

INEQUALITY AMONG NEIGHBORS: UNDERSTANDING FOREIGN DIRECT INVESTMENT AS A
FUNCTION OF REGIONAL DETERMINISM WITHIN INDIA

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Inequality Among Neighbors: Understanding Foreign Direct Investment as a Function of Regional Determinism within India

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Since 1991, India's period of economic liberalization has catapulted the country into international limelight as a rapidly growing emerging market with much economic potential. Most of this story begins with foreign direct investment (FDI), a strategy that has imbued India's once stagnant industrial sector with capital and job opportunity. However, as the world grapples with rising inequities between wealthy and poor countries, as India's GDP grows ever larger, there is a concern that the growth within the country is not evenly distributed and may in fact exacerbate current economic disparities. This paper seeks to look at potential avenues poorer states can take to attract FDI if they choose to as a method to stay competitive within the country. Our hypothesis was that measures such as power rating (as a proxy for infrastructure), literacy, and minimum wage would be highly significant related to the dependent variable of FDI dollars. Two main regressions series were conducted with FDI dollars as a dependent variable and growth rate of FDI dollars as a dependent variable. While our growth rate regression series were not statistically significant, the pooled regressions used to study FDI dollars as the dependent variable were statistically significant at. Some interesting outcomes resulted, such as an unexpectedly inverse relationship between power rating and FDI dollars which is explained by an interesting policy measure on the part of poorer states. However, overall the results indicated that an increase in infrastructure aimed at Multinational Enterprises (MNEs) would likely promote an increase in FDI dollars.

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Introduction

As economists around the world consider ways to alleviate poverty and raise the standard of living in many different countries, the issue of regional disparities and their effects on development has come up when looking at why some countries and even continents are not growing as fast economically as othersⁱ. However, even looking at some of the faster growing countries, particularly emerging economies that are considered success stories, observing their growth holistically may obscure some of the problems either caused, or exacerbated by, their rapid growth. That is to say regional disparity, while a recognized concern at the level of nation-state in terms of economic growth, may also be an issue that requires careful understanding within a country as well. This paper aims to look at regional disparities within a country, India, to understand the relationship between the states of this particular country and the economic growth potential of those states, with specific reference to foreign direct investment (FDI).

History: India's Relationship with Foreign Direct Investment

On March 6th, 2006, one of America's premier newsmagazines wrote: "Every year at the World Economic Forum in Davos, there's a star. Not a person but a country. One country impresses the gathering of global leaders because of a particularly smart Finance minister or a compelling tale of reform or even a glamorous gala. This year there was no contest."ⁱⁱ These words, written about India, are from an article that is joining legions of articles praising India as burgeoning economic powerhouse that is joining the

ranks of wealthier countries through a combination of foresight and opportunity.

India has become a model financial experiment in the world of developing nations, recently experiencing economic growth that, while initially surprising, has come to be expected by many in the global financial community. This new trend of increasing GDP growth has paralleled an unprecedented rise in the level of foreign direct investment in India that began in 1991. After Independence and prior to 1991, Indian policy-makers had imbued domestic economic policies with a sense of paranoia, preventing foreign companies from owning majority stock in companies, and in general, discouraging industrial growth and large corporations from growing domesticallyⁱⁱⁱ. The aim of the government was to staunch potential monopolistic bodies from gaining financial or political strongholds within the country, a response to a historical legacy of imperialism at the hands of merchants turned colonialists. Unfortunately, the side effects became unbearable as India's GDP grew too slowly to support a rapidly increasing population with either the jobs or infrastructure needed to sustain it.

A major balance of payments crisis occurred in 1991 and threw India's government into turmoil as it attempted to deal with extreme debts and few options to pay them back^{iv}. India's financial minister at the time (and the current prime minister as of this writing) Manmohan Singh led the reform process under then Prime Minister Narasimha Rao that virtually halted all previous notions about the benefits of isolationist economic policies and the protection they would provide against the imperialistic forces India had to face decades earlier. Instead, as he and his team of financial analysts began to revolutionize India's approach to growth, policies would become more liberal year

after year to allow foreign companies to set up branches within India, either to reduce the cost of manufacturing goods and providing services abroad, or catering to the domestic markets. Singh's approach proved to be a prescient move in a world that would soon see the dangers of uncertainty as the 1997 Asian Financial Crisis would claim the economies of the Asian Tigers after speculative bubbles set off a domino effect to unravel countries like Indonesia, Thailand, and Singapore^v. Singh and his liberalization policies allowed industrial growth in many sectors, focusing for the most part on technology to capitalize off of rapid advancements in the computer age as well as other industries like soft drinks, food franchises, and the service sector.

It is important to note that these policies were certainly not implemented in a catch-all fashion that could apply to any country in need of outside capital as a catalyst for growth. In fact, it is speculated that the very policies that led to the macroeconomic crisis of 1991, perhaps most importantly those of import substitution, were the very policies that allowed domestic industries to stay strong in the midst of foreign competition^{vi}. For decades, many brands of products had gained consumer loyalty and were not easily defeated by even the most popular international brands of goods, a trend that reduced the fear that foreign market forces would quickly subsume India's hardworking domestic industrial sector. Also, by building a strong domestic industrial sector to support import substitution forced India to develop at least the framework for infrastructure that would be essential for attracting the investments of Multinational Enterprises^{vii}.

Overall, as Singh predicted and the government of Rao implemented, the time for

India to fear the influences of external big business was over. India halved its debts year after year and began to see growth rates of up to 12% in some sectors^{viii}, unheard of in that country, and though the growth has slowed down to the single digits, the trend was established: foreign investment could provide the capital and job opportunities needed to help jumpstart India's GDP, and would become a way of life.

How FDI is Shaping India Today

As India's GDP grows at rates previously unknown to it prior to its economic liberalization, it has been touted by many as a glowing example of how multinational companies, through outsourcing or setting up foreign branches of their enterprises, can help infuse an otherwise stagnant economy with capital and jumpstart its growth. China, and perhaps in the near future Brazil and many of the Asian Tiger economies, also have come to represent a recent entrance into economic partnerships with culturally and historically disparate interests in the hopes that foreign investment will revitalize host countries and provide opportunities to its citizens in the form of jobs, improved infrastructure, and consumer choice. In return, it is presumed, the investor chooses relatively low-risk, high yield opportunities among a wealth of choices.

Unfortunately, GDP growth and rates of inflation are tools too blunt to understand the nuances of the effects of foreign influences that are pervasive as FDI, largely in the form of MNEs, or Multinational Enterprises, on the development of emerging markets nations. In particular, my interests lie in examining the very diverse states within India to understand whether they are attracting different levels of FDI, and if that is the case,

whether quantifiable reasons lie behind the situation. I believe that looking at FDI at the national level, while helpful, may ignore what is happening within the country when it comes to distribution of FDI and, accordingly, its effects on different regions. For example, we do not know if some states are suffering from a lack of resources because FDI favors other states. We do not know if internal migration patterns are changing or if domestic industries are faltering in some states while lifting off in others. We also do not know if the FDI concentrations in particular areas, like Bangalore, Mumbai, Chennai, and Delhi, are driving overall GDP growth and potentially masking the descent of other states into poverty. Such a trend would not be unprecedented as other countries with a similar history with FDI, like China, have experienced disparities in growth between their export-processing zones on the coast, and the more growth-deprived areas in the interior of the country.^{ix}

I believe that, while India's growth is impressive and remarkable, it must be approached with healthy skepticism to understand whether inequalities persist and if so, how they are manifesting, whether they assist (or hinder) states in attracting foreign direct investment. States that are not performing as well as their neighbors should not be overlooked because the world is blinded by India's overall performance. This paper seeks answers to understand some of the causes of some states' inability to attract foreign direct investment in an attempt to understand methods those states can adopt to "catch-up" to other, higher-performing states if they feel that FDI is the best method to achieve growth.

Literature Review

Because of the fascinating turn in India's economy, the country as a whole has come under scrutiny as economists the world over are eager to see the interplay between foreign investment, advances within the country in terms of infrastructure and social development, and improvements in health and education indicators. The analysis gets very specific at times, looking at particular industries and even companies within India. These types of analysis of course are not limited to studying only India, but as India is one of the most populous countries in the world with some of the world's most notable extremes of poverty, it tends to be singled out as a country that can benefit greatly from FDI.

The need to understand the effects of Foreign Direct Investment at the state level in India is becoming more important day by day, however. As with many countries that are large both in terms of territory and population, India's states are teeming with diversity. While some states are quite notable for their ability to attract the attention of overseas investors, there are four states that are considered "backwards" by the Indian government. The so-called "Bimaru" states (the term plays off the Hindi word "Beemar", meaning "ill") of Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh, tend to have poorer social and economic indicators than those of other states, particularly those of Andhra Pradesh, Karnataka, Tamil Nadu, and to a lesser extent, Gujarat and others^x. Higher population growth and lower literacy rates are only a few of issues the "Bimaru" states must contend with (see table 1 below).

Indicator	Bihar	Madhya Pradesh	Rajasthan	Uttar Pradesh	Karnataka	Andhra Pradesh
Overall Literacy	47.53%	64.11%	61.03%	57.36%	67.04%	61.11%
Power Rating	10.63	24.75	41.83	41.85	51.25	56.75
FDI in Nov. 01	739,528	9,160,636	2,646,991	4,288,822	21,060,078	1,259,154
FDI in Sept. 04	739,705	9,271,408	2,911,204	4,826,692	24,163,689*	13,808,045*

Table 2: BIMARU vs. Non-BIMARU (e.g. Karnataka and Andhra Pradesh) states

*Last data point available for this measure.

In looking at the effects of FDI across states, it is important to understand a) which states are attracting the most FDI and why, as well as b) what benefits these states are receiving because of FDI influence. To exemplify this issue, let us examine the power sector. A state like Karnataka (where Bangalore is situated and which has a great deal of FDI) has to have a functioning power sector to support many of the technologically advanced machinery and offices that companies like Sun Microsystems and Texas Instruments from abroad, as well as India's own Wipro. Thus the state, in order to keep FDI intact and avoid losing it to other states, would likely invest more in its power infrastructure to keep companies functioning and, though indirectly, serve the residents of that state with a better power sector. The question remains: do they neglect to invest in

their infrastructure as a result, either because they feel that they cannot compete and thus it is pointless to invest, or because there isn't enough FDI capital to provide the resources to improve infrastructure? If either of these hypotheses held true, it would indeed be reason to worry.

Understanding the regional aspect of development in India is not necessarily a unique subject, though unfortunately it is a somewhat convoluted endeavor to undertake. Jeffery Sachs, Nirupam Bajpai, and Ananthi Ramiah (2001) worked together on the paper "Understanding Regional Economic Growth in India,"^{xi} an effort to understand the growth experiences of some Indian states. The abstract states that:

This paper aims to explain the growth experiences of 14 major states of India between 1980 and 1998. Using two measures of convergence, β -convergence and \hat{u} -convergence, I examine whether per capita incomes in the states have been converging or diverging. By both standards of convergence, India demonstrated overall divergence during 1980-98, as well as during both the pre-reform and post-reform subperiods. Interestingly, the richer states experienced a degree of convergence during the post-reform period, whereas the poorer states did not. Divergence was most notable within the poorer group of states. A remarkable 82 percent of the cross-state variation in growth is explained by just the urbanization variable in India, with no hint of any conditional convergence after controlling for the degree of urbanization. The regression estimate shows that a 10 percentage point higher rate of urbanization is associated with 1.3 percentage points per year higher rate of annual growth.

While this paper looks at such important factors as urbanization and the nexus between growth and the post-reform period, the data set ends at 1998 and does not include a formal study of Foreign Direct Investment at the state level in particular.

Furthermore, the study only looks at 14 “major states” in India as opposed to India as a whole, and also asserts that they were unable to find a variable that would adequately capture the “public investment” aspect of states, a variable which would likely incorporate some measure of infrastructure and would therefore be fairly significant. Also, because of the timing of this paper (written pre-2001), it does not capture the way global politics has changed after the terrorist attacks of September 11th, 2001 and may have impacted not only multilateral financial partnerships, but also the priorities MNEs may have placed in seeking where to put their investments (e.g. new emphasis on security, certain areas may have become controversial or unstable).

A perhaps more relevant paper has been offered by Sebastian Morris of the Indian Institute of Management. The paper, “A Study of the Regional Determinants of Foreign Direct Investments in India, and the Case of Gujarat” (2004) has very similar premises to those that are included in my own work in this essay, as he states

“Essentially I argue that for all investments (other than those strictly confined to locations due to their requirements of either natural resources or the need to be very close to markets) it is the regions with metropolitan cities, that have the advantage in 'headquartering' the country operations of MNCs in India, that therefore attract the bulk of FDI. Even more than the quantum of FDI, the number of cases of FDI, as also the employment effects, and spillover effects are large for such regions.”

Where his paper and my own theories diverge are in two particular aspects. While Morris argues that metropolitan cities help to anchor FDI in certain regions, I am not satisfied with his analysis of why Kolkata, India’s most populous city has been somewhat

overlooked in the charge of FDI into the country despite its proximity to waterways and other important modes of transportation. In the same vein, as Morris's analysis seems centralized around Gujarat, I am interested in looking at all of the states, particularly the "Bimaru" states that are severely disadvantaged for one reason or another. Morris's work is notable however for being some of the first work directed at state level analysis of the effects of foreign direct investment within the country. I believe that where the analysis could go further is by examining the incentivization of state development in attracting FDI throughout the country in a way that is not regionally specific. Furthermore, I am interested in taking a perspective that diverges from previous views that seem to focus on urbanization as the main anchors of FDI and look at other measures that imply policy perspectives on internal state development in, for example, such areas as investment in education, infrastructure, and healthcare.

Method and Hypothesis

One of the most important implications of Morris's work for my own was in revealing potential sources of data. Unfortunately, though this may not be a universal truth in examining India, data can occasionally be laborious to find. Some of my concerns related to availability of data, but also the reliability of the data that were collected. Another issue relevant to my search was consistency of data, or whether or not the same measures were being collected the same way over a period of time.

The marriage between how to approach my question and what was feasible in

actually looking at the question was satisfied mainly by the information and data made available by the Secretariat of Industrial Assistance, the Census of India, and India's Ministry of Labor. The Secretariat of Industrial Assistance (SIA) puts out a monthly newsletter going back to the year 1998 that incorporates a number of statistical facts that amount to understanding investment flows into the country, which countries are responsible, what industries are funded, to name a issues. My main concern was to understand the data at the state level and over time, monthly being my preference. The preference for monthly data stems from an interest to look at a time period where changes could conceivably occur, and an interest in creating a data set that was not unnecessarily unwieldy. I thought that a monthly data set would be robust enough for analysis without becoming incomprehensible in raw format (see table 2 below)

STATENAME	TOTAPPROVAL	FDIAMTMILLS	FDIAMTGRTH	TOTPERC	TOTLIT
KARNATAKA	1746.00	21060078.00	0.00	78.00	6704.00
KARNATAKA	1768.00	21092825.00	3.91	778.00	6704.00
KARNATAKA	1797.00	21220881.00	0.45	776.00	6704.00
KARNATAKA	1828.00	21293815.00	0.31	775.00	6704.00
KARNATAKA	1860.00	21365838.00	0.15	777.00	6704.00
KARNATAKA	1891.00	21412681.00		771.00	6704.00
KARNATAKA	1907.00			771.00	6704.00
KARNATAKA	1950.00	21586526.00	0.68	77.00	6704.00
KARNATAKA	1973.00	21945098.00		78.00	6704.00
KARNATAKA	2003.00			781.00	6704.00

Table 2: Example of Data Set

The SIA did have a section in their newsletter over 35 months that compiled foreign collaboration and foreign direct investment data at the state and territory level and covered the same material over those 35 months--what I considered a consistent and appropriate data set to create my dependent variable and main independent variables. Unfortunately, some of the data created a source of concern in terms of reliability. The primary issue of concern was the exclusion of an entire state: Sikkim. This exclusion is not explained explicitly within the newsletter or on the SIA website, but is consistent throughout the entirety of the dataset which leads me to believe it is a systematic omission, as opposed to a simple error. Another issue was the need for extrapolation of data. Unfortunately, though trends in FDI have been increasing, data at the state level has only been collected starting from November 2001 and ending in September 2004. Thus, the data beginning from November 2001 incorporates all data from previous years and needed to be extrapolated using November 2001 as the initial point. In looking at our primary dependent variable, namely amount of FDI dollars (reported in "millions of rupees" however will be referred to as FDI dollars for this essay). However, the extrapolation exercise created a problem when creating the variable for "FDI Amount Growth" which subtracted the initial month's data point from each subsequent month for a state, dividing that number by the initial month's data point. However, using simple subtraction formulas within the spreadsheet, it became fairly easy to extrapolate the monthly data in terms of absolute terms after November 2001, as well as relative terms (both in change in FDI dollar amounts from month to month, and rates of growth). One final and significant concern with the entirety of the monthly data sets received from the

SIA was the number of unattributed FDI approvals. However, because I was more concerned with the number of approvals of each state relative to each other and there was no reason given by SIA to suspect that the number of unattributed FDI approvals came from particular states unevenly, I was not overly concerned with the effect that this might have on our model and regression.

After looking at the financial aspects of FDI inflows in terms of approvals and monetary inflows per state, it was important to look at other distinguishing attributes of each state that could be considered relevant to investors that are exclusive from overarching variables that consist of country-level effects (e.g. India's GDP, India's multilateral trade policies). This of course proved challenging as well, as state level data is frequently outdated or generally unavailable.

There is also the issue of comparability: ensuring that the measurements used are consistent across states and thus relatable and comparable. Below is the list of variables collected at the state level, the level of measurement and method of measurement, as well as the perceived importance to the project and hypothesis at hand.

Discussion of Variables

One of the variables that I considered essential to our model is literacy rate: the number of adult persons within a particular state who are deemed literate by national standards divided by the total number of adult persons within the state. This is an especially noteworthy variable because of the many implications inherent in its collection and reporting. Superficially, I was looking at the number of people who can read relative

to the rest of the population. But I also looked at a number of other issues including, to some degree, the overall education level of the state and, beyond that, a measure of the premium that a particular state is able to put on education. An even further implication for the purposes of the topic is what this would mean for attracting FDI. My expectation after regression is that MNEs are interested in skilled and educated workers and, as a result, will be more attracted to states with a higher overall literacy rate. This is to say that, in a regression, the coefficient for this particular variable is expected to be positive.

Similarly, I was concerned with literacy rates for each gender. This takes the initial idea proposed in the previous variable, namely that the literacy rate is essentially a proxy both for overall state education level and state current situation regarding education, and alters it so that incorporates another important issue that is relevant in India and will be for years, namely that of the gender gap. The gender gap, particularly in education, seems to be indicative of issues relating to social infrastructure. Evidence of such a gap in a state would, in my opinion, reveal the general attitudes throughout the state regarding women, their position in the family, and their position in society. My expectation of a foreign investor's attitudes towards the gender gap would be negative, meaning that a higher gender gap would be associated with a lower level of investment in that state. The level of measurement here is comparable to that of the overall literacy rate, however it is divided such that literate females are compared to the overall female population, repeated for males. Within the model, my expectation is that a higher level of investment is associated with higher levels of female literacy and male literacy rates.

Looking at the overall population as another measurement tool may seem self-

explanatory but warrants closer analysis. Inherent in the overall population of a state is the need to put away the distribution issues for a second (which will be looked at momentarily) in terms of such subgroups as child, adult, and senior/older adult, and instead look at the ability to provide a labor force for a Multinational Enterprise that may desire to invest a venture in the country. It could be argued that there are likely very places in India where an MNE might find it relatively difficult to acquire workers, but there are other inherent properties that are included in a population measure. One might make an assumption that higher populated states may have larger and more abundant urban centers. One might also expect that a state with a higher population might have more diversity in its people in terms of skill sets so that it might be easier to find people with the appropriate skill level for a variety of projects (since, of course, FDI comes in many different types of enterprises) than in states with lower populations. Thus, my expectation is that in a state with a higher population, I would associate that higher population with higher levels of FDI.

Examining the urban population in particular seems to be a given necessity in this model not only because of conventional wisdom in the form of other state-level studies that have proclaimed the association of levels of urbanization with higher FDI levels, but also in conjunction with other characteristics, may help to point out why, despite its high level of urbanization, Kolkata (West Bengal) remains somewhat behind other states in terms of attracting FDI. The measurement I am using for the urbanization variable comes from India's 2001 census which allowed states to self-report urban populations. The measurement therefore is absolute population residing in an urban area, as opposed to a

percentage of total population or ratio of urban to rural residing population. Because of the resources and infrastructure associated with levels of urbanization, my expectation is that the signage for this coefficient will be positive.

Similar to the measurement for urban population, slum population is also self-reported by states from the 2001 census in India. While slum and urban population analysis will likely cause multicollinearity in the regression, as it is hard to imagine a significant number of slum dwellers removed from an urban landscape, the slum measurement incorporates an additional aspect: social infrastructure. While the urbanization variable allows for an understanding of the size of an area that is presumed to be somewhat consolidated in terms of labor and resources (and thus desirable for MNEs to settle near), slums incorporate a social infrastructure measure—and the expectation would be that as much as MNEs may want to settle near urban areas, they may be repelled by slum areas that are associated with high crime rates, low quality of life, etc. Accordingly, my expectation is that the signage for the slum coefficient will be negative.

Though the urbanization variable is a proxy for infrastructure and resources available for an MNE to use within a state, the proxy doesn't capture a systemic view of infrastructure in terms of public investment, or its rating compared to that of other states. Again, as Jeffrey Sachs and his team observed, it is very difficult to obtain a reliable measure of infrastructure. However, the power rating, created and distributed annually by India's Ministry of Power, provides an interesting system to look at and compare each state's relative abilities to generate, transmit, and distribute power. Thus, this

measurement seems to be the best available proxy for infrastructure and public sector investment. The rating is measured such that a higher score represents a better power sector so that our expectation is that the coefficients associated with this variable will be signed positive.

Another important variable I wanted to look at is the idea of purchasing power in a particular state. This measurement has a number of important uses, but mainly addresses the idea that some MNEs, while they may be partially motivated to export their goods and services, may also be interested in promoting their products within the country. By setting up their operations in a particular state, they are settling themselves into an area where they will be able to build relationships and a reputation within the state and, as such, would want to choose a state where people have a relatively high level of purchasing power. As such, the best unit of measurement I could find was the CPI (Consumer Price Index) levels of January 2006 that are consistent across states. The urban population variable that we have included is a proxy for regional GDP, so we are able to use the CPI data to capture purchasing power. Furthermore, the expectation is that, as CPI increases in a state, so does the FDI investment level because an MNE is interested in promoting their product in the domestic market, and would find it easiest to do so on their “home turf”.

Partially as a proxy for input costs, I am also interested in the effect minimum wage has on attracting foreign direct investment. Because I want to assess the relative cost an MNE would incur by investing in a particular state, and costs of capital specific to each state was unavailable, I elected to look at labor costs in the form of minimum wage.

Because of the diversity of industry in India, each state has a “minimum minimum wage” and “maximum minimum wage” depending on the industry that the wage applies to because minimum wage varies across industries. Based on the type of work a person does, they may be entitled to either at least the “minimum minimum wage” or “maximum minimum wage”. Because of this range in minimum wages and the lack of specifics in where most MNEs would fall in terms of what they could expect for their lowest wage costs, I am using both ends of the range in two separate variables. Our expectation here is that as minimum wage goes up, FDI investment goes down because MNEs are likely interested in keeping their input costs as low as possible.

Associated with the issue of wage and input costs is the actual availability of labor. Despite India’s massive population, that population is not necessarily evenly distributed throughout the country, a prospect we should account for. As a result, three variables are used as different proxies to understand current and projected labor availability: population of people who are currently not working, population of people between the ages of zero and six (a proxy for measuring the younger population for now and in the future), and the overall population of the state. All of these numbers are absolute numbers, not percentages or ratios, and the expectation is that as these numbers increase, so does FDI investment. The reasoning again has to do with labor availability, and the idea that MNEs will choose to settle in areas where competition will be keen for a limited number of positions, and it will be easier to find workers for the company.

Finally, I also wanted to incorporate a measure that addresses a significant cultural issue in India, namely the overall gender ratio. Because of the pervasive sexism

that still exists in many communities, issues such as female infanticide and lower emphasis on health care directed at females have contributed to an environment where the gender ratio is quite unbalanced^{xiii}. This issue, often written about and examined, is rarely linked quantitatively to economic growth, especially as propelled by outside sources. However, the Indian Census of 2001 does offer state level data regarding the gender ratio, listing the number of female girls between the ages of zero and six per 1000 boys in the same age range. Because a higher ratio indicates that there is a lower prevalence of such gender biased practices as female infanticide, our expectation is that MNEs will be attracted to areas with more “socially forward” thinking. Essentially, this means that as our gender ratio variable increases in size, I would expect FDI to increase as well.

Discussion of Other Considerations

Because our variables have generally fallen into two categories, time-dependent panel variables (to be discussed in the Results section, but essentially variables that vary based on state and time) and non-time dependent variables (which have values of constants per state and do not vary over time in this study—the preceding variables), I identified the best way to treat these variables to obtain meaningful results.

The two main options available to us were a simple pooled regression that would regress our non-time dependent variables on the dependent variable of our choosing, and a panel regression for the variables that did vary over time. While the first type of regression would give us an understanding of how our non-time dependent variables like

literacy and power rating affected variables like amount of FDI related dollars in general, or growth in the amount of FDI dollars, the second type accounted for regional variation which is of central importance to this essay, was useful in that it helped to reduce the autocorrelation that could be inherent in a set of data with an emphasis on time. Whether either regression would lead to more robust results is not a question I could answer, however it was deduced that both regressions ought to be looked at for a more complete look at the picture given the nature of the variables and their availability.

Results

A number of regressions were conducted to examine the hypothesis and understand the impact of each previously described independent variable on the relevant dependent variable--ultimately, growth of foreign direct investment approvals within a state. The results of these regressions are described below.

Looking at Dependent Variable: Foreign Direct Investment in Millions of Dollars

Initial Regression

The main regression conducted had to take into account a number of my initial concerns in not only what was relevant to this particular question, but also what was feasible in terms of relating to policy implications. This meant that not only did I need to look at a number of variables that would create a robust model, but I had to be somewhat

discriminating during the regression and exclude extraneous information as well as adjust my dependent variable on occasion so that it would represent a measurement of FDI that could be well understood by multiple audiences.

The first model used to test the hypothesis, using a simple pooled regression, can be described as:

$$\text{fdiamtmills} = \text{totperc}\beta_1 + \text{totlit}\beta_2 + \text{totlitm}\beta_3 + \text{totlitf}\beta_4 + \text{minminwage}\beta_5 + \text{maxminwage}\beta_6 + \text{urbanpop}\beta_7 + \text{slumpop}\beta_8 + \text{popnonwork}\beta_9 + \text{popzerosix}\beta_{10} + \text{powerrating}\beta_{11} + \text{totalpop2001}\beta_{12} + \text{genratio}\beta_{13} + \text{cpi}\beta_{14}$$

where the dependent variable y is represented by the variable fdiamtmills , which is the cumulative rupee amount of approved FDI funds in a state between August 1991 and month n , and $x\beta_1$ (totperc) is the percentage of a state's monetary amount of FDI relative to the country's total in month n . The following variables should be fairly self-explanatory. $x\beta_2$ (totlit) is the overall literacy rate while $x\beta_3$ and $x\beta_4$ (totlitm and totlitf respectively) separated out these rates by gender. $x\beta_5$ (minminwage) and $x\beta_6$ (maxminwage) represented a state's minimum minimum wage and maximum minimum wage respectively. $x\beta_7$ (urbanpop) represented the population of state residents residing in an urban area, $x\beta_8$ (slumpop) looked at the population of state residents residing in a "slum" (as titled by the Indian Census Bureau). $x\beta_9$ (popnonwork) looked at the population of those not working. $x\beta_{10}$ (popzerosix) looked at the population of all children in a given state between the ages of zero and six. $x\beta_{11}$ (powerrating) looks at

each state's rating, given by India's Ministry of Power, which is scaled such that a higher score represents a better power rating. The measure is used as a proxy for state infrastructure. $x\beta_{12}$ (totalpop2001) is a state's total population in the last census year of 2001. $x\beta_{13}$ (genratio) is the gender ratio measured as the number of girls in a state between the ages of zero and six per every 1000 boys. $x\beta_{14}$ (cpi) is the measured consumer price index in each state and is a proxy for relative purchasing power between states.

These 14 independent variables were regressed (for specific results see Appendix Table 1) with an overall statistical significance at the <0.0001 level with an adjusted R-squared of .4988, and each individual independent variable reported a coefficient that was significant at the <0.0001 level except for one variable, *cpi*, that had a $p = 0.509$. However, this regression revealed a number of disconcerting aspects that needed immediate address. Most significantly, there were issues with the signing and magnitude of some variables that seemed to defy explanation as well as my expectations. These issues will be discussed in their turn. However, by and large we were able to get a number of variables associated with coefficients that were statistically significant and are explored in detail below.

Overall, the results were quite telling and interesting. While, as mentioned, many of the variables were surprising in magnitude and sign, most of the coefficients attributed to the independent variables seemed quite plausible.

The percentage of total FDI attributed to a state in a given month, the *totperc* variable, with a coefficient of -68292.05 and $p < 0.0001$ indicates that as the total

percentage of FDI attributed to a state (i.e. the more FDI dollars that a state has relative to the whole) increases by one percentage point, their overall amount of FDI dollars would be expected to fall by \$68292.05. Though this may seem strange intuitively, it may indicate the presence of a new trend: namely, the diversification of FDI distribution throughout the country. This result seems to show that higher concentrations of FDI in a particular state (represented by the *totperc* variable) may create a "crowding out" effect such that MNEs may start deciding to put their dollars (represented by the *fdiamtmills* variable) in other states, either because competition is not as keen, or for another reason.

The *totlit* variable, with a coefficient of 29852.09 and $p < 0.0001$ indicates that as the total literacy rate of adults in a particular state increases by one percentage point, their overall amount of FDI dollars would be expected to rise \$29852.09. This makes intuitive sense, as the *totlit* variable was described in the methodology sections because I would expect that many firms that are relocating branches or headquarters to the country would be interested in hiring from the vast pool of educated talent available. Going to an area that is known for their relatively educated public might not only yield them the greatest opportunity to find appropriate employees, but may also help to keep overall wages (or input and startup costs) on the low side because of the keen competition among the educated unemployed workers to fill the jobs offered by an MNE.

The results of the *totlit* variable seemed to be reinforced by the results for the *totlitm* variable which reports a coefficient of 5501.811 with a p-value of < 0.0001 . However, the results of the *totlit* and *totlitm* variables seem to be contradicted to some degree by the results of the *totlitf* variable. The variable, representing female literacy

rates in a particular state, reported a statistically significant coefficient of -13986.63 with a p-value of <0.0001. This coefficient seems to indicate that an increase in female literacy in a state is associated with an expected decrease in FDI dollars in that state. This result at least superficially indicates that MNEs and investors are not overly concerned with the gender gap, at least as manifested in education. However, while this does not necessarily imply that MNEs are interested in perpetuating the gender gap, the result suggests that basic economic concerns such as low labor costs may be overriding in the short run.

The results for the variables *minminwage* and *maxminwage* are more consistent with initial expectations however, both individually and in relation to each other. Their attributed coefficients of 6426.449 and 2212.076 respectively, and p-values both at <0.0001 are logically consistent with the idea that MNEs may be more interested in going to states where there is a higher quality of life and perhaps more purchasing power on the part of their constituents (and employees) as represented by minimum wages. Although an opposing argument could be made, namely for keeping input costs down as was my original expectation, the regression seems to indicate that the trend is more directed towards MNEs interests in settling in areas that have a relatively higher quality of life as evidenced by being a more expensive place to live and requiring a higher minimum wage. Furthermore, the results showing that the magnitude of the maximum minimum wage on the overall regression as lower than that of the minimum minimum wage is also particularly interesting. Investors may be more concerned with the absolute least they can specify in wages as opposed to the upper ranges for minimum wage, either because some of the upper bounds don't apply to their industry, or for another reason.

The next two variables *urbanpop* and *slumpop* seem to be confounded for some reason, perhaps due to multicollinearity or another reason. While *urbanpop* reports an unexpected -41.482 and *slumpop* reports an even more unexpected 83.831, both with a p-value <0.0001 , my initial reaction of surprise is reinforced by the realization that the variables have essentially switched signs. Though this issue will be addressed in subsequent regressions, it behooves me to discuss why this result is so perturbing. Aside from flying in the face of conventional wisdom, as well as the efforts conducted by Jeffrey Sachs and his team, as well as the work of Sebastien Morris in looking at the impact of urbanization on attracting FDI, it seems extremely odd that while an increase *urbanpop* would be associated with a decrease in FDI dollars, an increase in *slumpop* would be associated with an increase in FDI dollars.

The variables *popnonwork* and *popzerosix* had somewhat surprising results as well, though they did not entirely defy explanation. With coefficients reported as -3.885 and -9.883 respectively, with a p-value <0.0001 , the somewhat surprising signage seems a bit offset by the very low magnitude of the coefficient values. Also, the signage does not seem to indicate a major logical fallacy but perhaps a different interpretation in the variables as related to FDI dollars. Whereas I had expected that a greater population of nonworking citizens in a particular state (represented both by the amount of nonworking citizens in a state and the projected availability of labor given how many children are in the state presently) may increase the likelihood of an MNE settling in that state because of the desire to hire people quickly and at lower relative wages, there may be two influences that would staunch that explanation: minimum wage and education (as proxied

by literacy). The lower relative wages an MNE might seek might be bounded above the point where a higher wage level than what nonworking citizens might be willing to work for. For example, if a state's minimum wage is 20 Rs. per day but the unemployment rate of a state is such that most people would be willing to work for 15 Rs. per day, the MNE would not necessarily be attracted to that state because they will not be able to pay only 15 Rs. per day, but rather must abide by the minimum wage laws governing that state. In a different industry, the issue may not be wage and input costs but rather the quality of worker, or the need for more educated workers. In that case, the MNE might not be interested in the overall level of unemployment of a state, or the availability of labor from the "reserved army of the unemployed", but rather the availability of a particular type of worker.

One of the model idiosyncrasies was revealed by the *powerrating* variable that not only received a seemingly inappropriately high coefficient of -1648871, but the negative signage was particularly perturbing. As many other projects with a similar scope have not included a public investment variable, the hope was that an infrastructure variable like that of the power rating would be somewhat telling. Unfortunately, with a p-value <0.0001 and a rather high magnitude, this result was a disappointment. In subsequent regressions and with some research into the qualitative aspects of the power industry in India today, an explanation began to reveal itself that will be discussed in a later section. Regardless, these results may be call for an inquiry that explores this result in greater depth.

That the coefficient associated with population, *totpop2001* was positive at 4.186

with a p-value <0.0001 was not a surprise. However, the coefficient associated with the gender gap, *genratio*, was certainly unexpectedly high. Seemingly disproportionately high and but unsurprisingly positive at 247485.8, with a p-value <0.0001 , the coefficient was particularly interesting. This seemed to reinforce, to a rather high degree, that MNEs investment in terms of FDI dollars is associated with interest in areas with gender equality, as manifested by a higher quality of life and investment in social infrastructure. However, the extent to which this effect seemed to elicit FDI dollars was still unexpectedly high, especially given the surprisingly negative coefficient associated with the female literacy variable.

The coefficient associated with *cpi* also seemed disproportionately high and negative at -528909.9, though the result for that particular variable was not statistically significant. Another confounding result prompted a major review of the model related to the literacy variables. While *totlitm* was associated with a 5501.811 and *totlitf* was associated with an -13986.63, *totlit* was associated with a coefficient of 29852.09. Indeed, it seemed that some extraneous variables were inhibiting the power of this model and perhaps there were some issues of multicollinearity that were confounding our results. However, despite concern over the model and this particular regression, some potential alterations were deduced and implemented, both in changing the model itself and, eventually, the regression method.

Second Regression (pooled regression corrected for multicollinearity)

It was decided that, because *totlitm* + *totlitf* essentially added up to *totlit* methodologically speaking as well as mathematically in terms of the coefficient and that, while I was concerned with the overall education level of the state I could deduce that still with only one gender specific literacy variable, *totlit* and *totlitm* were excluded from subsequent regression. In a related vein, the variables *urbanpop* and *slumpop* were deemed fairly similar in terms of what they are measuring (indeed since slums are generally associated with urban areas) and that the more telling issue was that of social infrastructure and quality of life as represented by *slumpop* so it was decided that *urbanpop* would also be dropped. Additionally, because it was decided that separating out our minimum wage data into upper and lower bounds did not add much in the way of explanatory power, it was also decided that only the lower bound variable, *minminwage* was the most relevant, because it represented the very least a state would legally offer in wages, and would be retained. In total, after the model was adjusted to incorporate these changes, I dropped 4 variables, *totlit*, *totlitm*, *urbanpop*, and *maxminwage*. I was left with 10 independent variables.

In its second incarnation, using these 10 variables, I saw that the overall significance of the test was still at a <0.0001 level with an adjusted R-squared of .3535 (see Appendix, Table 2). Though the R-squared decreased from our initial regression, this second regression yielded some interesting results. Again, by and large most of the coefficients retained high significance levels (at worst $p = .05$) except for 2: *popzerosix* with a p-value of .346, and *cpi* with a very similar p-value to the initial regression, this

time .514.

Unexpectedly, the second regression again gave a negative coefficient for the power rating variable. This result is of course still inconsistent with our expectations and hypothesis that power rating would be positively associated with FDI because investors are drawn to areas that are more equipped to accommodate the needs of their enterprises--in short, they would be attracted to infrastructure. However, a recent development in some of the “backwards” states may help explain why this surprising result occurred twice. In Orissa for example, despite the fact that the power infrastructure is unable to meet the needs of its public, is attempting to woo investors by devoting a portion of their power grid to MNEs^{xiii}. Thus, while overall its power structure may be substandard, MNEs may not feel that effect because they are being wooed so heavily by certain states.

The coefficient associated with female literacy, though it decreased significantly (and my assumption is appropriately) in magnitude compared to the coefficient obtained in the initial regression, its signage was still negative. This result is inconsistent with the expectations outlined in the hypothesis, the expectations being that investors will be more attracted to areas that have a great emphasis on education (as proxied by literacy rate) and furthermore, will be drawn to states that have a greater emphasis on female literacy because, as is our assumption, higher female literacy would indicate lower levels of gender inequality and higher levels of social infrastructure in a community that values the female literacy rate. However, it may be the case that there is no actual correlation here, but merely that states with higher levels of FDI happen to be associated with a lower level of female literacy, and female literacy may be a variable that requires more long

term study than we can engage in within this context.

Another interesting outcome was the magnitude change for *slumpop*. Because the variable is now being regressed without the “distraction” of *urbanpop*, the resulting coefficient seems to be an amalgamation of the two effects: it is still positive, likely because the forces underlying the variable *urbanpop*, such as an already high income, would have made it positive, but the magnitude has decreased, likely because of the effect *slumpop* would have in repelling FDI. In this instance, it seems that *slumpop* represents a fine duality between the two forces that need to be included in this regression.

Also, in terms of the variables that were statistically significant at the end of this regression, a number switched signs from the previous regression and will be looked at in its turn: *popnonwork*, and *totalpop2001*. That the majority of the other variables retained their significance and sign is somewhat telling, though the sign change for the two population/labor variables warrants some scrutiny. In the previous regression, our sign for *popnonwork* was negative and is now positive, a result that makes a bit more sense given our expectation that a higher “reserve army of the unemployed” will be more of a draw than a population with a lower unemployed potential labor force. On the other hand, *totalpop2001* changed from positive to negative, which is not the most intuitive change. Again, because of the similarity of the population variables, there may be some degree of multicollinearity that has affected this particular coefficient, however in terms of policy implications, while total population is something I want to control for, it is not necessarily essential to use if it is for recommendations in attracting foreign direct

investment.

Overall, these two pooled regressions seem to indicate that level of urbanization, minimum wage, and labor force availability are three considerations that MNEs look at in deciding where to settle their enterprise. However, panel results will add another interesting dimension to this question, and it is what we look at next.

Third and Fourth Regressions

In looking at the variables that were state specific but not time specific, I were able to observe some fairly interesting results. However, the results could only be made more robust and reliable by conducting tests on our panel data that incorporated variables relating to the total approvals for foreign collaboration for each state and each month, as well as understanding rates of growth for both approvals and amounts of foreign dollars involved in FDI.

The third regression conducted, using the `xtreg` command provided by Stata as well as an analysis of fixed effects and a correction for autocorrelation (`xtregar`) looked initially at *totapproval*, the cumulative number of foreign collaboration approvals associated with a particular state, regressed on our dependent variable *fdiamtmills*, the cumulative amount of foreign direct investment dollars associated with a particular state. Though seemingly simplistic, the results (see Appendix, table 3) were rather interesting. Our random effects regression gave *totapproval* a coefficient of 18077.24, with a p-value <0.0001. The fixed effects model, our subsequent regression, gave *totapproval* a coefficient of 67672.64, again with a p-value <0.0001. Though both were positive, the

magnitude was quite different between the two regressions. Conducting a Hausman test to ascertain which regression was most appropriate, it was determined, because I had a significant p-value after our test was conducted (p-value = 0.0001) that our fixed effects regression was most appropriate. Subsequently, I corrected for autocorrelation using *xtserial* and *xtregar* to conclude that *totapproval* was associated with a coefficient of 20894.59 with a p-value <0.0001.

The significance of this particular regression is to understand the likelihood that a high amount of FDI dollars can be gained in a state with a low number of total foreign collaboration approvals. This regression indicates that that is not likely. Instead, it seems to indicate that as total approvals increase, FDI dollars also increase, and the p-value indicates that the two variables are highly correlated, rather FDI dollars are more evenly distributed. This seems to show that it is probably very unlikely that a state can have a lower number of total approvals with a high corresponding amount of FDI dollars. Following that, it seems that if a state is interested in attracting FDI dollars, it is not simply a matter of attracting high levels of investment from a few MNEs but attracting a greater number of MNEs in general.

To continue with this rather interesting line of analysis, I added a quadratic variable to the regression, *totapprovalsq* which was generated by multiplying the variable for *totapproval* to itself. The regression series, which was conducted this time exactly as the previous regression, yielded remarkable results (see Appendix, table 4). In this case, *totapproval* was associated with a coefficient of -6640.159 and p=.063 while *totapprovalsq* was associated with a coefficient of 7.625 and p <0.0001 after correcting

the fixed effects regression for autocorrelation (again because our Hausman test yielded a p-value = 0.0001), we picked the fixed effects model. The interesting signage in these results indicates that in fact there is a "U" shape that exists in this model, meaning that there is an inflection point in the trend between total approvals and FDI dollars such that at a certain point in a state's experience with FDI, their total number of foreign collaboration approvals will actually start repelling FDI dollars, perhaps due to a crowding out effect or change in investment atmosphere such that MNEs will move their businesses elsewhere.

An Alternative: Growth in FDI Dollars

Just as some states may be interested in attracting a larger absolute amount of FDI dollars from MNEs, some may be concerned with increasing the growth rates of their FDI. Though the two may sound somewhat identical, the issues are somewhat different. While a state may have a high level of FDI dollars, they may feel as though they are "stagnating" to some degree, or topping out at a level while other states are growing rapidly, building up and improving their investment climate, and becoming better competitors within the country. The goals therefore may be slightly different depending on the state and its motivations concerning foreign direct investment. Thus, regressions similar to those conducted with FDI dollars as the dependent variable were conducted to understand the similarities and differences in the relationship between these dependent variables and the independent variables we had chosen for this study.

First Regression with Dependent Variable: FDI Amount Growth (FDIAmtGrth)

In this regression, I was able to include *fdiamtmills* as an independent variable because there was a logical causal link between the two to some degree. In this instance, if *fdiamtmills* increases, *fdiamtgrth* may increase or may decrease from period to period depending on the amount that *fdiamtmills* has increased.

The initial regression, a pooled regression, included all of the non-time dependent variables included in the initial pooled regression conducted with *fdiamtmills* as the dependent variable, however this time it included *fdiamtmills* as an independent variable. The results of this regression (see Appendix, table 5) were insignificant overall with a p-value of .6178 and an adjusted R-squared value of -0.0044 (remembering that an adjusted R-squared can be negative). Furthermore, none of the 15 variables included in this regression emerged with a statistically significant coefficient. The variable whose coefficient had the lowest p-value was *totlitm*: .188. Though these results were uninformative, considering the outcome of the regression progression with *fdiamtmills* as the dependent variable led us to believe that omitting some of the controversial variables (*totlit*, *totlitm*, and *urbanpop*, this time with the addition of *popzerosix* which seemed to be somewhat multicollinear with *popnonwork*) would result in a more appropriate regression.

Second Regression

The results of this regression (see Appendix, table 6) were still statistically insignificant. Overall, the p-value of .5180 and adjusted R-squared of -0.0017 showed us

that this regression had no more explanatory power than the preceding regression. In addition, none of the remaining independent variables in this more restricted model were associated with statistically significant coefficients.

One of the main problems with these pooled regressions in terms of their lack of explanatory power may be a result of the fact that looking at the variable "growth" may require independent variable data that changes over time to understand the actual patterns of growth. While *fdiamtmills* is an absolute number, *fdiamtgrth* is a number that depends on relative amounts of other variables. With this in mind, I conducted panel regressions that I hoped would yield more desirable and interesting results.

Third and Fourth Regressions

Similar to the panel regressions conducted with *fdiamtmills* as the dependent variable and *totapproval* as the main independent variable, I were interested to see if there were similar associations to be made with *fdiamtgrth* as the dependent variable in this instance.

The first regression (see results Appendix, table 7), after a simple xtreg command (again with random effects being the default) yielded a coefficient for the variable *totapproval* of 0.0005033 but with a p-value of 0.335. The corresponding fixed effects regression yielded an even higher p-value of 0.564 and a coefficient of -0.0030355. A Hausman test was conducted to ascertain which was more appropriate and led us to believe that random effects was the better regression because of our insignificant p-value of 0.4989. After correcting for autocorrelation, I was still left with a statistically

insignificant coefficient of 0.0005006 and p-value of 0.353.

Though these results are not significant statistically, they may be significant in that they seem to establish that there is no causal relationship or association between the number of total approvals in a given state and that state's corresponding growth in dollars of FDI money. Combining this result with what I learned in the previous panel regressions conducted on the *fdiamtmills* variable, I may be able to deduce that while total approvals may affect total absolute numbers of millions of dollars in FDI, as I saw in the pooled regressions where *fdiamtmills* was an independent variable that was not statistically significant against its growth variable, it would logically follow that total approvals might not affect FDI growth. In a way, this follows a transitive property of a sort: if A begets B but B does not beget C, A may not beget C. Certainly not a conclusive statement but one whose relationship mirrors the associations in these regressions and can explain to some degree why, even in a panel regression, total approvals do not seem to be associated with growth in FDI.

The second panel regression conducted with *fdiamtgrth* as the dependent variable (see Appendix, table 8) yielded perhaps our most interesting results with this particular dependent variable. Mirroring the regression conducted with *fdiamtmills*, this extended the preceding panel regression by adding the quadratic variable *totapprovalsq*. The resulting coefficients had the lowest p-values yet with this dependent variable. The coefficient *totapproval* received was a .0026158 with a p-value of 0.079, while *totapprovalsq* received a $-5.85e-07$ with a p-value of 0.129, an inverted "U" shape and the opposite trend of what I saw with the relationship between *fdiamtmills* and the same two

independent variables. However, even more interesting results were gathered once a fixed effects regression was conducted. In this case, the signs of the coefficients were now reversed (so that the trend took on the conventional "U" shape and mirrored that of the results with *fdiamtmills* in its analogous regression) and all of the p-values, including that of the constant, were =0.001.

After conducting a Hausman test and determining that fixed effects was the more appropriate regression (with a p-value = 0.0006) and then correcting for autocorrelation, I saw that the initial results from the random effects regression with the associated inverted "U" shape trend was what needed to be analyzed. Unfortunately, the corrected regression, though containing relatively low p-values considering what I had seen so far with *fdiamtgrth* as a dependent variable, still was a statistically insignificant regression overall. The coefficient for *totapproval*, 0.0025848 was associated with a p-value of 0.095 while the coefficient for *totapprovalsq*, -5.78e-07 was associated with a p-value of .150.

This leads us to two potential interpretations. Certainly, I can leave it as a circumstance where I am not finding statistical significance when using *fdiamtgrth* as a dependent variable, and thus there are no firm policy implications to be gained in terms of suggesting appropriate actions to take if a state wants to increase their growth rate of FDI. However, the fact that the p-value seemed to be decreasing with different permutations of models using this dependent variable does leave the door open for potentially more appropriate models if more data are found that could have some explanatory power on this variable. Because we were so close, and at an alpha = 0.1 level

at least, I can say that the last regression's coefficient for *totapproval* was statistically significant (and positive), I strongly believe that there is room to grow and it is important to follow up on the *fdiamtgrth* variable in the future if and when more panel data becomes available.

Looking at Random Effects

To get another perspective on our data and how our non-time dependent data might inform us of its explanatory power, with some reservations, I engaged in panel regressions using the random effects option. Below are the results of the two regressions I completed, one with the dependent variable as the amount of FDI dollars (*fdiamtmills*) and the second with the dependent variable as the growth in FDI dollars (*fdiamtgrth*).

Random Effects: Looking at FDI Dollars

This regression had some fairly interesting results that were quite consistent with our results from our earlier pooled regressions with the same dependent variable. These results (see Appendix Table 9) had an overall R-squared value of .4007 and of the 14 variables that were regressed, all but 3 were significant at least at the .05 level. The three that were not significant were *popnonwork*, *genratio*, and *cpi*. Of the remaining 11 variables however, though the magnitudes of most of the coefficients was quite different from our previous pooled regressions, with the values generally 50% or less than that of the coefficients from the pooled regressions, the signs were all consistently the same.

Again, though I interpret these results with some reservation, they do seem to indicate that there is explanatory power in these variables upon the dependent variable *fdiamtmills*. To summarize our results, though a few variables defied my original expectations (as in the pooled regressions, these variables were *totlitf*, *urbanpop* and *slumpop* which again reversed their signages, *popnonwork*, *popzerosix*, and *powerrating*), by and large, the majority did fulfill my expectations. Among those that did defy expectations, we had already conjectured that *totlitf* was merely associated with a negative signage, but that it did not imply a causality, *urbanpop* and *slumpop* were multicollinear and that confounded the results to some degree, *popnonwork* and *popzerosix* also had a degree of multicollinearity between them as well, and *powerrating* while a useful variable, may not have taken into account a state's proclivity to use even their most meager infrastructure to woo MNEs, even at the expense of their public.

Random Effects: Looking at FDI Growth Rates

Unfortunately, just as in the pooled regressions, I was unable to cull any meaningful or informative results from this panel regression. The results (see Appendix Table 10) have an overall R-squared value of .0252 and none of the 14 variables that were regressed onto the dependent variable *fdiamtgrth* were statistically significant even at the .1 level. It is my opinion therefore that our policy implications and conclusions are to be drawn from our results working with *fdiamtmills*.

Variable	Model 1 FDIMills	Model 2 FDIMills	Model 3 FDIGrth	Model 4 FDIGrth	Model 5 FDIMills,RE	Model 6 FDIGrth,RE
Totlit	29852.09 (4158.189)	----	-.00128 (.00359)	----	11065.73 (4204.221)	-.0007657 (.00302)
TotlitM	5501.811 (683.484)	----	-.000798 (.000605)	----	1735.636 (656.951)	-.0006954 (.0004749)
TotlitF	-13986.63 (1474.485)	-2178.82 (865.27)	.000437 (.00136)	-.000471 (.000776)	-3809.325 (1279.512)	.0001622 (.0009308)
MinMinWage	6426.449 (1278.483)	3779.78 (1124.99)	-.000186 (.00106)	-.000689 (.000843)	3581.723 (1385.921)	-.0001081 (.001001)
MaxMinWage	2212.076 (479.986)	----	-.000018 (.000392)	.000199 (.000305)	947.5836 (515.949)	.000142 (.0003703)
UrbanPop	-41.482 (4.478)	----	-6.84e-07 (3.9e-06)	----	-24.546 (4.659)	-1.12e-06 (3.30e-06)
SlumPop	83.831 (8.478)	10.790 (1.166)	1.20e-06 (7.4e-06)	-2.11e-07 (8.9e-07)	48.813 (8.709)	-2.10e-06 (6.16e-06)
PopNonWork	-3.885 (.949)	1.827 (.805)	4.96e-07 (7.8e-07)	-2.17e-07 (5.4e-07)	-1.288 (1.018)	4.25e-07 (7.40e-07)
PopZeroSix	-9.883 (1.705)	1.425 (1.511)	-6.7e-07 (1.4e-06)	----	-4.859 (1.819)	-7.90e-07 (1.34e-06)
PowerRating	-1648871 (213465.2)	-307631 (99215.1)	.0789 (.187)	-.00509 (.0896)	-729339.4 (217756.7)	.054241 (.1602342)
TotalPop2001	4.186 (.793)	-2.602 (.589)	-1.5e-07 (6.6e-07)	2.13e-07 (4.3e-07)	1.667 (.841)	-8.44e-08 (6.15e-07)
GenRatio	247485.8 (67437.61)	265681 (65731)	-.0411 (.0566)	-.0626 (.0492)	126337.5 (73632.99)	-.037613 (.05472)
CPI	-528909.9 (800696.7)	418816 (641491)	-.552 (.637)	-.296 (.478)	-734739.4 (885641.8)	-.544546 (.635239)

Policy Implications

Through this series of regressions and results, ultimately our interests lie in the implications this study has on states that are interested in increasing their access to FDI dollars. Whatever controversies may lie in FDI and its unintended consequences, the issue is really in empowering a state and its public to evolve as it wishes in democratic tradition.

Despite some uninformative results in the regressions where the growth rate of FDI dollars is the dependent variable, I have seen some interesting developments where the absolute amount of FDI dollars is the dependent variable. It is from a compilation of these four regressions (again, listed in the preceding table as Models 1, 2, 5 and 6) that I will be able to formulate policy implications, mainly by examining the variables whose signs stay consistent across their regression pairs (the unrestricted and restricted versions of their models) and magnitudes of the coefficients I found.

Mainly it seems that there is a strong relationship between overall literacy rates, minimum wage levels, level of urbanization, and gender ratio that fulfilled my expectations, namely that with their increase, levels of FDI dollars would also increase. However, despite the surprising results of some of the other variables tested in the pooled and panel regressions conducted, which can again be attributed to factors such as associations and not correlations, or a momentum issue in that FDI may not have been measured long enough in our data set for us to be able to see the real relationship between it and the independent variables included in these regressions. Overall, I am quite pleased

with these results and believe they will be beneficial in building short-term and long-term policies for states interested in attracting FDI dollars.

In the short-term, I believe that data is essential and must be collected carefully and methodically so that more studies of this nature, and that of Dr. Sachs and Dr. Morris, can be conducted. Also, I believe in the short-term, it is essential to look at more state-level data in different areas (for example, health indicators, migration patterns) on a monthly basis if possible to understand if there are short-term effects on FDI.

In the long-term, I believe that, because levels of urbanization seem to be a significant anchor, yet gender ratio and literacy seem to factor in prominently as well, it would behoove states that do not currently have large urban centers to build them carefully, with an emphasis on public investment on the part of the state on education and healthcare and other policies that would indicate that that particular state values a higher standard of living. Such a maneuver would also be consistent with a higher minimum wage, as we saw in our pooled and panel regressions, and demonstrate to MNEs and potential investors that a particular state is interested in intelligent growth and perhaps an “up and coming” area.

In terms of infrastructure, a somewhat surprising variable in terms of our results with the *powerrating*, our proxy for infrastructure, variable, I am still holding firm to the idea that a strong infrastructure is enticing to investors. The temptation to reserve all infrastructure for potential investors to the disadvantage of the public must be resisted however. As we have seen in these regressions, MNEs seem to be attracted to areas that have higher levels of urbanization and overall emphasis on quality of life. The issue for

states who are interested in becoming competitive for FDI is not just how to seem like a valuable prospect for investment, but to actually become a valuable prospect by investing in the state and the public for its own good.

Conclusions

Overall, this study was not only gratifying on a personal level, to attempt to address questions that have interested me for some time, but on an intellectual level. To be able to emerge from this process with an eye for the next steps in policy development is a very satisfying feeling. It seems that MNEs do associate areas with high quality of life, as evidenced by higher minimum wage, literacy, and gender ratio, with valuable areas to invest in. Nevertheless, there are areas I can see that need improvement and thus the door is open for similar and hopefully better studies in a similar vein. The improvements that could be made if such a venture is attempted again come in two categories: data availability and questions to be answered.

It would certainly behoove the researcher, and I believe anyone interested in the outcome of this particular study, to have access to more data sets that not only look at state level data in India, but state level data that changes over time. Unfortunately, there is always a level of constraint on data availability, but to be able to procure time-dependent state level data would allow for greater flexibility with our panel estimations and a greater understanding of, after some time passes, how reciprocal effects can be felt, meaning that I will one day truly be able to study effects of FDI on social and health

indicators (and anything else that strikes one's fancy) at the state level.

Which leads me to the issue of the questions I should be asking in the future. Certainly, it would be presumptuous to say that this question has been answered, but thinking forward from the issue of attracting FDI, I may want to ask what effects FDI has once it has been brought to a state. I may want to look at the effects greater and lesser amounts of FDI have on the same state—is there a point where the positive effects “top out” and FDI suddenly begins to have a negative effect? In looking at effects of FDI, of course I should look at social indicators and economic indicators, but perhaps I may also want to look at implications in the legal sense as well. Will intellectual property rights become a new bastion of competition between states in India?

The issue of foreign direct investment is still so new in India, and hopes are high that FDI brings a chance for India to become a leader and inspiration to other countries. While I count myself among the many people who have faith that India's policymakers can harness the positive attributes of FDI and bring them to the public, I still remain inquisitive about the future. With every attempt to answer one question, I must be open to the possibilities that our answers beget more questions—and in the case of FDI and India, it would be prudent to embrace those questions sooner rather than later.

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Appendix

Table 1

Source	SS	df	MS			
Model	3.0416e+17	14	2.1726e+16	Number of obs =	562	
Residual	2.9069e+17	547	5.3142e+14	F(14, 547) =	40.88	
				Prob > F =	0.0000	
				R-squared =	0.5113	
				Adj R-squared =	0.4988	
Total	5.9485e+17	561	1.0603e+15	Root MSE =	2.3e+07	

fdiamtmills	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
totperc	-68292.05	6137.778	-11.13	0.000	-80348.55	-56235.55
totlit	29852.09	4158.189	7.18	0.000	21684.12	38020.07
totlitm	5501.811	683.4836	8.05	0.000	4159.237	6844.384
totlitf	-13986.63	1474.485	-9.49	0.000	-16882.98	-11090.29
minminwage	6426.449	1278.483	5.03	0.000	3915.111	8937.786
maxminwage	2212.076	479.986	4.61	0.000	1269.234	3154.917
urbanpop	-41.48166	4.478262	-9.26	0.000	-50.27836	-32.68497
slumpop	83.83114	8.477859	9.89	0.000	67.178	100.4843
popnonwork	-3.884902	.9496049	-4.09	0.000	-5.75022	-2.019583
popzerosix	-9.883034	1.705417	-5.80	0.000	-13.233	-6.533067
powerrating	-1648871	213465.2	-7.72	0.000	-2068183	-1229559
totalpop2001	4.186212	.7928099	5.28	0.000	2.628887	5.743537
genratio	247485.8	67437.61	3.67	0.000	115017.4	379954.1
cpi	-528909.9	800696.7	-0.66	0.509	-2101727	1043907
_cons	-3.06e+08	1.16e+08	-2.63	0.009	-5.33e+08	-7.77e+07

Table 2

Source	SS	df	MS			
Model	2.1712e+17	10	2.1712e+16	Number of obs =	562	
Residual	3.7773e+17	551	6.8553e+14	F(10, 551) =	31.67	
				Prob > F =	0.0000	
				R-squared =	0.3650	
				Adj R-squared =	0.3535	
Total	5.9485e+17	561	1.0603e+15	Root MSE =	2.6e+07	

fdiamtmills	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
totperc	-20875.66	5453.576	-3.83	0.000	-31588	-10163.31
totlitf	-2178.821	865.2655	-2.52	0.012	-3878.444	-479.1988
minminwage	3779.78	1124.985	3.36	0.001	1569.995	5989.564
slumpop	10.79023	1.166367	9.25	0.000	8.499162	13.0813
popnonwork	1.826625	.8052447	2.27	0.024	.2448999	3.40835
popzerosix	1.424997	1.51145	0.94	0.346	-1.543913	4.393906
powerrating	-307631.8	99215.18	-3.10	0.002	-502518.1	-112745.6
totalpop2001	-2.602133	.5898513	-4.41	0.000	-3.760765	-1.4435
genratio	265681.8	65731.28	4.04	0.000	136567.2	394796.3
cpi	418816.5	641491.9	0.65	0.514	-841252.4	1678885
_cons	-2.74e+08	1.05e+08	-2.61	0.009	-4.80e+08	-6.77e+07

Table 3 (a-d)

```

Random-effects GLS regression           Number of obs   =   1149
Group variable (i): statecode          Number of groups =    34

R-sq:  within = 0.1518                  Obs per group:  min =    25
        between = 0.9047                  avg   =   33.8
        overall = 0.4422                  max   =    35

Random effects u_i ~ Gaussian           Wald chi2(1)    =   359.47
corr(u_i, X) = 0 (assumed)              Prob > chi2     =    0.0000

```

fdiamtmills	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
totapproval	18077.24	953.4537	18.96	0.000	16208.51	19945.98
_cons	-2174214	1016345	-2.14	0.032	-4166213	-182215
sigma_u	4111214.1					
sigma_e	16442470					
rho	.0588396	(fraction of variance due to u_i)				

. xtreg fdiamtmills totapproval, fe

```

Fixed-effects (within) regression       Number of obs   =   1149
Group variable (i): statecode           Number of groups =    34

R-sq:  within = 0.1518                  Obs per group:  min =    25
        between = 0.9047                  avg   =   33.8
        overall = 0.4422                  max   =    35

corr(u_i, Xb) = -0.9889                  F(1,1114)      =   199.35
                                           Prob > F        =    0.0000

```

fdiamtmills	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
totapproval	67672.64	4792.948	14.12	0.000	58268.42	77076.86
_cons	-2.61e+07	2372225	-10.99	0.000	-3.07e+07	-2.14e+07
sigma_u	48740089					
sigma_e	16442470					
rho	.8978232	(fraction of variance due to u_i)				

F test that all u_i=0: F(33, 1114) = 6.33 Prob > F = 0.0000

. est store fixed

. xtreg fdiamtmills totapproval, re

```

Random-effects GLS regression           Number of obs   =   1149
Group variable (i): statecode          Number of groups =    34

R-sq:  within = 0.1518                  Obs per group:  min =    25
        between = 0.9047                  avg   =   33.8
        overall = 0.4422                  max   =    35

Random effects u_i ~ Gaussian           Wald chi2(1)    =   359.47

```


Table 4 (a-d)

```
. xtreg fdiamtmills totapproval totapprovalSQ

Random-effects GLS regression                Number of obs    =    1149
Group variable (i): statecode              Number of groups =     34

R-sq:  within = 0.2480                      Obs per group:  min =     25
        between = 0.9526                      avg =            33.8
        overall = 0.5085                      max =            35

Random effects u_i ~ Gaussian              Wald chi2(2)     =    999.09
corr(u_i, X) = 0 (assumed)                 Prob > chi2      =     0.0000
```

fdiamtmills	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
totapproval	-934.6236	1597.11	-0.59	0.558	-4064.903	2195.655
totapproval~Q	5.092282	.4187641	12.16	0.000	4.27152	5.913045
_cons	1665211	670730.9	2.48	0.013	350603	2979820
sigma_u	1270507.4					
sigma_e	15006143					
rho	.00711728	(fraction of variance due to u_i)				

```
. xtreg fdiamtmills totapproval totapprovalSQ, fe

Fixed-effects (within) regression          Number of obs    =    1149
Group variable (i): statecode              Number of groups =     34

R-sq:  within = 0.2941                      Obs per group:  min =     25
        between = 0.0050                      avg =            33.8
        overall = 0.0073                      max =            35

corr(u_i, Xb) = -0.8879                     F(2,1113)       =    231.90
                                                Prob > F        =     0.0000
```

fdiamtmills	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
totapproval	-110574.3	12676.04	-8.72	0.000	-135445.9	-85702.67
totapproval~Q	28.3025	1.889097	14.98	0.000	24.5959	32.00909
_cons	2.96e+07	4299335	6.88	0.000	2.11e+07	3.80e+07
sigma_u	42185217					
sigma_e	15006143					
rho	.88767611	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(33, 1113) =      8.66      Prob > F = 0.0000
```

```
. est store fixed
```

```
. xtreg fdiamtmills totapproval totapprovalSQ, re

Random-effects GLS regression                Number of obs    =    1149
Group variable (i): statecode              Number of groups =     34

R-sq:  within = 0.2480                      Obs per group:  min =     25
        between = 0.9526                      avg =            33.8
        overall = 0.5085                      max =            35
```

```

Random effects u_i ~ Gaussian          Wald chi2(2)      =    999.09
corr(u_i, X)      = 0 (assumed)       Prob > chi2      =    0.0000

```

```

-----+-----
      fdiamtmills |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
      totapproval |   -934.6236   1597.11    -0.59  0.558    -4064.903   2195.655
      totapprova~Q |    5.092282   .4187641   12.16  0.000     4.27152   5.913045
      _cons       |   1665211    670730.9    2.48  0.013     350603   2979820
-----+-----
      sigma_u     |  1270507.4
      sigma_e     |  15006143
      rho         |   .00711728   (fraction of variance due to u_i)
-----+-----

```

```

. est store random
. hausman fixed random

```

```

-----+-----
      Coefficients ----
      (b)      (B)      (b-B)      sqrt(diag(V_b-V_B))
      fixed   random   Difference   S.E.
-----+-----
      totapproval | -110574.3   -934.6236   -109639.7   12575.02
      totapprova~Q |    28.3025    5.092282    23.21021    1.842098
-----+-----

```

```

      b = consistent under Ho and Ha; obtained from xtreg
      B = inconsistent under Ha, efficient under Ho; obtained from xtreg

```

```

Test: Ho: difference in coefficients not systematic

```

```

      chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
              =      249.99
      Prob>chi2 =      0.0000

```

```

. xtserial fdiamtmills totapproval totapprovalSQ

```

```

Wooldridge test for autocorrelation in panel data

```

```

H0: no first-order autocorrelation
      F( 1, 33) = 920.450
      Prob > F = 0.0000

```

```

. xtregar fdiamtmills totapproval totapprovalSQ

```

```

RE GLS regression with AR(1) disturbances          Number of obs      =    1149
Group variable (i): statecode                     Number of groups   =     34

```

```

R-sq:  within = 0.2565          Obs per group: min =     25
      between = 0.9223          avg =          33.8
      overall = 0.5028          max =          35

```

```

corr(u_i, Xb)      = 0 (assumed)          Wald chi2(3)      =    298.31
                                          Prob > chi2       =    0.0000

```

```

-----+-----
      theta -----
      min    5%    median    95%    max
      0.0000  0.0000  0.0000  0.0000  0.0000
-----+-----

```

```

-----+-----
      fdiamtmills |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
      totapproval |   -6640.159   3576.005    -1.86  0.063    -13649   368.6822
      totapprova~Q |    7.624773   .941811     8.10  0.000     5.778858   9.470689
      _cons       |   2345452    1529335     1.53  0.125    -651989.1   5342893
-----+-----

```

rho_ar	.79895499	(estimated autocorrelation coefficient)
sigma_u	0	
sigma_e	9505640.6	
rho_fov	0	(fraction of variance due to u_i)

Table 5

Source	SS	df	MS	Number of obs = 505		
Model	3927.94552	15	261.863034	F(15, 489) =	0.85	
Residual	150095.3	489	306.943353	Prob > F =	0.6178	
				R-squared =	0.0255	
				Adj R-squared =	-0.0044	
Total	154023.245	504	305.601677	Root MSE =	17.52	

fdiamtgrth	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fdiamtmills	-1.42e-09	3.93e-08	-0.04	0.971	-7.87e-08	7.58e-08
totperc	.001881	.0059286	0.32	0.751	-.0097677	.0135296
totlit	-.0012839	.0035893	-0.36	0.721	-.0083362	.0057683
totlitm	-.0007979	.0006046	-1.32	0.188	-.0019858	.0003901
totlitf	.0004374	.0013563	0.32	0.747	-.0022274	.0031023
minminwage	-.0001862	.0010571	-0.18	0.860	-.0022632	.0018907
maxminwage	-.0000178	.0003917	-0.05	0.964	-.0007874	.0007517
urbanpop	-6.84e-07	3.87e-06	-0.18	0.860	-8.28e-06	6.91e-06
slumpop	1.20e-06	7.41e-06	0.16	0.872	-.0000134	.0000158
popnonwork	4.96e-07	7.85e-07	0.63	0.528	-1.05e-06	2.04e-06
popzerosix	-6.67e-07	1.44e-06	-0.46	0.642	-3.49e-06	2.16e-06
powerrating	.0788894	.1869035	0.42	0.673	-.2883436	.4461223
totalpop2001	-1.50e-07	6.65e-07	-0.23	0.822	-1.46e-06	1.16e-06
genratio	-.0410552	.0566413	-0.72	0.469	-.1523455	.0702351
cpi	-.5515585	.6366883	-0.87	0.387	-1.802541	.6994239
_cons	111.3503	95.60307	1.16	0.245	-76.49324	299.1938

Table 6

Source	SS	df	MS	Number of obs = 505		
Model	3107.15008	11	282.468189	F(11, 493) =	0.92	
Residual	150916.095	493	306.11784	Prob > F =	0.5180	
				R-squared =	0.0202	
				Adj R-squared =	-0.0017	
Total	154023.245	504	305.601677	Root MSE =	17.496	

fdiamtgrth	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fdiamtmills	-1.32e-08	3.29e-08	-0.40	0.688	-7.79e-08	5.14e-08
totperc	-.0011584	.0039587	-0.29	0.770	-.0089365	.0066197
totlitf	-.0004705	.0007755	-0.61	0.544	-.0019942	.0010532
minminwage	-.0006887	.000843	-0.82	0.414	-.0023451	.0009677
maxminwage	.0001986	.0003051	0.65	0.515	-.0004008	.0007979
slumpop	-2.11e-07	8.85e-07	-0.24	0.811	-1.95e-06	1.53e-06
popnonwork	-2.17e-07	5.39e-07	-0.40	0.687	-1.28e-06	8.42e-07
powerrating	-.0050899	.089604	-0.06	0.955	-.1811427	.1709629

totalpop2001		2.13e-07	4.31e-07	0.49	0.622	-6.35e-07	1.06e-06
genratio		-.0625963	.049179	-1.27	0.204	-.1592226	.0340299
cpi		-.2960168	.477903	-0.62	0.536	-1.234995	.6429611
_cons		94.79949	81.22477	1.17	0.244	-64.78993	254.3889

Table 7 (a-d)

```
. xtreg fdiamtgrth totapproval
```

```
Random-effects GLS regression           Number of obs   =   1077
Group variable (i): statecode           Number of groups =    34

R-sq:  within = 0.0003                   Obs per group:  min =    18
      between = 0.0248                               avg   =   31.7
      overall = 0.0009                               max   =    35

Random effects u_i ~ Gaussian           Wald chi2(1)    =    0.93
corr(u_i, X) = 0 (assumed)              Prob > chi2     =   0.3352
```

fdiamtgrth		Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
totapproval		.0005033	.0005223	0.96	0.335	-.0005204 .001527
_cons		.9999497	.5330693	1.88	0.061	-.0448469 2.044746
sigma_u		0				
sigma_e		15.680026				
rho		0	(fraction of variance due to u_i)			

```
. xtreg fdiamtgrth totapproval, fe
```

```
Fixed-effects (within) regression       Number of obs   =   1077
Group variable (i): statecode           Number of groups =    34

R-sq:  within = 0.0003                   Obs per group:  min =    18
      between = 0.0248                               avg   =   31.7
      overall = 0.0009                               max   =    35

corr(u_i, Xb) = -0.7767                   F(1,1042)      =    0.33
                                           Prob > F        =   0.5639
```

fdiamtgrth		Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
totapproval		-.0030355	.0052591	-0.58	0.564	-.0133551 .0072841
_cons		2.610325	2.440412	1.07	0.285	-2.178358 7.399008
sigma_u		4.2859851				
sigma_e		15.680026				
rho		.06952075	(fraction of variance due to u_i)			

```
F test that all u_i=0:      F(33, 1042) =    0.91      Prob > F = 0.6112
```

```
. est store fixed
```

```
. xtreg fdiamtgrth totapproval, re
```

```
Random-effects GLS regression           Number of obs   =   1077
Group variable (i): statecode           Number of groups =    34
```

```
R-sq:  within = 0.0003          Obs per group: min =      18
        between = 0.0248         avg =      31.7
        overall = 0.0009         max =      35
```

```
Random effects u_i ~ Gaussian          Wald chi2(1)      =      0.93
corr(u_i, X) = 0 (assumed)            Prob > chi2      =      0.3352
```

```
-----+-----
```

fdiamtgrth	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
totapproval	.0005033	.0005223	0.96	0.335	-.0005204	.001527
_cons	.9999497	.5330693	1.88	0.061	-.0448469	2.044746
sigma_u	0					
sigma_e	15.680026					
rho	0	(fraction of variance due to u_i)				

```
-----+-----
```

```
. est store random
```

```
. hausman fixed random
```

```
-----+-----
```

---- Coefficients ----				
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	random	Difference	S.E.
totapproval	-.0030355	.0005033	-.0035388	.0052331

```
-----+-----
```

```
b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
```

```
Test: Ho: difference in coefficients not systematic
```

```
chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
          =      0.46
Prob>chi2 =      0.4989
```

```
. xtserial fdiamtgrth totapproval
```

```
Wooldridge test for autocorrelation in panel data
```

```
H0: no first-order autocorrelation
```

```
F( 1, 33) =      0.400
Prob > F =      0.5316
```

```
. xtregar fdiamtgrth totapproval
```

```
RE GLS regression with AR(1) disturbances          Number of obs      =      1077
Group variable (i): statecode                    Number of groups   =      34
```

```
R-sq:  within = 0.0003          Obs per group: min =      18
        between = 0.0248         avg =      31.7
        overall = 0.0009         max =      35
```

```
corr(u_i, Xb) = 0 (assumed)            Wald chi2(2)      =      0.86
                                                Prob > chi2      =      0.6494
```

```
-----+----- theta -----+-----
```

min	5%	median	95%	max
0.0000	0.0000	0.0000	0.0000	0.0000

```
-----+-----
```

```
-----+-----
```

fdiamtgrth	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
totapproval	.0005006	.0005387	0.93	0.353	-.0005552	.0015564
_cons	.9969181	.5500281	1.81	0.070	-.0811171	2.074953

```
-----+-----
```

```

rho_ar | -.0316333 (estimated autocorrelation coefficient)
sigma_u | 0
sigma_e | 15.69876
rho_fov | 0 (fraction of variance due to u_i)
-----

```

Table 8 (a-d)

```

. xtreg fdiamtgrth totapproval totapprovalSQ

Random-effects GLS regression           Number of obs   =   1077
Group variable (i): statecode          Number of groups =    34

R-sq:  within = 0.0034                  Obs per group:  min =    18
      between = 0.1178                    avg =           31.7
      overall = 0.0030                    max =           35

Random effects u_i ~ Gaussian           Wald chi2(2)    =    3.23
corr(u_i, X) = 0 (assumed)              Prob > chi2     =    0.1988

```

```

-----
      fdiamtgrth |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
      totapproval |   .0026158   .001487    1.76  0.079   - .0002988   .0055303
      totapprova~Q |  -5.85e-07   3.86e-07  -1.52  0.129   -1.34e-06   1.71e-07
      _cons       |   .648013    .5810624   1.12  0.265   - .4908485   1.786874
-----+-----
      sigma_u     |           0
      sigma_e     |  15.609101
      rho         |           0 (fraction of variance due to u_i)
-----

```

```

. xtreg fdiamtgrth totapproval totapprovalSQ, fe

Fixed-effects (within) regression       Number of obs   =   1077
Group variable (i): statecode           Number of groups =    34

R-sq:  within = 0.0103                  Obs per group:  min =    18
      between = 0.0641                    avg =           31.7
      overall = 0.0019                    max =           35

corr(u_i, Xb) = -0.9936                  F(2,1041)      =    5.41
                                           Prob > F        =    0.0046

```

```

-----
      fdiamtgrth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----+-----
      totapproval |  -.0531071   .0163216  -3.25  0.001   - .0851341   -.02108
      totapprova~Q |   7.42e-06   2.29e-06   3.24  0.001   2.92e-06   .0000119
      _cons       |  17.67051    5.246114   3.37  0.001   7.376346   27.96467
-----+-----
      sigma_u     |  28.514878
      sigma_e     |  15.609101
      rho         |   .76943855 (fraction of variance due to u_i)
-----

```

```

F test that all u_i=0:      F(33, 1041) =    1.17          Prob > F = 0.2372

```

```

. est store fixed

```

```
. xtreg fdiamtgrth totapproval totapprovalSQ, re
```

```
Random-effects GLS regression           Number of obs   =       1077
Group variable (i): statecode           Number of groups =        34

R-sq:  within = 0.0034                   Obs per group:  min =        18
      between = 0.1178                               avg =       31.7
      overall = 0.0030                               max =        35

Random effects u_i ~ Gaussian           Wald chi2(2)     =        3.23
corr(u_i, X) = 0 (assumed)              Prob > chi2      =       0.1988
```

fdiamtgrth	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
totapproval	.0026158	.001487	1.76	0.079	-.0002988	.0055303
totapprova~Q	-5.85e-07	3.86e-07	-1.52	0.129	-1.34e-06	1.71e-07
_cons	.648013	.5810624	1.12	0.265	-.4908485	1.786874
sigma_u	0					
sigma_e	15.609101					
rho	0 (fraction of variance due to u_i)					

```
. est store random
```

```
. hausman fixed random
```

Note: the rank of the differenced variance matrix (1) does not equal the number of coefficients being tested (2); be sure this is what you expect, or there may be problems computing the test. Examine the output of your estimators for anything unexpected and possibly consider scaling your variables so that the coefficients are on a similar scale.

	---- Coefficients ----			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
totapproval	-.0531071	.0026158	-.0557228	.0162537
totapprova~Q	7.42e-06	-5.85e-07	8.00e-06	2.26e-06

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
 = 11.75
 Prob>chi2 = 0.0006

```
. xtserial fdiamtgrth totapproval totapprovalSQ
```

Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation
 F(1, 33) = 0.324
 Prob > F = 0.5728

```
. xtregar fdiamtgrth totapproval totapprovalSQ
```

```
RE GLS regression with AR(1) disturbances   Number of obs   =       1077
Group variable (i): statecode               Number of groups =        34

R-sq:  within = 0.0034                   Obs per group:  min =        18
      between = 0.1178                               avg =       31.7
      overall = 0.0030                               max =        35
```

corr(u_i, Xb) = 0 (assumed)		Wald chi2(3) = 2.92	Prob > chi2 = 0.4048			
----- theta -----						
min	5%	median	95%	max		
0.0000	0.0000	0.0000	0.0000	0.0000		

fdiamtgrth	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
totapproval	.0025848	.0015473	1.67	0.095	-.0004478	.0056173
totapprova~Q	-5.78e-07	4.02e-07	-1.44	0.150	-1.37e-06	2.09e-07
_cons	.6477414	.6059889	1.07	0.285	-.5399749	1.835458

rho_ar	-.0419603	(estimated autocorrelation coefficient)				
sigma_u	0					
sigma_e	15.719056					
rho_fov	0	(fraction of variance due to u_i)				

Table 9

```
xtreg fdiamtmills totlit totlitm totlitf minminwage maxminwage urbanpop slum
> pop popnonwork popzerosix powerrating totalpop2001 genratio cpi
```

Random-effects GLS regression		Number of obs = 562				
Group variable (i): statecode		Number of groups = 17				
R-sq: within = 0.0000	Obs per group: min = 25					
between = 0.9937	avg = 33.1					
overall = 0.4007	max = 35					
Random effects u_i ~ Gaussian		Wald chi2(13) = 366.44				
corr(u_i, X) = 0 (assumed)		Prob > chi2 = 0.0000				

fdiamtmills	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
totlit	11065.73	4204.221	2.63	0.008	2825.604	19305.85
totlitm	1735.636	656.9507	2.64	0.008	448.0361	3023.235
totlitf	-3809.325	1279.512	-2.98	0.003	-6317.123	-1301.527
minminwage	3581.723	1385.921	2.58	0.010	865.3679	6298.079
maxminwage	947.5836	515.9488	1.84	0.066	-63.65751	1958.825
urbanpop	-24.54604	4.659711	-5.27	0.000	-33.6789	-15.41317
slumpop	48.81329	8.709496	5.60	0.000	31.74299	65.88359
popnonwork	-1.287948	1.018398	-1.26	0.206	-3.283972	.7080753
popzerosix	-4.859314	1.819518	-2.67	0.008	-8.425503	-1.293124
powerrating	-729339.4	217756.7	-3.35	0.001	-1156135	-302544.1
totalpop2001	1.666896	.8406187	1.98	0.047	.019314	3.314479
genratio	126337.5	73632.99	1.72	0.086	-17980.52	270655.5
cpi	-734739.4	885641.8	-0.83	0.407	-2470565	1001087
_cons	-8.89e+07	1.26e+08	-0.70	0.482	-3.37e+08	1.59e+08

sigma_u	0					
sigma_e	25547780					
rho	0	(fraction of variance due to u_i)				

Table 10

```
. xtreg fdiamtgrth totlit totlitm totlitf minminwage maxminwage urbanpop slump
```

```
> op popnonwork popzerosix powerrating totalpop2001 genratio cpi
```

```
Random-effects GLS regression           Number of obs   =       505
Group variable (i): statecode           Number of groups =        17

R-sq:  within = 0.0000                   Obs per group:  min =       18
      between = 0.9054                               avg =      29.7
      overall = 0.0252                               max =       35

Random effects u_i ~ Gaussian           Wald chi2(13)    =      12.69
corr(u_i, X) = 0 (assumed)              Prob > chi2     =      0.4721
```

fdiamtgrth	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
totlit	-.0007657	.0030218	-0.25	0.800	-.0066884 .005157
totlitm	-.0006954	.0004749	-1.46	0.143	-.0016262 .0002354
totlitf	.0001622	.0009308	0.17	0.862	-.0016621 .0019865
minminwage	-.0001081	.0010015	-0.11	0.914	-.0020709 .0018547
maxminwage	.0000142	.0003703	0.04	0.969	-.0007115 .000074
urbanpop	-1.12e-06	3.30e-06	-0.34	0.735	-7.58e-06 5.35e-06
slumpop	2.10e-06	6.16e-06	0.34	0.733	-9.97e-06 .0000142
popnonwork	4.25e-07	7.40e-07	0.57	0.566	-1.03e-06 1.87e-06
popzerosix	-7.90e-07	1.34e-06	-0.59	0.556	-3.42e-06 1.84e-06
powerrating	.054241	.1602342	0.34	0.735	-.2598122 .3682942
totalpop2001	-8.44e-08	6.15e-07	-0.14	0.891	-1.29e-06 1.12e-06
genratio	-.037613	.0547249	-0.69	0.492	-.1448718 .0696458
cpi	-.544546	.6352391	-0.86	0.391	-1.789592 .7004997
_cons	105.1077	92.65561	1.13	0.257	-76.494 286.7093
sigma_u	0				
sigma_e	17.536263				
rho	0	(fraction of variance due to u_i)			