happiness is “confidence in national government”. This variable studies how much the people trust their governmental entities. Finally, “freedom to make life choices” is also the mean of a binary

variable, with one being “satisfied” and zero being “dissatisfied” with the ability to make one’s freedom to do what they please in life (Helliwell, Huang, & Wang, *Changing World Happiness*, 2019).

While it would be sufficient to look at a table of the general summary statistics of these variables, it would be more interesting to also look at the summary statistics of individual countries as well; however, there are over 150 countries, so it would be impossible to fit all of them in one table. As such, I have chosen to only report the UAE’s statistics.

Table 1.

Overall statistics

Variable	Observations	Mean	Standard		
			Deviation	Min	Max
Country	1,704	83.37265	48.00388	1	165
Year	1,704	2012.332	3.688072	2005	2018
Life Ladder	1,704	5.437155	1.121149	2.661718	8.018934
Log GDP per Capita	1,676	9.222456	1.185794	6.457201	11.77028
Social Support	1,691	0.8105703	0.1192104	0.2901842	0.9873435
Healthy Life Expectancy at Birth	1,676	63.11197	7.583622	32.3	76.8
Freedom to Make Life Choices	1,675	0.733829	0.1441154	0.2575338	0.9851778
Generosity	1,622	0.0000786	0.163365	0.3363845	0.6777426
Perceptions of Corruption	1,608	0.7513152	0.1860735	0.035198	0.983276
Confidence in National government	1,530	0.4819732	0.1920585	0.0687687	0.9936044

Table 2.

UAE Statistics

Variable	Observations	Mean	Standard Deviation	Min	Max
Life Ladder	11	6.840	0.246	6.540	7.218
Log GDP per Capita	11	11.081	0.119	10.955	11.386
Social Support	10	0.866	0.029	0.824	0.912
Healthy Life Expectancy at Birth	11	66.509	0.311	65.920	67.100
Freedom to Make Life Choices	10	0.914	0.036	0.849	0.962
Generosity	8	0.072	0.087	-0.051	0.199
Perceptions of Corruption	3	0.299	0.083	0.203	0.355
Confidence in National government	0	-	-	-	-

Table 3.

Matrix of Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) life ladder	1.000							
(2) Log GDP per capita	0.780	1.000						
(3) Social support	0.707	0.688	1.000					
(4) Healthy life expectancy at birth	0.754	0.854	0.619	1.000				
(5) Freedom to make life choices	0.525	0.368	0.417	0.391	1.000			
(6) Generosity	0.208	0.001	0.069	0.053	0.352	1.000		
(7) Perceptions of corruption	-0.466	-0.377	-0.233	-0.361	-0.497	-0.321	1.000	
(8) Confidence in national	-0.092	-0.169	-0.171	-0.174	0.415	0.281	-0.433	1.000

government

Another interesting set of numbers to study is the coefficient correlations. As the matrix of correlations depicts, freedom to make like choices is positively correlated with life ladder, which measures happiness. Moreover, to further illustrate this positive relationship, we can construct the following scatter diagram;

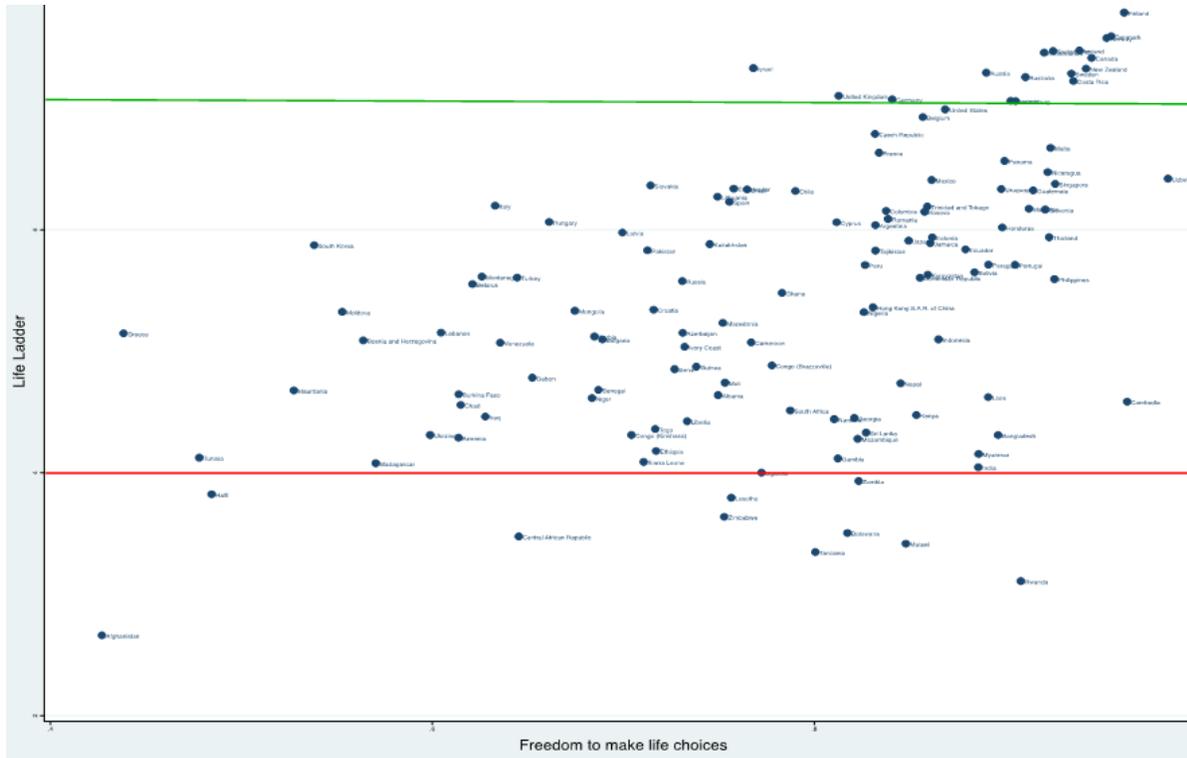


Figure 1. Scatter Diagrams of Freedom to Make Life Choices and Life Ladder (Data Points from Regression 2017)

From the scatter diagram, we can see that some countries are happier than others. The next step in our study of happiness is to conduct a regression analysis, or multiple regressions, to see which determinants of happiness are actually significant and which are not.

4. Econometric Model

The hypothesis I am testing is whether freedom to make life choices impacts our happiness. As my data is in the form of panel data, I test this hypothesis by running multiple regression approaches: heteroskedastic multiple linear regression, fixed effects model, time fixed effects model, random effects model, and finally, the tobit model.

The dependent variable I used to represent happiness is life ladder. Life ladder, in my dataset, is the national average answer to the question: “Please imagine a ladder, with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?” (Helliwell, Huang, & Wang, Statistical Appendix 1 for Chapter 2 of World Happiness Report 2019, 2019, p. 1). In this way, life ladder is ordinal in nature. More specifically, due to the fact that the happiness score is capped at a certain number, it is also censored in nature. As such, it is appropriate to use the tobit model. The following histogram illustrates this cap.

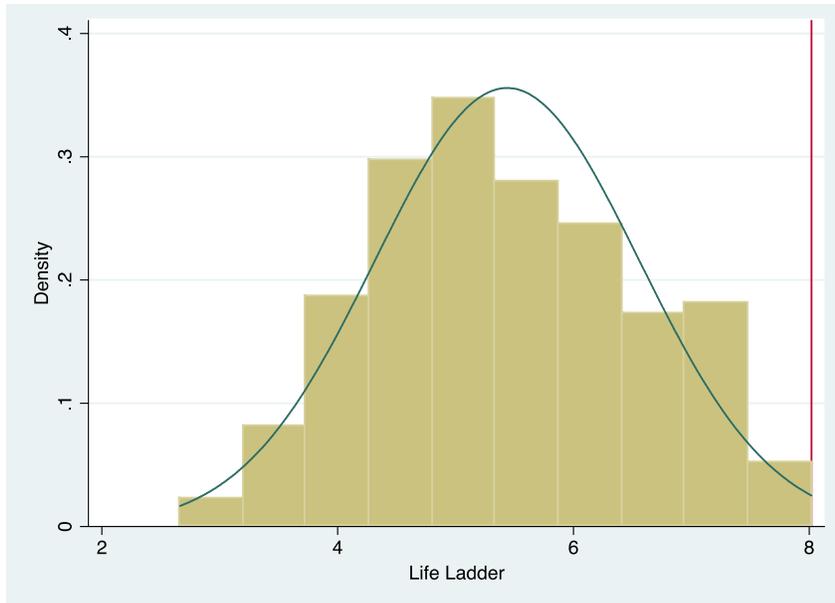


Figure 2. Histogram of variable ‘life ladder’

While I have previously defined the regressors, I have not outlined my expectations regarding their effect on happiness and the life ladder score. I believe that an increase in all the independent variables will increase the happiness score, except perception of corruption, which I believe will decrease happiness levels. To see whether my beliefs are true, we have to run the regressions.

5. Empirical Results

Table 4.

Regression Results with different models

	(1) OLS	(2) Fixed Effect	(3) Time Fixed Effect	(4) Random Effect	(5) Tobit
Log GDP per capita	0.294*** (0.03)	1.097*** (0.12)	1.034*** (0.14)	0.609*** (0.05)	0.609*** (0.12)
Social support	2.195*** (0.19)	1.420*** (0.22)	1.526*** (0.22)	1.782*** (0.21)	1.782*** (0.21)
Healthy life Expectancy at birth	0.026*** (0.00)	-0.045*** (0.01)	-0.048*** (0.01)	-0.009 (0.01)	-0.009 (0.01)
Freedom to make life choices	1.478*** (0.15)	0.500** (0.16)	0.584*** (0.17)	0.724*** (0.15)	0.724*** (0.15)
Generosity	0.736*** (0.11)	0.370** (0.14)	0.437** (0.14)	0.458*** (0.13)	0.458*** (0.13)
Perceptions of corruption	-1.049*** (0.11)	-0.180 (0.2)	-0.379 (0.21)	-0.456** (0.17)	-0.456** (0.17)
Confidence in National government	-0.872*** (0.11)	0.590*** (0.12)	0.479*** (0.13)	0.232* (0.12)	0.232* (0.12)
Constant	-0.579* (0.24)	-3.435*** (0.98)	-2.598 (1.36)	-1.351*** (0.38)	-1.351*** (0.38)
R ²	0.753	0.176	0.211		
dfres	1427	1278	1265		1164
BIC	2508.3	935.6	968.0		

Standard errors in parentheses

* p<0.05, **p<0.01, ***p<0.001

Since there are two panel data approaches, we have to utilize the Hausman test to establish which one we should rely on. According to the test, we reject the null that the difference in coefficients is not systematic; hence, we should rely on the fixed effects model.

Test: Ho: difference in coefficients not systematic

$$\begin{aligned} \text{chi2(7)} &= (b-B)' [(V_b-V_B)^{-1}] (b-B) \\ &= \mathbf{140.37} \\ \text{Prob>chi2} &= \mathbf{0.0000} \end{aligned}$$

Figure 3. Results of Hausman test

Further, by comparing the Bayesian Information Criteria (BIC), we can surmise that the model that best fits the estimation is the fixed effects model, as it has the smallest value. Now, we have to interpret the regressors' coefficients and study their significance.

All the coefficients are as expected except two. Before discussing the two anomalies, let's interpret the ones that are as expected. The coefficients for log GDP per capita, social support, freedom to make life choices, and generosity are all extremely significant, under all models. More specifically, with every additional one percent increase in GDP per capita, the life ladder score would increase by 0.011 points. Social support also increases happiness, but since it is defined as the average of a dichotomous variable, the interpretation will be similar to the interpretation of a log variable, as taking the average of a dummy transforms it into a proportion (Murray, n.d.). As such, every one percent increase in a country's social support will increase their life ladder score by 0.0142 points. In the same way, freedom to make life choice is interpreted as follows: every

one percent increase in a country's mean freedom will increase their life ladder score by 0.005 points.

The two problematic coefficients are confidence in national government and healthy life expectancy. For confidence in national government, the problem manifests itself in the form of a wrong sign, which is also highly significant. However, that problem is only present in the OLS model. After we used the fixed effects model, the coefficient assumed the sign we were expecting. The second problem arises in the coefficient of healthy life expectancy at birth. According to the literature and the positive correlation between it and life ladder, the sign should've been positive, but when we use the fixed effects model, it is negative (Ortiz-Ospina & Roser, 2017). While it would be exciting to uncover something new, it is more likely that this sign was negative because of deficiencies in the estimation: namely, omitted variable bias (Kennedy, 2002). One omitted variable could be a mental health measure. While healthy life expectancy measures the number of years lived from the perspective of being physically healthy, one of the dataset's and the regression's limitations is its lack of available measure for mental health, which is related both to life satisfaction and a person's lifespan. One more point of interest to note is perception of corruption's lack of significance.

6. Conclusion

To not lose sight of our purpose, we have to go back to the ultimate purpose of this empirical study: Does freedom of choice lead to more life satisfaction and happiness? From this study, we can conclude that there is such a significant positive relationship between the two. However, whether one causes the other is more difficult to prove. Moreover, in the process of my study, I encountered another potential point of interest: the relationship between life satisfaction

and healthy life expectancy. Unfortunately, there is a lack of explanatory variables that are related to the two, so further study is required to adequately elaborate on the relationship between them.

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