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## Trade Openness, Infrastructure, and the Wellbeing of Mexico's South

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This paper examines the effects of Mexican infrastructure and trade policy from 1940 to 2000 on the relative economic performance of its southern states of Chiapas, Guerrero, and Oaxaca. Building on the literature of economic geography, I develop an argument based on the importance of infrastructure in economic development, and discuss how the legacy of infrastructure policies that have excluded the south can explain both the south's overall performance and its particularly poor performance in the period of trade openness. Accessing international markets lowers the average costs of large infrastructure investments, thereby increasing the advantage of states that have received these investments. I support this argument by analyzing the industrial evolution of Mexican states, showing not only that states have predictably concentrated in infrastructure-intensive industries if they have such infrastructure (and vice versa), but also that those infrastructure-intensive industries have outperformed other industries in the period of trade openness.

Este artículo examina los efectos de la infraestructura y la política comercial mexicana de 1940 a 2000 en el desempeño económico relativo de los estados sureños de Chiapas, Guerrero y Oaxaca. Con base en la literatura de la geografía económica, desarrollo un argumento fundado en la importancia de la infraestructura en el desarrollo económico y discuto cómo el legado de las políticas de infraestructura que han excluido al sur puede explicar tanto el desempeño general de la zona como su comportamiento particularmente pobre en el periodo

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de apertura de mercado. El acceso a los mercados internacionales disminuye los costos promedio de grandes inversiones en infraestructura, incrementando así la ventaja de los estados que han recibido dichas inversiones. Sostengo este argumento con base en un análisis de la evolución industrial de los estados mexicanos, mostrando no sólo que los estados se han concentrado, previsiblemente, en industrias de infraestructura intensiva en caso de tener dicha infraestructura (y viceversa), sino también que aquellas industrias de infraestructura intensiva han rebasado a otras industrias en el periodo de apertura de mercado.

**Key words:** Mexico, Chiapas, Oaxaca, Guerrero, regional inequality, regional economic development, trade openness, infrastructure, industry development, transportation policy, agricultural policy.

**Palabras clave:** México, Chiapas, Oaxaca, Guerrero, desigualdad regional, desarrollo económico regional, apertura de mercado, infraestructura, desarrollo industrial, política de transporte, política agrícola.

## I. Introduction

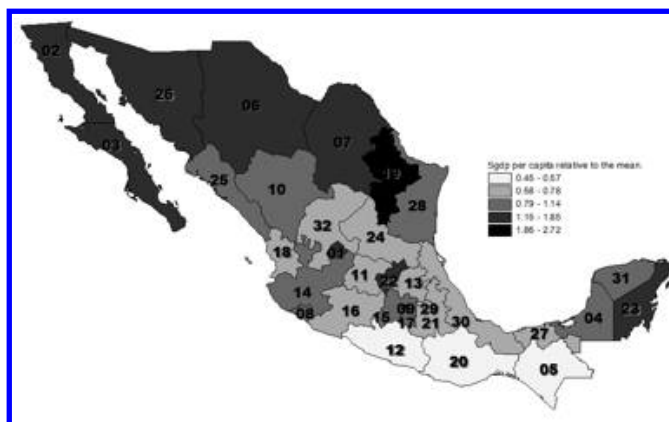
Seventeen years after the enactment of NAFTA and various other measures designed to free Mexico's trade regime, a common criticism is that the results promised for most Mexicans have yet to be realized.<sup>1</sup> The country's economic performance was much higher before trade openness than it has been afterward: average annual per capita GDP grew by approximately 4 percent from 1960 to 1980, whereas it only grew 0.8 percent from 1980 to 2000.<sup>2</sup> Even though the growth rate during 2000 to 2009 reached a higher level of 1.8 percent, this rate was still the lowest of all Latin American countries.<sup>3</sup>

However, the Mexican economy under NAFTA has not been bad for all Mexicans. Some industries in Mexico, such as the auto industry, have flourished under NAFTA, as have some service industries, such as the mass media and financial and insurance services. Given Mexico's overall economic performance, this, of course, means that some sectors were particularly hard hit, in particular agriculture and especially small farmers. And given that industries are concentrated substantially in a few states, it follows that trade's varying effects across sectors have affected

1. See, for example, Elisabeth Malkin, "NAFTA's Promise, Unfulfilled," *The New York Times*, (March 23, 2009).

2. Own calculation based on data from Gerardo Esquivel, *New Estimates of Gross State Product in Mexico, 1940-2000* (Mexico: El Colegio de Mexico, 2000). Cited in Gerardo Esquivel and Miguel Messmancher, *Sources of Regional (non) Convergence in Mexico*. IBRD mimeo. Chief Economist Office for Latin America (Washington DC: IBRD, 2003).

3. The Economist Intelligence Unit, "A Special Report on Latin America," (September 11, 2010): 4.



State number	State name	Abbreviation	State number	State name	Abbreviation
01	Aguascalientes	AGS	17	Morelos	MOR
02	Baja California Norte	BCN	18	Nayarit	NAY
03	Baja California Sur	BCS	19	Nuevo León	NL
04	Campeche	CAM	20	Oaxaca	OAX
05	Chiapas	CHIS	21	Puebla	PUE
06	Chihuahua	CHIH	22	Querétaro	QRO
07	Coahuila	COA	23	Quintana Roo	QROO
08	Colima	COL	24	San Luis Potosí	SLP
09	Distrito Federal	DF	25	Sinaloa	SIN
10	Durango	DGO	26	Sonora	SON
11	Guanajuato	GTO	27	Tabasco	TAB
12	Guerrero	GUE	28	Tamaulipas	TAM
13	Hidalgo	HID	29	Tlaxcala	TLAX
14	Jalisco	JAL	30	Veracruz	VER
15	México	MEX	31	Yucatán	YUC
16	Michoacán	MICH	32	Zacatecas	ZAC

SOURCE: Own calculation with data from Esquivel, 2000. Darker shade indicates higher value.

Figure 1: State Gross Domestic Product per capita for 2000, relative to the mean

the nature of regional inequality in Mexico. Indeed, as will be discussed in more detail here, these differences in industrial composition across states closely resemble the differences in state per capita GDP, as shown in Figure 1.

This paper focuses on the relative performance over time of the poorest states in Figure 1: Chiapas, Guerrero, and Oaxaca. These southern states have been among the poorest in the country since at least 1940, and several factors have been studied as important determinants of their

marginalization.<sup>4</sup> In this paper, I highlight the role of the combination of trade and infrastructure in the relative performance of these states. Studies analyzing the economic convergence of Mexican states over time have highlighted the varying levels of infrastructure across states as one key component in the evolution of regional disparities. States with lower infrastructure levels, like those in the south, are obviously disadvantaged when it comes to economic performance. However, the literature has not been clear as to why this effect seems to have been amplified under policies of greater trade openness. Indeed, the trade regime change in the 1980s is associated with a cessation of the reduction in Mexican regional inequality observed over the period from 1940 to 1980.<sup>5</sup> This paper, therefore, adds to the literature by focusing particularly on how the infrastructure disadvantages in these states were amplified by the move from import substitution industrialization to trade openness in Mexico.

I make my argument in three stages. In the next section, I establish two important facts regarding the performance of the south compared to other states in Mexico between 1940 and 2000. First, I review what is commonly known—that these states have been the poorest states in Mexico over this entire period. Second, I use spatial statistical methods to establish something less known—how unlikely it is that these underperforming states in Mexico would be randomly clustered together in one region so consistently over time. I find that this clustering is extremely unlikely, and that, as a result, some common aspect (or aspects) must have affected these states and not others. Combined with the fact that regional inequality has been increasing in Mexico during the period of trade openness, these points lead to the conclusion that explaining these states' relative performance over time must entail identifying not only a factor common to all of them, but also what has been intensified during trade openness. The next two sections take these in order.

First, I focus on one of the factors these states had in common throughout this period: a low level of infrastructure. Theories of economic growth have long highlighted the importance of infrastructure for economic performance, but, as I discuss, recent work on trade and economic geography has emphasized this importance even further.<sup>6</sup> In

4. Rafael Tamayo-Flores, "Mexico in the Context of the North American Integration: Major Regional Trends and Performance of Backward Regions," *Journal of Latin American Studies* vol. 33 (2001): 377-407.

5. Marcela González Rivas, "The Effects of Trade Openness on Regional Inequality in Mexico," *Annals of Regional Science* vol. 41 (2007): 545-561.

6. See, for example, Niles M. Hansen, "The Structure and Determinants of Local Public Investment Expenditures," *The Review of Economics and Statistics* vol. 47 (1965): 150-162; and, more recently, Masahisa Fujita, Paul Krugman, and Anthony J. Venables, *The Spatial Economy: Cities, Regions and International Trade*. (Cambridge, MA: The MIT Press, 1999).

this light, I examine the development of infrastructure in Mexico over the twentieth century, and I demonstrate that central government policies have either explicitly or implicitly marginalized the south while developing other areas of the country.

Finally, I examine the effects of these different levels of infrastructure by analyzing the industrial development of states over time. I show that at the dawn of trade openness, those states that were relatively rich in infrastructure had—not surprisingly—specialized in industries that were infrastructure-intensive. By contrast, the southern states, with relatively poor levels of infrastructure, had specialized in industries that were not infrastructure-intensive. These different specializations would have critical consequences as the country opened its borders to trade, as infrastructure-intensive industries tended to perform much better than others did.

I conclude with a summary of the argument and a discussion of implications for future development in the south.

## **II. The South and Mexico's Regional Inequality**

Mexico's southern states of Chiapas, Guerrero, and Oaxaca have consistently performed worse than Mexico's other states along a variety of socioeconomic dimensions. Looking at the evolution of their GDP per capita for every decade over the period from 1940 to 2000, one observes that these states have performed poorly during the entire period. In fact, these three states are the only states that rank among the bottom seven in every one of these decades. Even as some states have moved in and out of the bottom rankings, these three states have not moved up in rankings even for a brief amount of time. For example, in 1940, the five poorest states were Chiapas, Campeche, Tabasco, Guerrero, and Oaxaca. However, Tabasco's economy grew over the next several decades, so that by 1970, it had an income per capita higher than the mean in Mexico. The same was true of Campeche, which had a higher per capita income than the mean after 1980. Meanwhile Chiapas, Guerrero, and Oaxaca remained at the bottom. Specifically, Oaxaca was at least 50 percent below the mean state level of income for almost the entire period of 1940 to 2000, whereas Guerrero and Chiapas were around 50 percent of the mean for the entire period (see Table 1 for rankings by state GDP per capita by decade).

What are the chances that these three underperforming states would be so closely grouped geographically? Although Mexican observers often speak of the "south," keep in mind that underperforming states in other countries are not always clustered as they are in Mexico. If we could determine that the probabilities of this clustering were very

**Table 1:** *Rankings by State per Capita GDP from 1940 to 2000*

	Rank 1940	Rank 1950	Rank 1960	Rank 1970	Rank 1980	Rank 1990	Rank 2000
Baja California	1	2	3	3	3	4	6
Quintana Roo	2	1	16	12	7	3	3
Distrito Federal	3	4	1	1	1	1	1
Durango	4	11	13	16	16	18	16
Baja California Sur	5	3	5	4	4	6	7
Querétaro	6	25	24	14	13	10	9
Chihuahua	7	5	4	6	5	5	4
Aguascalientes	8	23	19	13	12	13	10
Nuevo León	9	6	2	2	2	2	2
Coahuila	10	9	6	7	6	7	5
Yucatán	11	12	10	19	17	20	18
Tamaulipas	12	10	14	8	8	11	11
Colima	13	20	28	18	15	14	12
Morelos	14	14	12	15	18	15	14
Sonora	15	7	7	5	9	8	8
Jalisco	16	13	11	10	10	12	13
Sinaloa	17	17	9	11	14	17	19
Veracruz-llave	18	8	8	17	19	25	26
Nayarit	19	15	18	20	22	24	25
Hidalgo	20	22	21	27	24	22	23
Zacatecas	21	16	22	26	29	27	28
San Luis Potosí	22	18	25	24	25	21	20
Guanajuato	23	24	17	21	23	23	21
Tlaxcala	24	29	31	31	28	30	29
Puebla	25	19	23	23	20	26	22
Michoacán	26	21	29	25	26	29	27
México	27	26	15	9	11	16	17
Chiapas	28	28	27	30	30	31	31
Campeche	29	32	30	28	31	9	15
Tabasco	30	31	20	22	21	19	24
Guerrero	31	30	26	29	27	28	30
Oaxaca	32	27	32	32	32	32	32

SOURCE: Own calculation with data from Esquivel.

low, it would indicate that while we should continue to focus on factors that affect states individually, we should also consider the factors that might be affecting the region as a whole.

In fact, statistical techniques are available for determining the probability that states would be randomly distributed in a country in this way. This section employs these techniques to examine the extent to which the south can be considered a “cluster” in this statistical way. I analyze the following indicators: state per capita GDP in 1993 pesos, the state share of labor occupied by the primary sector,<sup>7</sup> and the state share of population living in urban areas.<sup>8</sup> I examine how values of these indicators were clustered in 1940, 1970, and 2000, using data from the Mexican National Statistical Institute (INEGI) and Gerardo Esquivel (2000).

I use a spatial statistical technique known as the *Local Moran test* to identify local clusters—in other words, states that are very similar to their neighbors, compared to what one would expect if state performance were distributed randomly throughout the country. I also identify each decade’s spatial outliers—individual states that are very different than their neighbors.<sup>9</sup> In sum, the test identifies four types of areas: clusters of high values, clusters of low values, outliers of high values, and outliers of low values. I only report clusters and outliers statistically significant at least at the five percent level.

In general, the results of the Local Moran tests confirm what Mexico observers would expect: the existence of a low-value southern spatial cluster. Over the period of time under study, there is a cluster of low values in the south for per capita GDP and urban population. The cluster map of states’ per capita GDP, shown in Figure 2, demonstrate that

7. I look at share of labor occupied by the primary sector because economic development theories comparing the development gaps across countries pay particular attention to the sectoral composition of the economy. See, for example, Simon Kuznets, “Economic Growth and Income Inequality,” *American Economic Review* vol. 45, no. 1 (1955): 1-28; Arthur W. Lewis, “Economic Development with Unlimited Supplies of Labour,” *The Manchester School* vol. 22 (1954): 139-192; John Harris and Michael Todaro, “Migration, Unemployment and Development: A Two-Sector Analysis,” *American Economic Review* vol. 60, no. 1 (1970): 126-142; Walt W. Rostow, *The Stages of Economic Growth: A Non-Communist Manifesto*, (Cambridge, UK: Cambridge University Press, 1960). In general, these theories show a negative correlation between the level of development and the relative size of the primary sector, which consists of agriculture, livestock, forestry, fishing, and hunting.

8. The process of urbanization has been conceived of as a spatial response to the structural change in the economy including the specialization of labor, technology in the production process, interaction of labor, etc. Therefore, urbanization has been related to the economic level of development. See, for example, Luis Unikel, *El Desarrollo Urbano de México. Diagnóstico e implicaciones futuras* (México: El Colegio de México, 1978).

9. See Luc Anselin, “Local indicators of Spatial Association—LISA,” *Geographical Analysis* vol. 27 (1995): 93-115.





1940



1970



2000

SOURCE: Own calculation with data from Esquivel, 2000. The cluster of low values in the southern states is present in each of the three years.

Figure 2: Cluster maps of local indicators of spatial autocorrelation for state per capita GDP 1940, 1970, and 2000

although in the three years analyzed the spatial dynamics are somewhat different (such as a few outliers with dissimilar values compared to those states' neighbors—in black for high values and lighter grey for low values), the cluster of low values (in dark grey) is consistent throughout. Moreover, the cluster of low values in the south is the only spatial dynamic in 2000. Similar maps (available from this author) of the urban share of population also show a cluster of low values in the south that coincides with the GDP per capita cluster.

Not surprisingly, these two variables—per capita GDP and urbanization—follow a trend directly opposite to that of primary sector employment. Analyzing the share of labor employed in the primary sector reveals a clear cluster of high values in the south (cluster maps available from this author)—specifically the states of Chiapas, Guerrero, and Oaxaca. In general, the labor share employed by the primary sector is negatively correlated across countries with the level of development, and this is also true of states within Mexico. During the period of 1940 to 1960 in Mexico, lower shares of labor were generally employed in the primary sector in states bordering the United States than elsewhere. And since 1970, the difference in states' shares has become more pronounced. The shares in Nuevo León, Baja California Norte, and Estado de Mexico all decreased, whereas the shares in Chiapas, Guerrero, and Veracruz all increased. Not surprisingly, the Federal District had the lowest share during the entire period, as it is the largest metropolitan area of the country. In other words, since 1970, the economy of the southern states has become more dependent on primary sector activities, whereas other states' economies have experienced a decline in this sector (with corresponding growth in the secondary and tertiary sectors).<sup>10</sup>

In sum, the analysis thus far has established the extreme improbability of these underperforming states being randomly clustered together the way they are in Mexico. The statistical analysis suggests that if some common factor were not affecting these states, there would be less than a 5 percent chance of them being clustered in this way. In other words, any explanation of their relative performance over this time must focus on a factor that has affected them in a relatively common way.

Nevertheless, although southern states have consistently performed worse than other states, their relative performance has fluctuated over time—particularly since the onset of policies leading to greater trade openness in Mexico. As mentioned in the introduction, several studies now show that although poorer Mexican states, including those in the south, were gradually catching up to richer states during the period from

10. This process is consistent with the process of industrial development conceived by Rostow, "The Stages of Economic Growth."

1940 to 1980, the trend stopped after that. In fact, since 1980, not only are poorer states no longer converging on richer states, but they also are actually falling further behind.<sup>11</sup> As such, an explanation of the south's relative performance over time must account not only for its low level of performance in general, but also for its particularly poor relative performance in recent decades. The next two sections take these up in turn.

### III. Southern States' Common Lack of Infrastructure: History and Implications

The role of public capital or physical infrastructure has long been theorized to be a central factor in promoting economic growth.<sup>12</sup> The importance of capital investment for raising productivity was a predominant idea during the 1950s to 1970s and continues to be a focus of institutions like the World Bank<sup>13</sup> and the World Economic Forum. Physical capital infrastructure influences output productivity by lowering production costs and by enabling firms to capture economies of scale that arise from market expansion possibilities. In fact, theories of economic geography, which focus on the spatial dimensions of economic development, argue that one key factor determining a region's development is its access to transportation infrastructure because such infrastructure allows products to be distributed at lower costs to different markets.<sup>14</sup>

11. See, for example, Clemente Ruiz Durán, "México: redimensionamiento territorial, desigualdades y surgimiento de un nuevo orden." *Foreign Affairs Latinoamérica* vol. 9, no. 1 (2009): 2-11; Josep Lluís Carrión and Vicente German Soto, "Stochastic Convergence amongst Mexican States," *Regional Studies* vol. 41, no. 4 (2007): 531-541; Javier Sánchez-Reaza and Andrés Rodríguez-Pose, "The Impact of Trade Liberalisation on Regional Disparities in Mexico," *Growth and Change* vol. 33 (2002): 72-90; Esquivel and Messmancher, "Sources of Regional (non) Convergence in Mexico"; Cermeño Rodolfo, "Decrecimiento y convergencia de los estados mexicanos: Un Análisis de Panel," *El Trimestre Económico* vol. 28 (2001): 603-629; Gerardo Esquivel, "Convergencia Regional en México, 1940-1995," *El Trimestre Económico* vol. 66 (1999): 725-761; Hugo Juan-Ramón and Luis A. Rivera Bátiz, "Regional Growth in Mexico: 1970-93," International Monetary Fund Working Paper 96/92 (Washington, DC: IMF, 1996); Alberto Díaz-Cayeros, *Desarrollo Económico e Inequidad Regional: Hacia un Nuevo Pacto Federal en México* (México: Porrúa, 1995).

12. See, for example, Hansen, "The Structure and Determinants of Local Public Investment Expenditures."

13. See, for example, William Easterly, *The Elusive Quest for Growth* (Cambridge, Massachusetts: MIT Press, 2001). Easterly argues that since its inception the World Bank's development agenda has focused on infrastructure development projects like electricity and transportation. Although this narrow focus has expanded to more programmatic as opposed to capital investment projects, like promotion of education and health, capital investment continues to be a key component of project lending.

14. The other factors are the extent to which an economy is opened or closed, labor mobility, and the agglomeration economies that exist in markets. See Fujita et al., *The Spatial Economy*.

For example, transportation infrastructure serves to reduce transportation costs, connect places, and enhance the mobility of factors and inputs for production. Production costs are also reduced by general public infrastructure other than roads, such as gas pipelines, electricity, water supply, drainage and sewer systems, bridges, harbors, river transportation systems, and so forth.<sup>15</sup>

However, given that infrastructure has large fixed costs, it tends to be unevenly distributed throughout a country, and this unevenness is likely to increase over time. For example, Kashif Mansori argues that “an airport, a railway line connecting two cities, or a port can easily cost billions of dollars to construct before any transportation services can be provided, and then require periodic and costly maintenance thereafter.”<sup>16</sup> He also argues that regions receiving this investment are likely to have innate geographic or topographic advantages that lowered their transportation costs in the first place. Once in place, infrastructure tends to beget further infrastructure, such as roads leading to and from airports, railways leading to and from shipping ports, and so forth.

Most importantly for the perspective of this paper, the effect of infrastructure inequality can be exacerbated by trade openness. Because trade increases the use of infrastructure, the average costs of that infrastructure decline, thereby giving those regions with already existing infrastructure an additional advantage. For example, if it cost 100,000,000 dollars to build a port, that cost is incurred whether the port is used 10 times a month or 1000 times a month. Therefore the port's cost per use drops dramatically (and, accordingly, the overall benefit per use rises) the more the port is used. Since opening a country to international trade generally increases the usage of large fixed-cost infrastructure, such an opening gives great advantages to places that already have that infrastructure. In this sense, access to transportation infrastructure becomes even more important when an economy is more open to international trade.<sup>17</sup>

Based on this literature, this paper argues that one of the common factors affecting the economic performance of these southern states in Mexico has been their low level of infrastructure, and that this disadvantage has been accentuated by the turn to open trade policies since

15. See, for example, Hansen, “The Structure and Determinants of Local Public Investment Expenditures,” who argues that public capital investment like that mentioned previously promotes economic growth indirectly.

16. Kashif Mansori, “The Geographic Effects of Trade Liberalization with Increasing Returns in Transportation,” *Journal of Regional Science* vol. 43, no. 2 (2003): 251.

17. Stephan Straub, “Infrastructure and Development: A Critical Appraisal of the Macro Level Literature,” Policy Research Working Paper 4590 (Washington, DC: World Bank, April 2008).

the 1980s. As I will explain in more detail in a moment, transportation networks in Mexico have always been designed by the central government in order to access external markets—first Europe and then the United States—with the result being that the south has been systematically excluded. The concentration of infrastructure in the core urban areas in the center and north of the country has its origins in the colonial period when the first communication routes were established. This geographic focus has only been strengthened by subsequent transportation decisions pursued by governments, first with regard to the pre-revolutionary establishment of the railroad network that began in 1850, and later with the construction of the national highway system that began in 1925.<sup>18</sup> And, as I discuss later in this section, this early infrastructure advantage has been further reinforced by the country's agricultural policies.

During colonial times, the Spanish crown established routes for transporting mining production (mainly silver) to the main port in Veracruz and foreign imports from the port to the center of the country—Mexico City, Zacatecas, San Luis Potosí, and Guanajuato.<sup>19</sup> The importance—and advantage—of Veracruz was accentuated when the railroad network was constructed during the Porfiriato. Like the road system, the railroad system was originally designed to connect the political center of the country, Mexico City, to the port of Veracruz. In the following years, the railroad also connected the capital to the mining and agricultural areas in the center and north of the country. In 1881, the longest railroad line connected the capital to the north (Paso del Norte), as primary commodities began to be exported to the United States. The south, however, remained largely disconnected from this development. According to Luis Jáuregui,<sup>20</sup> although the railroad network benefited the entire country because it consolidated its union, it tended to benefit regions unequally, as only four stations—Mexico City, Guadalajara, San Luis Potosí, and Chihuahua—accounted for 45 percent of the total cargo. More importantly, Jáuregui argues that the railroad network mainly linked the country to the world economy, as the two main lines connected Mex-

18. Ernesto López Malo, *Ensayo sobre Localización de la Industria en México* (Mexico: Universidad Nacional Autónoma de México, 1960); and Unikel, *El Desarrollo Urbano de México*.

19. See Stephen Haber, *Industry and Underdevelopment. The Industrialization of Mexico, 1890-1940* (Stanford, CA: Stanford University Press, 1989). Unikel argues that during this period the urbanization trend in the country was defined by the communication routes that connected the capital to the Spanish Crown. *El Desarrollo Urbano de México*, 18-20.

20. Luis Jáuregui, *Los Transportes, Siglos XVI al XX*, Serie Historia Económica de México, (México: Océano, 2004).

ico City with Veracruz and the northern border.<sup>21</sup> The railroad network did not connect the southern states with the rest of the country because of their lack of mineral resources, their topography, and their remoteness from the US market.<sup>22</sup>

The road system that was built during 1860s and 1870s further benefited the center of the country, as did the construction of a national highway system that took off in 1925. Among the main highway projects was the route connecting Mexico City to the border (Nuevo Laredo) to foster tourism from the United States into Mexico. During the 1950s, the major highway projects mainly connected the center to the north of the country, and it was not until the 1980s that new roads were built beyond the established routes. The transportation system has, therefore, given marked priority to the center and north of the country throughout Mexico's modern history.

This infrastructural advantage inferred by transportation policies has only been reinforced by the country's agricultural policies, particularly since the 1930s when the period of import substitution industrialization (ISI) began. The central government played a key role in modernizing agriculture, mainly in terms of large investments in infrastructure (irrigation, highways, and electricity) and the extension of credit. These investments mainly benefited the northern states—specifically Baja California Norte, Chihuahua, Sinaloa, Sonora, and Tamaulipas—where 53 percent of irrigation investments were directed between 1940 and 1970.<sup>23</sup> The infrastructure, incentives, and technical support provided since the 1930s to the northern states resulted in substantial differences in land productivity compared to the rest of the country: on average the rate of yield growth from 1946 to 1962 was 3.6 percent in the north, whereas in the rest of the country it was 1.8 percent.<sup>24</sup> This also resulted in a much faster rate of growth in the amount of land under cultivation in the irrigated northern states—8.4 percent annually—compared to the slow growth—1.3 percent per year—in the center and south.<sup>25</sup>

21. *Ibid.*, 93.

22. Rafael Tamayo Flores, "The Determinants of Growth across Mexican Regions. A Review of the Empirical Evidence and the Role of Public Policies," CIDE Working Paper 57 (Mexico: CIDE, 1997).

23. Esperanza Fujigaki, *La Agricultura, Siglos XVI al XX*, Serie Historia Económica de México (México: Océano, 2004), 123.

24. Cynthia Hewitt de Alcántara, *Modernizing Mexican Agriculture: Socio-economic Implications of Technological Change 1940-1970* (Geneva: United Nations Research Institute for Social Development, 1976) 107.

25. *Ibid.*, 107. Programs instituted after ISI have only compounded these effects. As Fujigaki notes, the agricultural sector has become geographically bifurcated: specialization in more profitable crops like cotton and wheat in the north (due to the availability of infrastructure and production inputs) and concentration in the center and south on pro-

As Blanca Rubio Vega<sup>26</sup> discusses, during ISL most countries satisfied their internal food demand through domestic production because of the high protectionist measures required by ISI. Although one might expect this to benefit the agricultural sector, in fact, food prices had to be kept low to keep workers' salaries high in terms of purchasing power, thereby increasing demand for industrial goods. Thus, food prices were suppressed through internal competition and state regulation. Ian Little, Tibor Scitovsky, and Maurice Scott argue that Mexico implemented a successful agricultural development program during the 1950s and 1960s that aimed to compensate, at least partially, for the bias against the agricultural sector.<sup>27</sup> However, as Luis Unikel<sup>28</sup> points out, this program was targeted at rewarding capital-intensive export crops with high productivity. And due to the agricultural policies mentioned in the previous paragraph, which modernized agriculture in the northern and central parts of the country, those states were the ones that benefited from the program. The agricultural sector in the south did not benefit from these compensation policies and suffered the most under ISI.

In sum, the combined transportation and agricultural policies have had a direct effect on the uneven development of infrastructure across states in Mexico, by systematically improving infrastructure and economic activity in certain areas of the country while neglecting other areas, particularly those states in the south. The next section turns to

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duction of maize and beans (due to the lack of inputs and irrigation infrastructure). Because the crops in the center and south compete directly with the US and Canada, these states have suffered under NAFTA, particularly the southern states where agriculture employs a large share of their population. However, the government programs that were set up to help farmers face the increased competition arising from NAFTA largely benefited the *northern* modernized agricultural producers. This is because the programs were aimed at allowing farmers to sell their crops to food processors at competitive prices by providing marketing support for farmers in regions where there was a basic crop surplus. Fujigaki, *La Agricultura, Siglos XVI al XX*. Antonio Yunez Naude and Edward Taylor state that the program "aids large farms, those with the capacity to produce surplus; therefore, most of its sponsorship goes to surplus producing regions of the irrigated areas of the northern states." Antonio Yunez Naude and Edward J Taylor, "The Effects of NAFTA and Domestic Reforms in the Agriculture in Mexico: Predictions and Facts," *Région et Développement* no. 23 (2006): 161-186.

26. Blanca Rubio Vega, "La Dimensión Agraria," in *Siglo XXI: México para armar. Cinco Dimensiones de la Economía Mexicana*, eds., Jorge Isaac Egurrola and Luis Quintana Romero (México: Plaza y Valdés, 2004).

27. The incentives provided were cheap fertilizers, improved seeds, farm machinery, credit, and irrigation infrastructure investment. Ian Little, Tibor Scitovsky, and Maurice Scott, *Industry and Trade in Some Developing Countries, A Comparative Study* (London, New York: Development Centre of the Organization for Economic Cooperation and Development 1970), 107.

28. Unikel, *El Desarrollo Urbano de México*.

analyzing the effect of this disadvantage on the relative performance of the south over time.

#### **IV. The Role of Trade and Infrastructure in Mexico's Regional Inequality**

In the late 1940s, Mexico established a system of import barriers, licensing restrictions, and official reference pricing as part of its import substitution industrialization strategy.<sup>29</sup> This system remained in place until the economic crisis of the 1970s and 1980s, after which Mexico underwent major economic reform.<sup>30</sup> One of the main characteristics of the new economic regime was (and is) the promotion of the economy's external sector. The change of regime included eliminating protection for the domestic industry maintained during the import substitution period, as well as instituting additional policies to boost exports. The aim was to encourage national industry to compete with international industry and thus make local producers more efficient. Mexico joined the General Agreement on Tariffs and Trade in 1986, and from 1982 to 1990, the share of total imports that were subject to import licenses decreased from 100 percent to 14.1 percent. The highest tariff barrier fell from 100 percent to 20 percent.<sup>31</sup> Moreover, since the 1990s, Mexico has signed twelve free-trade agreements, including the North American Free Trade Agreement in 1994. As might be expected, the volume of trade has increased substantially as a result of these changes, going from about 17 percent in 1970 to 24 percent in 1980, 38 percent in 1990, and 64 percent in 2000.<sup>32</sup>

How did these changes in trade policy affect Mexico's regional inequality in general and the performance of the southern states more specifically? Continuing the argument just put forth, in this section, I present evidence that at the dawn of trade openness in Mexico, the southern states specialized in industries requiring comparatively little infrastructure, whereas other parts of the country specialized in industries

29. The aim under Import Substitution Industrialization (ISI) was to achieve industrialization, avoiding external disequilibria that arise from unfavourable terms of trade and consequently avoiding structural unemployment. This strategy was based on the center-periphery development theory of Raúl Prebisch. Leopoldo Solís, *La Vida y Obra de Raúl Prebisch* (Mexico: El Colegio Nacional, 1988).

30. Luis Quintana Romero, "La Dimensión Industrial" in *Siglo XXI: México para armar: Cinco dimensiones de la economía mexicana*, eds. Jorge Isaac Egurrola y Luis Quintana Romero, (México: Plaza y Valdés, 2004).

31. *Ibid.*, 48.

32. Data from the World Bank, "World Development Indicators 2005," Washington, DC.



**Table 2: Average Annual Growth Rate of Output by Economic Sector and Manufacturing Industry**

Economic Sectors	1970-75	1975-80	1980-85	1985-88	1993-98	1998-03
Agriculture, forestry, and fishing	5.1	2.0	2.4	-8.7	1.8	2.1
Mining	9.5	25.1	-6.8	-15.8	2.9	1.4
Manufacturing	6.5	7.6	1.0	1.0	5.2	1.0
Construction	9.2	9.4	-7.1	-6.6	0.7	1.7
Electricity, gas, and water	1.5	9.9	-0.1	5.9	3.6	4.5
Commerce, restaurant, and hotel	6.2	6.4	4.3	-4.8	2.0	3.0
Transportation, storage, and communications	10.1	10.6	1.1	0.3	5.4	5.3
FIRE	3.3	4.2	-0.4	-2.1	2.7	4.3
Community, social, and personal services	9.5	9.3	-0.7	-6.4	1.2	1.0
<i>Average Aggregate Output</i>	6.8	9.4	-0.7	-4.1	2.8	2.7
<b>Manufacturing Industries</b>	<b>1970-75</b>	<b>1975-80</b>	<b>1980-85</b>	<b>1985-88</b>	<b>1993-98</b>	<b>1998-03</b>
Food, beverage, and tobacco	7.3	3.8	2.5	-0.8	3.2	2.7
Textiles	5.5	6.2	-2.2	-2.3	4.6	-2.7
Wood and wood products	4.9	12.2	0.5	-0.7	2.3	-2.0
Paper, printing, and editing	4.5	8.9	3.0	4.0	2.8	0.0
Chemical, oil, and plastics	6.3	8.7	-2.0	8.6	4.3	0.6
Mineral non-metallic products	5.7	7.8	6.0	0.4	2.1	1.6
Basic metallic industry	6.9	9.1	-0.3	7.0	8.3	0.3
Metal, machinery, and equipment	6.5	10.6	0.2	-0.8	8.8	1.0
Other manufacturing industries	11.2	12.2	-0.1	-4.0	4.5	1.3
<i>Average Manufacturing</i>	6.5	8.8	0.8	1.3	4.5	0.3

SOURCE: Own calculations with data from INEGI, System of National Accounts, in 1993 pesos.

that were relatively infrastructure-intensive. One would expect this based on the uneven availability of infrastructure across the country. In general, the infrastructure-intensive industries have performed well in Mexico since the 1980s, and obviously this has been to the disadvantage of southern states.<sup>33</sup> (See Table 2 for the average annual growth rates of output by economic sector and manufacturing industry.)

Comparable data on the industrial composition of Mexican states only begins in 1970, so unfortunately information on the evolution of industry is relatively scarce before then. However, we know that during much of the ISI regime, manufacturing and service industries were highly concentrated in the capital (Federal District) and states in the northern part of the country. For example, in 1940, four states—Baja California, Coahuila, Federal District, and Queretaro—contained 43 percent of the total national capital investment of manufacturing industries per capita.<sup>34</sup> This high concentration of manufacturing activities was basically maintained for most of the ISI regime, but some states in the center (like Queretaro and Jalisco) increased their share slowly. Looking at the number of manufacturing establishments, one can observe that by the 1970s a deconcentration of manufacturing had started to take place, from the Mexico City metropolitan area mainly to the surrounding states of Puebla, Queretaro, Hidalgo, and Tlaxcala.<sup>35</sup> Still, by the beginning of the 1970s, manufacturing activity was largely concentrated in the northern and central areas of the country with the south trailing behind.<sup>36</sup>

33. Cross-national comparative studies have pointed out that the trade openness effects on regional inequality depend on the differences in regional industrial composition as well as the composition of trade. See Andrés Rodríguez Posé and Nicholas Gill, "How Does Trade Affect Regional Disparities?" *World Development* vol. 37, No. 7 (2006): 1201-1222.

34. Own calculation based on INEGI, Industrial Census, various years, Mexico: INEGI.

35. This deconcentration trend is also documented by Ismael Aguilar Barajas, "An Evaluation of Industrial States in Mexico, 1970-1986" in *Progress in Planning* Vol. 34 (Pergamon Press: UK, 1990), 93-187.

36. Border states have benefited from programs like the Border Industrialization Program. This program was established in 1965 as a response to the high unemployment rate of Mexicans returning to bordering states (and in the US) after the Bracero Program was terminated in 1964 after more than forty years. The program was part of a federal program (*Programa Nacional Fronterizo*) that started in 1961 with the objective of fostering economic development in the border region, even though the border region already had a higher level of development than the national mean. The idea was to take advantage of the geographic opportunity that came from bordering the US market. Secretaría de Planeación y Presupuesto, *Antología de la planeación en México. Los programas de desarrollo y la inversión pública*, (Mexico: Fondo de Cultura Económica, 1985), 17. The program allowed US products to be imported for free if they were used to manufacture products for export from Mexico, with the aim not only of employing the workers coming

This pattern becomes clear when looking at the more fine-grained industrial data that becomes available starting in 1970. In addition, the cumulative effects of the inequalities in infrastructure become ever clearer over time. For their part, Chiapas, Guerrero, and Oaxaca were all characterized by a similar pattern of industrial specialization, with the two most prominent industries in these states being the food, beverage, and tobacco industry and the wood industry.<sup>37</sup> Analysis shows that both of these industries are less dependent upon infrastructure and technology than others.<sup>38</sup>

In contrast, states in other parts of Mexico specialized in infrastructure-intensive industries. For example, states in the center of the country—such as the Federal District, Mexico, Veracruz, Jalisco, and Nuevo Leon—were particularly strong in the transportation, storage, and communication industry, a sector highly dependent on road infrastructure.<sup>39</sup> All of these states had relatively high levels of infrastructure compared to the rest of the states, and the southern states had little presence in this industry. Other infrastructure-intensive industries were concentrated elsewhere. For example, the basic metal production industry and the metal,

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back from the United States but also of enabling Mexico to attain valuable international currency and technology. This program benefited the northern states, and specifically those on the border, by fostering the growth of the manufacturing industry limited to this geographic zone. This advantage has only been strengthened by the more recent set of export promotion policies of the mid-1980s (mainly giving incentives to firms to export by providing tax rebates, and facilitating the administrative and fiscal process of exporting goods), which have benefited those states with already established manufacturing sectors in the north and center.

37. In the more recent period, Oaxaca's state production of products derived from oil rank eleventh in the country (in 2008) due to the construction of the Salina Cruz refinery in 1979. The refinery is located in the state's sea port, which is key due to the geography of the Isthmus of Tehuantepec. It is important to note, however, that in 1999 products derived from oil constituted 84 percent of total manufacturing production in the state, giving a sense of the low level of industrialization in the state beyond the refinery.

38. Stephen Yapple and Stephen Golub, "International Productivity Differences, Infrastructure and Comparative Advantage," *Review of International Economics* vol. 15, issue 2 (2007): 223-242. Isabel Angoa, Salvador Pérez-Mendoza, and Mario Polese, in their study of industry location in Mexico's municipalities in 1999, observe that the south lags behind in both manufacturing industries and services, and that the only industries that are more dispersed throughout the territory are traditional industries like food and beverage processing. They observe that even when the north of the country specializes in advanced manufacturing industries and traditional industries—like apparel, textiles, and food processing—are relocating to cheaper locations, the south is not capturing even these industries. Isabel Angoa, Salvador Pérez-Mendoza, and Mario Polese, "Los tres Mexicos: Análisis de la distribución espacial del empleo en la industria y los servicios superiores, por tamaño urbano y por región," *Revista Eure* (Santiago, Chile), vol. 35, no. 104 (2009): 121-144.

39. Yapple and Golub, "International Productivity Differences, Infrastructure and Comparative Advantage."

machinery, and equipment industry (including the auto industry)—both of which require high levels of road infrastructure to transport heavy parts and machinery to markets—were concentrated in Coahuila and Nuevo Leon in the 1970s and spread also to San Luis Potosi and Michoacán in the 1990s. Again, all of these states had high levels of infrastructure to begin with, and Chiapas, Guerrero, and Oaxaca had little or no production in any of these industries.

These industrial advantages would become central to these states' performance after trade was opened. Consistent with the argument outlined previously, infrastructure-intensive sectors and industries performed exceedingly well in the neoliberal era, even as economic performance in Mexico as a whole was disappointing. The transportation, storage, and communication sector was the fastest growing (at 5.4 percent) in Mexico between 1993 and 1998. The metal, machinery, and equipment industry and the basic metal production industry were among the fastest growing industries, growing at 8.8 and 8.3 percent, respectively. Obviously the southern states, with no presence in these economic activities, were completely left out of these high-growth opportunities.

Unfortunately, little reason exists to think this pattern will abate any time soon. In fact, looking at the more recent trends of growth across industries, it is evident that service industries have begun to flourish. Although these industries do not rely as heavily on the traditional types of infrastructure discussed earlier, they do rely on advanced telecommunication infrastructure, such as financial and insurance services, mass media information services, and corporate and directive office services. This sort of infrastructure has coalesced in exactly the same places as the previous types of infrastructure, as evidenced by the fact that, in 2008, these industries were highly concentrated in the better equipped and highly urbanized states of Federal District, Nuevo Leon, Mexico, and Jalisco. The growth of these service industries closely resembles the pattern of geographic concentration that manufacturing industries followed in the early phases of industrialization in Mexico as part of the ISI regime.

## V. Conclusion

This paper has attempted to accomplish two objectives. First, I characterized the southern states of Chiapas, Guerrero, and Oaxaca in relation to the rest of Mexico in terms of their level of development. I showed that (a) these southern states have consistently had the lowest levels of socioeconomic indicators since 1940; and (b) the clustering of these underperforming states is extremely unlikely, indicating some common factors contribute to their low level of development. Combined with the

fact that regional inequality has been increasing in Mexico during the period of trade openness, these points lead to the conclusion that explaining the relative performance of these states over time must entail identifying a factor common to all of them, as well as to something that has been intensified during trade openness.

Second, in order to explain these overall patterns, I developed an argument based on the importance of infrastructure in economic development and discussed how the legacy of infrastructure policies that have excluded the south can explain both these states' overall performance and their particularly poor performance during the period of trade openness. Building on theories of economic geography, I explained how accessing international markets lowers the average costs of large infrastructure investments, thereby increasing the advantages for states that have received these investments. I supported this argument by analyzing the industrial evolution of Mexican states, showing not only that states have predictably concentrated in infrastructure-intensive industries if they have such infrastructure (and vice versa), but also that those infrastructure-intensive industries have outperformed other industries in the period of trade openness.

The result is that these southern states—Chiapas, Guerrero, and Oaxaca—have fallen farther behind the rest of Mexico during the period of trade openness, and that Mexico's historically high levels of regional inequality have been increasing. This trend is disturbing, as scholars have argued that understanding regional inequality is important, not only because it reflects the overall level of inequality in a country but also because of its political and social implications.<sup>40</sup> Regional inequality in Mexico has already had effects beyond the economic realm. For example, in the controversial 2006 Presidential election, many analysts described Mexican society as deeply fractionalized over the two main candidates (from the left- and right-wing parties). In some quarters, the election was cast as a contest between the south versus the north of the country, and indeed Figure 3, which shows election results by state (with states that voted for the left-wing PRD in darkest shade), looks remarkably similar to Figure 2's cluster map of GDP per capita in 2000. Furthermore, the most recent and significant social unrest has taken place in Chiapas, Guerrero, and Oaxaca.<sup>41</sup> The magnitude and persistence of

40. See, for example, Ravi Kanbur, Anthony Venables, and Guanhuan Wan. "Introduction to a Special Issue: Spatial Inequality and Development in Asia," *Review of Development Economics* vol. 9, no.1 (2005): 1-5.

41. Guillermo Trejo, "Social Conflict and the Mexican Transition to Democracy," in *24 Años de Desarrollo Social en México*, eds. Rubén Aguilar et. al (Mexico City: Banamex, 2004); Lorenzo Meyer, "Oaxaca y los Nuevos 'Rurales de la Federación'," *Reforma* (Mexico) (November 2, 2006), 13; Meyer, "Guerrilla," *Reforma* (Mexico) (July 19, 2007), 15.



SOURCE: Federal Electoral Institute, 2007, p. 67. Light gray indicates states where the PAN (right-wing party) won; darker gray indicates states where the left-wing party (PRD) won.

Figure 3: 2006 Presidential election results by state

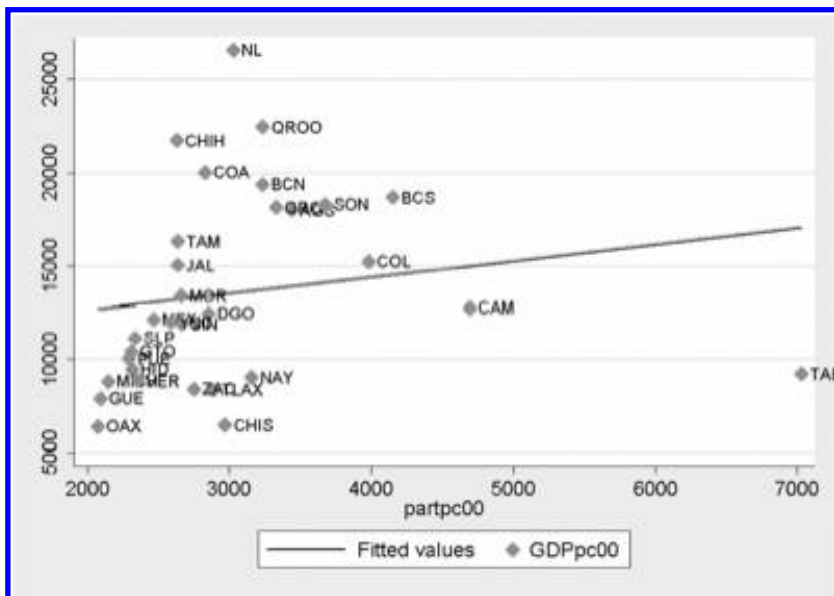
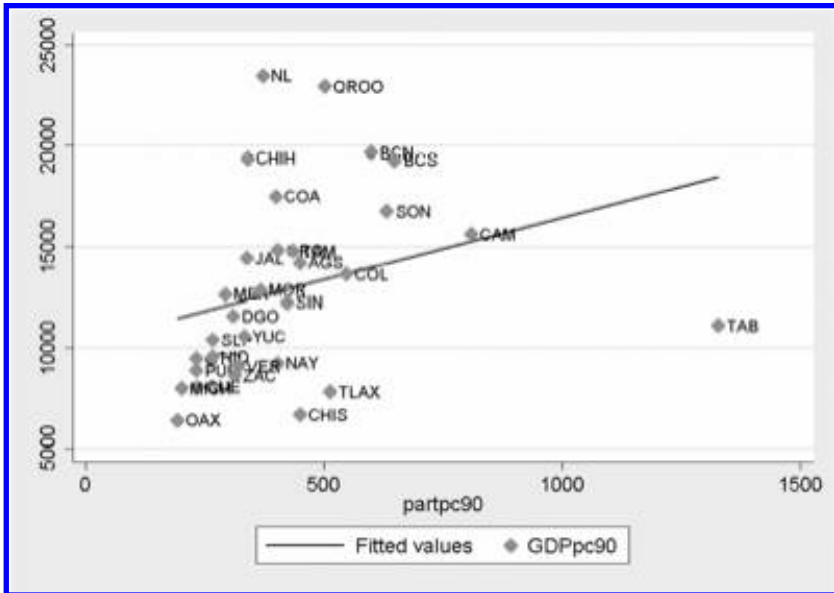
regional inequality in Mexico may plausibly be a growing source of political instability for the country.

What can be done to address this inequality in the context of an open-trade regime? A clear answer is suggested by the analysis in this paper: improve the levels of basic infrastructure in the southern states. As I have argued here, this infrastructure is especially key during a time of increased market linkages, not only for the efficient distribution of final products to other markets but also for the transportation of inputs for production. In fact, the idea that relatively equal access to general infrastructure is necessary for the dispersion of economic activities, and thus the reduction of regional inequality, has been part of the discussion surrounding NAFTA's results. Indeed, an architect of the agreement during the Clinton administration, Bradford DeLong, was quoted in *The New York Times* as saying that Mexico's inequality across regions in terms of infrastructure and human capital was ignored while NAFTA and its "alluring" promises were conceived and enacted.<sup>42</sup> It seems likely that NAFTA would have provided more (and more equal) benefits to Mexico if it had been combined with a series of complementary policies.<sup>43</sup>

Unfortunately, although analyses like those of DeLong (and this paper) suggest that infrastructure improvement in Mexico would be a

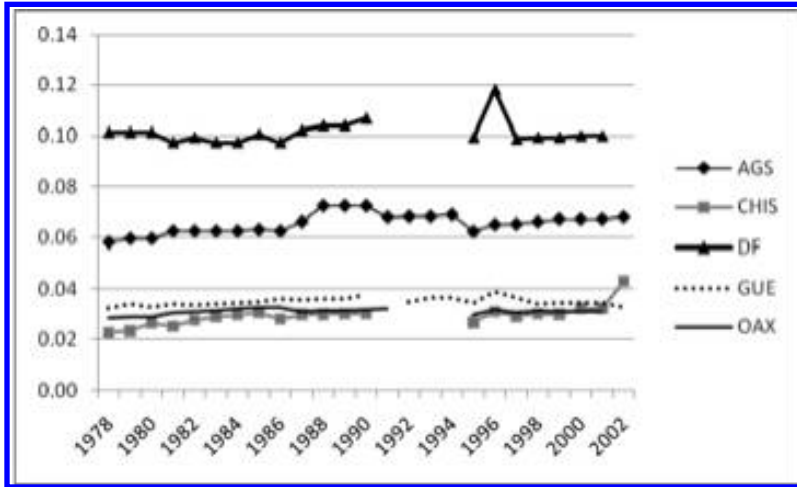
42. Louis Uchitelle, "NAFTA Should Have Stopped Illegal Immigration, Right?" *The New York Times* (February 18, 2007).

43. As Dani Rodrik notes, one major problem with trade openness in Mexico (and in many other countries) is that it was implemented as if trade openness is, in itself, a development strategy. He argues that trade policy needs to be complemented with industrial, development, and institutional policies in order for the benefits of open trade to be realized. Dani Rodrik and Francisco Rodriguez, "Trade Policy and Economic Growth: A



SOURCE: Own calculation with data from INEGI, *Finanzas estatales*, 2007. Horizontal axis is federal transfers per capita by state, and vertical axis is the level of GDP per capita, 1990 (top) and 2000 (bottom). Fitted values refer to the values predicted by a model fitted to a dataset. Please refer to Figure 1 for abbreviations.

Figure 4: Federal transfers ( participaciones) by states per capita vs. level of per capita GDP, 1990 and 2000



SOURCE: Own calculation with data from INEGI, *Anuarios Estadísticos de los Estados*; please refer to Figure 1 for abbreviations.

Figure 5: Federal highway density for various states, 1978 to 2002

highly effective policy with which to address regional inequality, federal transfers to states and municipalities in Mexico have been highly regressive, in keeping with the broad historical pattern described here. According to Alberto Díaz-Cayeros,<sup>44</sup> richer states received more federal funding per capita than poorer states in 1990. I have replicated his analysis for both 1990 and 2000, and the same pattern appears in 2000, as shown in Figure 4, though the pattern in 2000 was not as pronounced as in 1990. Moreover, it is interesting to note that in more recent years (specifically since 1994), Chiapas has been the beneficiary of more federal investment in federal highways, as shown in Figure 5.<sup>45</sup> This latest investment has lessened the gap between Chiapas and other states, but the difference still remains enormous, and that Chiapas' neighbors have not seen similar investment is notable. Unless the gap between these states and others is reversed, the analysis in this paper indicates that regional inequality in Mexico will continue to widen, and Chiapas, Oaxaca, and Guerrero will continue to fall further behind the rest of the country.

Skeptic's Guide to the Cross-National Evidence," in *NBER Macroeconomics Annual 2000*, Vol. 15 (Massachusetts: NBER, Inc., 2001) 161-338; and Dani Rodrik, "Why Do More Open Economies Have Bigger Governments?" *Journal of Political Economy* vol. 106, no. 5 (1998): 997-1032.

44. Díaz-Cayeros, *Desarrollo Económico e Inequidad Regional*.

45. As opposed to federal transfers, which states can use for infrastructure development within municipalities, Figure 5 shows the results of direct federal investment in roads.