India's twelfth five year plan: accurate indicator of economic growth or a relic of the past?

I. Introduction

For the majority of its independence since 1947, India's economy has been characterized largely by market socialism. Similar to other emerging markets at the time, such as China, India took inspiration from the Soviet Union's planned economy approach. An important element of this planned economy approach is centralized planning. Centralized planning is characterized by the government controlling allocation of resources, in contrast to free market economies which have very little government intervention (Britannica).

The topic of my research is India's twelfth five-year plan from 2012-2017. Five-year plans are centralized plans that, as the name suggests, consist of five year periods; for each period, India's government set average GDP growth targets that it planned to reach by the end of the period. I narrowed my focus on the most recent twelfth plan, from 2012-2017, which was a time of rapid growth in India's economy. The impact of the policy change on economic growth is the primary concern here.

My research question is: "how did the twelfth five-year plan of India affect its GDP growth rates?" This is an interesting question because the premise of five-year plans is based precisely on GDP growth targets. In their report on the plan, the Planning Commission (2012) set an average GDP growth target of 8%, which is ambitious. If the most recent twelfth plan was not indicative of GDP growth rates, the effectiveness of the plan on economic growth should be questioned. Particularly, during the time period studied, around 2012-2017, India was the world's

fastest growing major economy (IMF). Understanding the important variables related to this rapid growth can help inform future policy in India. If the twelfth plan had a positive impact on GDP, then they should consider using five-year plans again. If not, it might be worth considering more laissez-faire policies in the future.

To estimate this relationship between the twelfth five-year plan and GDP growth rates, I used a differences-in-differences regression by using Bangladesh, a similarly fast-emerging East Asian economy, as a control group. The purpose of this approach was to prevent issues of endogeneity with regards to GDP growth rates, as there are many variables correlated with it. Bangladesh did not take part in centralized planning and is in a similar region of Asia and has similar GDP growth rates to India before 2012.

Results of my regression show that the twelfth five year plan actually had a negative impact on economic growth. The estimates of the regression show that tertiary school enrollment is more positive for economic growth. Outside factors are definitely at play here, and the results of this paper encourage further research into what elements of the five-year plan caused this.

II. Literature Review

The first paper to review is from the Indian Journal of Agricultural Economics, "*Rural Poverty and Agricultural Growth in India: Implications for the Twelfth Five Year Plan*" by Anjani Kumar (2011). The paper discusses rural poverty and its determinants in India, as well as advocating for more attention on poverty with the coming twelfth five-year plan. Kumar also notes that aggregate growth in GDP per capita has a significant effect on poverty reduction in rural areas. After running a log-linear regression to show the main determinants of poverty, Kumar argues that the abundance of poverty in rural India can be attributed to the lack of support in economic reforms. Economic liberalization and the five-year plans have left rural India

behind, instead opting for large-scale shifts to industry as many other emerging economies (such as China with its Great Leap Forward) did in the 20th century. The purpose of this paper was to convince the plan commissioners to invest in irrigation, rural infrastructure, etc. to help the impoverished rural population.

Kumar mentioned that GDP growth is highly correlated with poverty reduction in rural areas. My contribution to existing literature will be to see how the twelfth five-year plan, which sought to alleviate the poverty gap in rural and urban areas, contributed to GDP growth. If GDP growth is indicative of reduction in poverty, GDP growth rates should be the core of economic reforms as it is more easy to measure than poverty levels. I will not be using poverty levels as a variable in my regression, primarily because of this difficulty, but it is important to consider the effects of it on GDP growth.

The next article I reviewed is Bhide et al. (2014) which highlights the differences in the twelfth five-year plan compared to previous ones. For the first time India's five-year plan incorporates "scenario planning" which highlights the best case and worst case scenario of the five-year plan's policy changes. The best case scenario is if India's government is able to enact its tax reforms without delay. One of the policies planned during the twelfth plan was India's Goods and Services tax (GST), which was delayed until 2017 due to disagreements in parliament. Bhide's results from their macroeconomic model show GDP growth rates declining due to delays in roll out of the five-year plan's new tax reforms, such as GST. Unfortunately, during 2012-2017, India was unable to achieve the best case scenario and Modi's GST is highly criticized (Kajal). This could be an exogenous variable negatively impacting India's GDP growth during the five years found in my results.

Byrd (1990) is an earlier paper that also takes a pessimistic argument against five-year plans. His paper highlights the failure of five-year plans to reduce abject poverty, a defining characteristic of the most recent five-year plan. Relating this paper to Kumar and Bhide et al., we can see a history of politicians and special interest groups blocking important policy reforms that aim to reduce poverty. These special interest groups have been blamed for appropriating surplus from the public economy, stymying the developmental goals of the five-year plans. This could be another exogenous factor explaining the negative impact on GDP growth found in my results.

III. Data

My dataset consists of panel data from the World Bank website: the variables I chose are GDP growth (annual %) and school enrollment, tertiary (% gross). GDP growth, as usual, is the sum of gross value added by all residents in the country, in U.S. dollars, and adjusted for inflation. Tertiary school enrollment is the ratio of total enrollment to the population of the age group; tertiary education is any education completed above secondary schooling. I chose to observe on the country level, using India and Bangladesh because of their similar GDP growth rates over the years. School enrollment is one of my control variables; education is correlated with both the five-year plan (my difference-in-differences estimator) and GDP growth rates. The time period of study is 1973-2019, after Bangladesh seceded from Pakistan and before COVID-19 as an exogenous variable affecting GDP growth. There is data from before 1973 and 2020, but I did not want any crises's outside of India's control impacting my outcome variable. The dataset consists of 169 observations from that time period. Because the differences-in-differences regression insulates me from most endogeneity, my regression has few control variables. The GDP growth variable is administrative data but the school enrollment is

survey data (however the World Bank still has observations for most years). Included below is a table of descriptive statistics for my data.

Table 1: Descriptive Statistics

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
GDP Growth	94	5.338	2.438	-5.238	3.984	7.070	9.628
Enrollment	75	9.913	7.490	2.391	4.975	13.409	28.573

We can see there are some missing observations (94 vs 75) in my variable enrollment compared to GDP, which could cause some inaccuracy in the model. It should also be noted that enrollment has a clear pattern of increasing over time, whereas GDP growth is more stationary (there is no clear pattern of growth over time).

To match the number of observations for enrollment with GDP growth, I will rely on R studio's prediction function. Thankfully, tertiary education enrollment shows a clear increasing pattern so we can assume accurate predictions.

IV. Theory

It is important to understand the objectives of the twelfth plan to see how it might be a determinant of economic growth. According to the Planning Commission of India's "*Approach to the Five Year plan*" (2012), the objectives of the twelfth five-year plan were:

- To create 50 million new work opportunities in the non-farm sector
- To remove gender and social gaps in school enrollment
- To enhance access to higher education

In growth accounting studies, Roubini (1998) shows that productivity-improving technologies are one of the main determinants of GDP growth. One of these technologies is human capital. In the case of the twelfth plan, India sought to improve human capital by increasing access to tertiary education for its population. Some problems with this measurement is that education does not always have an immediate impact on society, as students require a few years to complete their degree.

Enhancing access to higher education through the five-year plan can certainly lead to economic growth. Primary education as a determinant of economic growth, as opposed to secondary and tertiary schooling, is widely contested. But studies from Colclough (1982) show that increases in primary education can lead to increased productivity in urban and rural sectors, contributing to GDP growth. Through this channel the five-year plans could possibly impact growth in a positive way.

Another productivity-improving technology, besides human capital, is physical capital. Since the five-year plan does not take physical capital improvements into account, sources of endogeneity may arise. Physical technological improvements are not as simple to measure as educational enrollment and attainment are, making it a tricky source of omitted variable bias.

Despite this possible source of endogeneity obscuring the impact of the five-year plan on economic growth, India has similar resources to other south-east Asian economies. Bangladesh, which is the control group in my regression, is keeping up with India's rapid pace because of a variety of productivity improvements. In particular, Dhaka (2010) states that Bangladesh's information technology sector has seen huge boosts in software exports. On the other hand, according to Nasscom (2012), India's information technology sector received $88 billion in 2012, or 4.8% of its GDP. India and Bangladesh have similar levels of productivity improving

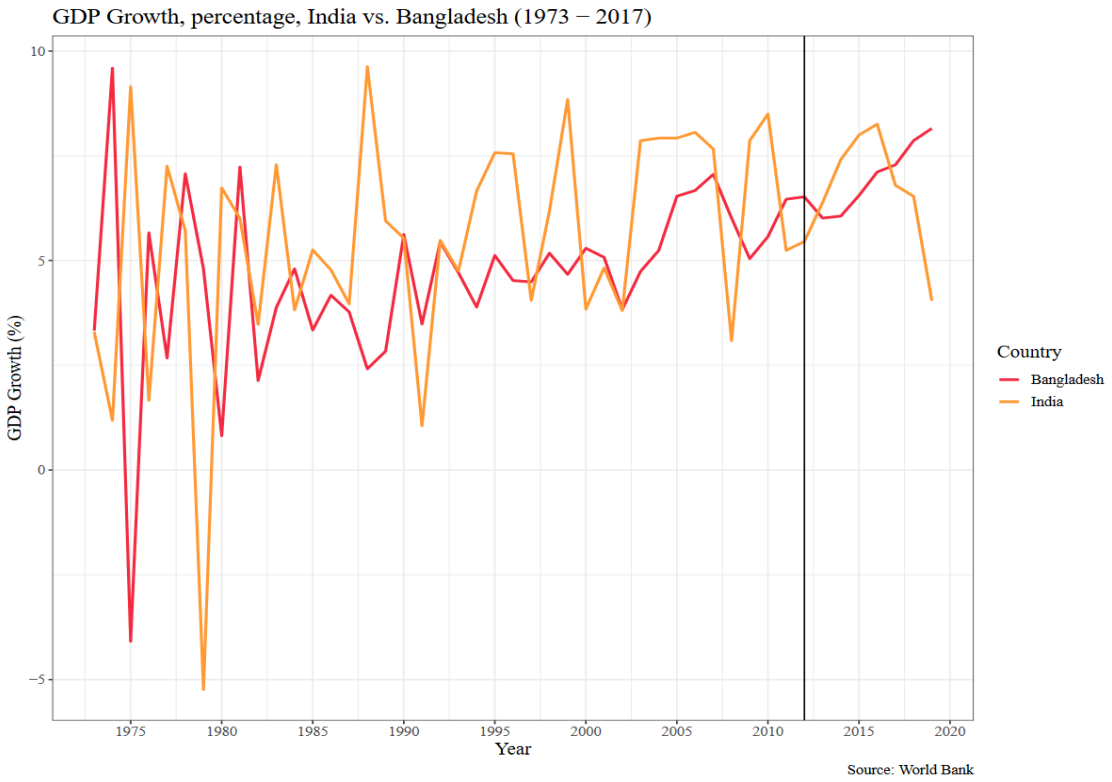
technologies (e.g. their information technology sectors) before the twelfth plan, so it is possible to control for this bias using Bangladesh's economy as a control group.

Bjork (1999) shows that another determinant of GDP growth rates are demographic transitions, such as transitions from rural to urban areas. Although the Indian government's plan of introducing 50 million new jobs in the non-farm sector seems like it will improve economic growth, diminishing returns suggests otherwise. Factor accumulation such as human labor in the non-farm sector may encourage demographic transitions away from rural areas, which in turn could negatively impact the agriculture sector. This is the first hint that the twelfth five-year plan may not positively impact economic growth and may in fact decrease it.

V. Estimation

To find the correlation between the five-year plan and GDP growth rates, I used a differences-in-differences approach. Using India as the treatment group and Bangladesh as my control group, I hope to find a positive or negative effect on GDP growth from difference-in-difference estimator in the regression.

The main issue with this difference-in-differences approach is the parallel trend assumption, which in this case we should see if the growth rates are parallel over time. GDP growth is tricky as it's rather chaotic on a typical plot, but I believe India and Bangladesh's economies are similar enough to warrant further analysis. Below is a graph of India's and Bangladesh's growth rates from 1973 onward:



The vertical line shows the treatment time of the five-year plan (2012). As we can see in the above graph, India and Bangladesh don't necessarily have parallel trends all the time, but respond similarly to temporary shocks such as the Indo-Pakistani war in the 1970s. As we can see, India and Bangladesh's economies are tight-knit.

To further control this endogeneity issue, I included a control variable, tertiary school enrollment, which is related to the five-year plan as discussed above and also related to GDP growth. Studies by the OECD (2012) show that tertiary education is positively correlated with GDP growth outcomes.

My regression equation is as follows:

$$GDP\ Growth_{\ i} = \sum_i \alpha_i^{Country} + \sum_i \alpha_i^{Time} + \beta_1 Plan_i + \beta_2 Enrollment_i + \varepsilon_{it}$$

Where *country* is India or Bangladesh to identify the treatment/control group, *time* is 1973-2019, *Plan* is my difference-in-differences estimator (time treated multiplied by the country dummy variable), *Enrollment* is the added control variable described earlier.

To run my regression, I used R, first creating a dummy variable to identify the treatment groups (India=1, Bangladesh=0), then creating a variable *time* to identify the time when India was treated, (1973-2011 = 0 and 2012-2019 = 1). Then I multiplied time by the treatment group to create the difference-in-differences estimator.

VI. Results

To find the effect India's twelfth five-year plan (2012-2017) had on GDP growth, I ran this difference-in-differences regression in R to find it had a negative impact on GDP growth rates, controlling for tertiary school enrollment. Below is the output table of my regression in R.

Table 2: Regression Output

	GDP Growth	
Predictors	*Estimates*	*CI*
(Intercept)	3.96 *** (0.56)	2.82 – 5.09
Country	0.00 (0.61)	-1.21 – 1.22
Time (Treated)	0.18 (1.36)	-2.54 – 2.89
Plan	-1.96 (1.37)	-4.71 – 0.78
Enrollment	0.17 * (0.07)	0.02 – 0.31
N: 94		
R^2 / R^2 adjusted	0.158 / 0.110	

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

The important variables here are *Plan*, which is my difference-in-differences estimator, and the control variable *Enrollment*. Country and time (treated) are just dummy variables to get to the difference-in-difference estimation. This regression suggests that the twelfth five-year plan actually had a negative effect on GDP growth rates, with it decreasing GDP growth by around 1.96%. However, the important result of the coefficient is not necessarily its magnitude (1.96), but its negative sign, which suggests that the plan had a negative effect on GDP growth from 2012 onwards. The confidence interval suggests even if it plausibly had a positive effect, it was very little (0.78% growth at most). Because the confidence interval is so large here, we should focus our attention on its negative sign instead of it falling within a certain percentage.

Our control of enrollment in tertiary school is significant at the 5% confidence level, suggesting we can be more confident in its effect on economic growth. Enrollment suggests a small percentage increase in GDP growth; with every 1% increase in tertiary school enrollment, GDP growth goes up by 0.17%. This is to be expected; as we saw earlier with Roubini's (1998) notes on the determinants of economic growth, human capital is a major contributor.

The main takeaway here is that India's twelfth five-year plan did not provide good outcomes for economic growth. Exactly which elements of the plan caused this decrease is not the purpose of the paper, but from the enrollment control variable we can see that the part of the plan which supports education growth is not of concern, considering its statistically significant impact on economic growth. It is more probable that other issues, perhaps with India's push to create "50 million new jobs in the non-farm sector" may have caused demographic transitions which are more difficult to measure than tertiary enrollment rates.

Of course, there are limitations with the model which come from the parallel trend assumption. Here we assumed Bangladesh was accurate enough of a control for India that we somewhat violated the most general assumption of difference-in-differences regressions, which tend to have more closely parallel lines. Regardless, as I discussed in the theory section, India and Bangladesh have tight-knit economies, both relying on technologies (their IT sectors) and access to similar natural resources which are both determinants of GDP growth.

VII. Conclusion

The Planning Commission has stopped producing five-year plans in recent years. Despite this, goals of the twelfth five-year plan (such as alleviating the education gap between men and women, increasing the number of jobs in the non-farm sector, and reducing poverty) are still a concern for India's government and should influence future policies. India's twelfth plan was an ambitious step towards solving the wealth inequality gaps in the country. To understand where the five-year plan may have gone wrong, future research could be based on how India went about creating those 50 million jobs, if they fulfilled their promises, and if it was correlated with economic growth or wealth inequality.

My results show that the twelfth five-year plan, although containing elements which would suggest positive economic growth such as increased school enrollment and job creation, actually has a negative impact on growth. As the planning commission has disbanded in recent years, if five-year plans ever happen to return in India, I suggest they focus more on education as my results show positive returns from education on economic growth.

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