Research Proposal

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GR5010 Quantitative Theory & Methodology

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Sustainable Development goals affect developing countries more than developed ones- An IV approach

Abstract

Sustainable development has quickly become one of the most important goals for every single unit of the world economy to consider, be it industries, small manufacturers, governments, countries, everyone. It is today an established fact that the environment is eroding and that human capitalistic needs are the cause of it. But a capitalistic economy is also the path that is believed to bring equality among people by eliminating social class, eliminate poverty and provide equal opportunities to everyone. When this is the case, sustainable development is our mechanism to take care of our planet and environment while ensuring that there is continual societal progress of bringing equality and access to opportunity to everyone and pulling people out of poverty.

Under the Paris Agreement within the United Nations Framework Convention on Climate Change (UNFCCC) there are higher or more ambitious targets for developing countries than for developed countries in regards to Sustainable Development Goals (SDG), the reason being that developed countries risk their economic viability (jobs loss) in making the quick transition, whereas developed country have the opportunity to set up industries within sustainable tenets as they grow.

The primary research question is to quantitatively establish the fact that the cost of sustainable development is higher, and hence less probable, for developing countries than it is for

developed countries. To establish this I wish to use consumer products packaging as an industry/example to compare costs between a developed and a developing country, draw a causal graph (like a bayesian network) and establish the elements that drive/affect the sustainable development of consumer packaging goods, find the most causal element of the network and use it to establish the cost to SDG and then compare it among a developed and a developing country.

Introduction

The world needs a capitalistic economy to bring equality among people by eliminating social class, eliminating poverty and providing equal opportunities to everyone and to grow we need more economic activity and the economic activity has to be sustainable so we do not affect our environment the way we have in the last few decades. With this established, how should the world prioritize so that there is continuous progress being made towards transitioning into sustainable development practices? The United Nations as a part of its Paris Agreement within the United Nations Framework Convention on Climate Change (UNFCCC) signed on 22nd April 2016 agreed that there will be sustainable development goals that each country is required to meet in the stipulated timeframe.

These SDG goals are harsh on developing countries who already have challenges in continuing economic practices what made them a developing country in the first place. Now adding to them the list of ambitious goals would affect their progress and hence at the risk of rising global poverty. This research tries to establish that the SDG goals are affecting the growth and development of developing countries and it is leff of impact for developed countries. The research plans to use consumer packaging data and the consequently generated waste as an instrument variable to see what has been the chnag in the sustainability of this and if the

exogenous variation in this variable can define the endogeneity in the GDP growth of a country. This data is compared between two groups of developed and developing countries to establish causally that SDG goals are negatively affecting developing countries. A secondary hypothesis, conclusions for which can be drawn from the same study, would be to see if it also affects developing countries negatively in its intrinsic nature.

The study expects to find that the regression coefficient between Instrument variable, non-sustainable consumer packaging waste and economic growth rate to be negative for those set of countries that have met the SDG goals in the years since the 2016 Paris Agreement and when controlled for the other exogenous variables i.e SDG goals met the effect should still be the same and significant.

Literature review

The economic development of developing countries is primarily driven/defined by poverty reduction, the creation of a larger middle class, ensuring access to basic sociological needs and now along with those add another important element i.e urbanizing with minimum environmental impact. What compounds the magnitude of this goal is the volume of people who live in these tenets. Today ~ 1.89 billion people or nearly 24% of the world's population live in poverty and 46.4% of the population live in less developed countries (not even developed countries) and about 90% of population growth in the next 3-4 decades is expected in developing countries. (Peer 2020)

Now with this background imagine the needs of this population as they grow to middle-class economic status, it would be of immense stress on natural resources on the planet, certainly, which are challenges to be dealt with resource management and development. But the

problem we need to actively think of a solution for and solve is that how are we going to manufacture goods that are consumed today in the urban parts of the world and in developed countries which are certainly something that the developing countries will increasingly consume as they grow a larger middle-class and come out of poverty, things like packaged milk, bread,, etc.

The global waste statistics disclose that the US is the largest contributor of municipal solid waste across the world that produces 12% of global municipal waste and represents only 4% of the global population. In contrast, India and China generate 27% of global waste and carry 36% of the global population (World Bank, 2019). United Nations, where sustainable development is linked with sustainable development goal-12 “responsible consumption and production”, and target 12.4 makes obvious reference to “achieve the environmentally sound management of chemicals and all wastes throughout their life cycle"

In this research, I am particularly interested in arguing that sustainable development is crucial for developing countries and as much a priority as uplifting people out of poverty but, laying the onus of major innovation and first-movers expectation at the feet of developed countries for whom the transition will come at a lower economic cost than it is for developing countries Although recycling industry in the US has shown an increasing trend in both ecological and economic aspects, yet it is far behind their maximum potentials (Lonca et al., 2020). Indicators of these SDG goals can be seen to be the same for all countries although the goal in itself may be different (UN, 2020).

The study that is close to what I want to conduct in my research is the Razzaq et.al. 2021. This study estimates the material recycling effect on environmental quality and economic development in the United States. Few studies have been studied through national scale material

recycling, environmental, and economic indicators. This study employs a novel bootstrapping autoregressive distributed lag modeling for investigating the attributes' causality interrelationships. This study utilizes quarterly data from 1990 to 2018 to confirm a unidirectional causality from material recycling to economic growth, carbon emissions, and energy efficiency.

I wish to use a similar methodology, but with additive regression trees probably but this depends on the data I will manage to find. The above study also uses bootstrapping method as a resampling technique to achieve an exemplary amount of data which I probably will not have the need for, but it depends on the data. This study utilizes quarterly data of USA spans from Q1-1990 to Q4-2017, which include: CO2 emissions (CO2) in metric tons per capita; MSW recycling (RCY) in tons; energy efficiency (EEF)3; economic growth measured as the gross domestic product (constant 2010 US$) (GDP). At the moment I have not yet found suitable data as I wish for both the waste generation and economic survey data for a bunch of countries that are both developing countries and developed countries. Preferably I want my economic survey data to be split pre and post the Paris Agreement UNFCCC signed on 2 April 2016 the pre-data can be between periods 2010-2016 and the post data between 2017-2019 before the world was hit by the pandemic and both SDG goal and waste generation along with economic indicators were taken by a storm.

Theory

If packaging material used for consumer products were to be mandated/regulated to be made out of fully recycled product and should be recyclable too then what would the cost of such a policy be for a developed country(USA) and same for a developing country (India)? and compare them to prove the causal relationship.

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Existing literature does not adequately address the endogeneity of these economic variables to SDG. In addition to endogeneity, omitted variables, for example, cost of cutting-edge technology, etc., may drive both poor economic growth due to debts and investment needs of a tall order and underachievement of SDG targets.

There are some approximations and estimations that are needed in this process. For example, to find the amount of waste generated from consumer goods, we'd use the amount of consumer goods produced and use an approximation count to estimate the waste generated. And then later split it into sustainable and unsustainable waste also based on approximation knowing how many consumer goods packaging is fully sustainable in each year in each of these countries. The above will not tell us the amount consumed since a large portion of the goods produced are still in supply chains and inventory, which also needs to be discounted for based on a to-be-researched factor.

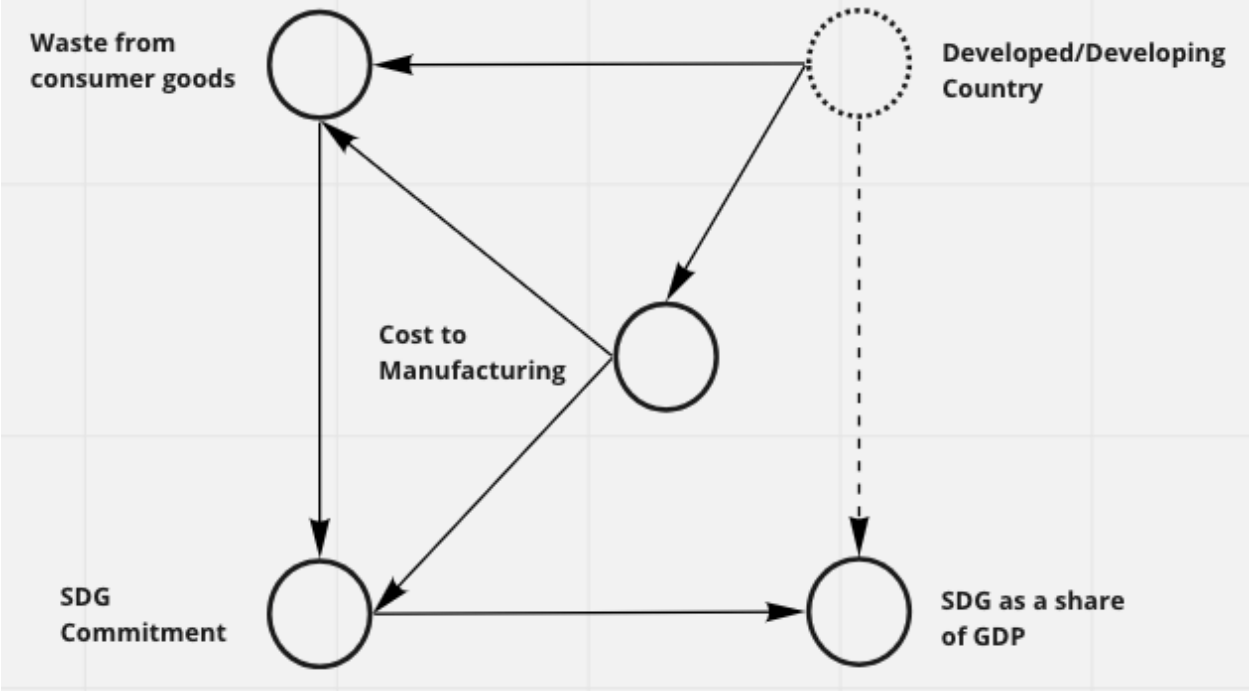

Fig1: A DAG to show the effect of Waste on SDG

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Research Methodology

Instrument variable (IV) approach is a very effective Causal Inference technique, variables called instruments are used to determine an exogenous part of the variability from the endogenous predictor. In other words, this approach allows the use of only that part of the variation in the predictor that is "arguably random" i.e., is not related with unobservable factors affecting both predictor and outcome. This approach allows researchers to effectively estimate the causal relationship between the outcome and the predictor.

In this study, use the IV approach along with stratification to group countries into groups of close properties. I plan to use all economic indicators captured in the world bank (World Bank, 2019) reports between the years 2010-2019. But given the diverse and widely spread out nature countries even after clustering them into Developed and Developing, regressing them will not be an effective technique, hence I plan to use additive regression trees so that we improve the explanatory power of our variable to see effective values from which inference can be drawn.

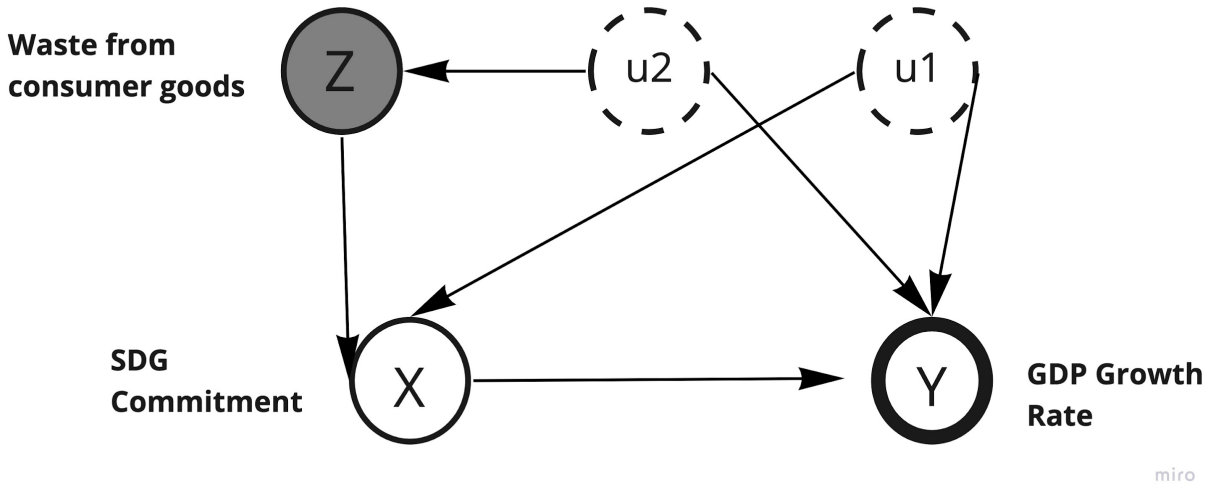

Fig2: The Causal DAG

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Using an Instrumental Variable, in my case the amount of packaging waste production, to establish that the SDG goals are a burden on a Developing country and contrast it with a Developed country. In this research, we will use exogenous variation in waste production as an instrument variable to predict the economic performance of both developed and developing countries and compare them to establish the above research hypothesis

1. Find data on how much waste is generated in two sets of countries- Developed and Developing countries.
2. Gain specificity/approximation as to how much of it is packaging waste.
3. See what share of it is made out of sustainable products.
4. Stratify countries bases on their Economic Status and the sustainable waste share.
5. As shown in the Causal DAG below, try to establish there are no unobserved confounders

   U1- May require a few regression outputs to establish this fact
6. Finally, use the Instrument Variable to regress the causal state $Y \sim X + Z$
7. Do this for all/both of the strata, depending on how it is stratified.
8. Compare them in tables and graphs. Interpret the results and draft conclusions

The reason for choosing this study design is to argue if this research is needed ot not, the first reasoning is that how else can it be established that developing countries, when they focus on ambitious SDG targets, let other crucial elements of a rapidly growing country i.e education, social housing, healthcare for all and jobs creation which are essential to lifting people out of poverty, slip away back to poor status, which made these countries be a developing nation in the first place.

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Hence to use the actual numbers of the "sustainable" changes that a developing country has made in the last 4 years since the Paris Agreement within the United Nations Framework Convention on Climate Change (UNFCCC) and establish that focusing on steep SDG targets are coming at a cost to a developing country, and the cost is slipping back into poverty.

The instrumental variable approach for controlling unobserved sources of variability is the mirror opposite of the propensity score method for controlling observed variables (Angrist et al. 1996, Winship and Morgan 1999). Unlike an observed control variable, an instrumental variable is assumed not to have any direct effect on the outcome. Instead, the instrumental variable is thought to influence only the selection into the treatment condition. In other words, the effect of the instrumental variable on the dependent measure is entirely mediated via its effect on treatment assignment

There are certain limitations with the IV approach- Every violation of the main assumption of IV will naturally result in a biased estimator. More interesting is that only a small violation of this assumption will result in large bias in the case of a weak instrument because of its multiplicative effect in the estimator (Martens et.al)

Apart from this, the World Bak data variables are a bit limited and sometimes controversial which when used in stratification may become the source for bias. At the moment, in my research proposal, the waste generation data is to be approximated based on the number of consumer goods produced/taxed within a country. This approach itself is not the most accurate but given the fact that waste generation data is not well-sourced, this is probably the best way to interpolate this value.

Some of the key variables that are most crucial with a brief description are- **Amount of Consumer goods produced-** This is to be obtained from state consumptions records which

countries and their economy branches should be logging somewhere. **Non-recyclable (unsustainable) waste generated-** Unsustainable waste that is generated from consumer goods. This is to approximated based on some research as to what is an average amount of waste that is generated per consumer good (Weight per Good). **SDG as a Share of GDP-** We need to approximate down to a figure on how much is each country in each of these subgroups committed to and how has it changed over time.

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References

Fig1 and Fgi2 - Both are figures generate as a part of this research proposal