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### Analysis of Poverty Trap Caused by Contagious Social Norms

As proposed in the simplest yet the most prevalent model in the Economics textbook, the view toward the global economy is optimistic. According to the Solow Diagram, all countries will eventually converge into an equilibrium, regardless of its initial state in the process. To extend further into a specific context, the “convergence hypothesis” explains that third-world countries with underdeveloped economies per capita are more likely to grow at a faster rate than those with more flourished economies. However, the reality does not suggest that this is a promising future.

According to the World Bank, the world poverty rate in 2015 is approximately 10 percent, which seems to be a remarkable improvement from 36 percent poverty rate in 1990. But the fundamental problem still persists – the problem is that although the APAC region, Europe, and Central Asia have reduced extreme poverty population by 54 million people, the number of people living in poverty in Sub-Saharan Africa has increased by 9 million, with 413 million people living on less than US\$1.90 a day in 2015. As Percy Bysshe Shelly stated in “A Defence of Poetry”, the rich have become richer and the poor have become poorer.

Recent decades have witnessed the general public growing an interest in international organizations and in issues related to global poverty. Among many continents, Africa is the labyrinth of the poverty trap. Endless war, corrupted authorities, or lack of necessities are common phenomenon in the continent. The worse thing is that those “poverty traps” drag African nations even further down. Kiminori Matsuyama defines the term as “a self-perpetuating condition where

an economy, caught in a vicious cycle, suffers from persistent underdevelopment” (Matsuyama 2008).

The concept of poverty trap is not only a fiscal and economic risk for our global community. By examining closely with deep scrutiny, we can see that the inhabitants of the impacted regions are severely limited in their hopes of establishing a stable life that properly compensates their labor, therefore enabling to support their family. Also, the impact of the poverty trap is detrimental to the growth of the nation, as high government officials turn a blind eye to the situation for their personal benefits and let the corruption slide unnoticed. The lack of literacy and education fools the people into being the victims of the poverty trap. As this, the immorality of the poverty trap and the chasm between the poor, rich, and the middle class is somehow justified and accepted.

Through the integration of academic literature, I am going to prove the existence of poverty trap in Sub-Saharan Africa caused by inherent social norms that are deeply embedded in their cultures (Matsuyama 2008). The first section is about a basic conceptual framework behind the poverty trap and also a mathematical model to concretize the phenomenon. Then, the following sections will introduce and apply real world examples and examine the mathematical model based on the quantitative data. Finally, the paper will conclude with a proposal of possible solutions to the phenomenon.

### **Basic Framework behind the Poverty Trap**

This section intends to explain basic assumptions and the theoretical framework behind the poverty trap. The first exemplary situation is caused by high fertility rate and low human capital ability. From a simple Cobb-Douglas production function, output  $Y_t$ , is determined by the capital today,  $K_t$ , and  $(hl)_t$ . The population growth curve is in the form of a Sigmoid function that has the characteristic of an S-shape. The population growth is determined by initial population,  $L_0$ ,

and population growth rate,  $r$ , and the time passed after the initial time point. Consequently, when the population reaches the carrying capacity, the population oscillates around the carrying capacity,  $C$ .

$$Y_t = AK_t^{\frac{1}{3}}(hL)_t^{\frac{2}{3}}$$

$$K_{t+1} = K_t(1 - \delta) + (Y_t - C_t)$$

$$C_t = f(N_t)$$

$$N_t = C \frac{e^{rt}}{C^2 + e^{rt}}$$

$$N_t \cong L_0 e^{rt} \text{ during the "peak" growth}$$

$$N_{t+1} \approx N_t e^r$$

Now, the output per capita,  $\frac{Y_t}{N_t}$ , will increase if and only if  $dY > dN$ . If  $\frac{Y_t}{N_t} = \frac{Y_{t+1}}{N_{t+1}}$ , then we are implicating that the country is at the steady state level. Otherwise, the country has decreasing GDP per capita. The problematic part of the population function being exponential during its “peak” moment is that if the country’s output growth could not follow the growth in population, it would fall in to a vicious cycle of self-perpetuating condition of decreasing output per capita, so called the poverty trap. It is also important to note that the saving is related to output and consumption and consumption is highly related with population. As newborn babies do not have an ability to produce an output, only consumption increases in the short term. Furthermore, less saving produces less capital tomorrow, then even less growth in output tomorrow.

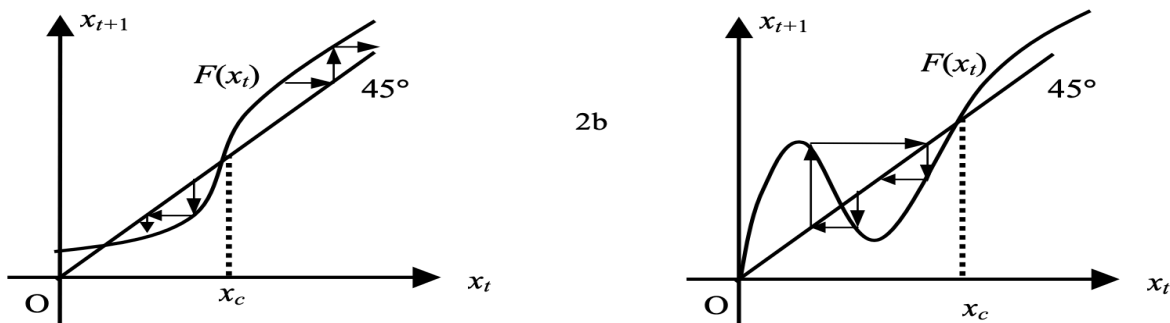


Figure (1)

Another variable of poverty trap is the contagious social norms that influence the inhabitants of the region. An individual's income simply can be represented as the capital today,  $K_t$ , and productivity rate of an individual with a capital,  $A$ . Savings for today,  $S_t$ , is the difference between the earnings today and the cost today. Tomorrow's capital is the depreciated capital today plus savings today. However, an individual is required to pay bribe,  $B_t$ , with probability  $p$  in the corrupted regions. This setting is unique in that one does not gain more from the bribery. If one refuse to pay the bribe, he cannot continue his economic activity. Now, one's new earnings,  $NE_t$ , can be written as an expected value with a given probability.

$$\begin{aligned}
 E_t &= AK_t \\
 S_t &= E_t - C_t \\
 K_{t+1} &= K_t(1 - \delta) + S_t \\
 NE_t &= p(AK_t - B_t) + (1 - p)(AK_t) = AK_t - pB_t
 \end{aligned}$$

With  $p$  low or  $B_t$  low, one's new earning would not be different from that of the original setting. However, citizens in third-world countries tend to earn low due to small capital. Therefore,  $pB_t$  would cause a relatively large impact to the earnings since  $AK_t$  is small. With the addition of  $pB_t$ , one now has  $E_t$  lower than  $C_t$ . Negative savings, in fact borrowing, lowers the capital tomorrow and negatively affects the earnings for tomorrow. With lower earnings tomorrow, one would have even lower earnings the day after tomorrow. Consequently, one would fall into the cycle of poverty trap due to corruption and neglect.

Since it is difficult to capture the aforementioned microeconomic poverty trap, we instead look for macroeconomic situations of social norms that induce the poverty trap. From a macroeconomic view, corruption, or bad governance, has a negative correlation with internal instability of a country that often cause disputes between parties and political institutions. As Paul Collier states in his book *The Bottom Billion*, underdeveloped countries tend to have a high

possibility of facing an internal war. A country's economy growth has a positive correlation with reducing the probability of facing an internal war. But whenever a country faces an internal war, a country's growth is reduced by a certain amount. With the reduced growth, a country now has higher probability to face another war. Then the country enters a self-perpetuating cycle of the poverty trap. In this situation, a country's initial state of a governance and finance is the most important factor. The poorer and the more corrupted an initial state the country is in, the higher the chance of facing national destruction. The higher the chance of facing war means the higher likelihood for a country's growth to diminish in the form of a capital destruction or withdrawal of a foreign investment.

We have observed a basic framework behind the poverty trap in multiple situation. Now, the following section will introduce possible evidence of poverty trap caused by the contagious social norms in the real.

### **Contagious Social Norms**

As a way of eliminating prevalent corruption, more than 40 African countries, have adopted the multi-party system and periodic elections. However, the multi-party system that should benefit all citizens, is only lucrative for the benefit of the high authorities. The system is mainly used as a mean to distribute power among the upper class. As we can observe from the recent rejection of Nigeria's opposition leader to the election outcome, the elites often disobey the core value of democracy and attempt to distort the reality to whatever comes to their convenience.

In result, the corruption and rent-seeking phenomenon that derives from what is stated above leads to unescapable poverty and a failure to regulate social order. To extend further, this may become a valid starting point for an internal civil war, leaving many homeless in their own country. These wars within the country is likely to increase political instability, therefore bearing

an even higher poverty rate and social injustice. According to Collier, third-world countries with underdeveloped economies have a 14% rate of facing the danger of military activity every five years. Also, if a country's economy grows by 3%, then that rate decreases from 14% to 11%. In contrast, if the economy falls by 3%, the rate is found to increase by 16%. These military activities within the country stalls growth by 2.3% annually, so an ongoing dispute of seven years would bear 15% of growth decrease. Also, he argues that these activities do not explicitly bear but imply a negative influence on the economic growth of the nation, especially when capital and potential investors turn away from the country due to their social and political instability. We are going to examine the importance of a governance by comparing Democratic Republic of Congo to Tanzania which had a successful transition from corrupted governance to a genuine democratic system.

According to the Corruption Perceptions Index given by Transparency International, Democratic Republic of Congo (D.R of Congo) is the seventh most corrupted country in Africa. Corruption in Congo is very prominent, that the word "Kleptocracy" was even coined after a formal dictator of Congo, Mobutu Sese Seko, who looted the country's wealth for personal use. Also, Congo has a high Gini index (World Bank estimates 2011) of 48.9, which places them as the 16<sup>th</sup> most unequal country in the world. On the other hand, Tanzania has a fairly moderate Gini index of 37.8 and corruption perception index compared to Congo and other countries in the Africa. Two African countries share a similar initial state. From 1960 to late 1990s, Congo had faced 9 wars involving Congo which includes the famous Rwandan Civil War, First Congo War or Congo Crisis. Even though Tanzania had only faced 2 wars during the same time period, the duration of a war lasts for 17 years which did affect similar as going through 9 wars. From figure (2), it is visible that the impact of civil war clearly stands out in the Real GDP per capita. As any

underdeveloped country does, their population has constantly and exponentially increased through the periods. However, due to the detrimental and cyclical impact of a war that is discussed in the Abstract, their real GDP per capita had constantly decreased over time. Then the difference became quite apparent when Tanzania changed its system to have multi-party politics. After 1995, when President Benjamin Mkapa was elected as president in Tanzania's first multi-party election, re-elected for a second term and declared a war against corruption, Tanzania hit a turnover for the Real GDP per capita growth. On the other hand, D.R. of the Congo is still suffering from repeating trap of major and minor wars, and the destructive influence of wars that cause another one.

Other than the Real GDP per capita, the inflow of foreign investment also receives huge influence from the poor governance. Figure (3) shows data from the IMF that shows the amount of direct foreign investment and net inflows. Compared to Tanzania, D.R. of Congo has few periods with higher net inflows from foreign investors. The only problem is that the amount of foreign investment lacks consistency. During a period of financial crisis in 2008, the investment dropped from 1.7 billion dollars to negative 242 million dollars. The main reason for the sudden outflow of the investment is due to the political and social instability of Congo. Tanzania, which showed more national stability, has less variance between the amount invested, thus proving better ability to utilize the investment.

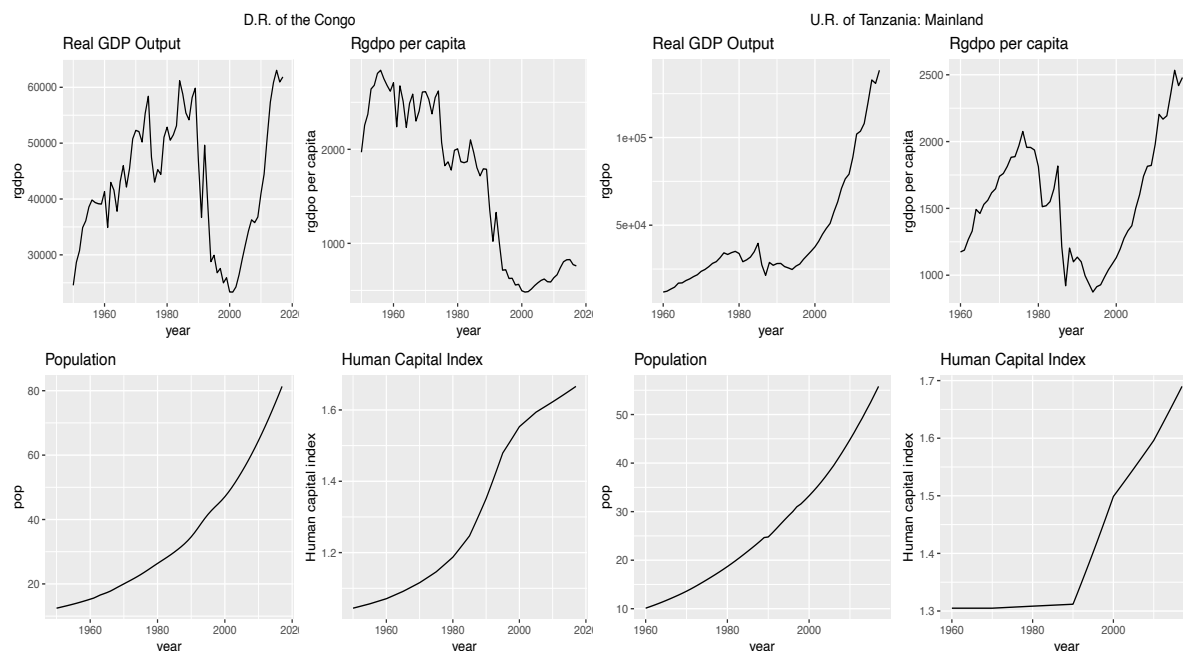


Figure (2) Data from Penn World Table

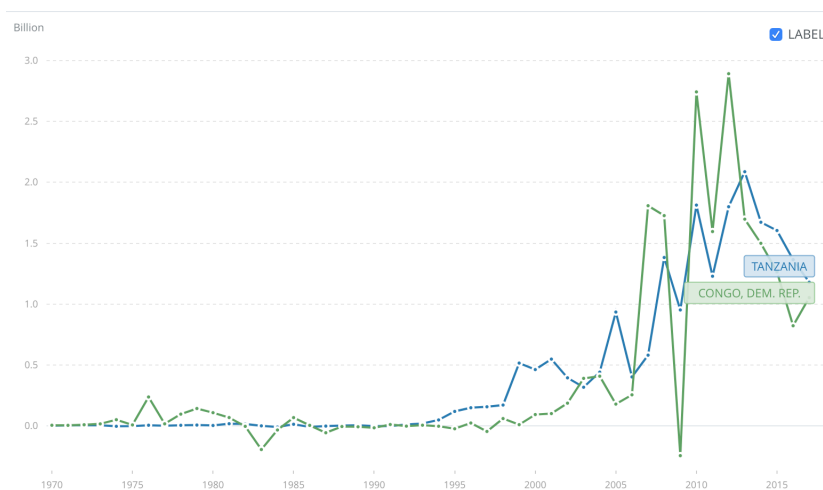


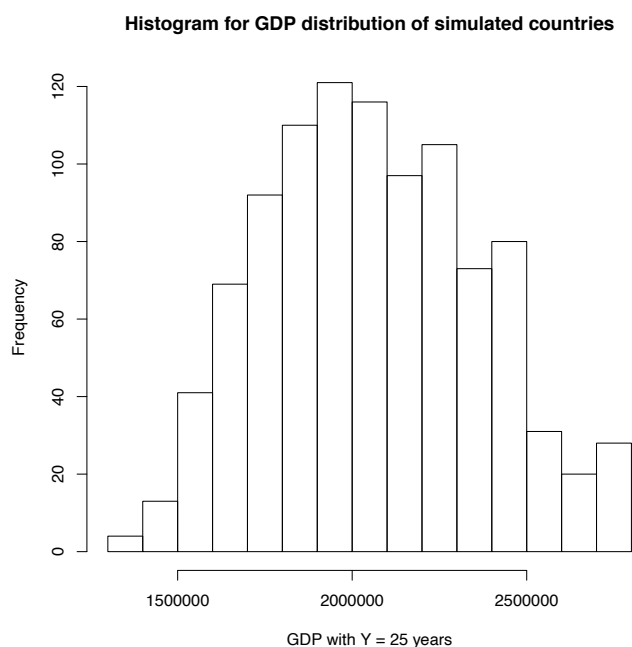
Figure (3) International Monetary Fund

## Computer Simulation

Based on the claim from Collier (2008), I designed a simulation through R of randomly generated 1,000 underdeveloped country variables with the same initial point. Initial GDP is 914,410 dollars for all variables which is an average real GDP output of developing countries with human capital index of 10% quantile (low 10%). Set an average GDP growth rate as 4.1% and each year growth increase by .1%. Each country starts with the same probability of 15% to face an



internal warfare which lasts for at least 2 years or random variable that follows normal distribution with mean 4 and standard deviation of 2. If the country is in the state of war, each year its growth rate reduced by 2.3%. A probability to face internal warfare resides in the range of (11%,16%). By running the same simulation 10 times, histogram below is the final year's GDP of the countries after 25 years. The simulated result does not follow the anticipated result which can be resulted from various factors such as weak impact of poverty trap in the experiment design or possibly missing assumptions.



*Figure (4)*

## Conclusions

Through this paper, we have observed multiple evidential situations of the poverty trap, from the demographic trap to the trap of contagious social norms. Through the comparison of Tanzania and D.R. of Congo, we are able to observe empirical evidence that the initial state of a government, corrupted or well-governing, is crucial in determining the future of a country, a war and perpetuating poverty or a continuous growth. For simpler poverty traps such as the calorie poverty trap, it is easier to come up with a policy to save from the trap. However, for a problem

associated with a nation-wide involvement (i.e. a war, corrupted authorities), it is hard, but not impossible, to find a realistic solution to the situation. Nonetheless, the improvement in education reform and human capital is the most realistic and the most practically effective solution to the long-standing problem of the poverty trap. As Professor Rotemberg mentioned few times during the lecture, a method of unconditional or conditional cash transfers that encourage education is a one way to approach the problem. The core of supporting educational improvement is that the more educated people will be able to distinguish what is wrong and right and consequently will be able to eliminate the corruption of the government.

## Work Citation

Matsuyama, K. (2008). Poverty traps. In S. Durlauf, & L. E. Blume (Eds.), *The New Palgrave Dictionary of Economics* (2 ed.). Palgrave-Macmillan.

The World Factbook: Tanzania. (2018, February 01). Retrieved May 11, 2019, from <https://www.cia.gov/library/publications/resources/the-world-factbook/geos/tz.html>

Collier, P. (2008). *The bottom billion: Why the poorest countries are failing and what can be done about it*. New York: Oxford University Press.

Foreign direct investment, net inflows (BoP, current US\$). (n.d.). Retrieved from <https://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD?end=2017&locations=TZ-CD&start=1970&view=chart>

## R Code for Simulation

```

####Simulation###
int_time = 25
N = 1000
countries <- matrix(0,ncol=int_time,nrow=N)
countries[,1] <- rep(914410.2,N) # Average RGDP0 of developing countries
growth <- rep(.041,N)           # Average growth rate of developing countries
prob <- rep(.15,N)              # 15 Percent
duration <- rep(0,N)

for (i in 2:int_time) {
  time = i
  for(i in 1:nrow(countries)){
    random <- runif(1)
    if (duration[i] == 0) {
      if (growth[i] - .041 > 0){
        prob[i] = max(prob[i] - (growth[i]-.041),.16)
      }
      if (growth[i]-.041 < 0){
        prob[i] = max(prob[i] + (growth[i]-.041),.11)
      }
      if(random < prob[i]){
        duration[i] <- max(ceiling(rnorm(1,mean=4,sd=3)),2) # Normal
distribution with Mean of median duration of a war
      }
      if(random >= prob[i]){
        countries[i,time] = countries[i,time-1]*(1+growth[i])
        growth[i] = growth[i] + .001 #.1% increase in growth every
year
      }
    }
    if (duration[i] != 0){
      countries[i,time] = countries[i,time-1]*(1+growth[i])
      duration[i] = duration[i] - 1 # a country is in war
      growth[i] = growth[i] - .0023 # a war decrease growth by 2.3%
    }
  }
}

head(countries,100)

negative = rep(0,N)
for (i in 1:nrow(countries)){
  if(countries[i,1] > countries[i,int_time]){
    negative[i] = 1
  }
}

summary(countries[,int_time])

pdf("histgram.pdf")
hist(countries[,int_time],
     main="Histogram for GDP distribution of simulated countries",
     xlab="GDP with Y = 25 years"
)
dev.off()

```