

## Guatemala and Libya: How the Harrod-Domar Growth Model Helped Define Economic Growth

**Jon West, Economics Major**

Department of Economics  
Metropolitan State University of Denver

**Kishore G. Kulkarni, Ph.D.**

Distinguished Professor of Economics  
Chief Editor, International Review of Business and Economics

### Abstract

*Since year 2020, growth in many developing nations has slowed down due to the advent of global Coronavirus. Though this global pandemic has recently exposed many global disparities and displayed the global social and economic injustices that create havoc on the developing world, this does not account for the disparities prior to 2020. Libya and Guatemala are two countries on the opposite sides of the world, yet they share many similarities in social and economic strife. Both countries have seen incredible political unrest, war, and a duality within society where the rich seem to get richer, and the poor cannot escape the level of subsistence. This paper addresses a brief political and economic history of each country and looks at how the Harrod-Domar theory of growth can explain the economic advancement, if any, each country has experienced over the last 25 to 30 years; as well as addressing if further progress can be made when looking at Harrod-Domar's and other neoclassical growth theories. The first section is an introduction and brief overview of Guatemalan and Libyan political rule and economic landscape. The second section addresses literature regarding both countries, as well as an introduction to studies based on the Harrod-Domar Theory. The third, method section defines the Harrod-Domar model as well as the data used for the conclusion. The fourth section includes the conclusion regarding if Harrod-Domar model was the best model to demonstrate growth in Libya and Guatemala.*

**Keywords:** Harrod Domar Model, Libya and Guatemala economies, Economic growth

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#### Introduction

Libya and Guatemala, though on opposite sides of the world have much more in common than a warm climate due to their respective latitudes. Each country has experienced large amounts of political unrest, low levels of economic growth and high levels of people living at, or below the subsistence level. The world bank stated that up to 60% of the Guatemalan population is living below the poverty line of \$4 US dollars per day (World Bank, 2015). Though data are not available for people living below the standard \$4 US Dollar per day level in Libya, the Borgen Project estimates this number to be around 33% of the population. With the current population of 6.777 million people (World Bank, 2019), that is over 2 million people living at or below the designated world poverty line. If that number is added to the roughly 10 million people (World Bank, 2019) living at or below subsistence in Guatemala, we can imagine how this pandemic has exacerbated the level of distress for these people and their governments, political systems and infrastructure. A brief history of each of country will better allow us to understand their current economic states.

Guatemala was home to the Mayan nation, dating back to roughly 300 B.C. Though the Maya were almost wiped out by the Spanish conquistadors who arrived in 1523, starting with Herman Cortes (nationsencyclopedia.com, 2010), Guatemala was able to claim independence in from Spain in 1821. Central America in general was made independent from the European ruling nation by 1824. After centuries of long rule of European settlers, Guatemala's government policies, its economy, and political affairs were addressed by multiple military style leaders (nationsencyclopedia.com, 2010). This changed in the election of 1945; Jose Arevalo Bermejo was the first elected president. Arevalo was the reform candidate and the populous believed he had specific plans to ensure economic growth of the Guatemalan state. Though Arevalo made progress with the local United Fruit Company and United States delegation, he was replaced by Jacobo Arbenz Guzman; Guzman introduced land reform that removed land from the ownership of the indigenous people and gave it directly to the United Fruit company, eliminating land ownership and prosperity for many of the agriculturally dependent people in Guatemala.

Data show that agriculture was as important to the economic landscape of Guatemala in 1954 (when the CIA helped overthrow Arbenz), as it is today; the United States Drug Administration (USDA) stated that in 2015, the value of bilateral agricultural trade between the US and Guatemala is close to \$3 billion US Dollars (USDA/FAS, August 2016). Though the USDA states that “Guatemala has a population of 16.5 million, as well as the largest middle class in Central America...The country continues to experience a vast rural to urban migration, with the urban population increasing from 5.6 million in 2005 to 8.5 million in 2015. In 2015, the country’s urban population exceeded the rural population, according to Global Insight. (USDA/FAS, August 2016).” The recent CAFTA trade agreement has given a clear path toward economic growth for Guatemala, but history of military government rule and guerilla warfare within the country have led to greater economic despair for its inhabitants.

Though the USDA claimed that a large middle class has developed in Guatemala in the last 30 years, data from the World Bank and International Monetary Fund show a much different perspective regarding the middle class. To discuss population well-being and growth, we must look at economic and human development regarding the Human Development Index, or HDI. The HDI, according to Todaro and Smith, has three specific components: an income index, a life expectancy, and an education index (Todaro, 2012). Though the income index, or per capita income has been a main factor in determining economic growth, we would be neglectful to not include education and health or life expectancy as inputs to overall growth, or development.

Libya has a population that is close to the size of Guatemala at 6.8 million and 16.6 million people, respectively (World Bank, 2019). Both countries have had military rulers and a government that has been marred by corruption or protectionist trade policies. Though these similarities exist, the last 70 years have been vastly different for Libya. Libya was a part of an empire that was broken up after World War II, and according to Najeb NH Masoub, went through a period of growth in the 1950’s that would have stagnated if not for the discovery of oil and the commercial sale of the country’s most abundant resource 1961 (Masoub, 2013). In 1969, Colonel Muammar al-Ghaddafi overthrew the government in a bloodless *coup d’etat* and introduced socialist ideals to the newfound “Oil-State” of Libya. Under his rule, the per capita GDP increased to roughly \$11,000 US dollars per person (Wikipedia.com, 2021). Though this newfound growth rate from oil deposits increased the GDP at an average rate of 22.6% from 1955 to 1969 (Masoud, 2013), this growth would not continue with the oil crash and embargo of 1973. Libya has seen multiple economic and social repercussions due to Ghaddafi and his regime, and after multiple embargo’s, attempted *coups*, and political unrest, he was overthrown in 2011. GDP was shown to have dropped sharply in 2011, though it rebounded in 2012 (datacommons.org, 2019).

Though Libya and Guatemala share commonalities in political history regarding military rule, the low economic well-being for a large percentage of both populations is a trait they share, and this paper aims to demonstrate these values using the Harrod-Domar growth equation. Now that a brief political and resource history of Guatemala and Libya has been addressed, we want to focus the remainder of the paper on the Harrod-Domar growth model, and how it relates to savings and investment within each country. WillamC. Smith (2010) believed that “the Harrod-Domar model has become the most widely used economic growth perspective in history due to its simplicity, resiliency, and ability to evolve (Smith, pp.48, 2010). In the conclusion, this paper addresses if the Harrod-Domar model properly explains growth, or if it is not sufficient to explain the current economic condition of each country. In the next section, we carry out the literature review on this topic.

## Literature Review

According to Choukhi, the price of oil is the most influential factor in GDP growth for Libya (Choukhi 2009). “The Role of Oil Price in an Exporting Country: An Empirical Study of the Libyan Economy,” addresses the output of Libya and its oil production up until in 2008. Being that Libya is a member of the Oil Producing and Exporting Countries or OPEC, it has a quota of 1.5 million barrels per day. Choukhi stated that Libya exported 85 percent of the oil that it produced in 2003, which represented 97 percent of the nation’s exports and 42 percent of the country’s GDP (Choukhi 2009). “Some 60 percent of the oil is produced by subsidiaries of the state-owned National Oil Company (NOC), the main oil company in Libya. (Choukihi, pp. 175, 2009). The primary information drawn from this paper is that oil prices directly affect real prices within the economy, and oil prices have a direct relationship with growth. Choukhi shows that the problems of the Dutch Disease are apparent and can lead to appreciation in the real exchange rate. In the concluding remarks, the author indicates that “the decrease of economic activity is largely dependent on oil price changes (Choukhi, pp. 184., 2009).”

After addressing the effects of oil price on the Libyan economy, addressing the historical background of Libya via “A Review of Libyan’s Economy, Structural Changes and Development Patterns” sheds light on the economic policies and the dependence Libya has placed on its oil reserves and recovery.

“Libya, like many countries, had long suffered from deficiencies in the economy, especially in areas such as inflation, balance of payment deficit, low rate of employment and growth, all of which has created imbalance in the economy (Masoud, pp. 1, 2013).” This quote sums up the Masoud’s findings, directly showing that from 1961 and the first commercial sale of oil, that fossil fuel resources have been the primary source of income for the Libyan economy. This paper addresses that government officials have attempted economic reform multiple times due to issues with the correlation between economic growth and the price of oil. The Libyan economy grew rapidly in the 1960s and 1970s, up to 10% GDP growth per year, but then it slowed in 1973 and the 1980s due to political strife, embargos and war. Since the embargos lifted in 2003, the government has done its best to reform and grow with new and renewed alliances and more free market trade (Masoud, 2013).

If oil is such an important factor for Libyan economic growth (Masoud, 2013), and oil accounts for 97 percent of Libya’s exports (Choukhi, 2009), how can oil production be increased? Kouramoudou Keita and Hannu Laurila (2021) demonstrated how corruption within the government and tax burdens affects the total factor production of economy. Corruption is a valid factor when discussing economic growth, specifically when discussing Libya and its past corrupt leader Ghaddafi, an individual that supported Cuba and multiple other insurrections by communist and socialist parties (businessinsider.com, The Oil Drum, 2011). Corruption was not unique to Libya’s rulers, Guatemala had to deal with years of guerilla warfare due to the US intervention into political affairs and attempted *coups* (britannica.org, 2021). The empirical article by Keita and Laruila demonstrated that tax burden as well as corruption each had a significant, negative effect on Total Factor Production, or TFP, but only when ran separately in the regression. When the relationship was tested, tax burden eased the effects of corruption of the economic growth within the economy.

To increase TFP, another option is addressing the FDI, or Foreign Direct Investment within a country’s economy. Issouf Soumare addressed if FDI in North African countries led to improved economic development; the paper demonstrated that FDI led to increased GDP per capita as well as increased values regarding the Human Development Index and welfare improvements for the population of Libya with a higher rate of FDI inflows (Soumare, 2015). Soumare, like Todaro and Smith, defines the HDI as having three components regarding human development: health, education and standard of living, or GDP. “As a check and to ensure robustness, we also use an alternate welfare measure common to the literature; real GDP per capita (Soumare 2015). The author found a “strongly positive relationship between FDI and welfare improvements (Soumare, pp. 5532. 2015).

Foreign direct investment may have proven positively correlated and significant regarding north African countries, but Libya has had little FDI over the years due to the country’s contentious relationship with the Western world (datacommons.org, 2019). Another example of a form of investment that is pertinent possibly in Libya, but much more in Guatemala is remittances, which are direct inflows of capital from expatriates. Remittances account for a large portion of the GDP of many Central American countries, and a large amount within Guatemala. Remittances are estimated to be at 10% of the GDP for Guatemala, or \$5.8 Billion US dollars according to the World Bank report of 2014 (World Bank, 2014). This report addresses many of the economic hurdles to the reduction of poverty and despair within Guatemala; it indicates that though some aspects of the HDI have improved, such as education and healthcare within the urban regions, there is still a large disconnect between economic growth and poverty reduction (World Bank, 2014).

The World Bank as well as the International Monetary Fund (IMF) have addressed this disparity in many papers addressing the economic and human welfare of the people of Guatemala. The IMF country report of Guatemala in 2018 stated that “income per capita over the past decade has grown at an average rate of 1.2 percent, a rate that is insufficient to meaningfully remove Guatemala’s high level of poverty (currently at 60 percent of the population).” (IMF Article IV Consultation 2018).” The conclusion of this IMF report was to increase taxes and raise government spending, but also, that this must be accomplished by utilizing the correct factors of production, more specifically, the factors that will raise human capital and welfare at the greatest rate. One way to ensure an increase in government spending is to raise taxes. One of the best ways to increase taxes revenue without increasing tax rates, is increasing total production. Therefore, growth must occur within the private and public sectors. We need to increase the savings and investment rates to increase the economic welfare of Guatemala, this is where the Harrod-Domar model and literature becomes the most important for this study as it can be applied to both countries.

The Harrod-Domar model of savings, investment and the “financing gap” are addressed by Kulkarni and Westerberg (2005). The model they created “essentially...calculates the investment required for a target growth rate. The gap between the required investment and the available resources will then be the financing gap, which can be filled by foreign aid (Kulkarni and Westerberg, pp. 101, 2005).

” Westerberg and Kulkarni reviewed literature that focused directly on policy aid effectiveness, and in this paper, addressed endogenous factors that would affect how effective this foreign aid would be. These factors are: Microeconomic Policies (monetary and fiscal), Structural Policies (infrastructure such as roads), Public Sector Management (services for the private sector), and Social Inclusion (how inclusive the policies are for the entire society.) (Kulkarni and Westerberg 2005). This paper demonstrates that corruption and misallocation of resources can lead to low economic growth. “The internal characteristics of many developing countries have unfortunately led to irresponsible and corrupt political leaders who are unable, or unwilling, to control the flow of aid into the country (Kulkarni and Westerberg 2005).

The idea that economic inflows will create economic growth only in countries with sound fundamentals is also addressed in the paper by Will Smith (2012). After deriving the Harrod-Domar growth equation as did Kulkarni and Westerberg did, and addressing the fact that countries with sound government policy focus (Kulkarni and Westerberg, 2005), Smith addressed how to calculate projected growth rates by using the gross capital formation percentage instead of the savings rate (which can be hard to differentiate within an economy). In this paper, we will attempt to use the same method of calculating growth by utilizing the capital growth formation of Libya and Guatemala to see if the projected GDP per Smith will match the actual GDP, therefore confirming the relevance of the Harrod-Domar model for explaining the growth of the economies of Guatemala and Libya.

### Method and Results

The Harrod-Domar growth theory has been used countless times to define growth in developing countries; therefore, Smith defined the Harrod-Domar theory as “resilient in the past 50 years; its evolution has led to multiple applications and an engrained presence in all financial development institutions. (Smith,2010)”

In the Harrod-Domar theory, there is a direct relationship between capital stock (K) and total GDP (Y). This ratio is referred to as the capital input ratio. The capital input ratio is a constant number that will not change in this equation; it defines how much input of capital stock is required for each unit of GDP output. We will define this ratio, the change in capital stock to change in GDP as (j); or  $\Delta K/\Delta Y=j$ .

The next assumption is that not all GDP is utilized for manufacturing, inventory, or machinery and maintenance, or that some proportion of the GDP is saved, or (s). If we consider a certain proportion of GDP is saved, it will be (s).

$C=cY$  – this equation is the marginal propensity to consume, also known as the consumption ratio of the economy.

$$S = Y - C$$

To get the savings ratio, we know that  $C = cY$ , therefore:

$$S = Y - cY = (1 - C)Y, \text{ therefore:}$$

$$S = 1 - C$$

$$S = sY - \text{this is the savings function}$$

The production side of the Harrod-Domar equation is as follows:

$$\text{Capital} = K$$

The capital output ratio, or (j) is the change in capital it takes for change in GDP – this is assumed to be constant. For (j) to be constant,  $\Delta K/\Delta Y$ , must be constant. The change in capital investment, or  $\Delta K$ , will be equal to real investment in the economy, denoted by (I); therefore

$$\Delta K = I. \text{ Also, because of this inference, } j = I/\Delta Y, \text{ or } I = j(\Delta Y).$$

On the production side, we are also assuming that real interest rates are fully flexible, so that savings directly equals investment; or  $S = I$ . If  $S > I$ , then the interest rate will decrease to reach equilibrium, and the opposite is true.

The savings function is  $S = sY$  and the economy’s investment function is  $I = j(\Delta Y)$ . Therefore, the savings rate of GDP = capital input ratio (change in GDP), or  $\delta Y = j(\Delta Y)$ .

Or  $\Delta Y/Y = \delta/j$ ; the percentage change in GDP is equal to the savings rate in terms of the “constant” capital input or capital stock ratio. This data replicates Smith regarding testing the Harrod-Domar model; to calculate the expected GDP growth of Guatemala and Libya, we utilize the gross capital formation as a percentage of GDP (Smith 2010), this is used as a measure of total investment in capital. Again, following Smith’s lead, we will calculate the GDP per capita growth rate for both economies, which Soumare proved that an increase in this value demonstrates economic growth within said country (Soumare, 2015).

So  $\Delta Y/Y = \delta/j - p$ , we then utilize the gross capital formation percentage for the savings rate, or  $\delta$  (Smith, 2010). In Guatemala for 2000  $\delta = 17.835$  and GDP growth is 3.61 percent, therefore our capital output ratio, ( $j$ ), is  $17.835/3.61$  or 4.94. This will be our constant rate, or 4.94 units of capital produce one unit of GDP. Please see the data tables and graphs below showing the expected GDP versus the recorded GDP for years 1990 through 2008. The values for Libya for the year 2000 are  $\delta = 11.637$  and GDP growth was 3.7 percent, therefore the capital output ratio, ( $j$ ), is  $11.637/3.7$  or 3.15.

Figure 1 shows the GDP Growth Rate, per capita, for Libya from years 2000-2008. Figure 2 indicates the population growth within Libya from 1990-2008. Figure 3 is the GDP growth per capita in Guatemala while figure 4 shows the population growth in Guatemala in that same time period. Figures 5 and 6 are graphs showing the World Bank data regarding the Gross Fixed Capital Formation that we utilize for investment in the model.

**Table 1 Capital Output Ratio for Libya and Guatemala**

Libya

	S	J	P	$f(x) = (s)/(j)-(p)$
1990	13.87	3.7	2.5	1.248649
91	11.52	3.7	2.4	0.713514
92	10.56	3.7	2.3	0.554054
93	16.12	3.7	2.2	2.156757
94	16.27	3.7	2.1	2.297297
95	11.66	3.7	1.9	1.251351
96	13.47	3.7	1.8	1.840541
97	11.91	3.7	1.6	1.618919
98	10.96	3.7	1.5	1.462162
99	9.21	3.7	1.5	0.989189
2000	11.64	3.7	1.5	1.645946
1	10.46	3.7	1.6	1.227027
2	12.94	3.7	1.6	1.897297
3	8.95	3.7	1.6	0.818919
4	13.96	3.7	1.6	2.172973
5	15.17	3.7	1.5	2.6
6	20.79	3.7	1.5	4.118919
7	25.69	3.7	1.5	5.443243
8	29.83	3.7	1.4	6.662162

	S	J	P	$f(x) = (s)/(j)-(p)$
1990	13.6	4.94	2.7	0.053036
91	14.3	4.94	2.7	0.194737
92	18.33	4.94	2.6	1.110526
93	17.25	4.94	2.6	0.891903
94	15.68	4.94	2.5	0.674089
95	15.05	4.94	2.5	0.546559
96	12.69	4.94	2.4	0.168826
97	13.69	4.94	2.4	0.371255
98	17.4	4.94	2.4	1.122267
99	17.35	4.94	2.4	1.112146

2000	17.84	4.94	2.4	1.211336
1	19.66	4.94	2.4	1.579757
2	20.55	4.94	2.3	1.859919
3	20.3	4.94	2.2	1.909312
4	20.85	4.94	2.1	2.120648
5	19.74	4.94	2.1	1.895951
6	20.82	4.94	2	2.214575
7	20.83	4.94	2	2.216599
8	16.4	4.94	1.9	1.419838

Figure 1 shows that GDP per capita in Libya had a great decline from 2000 to 2002, primarily due to sanctions against Libya and its ruler, Ghaddafi. As Muammar accepted more responsibility for known terrorist attacks and attempted to resolve Libya's economic and diplomatic relationship with the European Union and United States in 2003, Libya's per capita income increased dramatically, as shown in figure 1. By 2004, President George W. Bush lifted all economic sanctions on Libya, just as the European Union had done; this is represented by the sharp incline in GDP from 2003-2005. This would not alleviate all economic turmoil, though positive trade relationships increased, the world would soon experience the effects of the Great Recession.

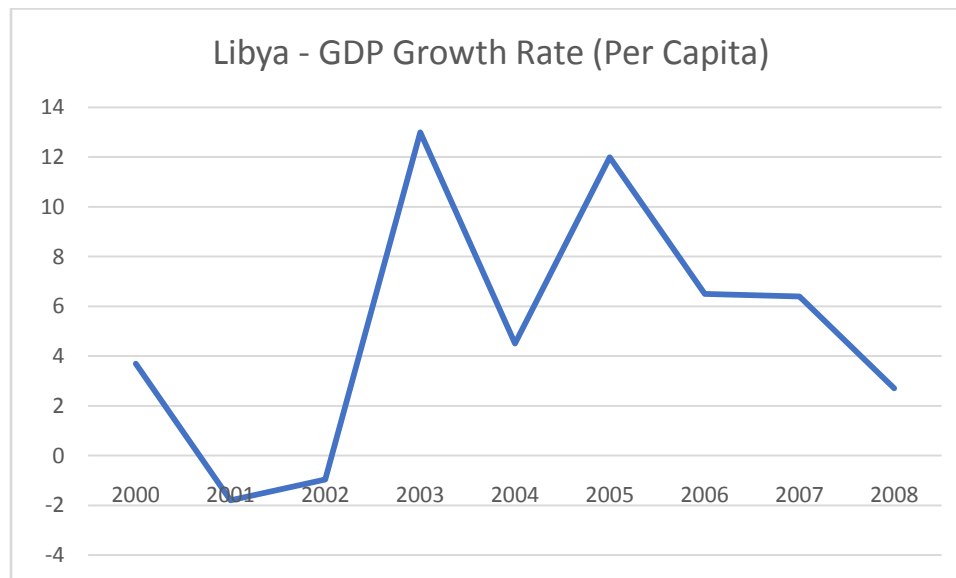


Figure 1 : GDP Growth Per Capita in Libya from 2000-2008

Source:

[https://datacommons.org/tools/timeline#&place=country/LBY&statsVar=GrowthRate\\_Amount\\_EconomicActivity\\_GrossDomesticProduction](https://datacommons.org/tools/timeline#&place=country/LBY&statsVar=GrowthRate_Amount_EconomicActivity_GrossDomesticProduction)

Figure 2 demonstrates how Libya has developed a decrease in population growth since the 1980's. Though there were small rebounds in the percentage growth in 2001-2004, this ratio decreased further from 2005 on.

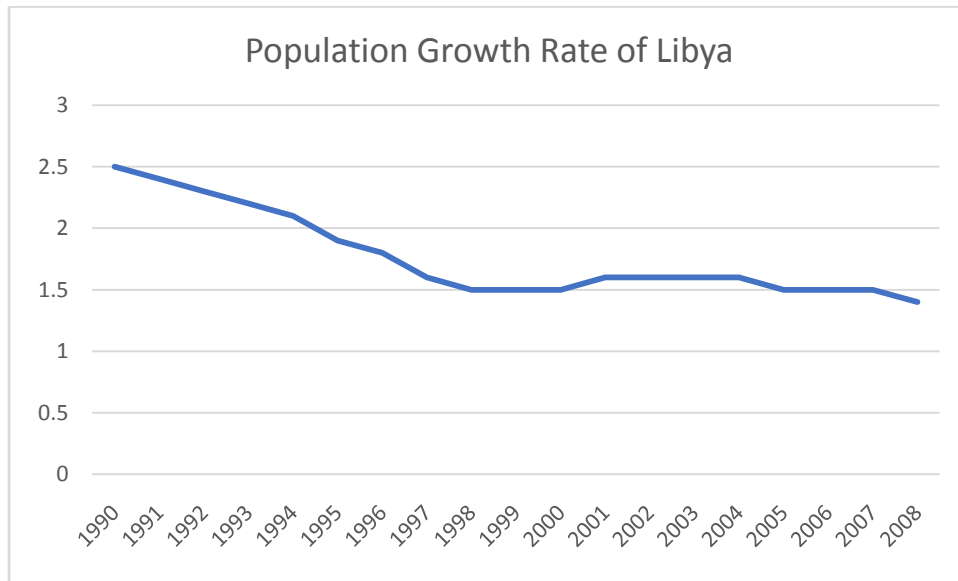


Figure 2: Population Growth Rate in Libya from 1990-2008

Source: [https://datacommons.org/tools/timeline#&place=country/LBY&statsVar=GrowthRate\\_Count\\_Person](https://datacommons.org/tools/timeline#&place=country/LBY&statsVar=GrowthRate_Count_Person)

Figure 3 shows GDP growth in Guatemala from 1990 to 2008; though large fluctuations in this average, it does not show the depth of dualism within the society. Though the GDP per capita remains close to \$3,500.00 per year, the disparities between the wealthy urban, and poor rural sectors are not represented. Many of these fluctuations can be attributed to increased remittances, trade realtion increases, etc.

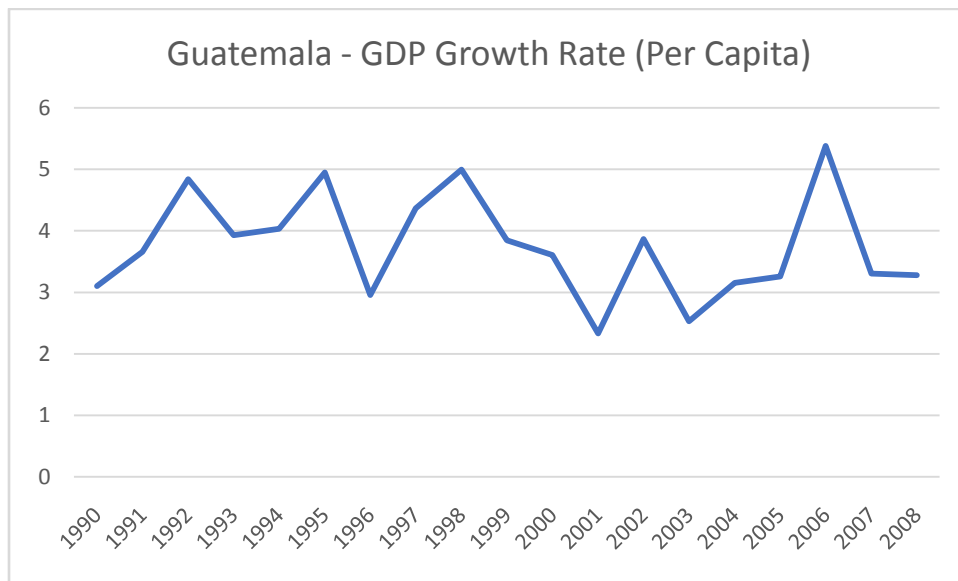


Figure 3: GDP Growth Per Capita In Guatemala from 1990-2008

Source: <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=GT>

Figure 4 shows the population growth rate with Guatemala from 1990-2008. We saw large fluctuations regarding GDP per capita during these years, but with a decreasing growth rate, one would expect to see less volatility in the GDP per capita during this time, with fewer dependents within the Guatemalan economy.

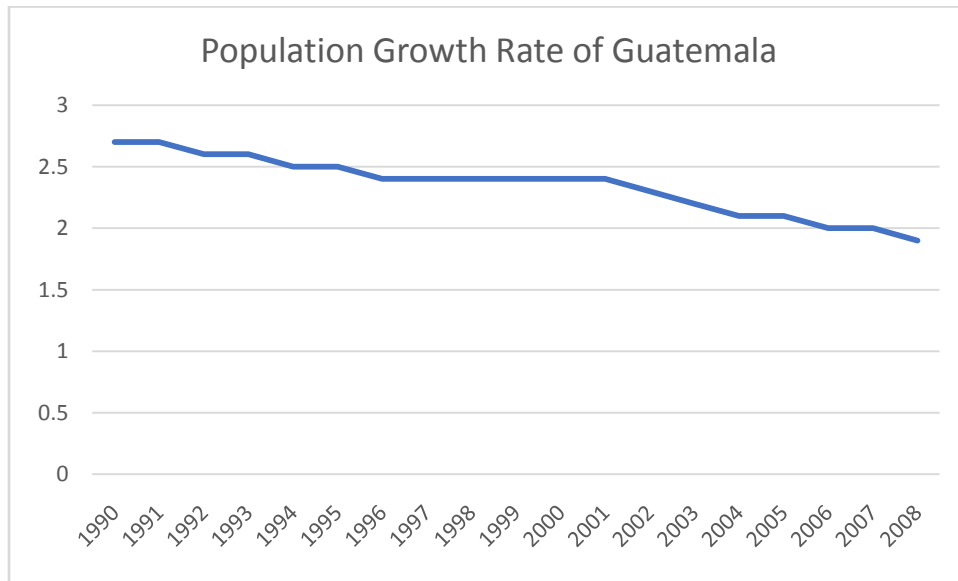


Figure 4: Population Growth Rate in Guatemala from 1990-2008

Source: <https://data.worldbank.org/indicator/SP.POP.GROW?locations=GT>

The gross fixed capital formation is shown for both countries in the following two figures. Figure 5 shows that from 2003 onwards the Libyan influx of fixed capital formation increased from 10% to 25% of her GDP.

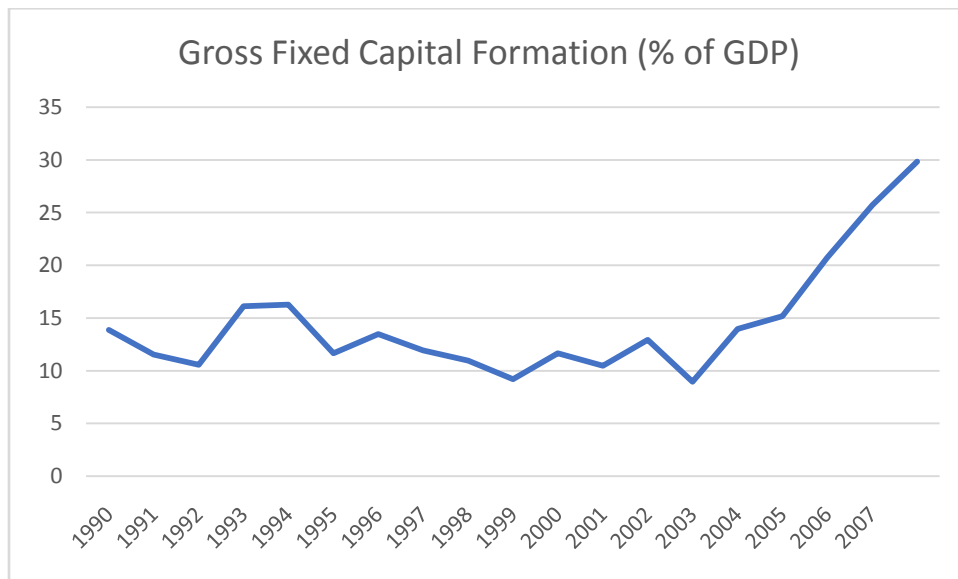


Figure 5: Growth Fixed Capital Formation in Libya as a Percentage of GDP

Source: <https://data.worldbank.org/indicator/NE.GDI.FTOT.ZS?locations=LY>

The following table shows that the gross fixed capital formation as a percentage of Guatemala’ GDP has steadily increased in the long run, but has some severe fluctuations in the short run such as in 1990s. In recent years like from 2005-2008 there has been a drastic decline from 20% to 18% due to political turmoil.



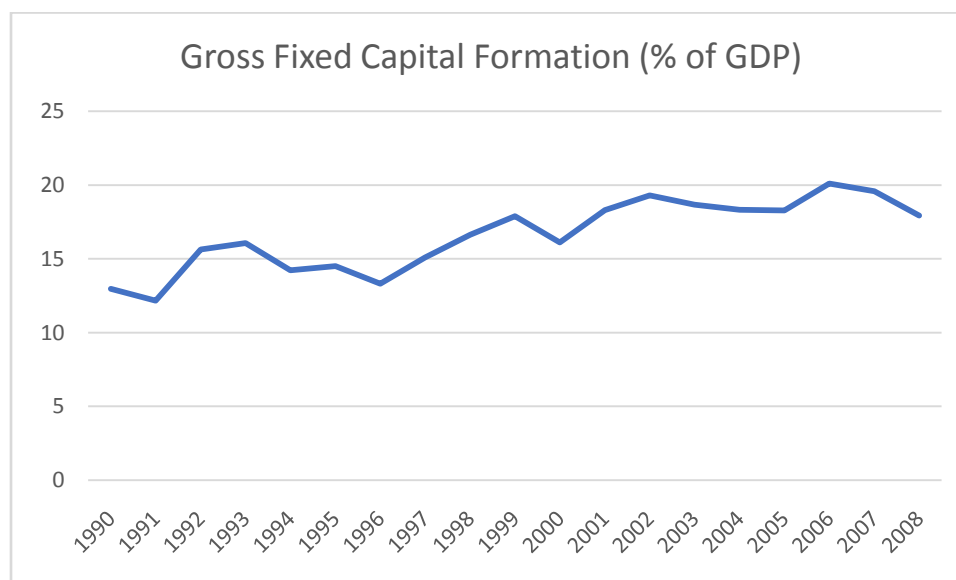


Figure 6: Gross Fixed Capital Formation in Guatemala as a Percentage of GDP

Source: <https://data.worldbank.org/indicator/NE.GDI.FTOT.ZS?locations=GT>

### Conclusion and Summary:

Though Libya and Guatemala have had political interference that has led to economic setbacks, they have seen GDP per capita growth over the last 25-30 years. Much of this growth is dependent on oil prices and stability within the political and global realm for Libya, while GDP per capita growth for Guatemala seems dependent upon international trade agreements, foreign direct investment as well as an increase in their savings rate.

Libya has shown that GDP per capita will increase when trade agreements and political unrest are at their lowest levels as their economy is based on the price of oil, as Choukhi demonstrated (Choukhi, 2009), this is shown in the graphs with large spikes of GDP per capita growth in 2004-05 when the worldwide embargos were lifted.

The data from the World Bank show that Guatemala can increase its GDP per capita with increased trade agreements, such as CAFTA, though their gross capital formation amounts have declined since the agreement.

The Harrod-Domar model, which essentially demonstrates that for an economy to grow, it must increase its savings rate, has shown that it is valid to show the growth rates within Guatemala and Libya, it is not sufficient, which was also recognized by Smith (200.), Kulkarni and Westerberg (2005), as well as Soumare when looking specifically at direct foreign investment. By using the method set forth by Smith (2010), it looks like the Harrod-Domar model is a good representation of growth for both countries, when we consider the savings ratio (Gross Capital Formation), the capital output ratio and subtract population growth. The values represent slow growth for Guatemala from 1990-2000, and a great increase in GDP per capita growth in Libya after the embargos were lifted in 2003-2004.

Though the Harrod-Domar explains some of the growth of each country, the Human Development Index and welfare are the focus of the International Monetary Fund and the Borgen Project to alleviate the burden of poverty within each state (IMF 2018, borgenproject.org). As Kulkarni and Westerberg pointed out, “aid only stimulates growth in countries with sound economic policies. (Kulkarni and Westerberg, 2005). Guatemala and Libya each need to increase their government efficiency as well as trade agreements in order to improve the welfare of their vast numbers of impoverished people, as the Harrod-Domar model is not sufficient to address the changes needed to help people out of subsistence levels.

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