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Financing the Future

Infrastructure Needs in Latin America, 2000–05

Marianne Fay

A model developed to predict demand for infrastructure in Latin America performs reasonably well for power and telecommunications—and less well for water and sanitation (for which data are scarce) and transport infrastructure (which is less closely related to per capita income). The model projects a doubling of telephone mainlines per capita, a steady increase in power infrastructure, steady growth in road infrastructure, and small increases in water and sanitation coverage.

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Summary findings

To assess five-year demand for infrastructure investment in Latin America and the Caribbean, and the private sector's role in meeting this demand, Fay developed a model to predict future demand for infrastructure—defined as what consumers and producers would ask for, given their income and level of economic activity.

Overall projections over the next five years:

- A doubling of telephone mainlines per capita.
- A steady increase in electricity generating capacity.
- Small increases in water and sanitation coverage.
- Steady expansion of road infrastructure, with rail transport becoming less important.

Investments of $57 billion annually for 2000–05 (roughly 2.6 percent of Latin America's GDP) are expected to be absorbed largely by electricity ($22 billion), roads ($18 billion), and telecommunications ($6 billion).

A surge in private financing of infrastructure in recent years (roughly $35 billion in 1998, excluding divestiture payments) has disproportionately favored telecommunications ($14 billion) and transport ($12 billion). Private investment exceeds predicted need for telecommunications (although the model did not include costs associated with the emergence of cellular phones), covers about half the demand for roads, and meets just a fraction of needs in power and water and sanitation—where there will be a shortfall in investments. Projections are likely to be on the low side because they cover the extension of networks rather than upgrading and cover new investments, not rehabilitation or maintenance.

This paper—a product of the Finance, Private Sector, and Infrastructure Sector Unit, Latin America and the Caribbean Region—is part of a larger effort in the region to develop its knowledge of future client needs. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Adeline François, room I5-004, telephone 202-473-7841, fax 202-676-9594, email address afrancois@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at mfay@worldbank.org. February 2001. (25 pages)

Financing the Future:

Infrastructure Needs in Latin America, 2000-2005

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Executive summary

This paper was commissioned by the Inter-American Development Bank as input to an examination of private sector operations at the IDB by an External Review Group. The terms of reference asked for an assessment of the existing and future demand (next five years) for infrastructure investment in the Latin America and Caribbean Region, and of the role of the private sector in fulfilling this demand.

We develop a model to predict future demand for infrastructure, where demand is defined as what consumers and producers would be asking for given their income and level of economic activity. This model is applied to Latin America for the period 2000-2005, where it performs reasonably well for telecommunication and electricity. For water and sanitation, where the base data is scarce and often unreliable, and transport infrastructure, which is less closely related to income per capita our estimates are less reliable, and we offer an alternative approach based on middle income countries' experience. Note that where the word "need" is used, it refers to the investment needed to satisfy consumer and producer demand, rather than to some socially optimal measure of need for infrastructure service or infrastructure investment.

Overall we expect to see a doubling of telephone mainlines per capita and a steady increase in electricity generating capacity in Latin America over the next 5 years. In the case of transport, rail should become less important, while road infrastructure should expand steadily. We expect small increases in water and sanitation coverage.

The investments needed should amount to about $57 billion per annum over 2000-2005, equivalent to 2.6% of Latin America's GDP. The electricity sector will absorb the largest share ($22 billion), followed by roads ($18 billion) and telecommunications ($6 billion.)

Private financing for infrastructure has surged in recent years, representing about $35 billion in investment (exclusive of divestiture payments) in 1998. Overall, however, this has disproportionately favored telecommunications ($14 billion) and transport ($12 billion.) Private investment exceeds predicted need for telecom (thereby reflecting the radical transformation of the sector with the emergence of cellular lines that our model does not include), covers about half for roads, but is just a fraction of what is needed in power and water and sanitation. This suggests that barring a continued important role for public financing in these sectors, there will be a shortfall in investments.

Our estimates compare well with what has been found elsewhere or in the past. They are, however, on the low side. This is partly due to the fact that costs, notably in power and telecom, have fallen. It can also be explained by the fact that we only include investments that translate into extension, rather than upgrading, of a network. This is likely to lead to severe underestimation of investment demand in rail, and to a lesser extent in roads. Also, we only look at new investments, as opposed to rehabilitation or maintenance. Maintenance is estimated at about $35 billion per annum, but rehabilitation needs cannot be estimated given the absence of systematic data across sectors on the current state of infrastructure. Finally, data limitation precludes taking into account investments in other transport infrastructure such as ports, airports and canals (though these represent small amounts relative to road and rail.)

Introduction

Latin America is expected to grow by close to 3 percent per annum in per capita terms between 2000 and 2005. Accompanying this growth will be an increase in demand for infrastructure services, for both consumption and production purposes. A failure to respond to this demand will cause bottlenecks to growth and hamper poverty alleviation efforts.

This paper sets out to estimate the change in demand for infrastructure services that will spring from the expected structural change and growth in income the region is expected to undergo in the next 5 years. This is done using a macro model linking growth and infrastructure demand in telecommunication, power, roads, rail, water and sanitation. These results are contrasted with those obtained from country studies. The paper then reviews recent experience with private financing for infrastructure to examine to what extent future investment needs will continue to require public financing. The last section concludes and summarizes.

The infrastructure sectors covered in this paper are roads, railroads, telecommunications, power, water and sanitation. For lack of comparable data across countries, we excluded ports, airports, and canals – which represent a small share of overall infrastructure endowments and power only includes electricity infrastructure. A quick review of Latin America's stock of infrastructure is offered below, and contrasted with the situation in similar countries elsewhere.

Table 1. Average infrastructure stock per capita, by income group:

Income group	Region	GDP per capita (1995)	Tel (1995)	Electricity (1995)	Road (1990)	Rail (1990)	Water (1990-98)	Sanitation (1990-98)
LMIC	World	1847	81	0.37	1.08	0.23	70.0	69.98
	LAC	2039	80	0.38	0.69	0.15	71.4	67.7
UMIC	World	4660	124	0.62	2.32	0.48	79.9	78.9
	LAC	4922	136	0.56	1.16	0.61	85.8	80.13
HIC	World	23195	496	2.12	9.74	0.66	96.6	98.6

Units are telephone mainlines per 1000 person, KW of generating capacity/person, km/person for both road and rail, and % of population with access for both safe water and sanitation. Sanitation does not necessarily imply sewerage connection . See Annex I for definition and data sources.

Latin America's infrastructure endowments today

Latin America is near world averages in term of stocks per capita for telecommunication, power, water and sanitation but substantially lower for paved roads (Table 1.) In the case of rails, lower middle income countries of Latin America have less than average, while upper middle income Latin American countries have much more than average. Overall, however, Latin America is substantially less endowed in transport routes than countries at similar levels of income.

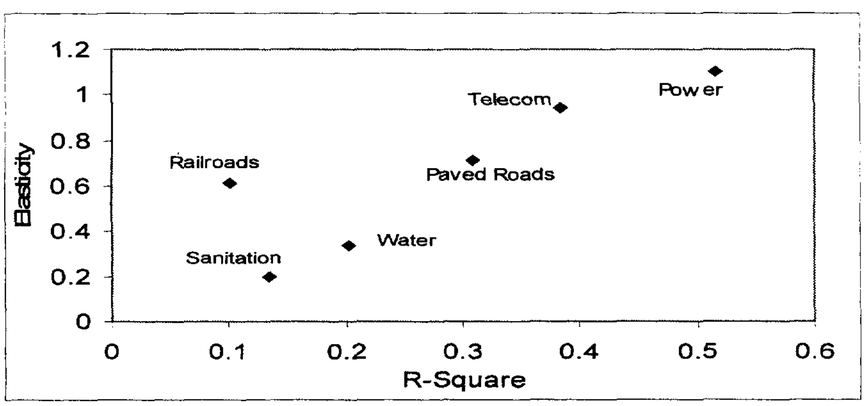
Table 2: The composition of infrastructure stocks in Latin America and in middle income countries, 1990

	Middle income countries 1990	Latin America 1990
Electricity	40%	46%
Roads	17%	11%
Rail	14%	16%
Sanitation	14%	12%
Water	9%	9%
Telecom	7%	6%

Source: for middle income countries, Ingram and Fay (1994); for Latin America, own calculation using Ingram and Fay methodology and prices[1].

These differences are reflected in the composition of infrastructure stocks (table 2.) In Latin America, power infrastructure accounts for close to half of total infrastructure and dominates at the expense of transport routes. Within transport, rail dominates over roads, the opposite of what prevails in the average middle income country. Shares of telecom and water/sanitation are comparable across both samples.

Figure 1: Infrastructure and income: elasticity and strength of association, Latin America, 1965-95[a]



a. The R^2 measures the proportion of the variation in the infrastructure variables that is explained by income per capita. The elasticity measures the % change in the infrastructure variables associated with a 1% change in the infrastructure variable.

Infrastructure and income

As countries grow, the need for infrastructure services changes. However, the strength of association between income and infrastructure services varies across sectors. In Latin America, income per capita is most strongly associated with electricity services, followed

[1] These estimates use 1994 prices for infrastructure. Using the 2000 prices shown in Table 5, the stocks would be: power-39.91; roads=12.75; rail=17.98; sanitation=14.24; water=10.72; telecom=4.39.

by telecom (figure 1.) In most other regions, the opposite is found, with sectoral elasticities ranging as high as 1.6 or 1.7 for both power and telecom (World Bank, 1994.)

Projecting demand for new infrastructure

The literature on infrastructure and growth is fairly large, but none of it is directly useful in projecting demand for new infrastructure. It focuses on contribution of infrastructure stock (Canning 1998; Canning and Fay 1993) or investment flows (Aschauer 1989; Easterly and Rebelo, 1993) to subsequent growth, rather than asking the question of what infrastructure levels will be required in the future, either as consumption goods, or as input into production function.

A model of Infrastructure demand

We develop a model to estimate future demand for infrastructure, where infrastructure services are demanded both as consumption goods by individuals and as inputs into the production process by firms. On the consumption side, the amount of service demanded is a function of income and prices:

$$I_j^c = f(Y_j; q_I)$$

Demand for a particular type of infrastructure service I by individual j is a function of j's income, Y_j, and the price of infrastructure service I, q_I. Aggregating over the population, national per capita demand of infrastructure service for consumption, I^c, will then be given as:

$$1. \quad \frac{I^c}{P} = \frac{1}{P}\sum_j I_j^c = F(\frac{Y}{P}; q_I)$$

where Y/P is income per capita.

On the production side, each individual firm's demand for infrastructure service I will be based on a profit maximization decision which yields the usual first order condition:

$$\frac{\partial Y_i}{\partial I_i^p} = \frac{q_I}{w_i}$$

where Y_i is output of good i by the firm, and w_i is the price of that good.

To go any further, we must adopt a specific functional form for the production function. Assuming a Cobb-Douglas, we can rewrite the first order condition as:

$$K_i^\alpha L_i^\beta \phi I_i^{\phi-1} = \frac{q_I}{w_i}$$

where K is physical capital (excluding infrastructure), L is labor or human capital, and I is the flow of infrastructure services consumed by the individual firm in the production of good i. Solving for I_i yields the derived demand for infrastructure services of firm i:

$$I_i^P = \left[\phi \frac{w_i}{q_I} K_i^\alpha L_i^\beta\right]^{1/(1-\phi)}$$

Aggregating over all firms yields the following:

$$2. \quad I^P = \sum_i I_i^P = \sum_i \left[\phi \frac{w_i}{q_I} K_i^\alpha L_i^\beta\right]^{1/(1-\phi)}$$

The derived demand for any given infrastructure service I^P is the sum of weighted individual firms' demands.

Equation 2 is however of limited usefulness since we do not have firm level data. A reasonable proxy for firms' aggregate demand for infrastructure is given by aggregate output. However, it is unlikely that the elasticity of demand for a particular infrastructure service, ϕ, is the same across sectors of the economy. Thus the weight attributable to a given firm's demand depends on the sectoral composition of the economy. Also, as technology changes, ϕ may change. Finally, the weighted average of the relative price w_i/q_I can be proxied by the real price of the infrastructure good -- q_I/w where w is the price level. The reduced form of equation 2, is then given as:

$$3. \quad I^P = F\left(Y, \frac{w}{q_I}, Y_{AG}, Y_{ind}; A\right)$$

where Y is aggregate output, Y_{AG} and Y_{IND} are the share of GDP derived from agriculture and industry, and A is a term representing technology level. Combining equations 1 and 3, and expressing infrastructure demand in per capita terms yields the following for overall production and consumption demand for infrastructure services:

$$4. \quad \frac{I}{P} = F(\frac{Y}{P}; \frac{q_I}{w}; Y_{AG}; Y_{IND}; A)$$

Estimating infrastructure demand empirically

The purpose of this paper is to estimate investment needs in infrastructure. For this the variable of interest is the stock of infrastructure, rather than the flow of services that will be produced from it. To the extent that services are proportional to the physical stock (though intensity of use may vary), equation 4 can easily be understood as demand for physical stocks of infrastructure.

Proxies

Lacking measures of technological change or actual real prices of infrastructure services, we use time dummies and country fixed effects as proxy. The country fixed effect allows each country to have a different intercept, which combined with the time dummy allows us to capture (albeit roughly) the price variable. We therefore estimate equation 4 as follows:

$$5. \quad i = a + b\,y + c\,y_{ag} + d\,y_{manuf} + e_t\,d_t + f_j\,d_j$$

where all variables are in natural logs, to linearize the model, i is infrastructure demand per capita, y is GDP per capita, y_{ag} and y_{manuf} are the shares of GDP derived from agriculture and manufacturing respectively, d_t are the time dummies and f_j are the country fixed effects.[2]

Most infrastructure goods are provided through networks so that the price of the service is reduced with higher population density. Urbanization, in particular, allows easier and cheaper access to water, electricity, telephone. In the case of roads, roads per capita tend to decrease with higher population density. We therefore added urbanization and population density to our basic model of equation 5 to capture the density effect and its impact on demand (both direct and through price.) We also added trade as a share of GDP with the idea that the more open a country is to the rest of the world, the greater its need for transportation and communication infrastructure.

Finally, infrastructure stocks tend to change reasonably slowly over time and have a long life span. Thus, to increase explanatory power we include the lagged value of the infrastructure stock.

Data

The infrastructure variables we use are telephone mainlines, MW of installed electricity generating capacity, km of paved roads, km of rail – all in per capita terms—and percentage of the population with access to water and sanitation. Annex XX discusses the variables and their source. Our data base is organized as an unbalanced panel with observations every 5 years from 1960 to 1995 and includes all independent middle and high income countries with population of more than 500,000 in 1990 for which data was available (60 countries).

Results

Using OLS with fixed effects, we ran both our basic model -- given by equation 5-- and the extended model -- which includes density, urbanization and trade-- on all 5 infrastructure variables. In all cases, we ran regressions both on the full sample of up to 60 countries and on the Latin American sample only.

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[2] Manufacturing rather than industry was used here because industry includes mining, which has very different implications on the demand for infrastructure.

As mentioned, country fixed effects proxy for differences in technology and price across nations. Their use also allow us to obtain consistent parameter estimates. Canning (1998), shows that per capita infrastructure levels are nonstationary, which implies that running the regressions in levels may produce misleading results unless the variable variables used in the regressions are cointegrated. Unfortunately, our sample size is too small to check for cointegration, leaving us with two possible solutions. One is to run the regressions on first differences, which Canning shows to be stationary. This would reduce our sample size considerably since we only have up to eight time series observations, and the series are often incomplete. The second possibility – which we use-- is to include fixed effects. Kao (1997) shows that in this case parameters estimates are consistent even if the estimated relationship is not a cointegrating one.

A Chow test of structural change allows us to determine whether the relation between infrastructure and the independent variables is the same for the Latin American sample as for the whole world sample.[3] With the exception of roads, we reject the hypothesis that coefficients are equal across samples and therefore run the regressions only on the Latin America sample. For roads, however, we cannot reject the hypothesis that they are equal, and therefore run the regression on the world sample.

In the cases of telephones, electricity, rail, water and sanitation, we find that including trade, density or urbanization helps little in predicting infrastructure endowments. For roads, however, both density and urbanization have explanatory power although trade does not.

We first ran the regressions using time dummies as in equation 5. For telecom and electricity we find that the coefficients were increasing as time went by, suggesting that the impact of technological change or price reductions became greater over time. This was not the case for roads, rail, water or sanitation were no discernable pattern was noticeable and were the coefficient were broadly equal across the time dummies.

Using time dummies (d_t), rather than a time trend (entering year directly in the equation) presents an additional problem. Our purpose is to predict values for 2005. The model with time dummies does not yield a coefficient that is applicable to the 2000 or 2005 values and predictions are therefore biased downwards. For this reason, rather than using equation 5 we use:

$$6.\quad i = a + b\,y + c\,y_{ag} + d\,y_{manuf} + e\,(year) + f_j$$

Data limitation force us to use the basic model on the Latin America sample for roads (data projections are mostly available for LAC and for GDP data for 2000 and 2005.) Thus, Table 3 presents the regressions that were subsequently used for the prediction.

[3] Note that the presence of fixed effects somewhat complicated the estimation of Chow test. The hypothesis tested (H_0) was not in fact whether all coefficients were the same across samples, but only whether the coefficients on the explanatory variables other than the country fixed effects and the time dummies.

Table 3. Access to infrastructure

Dep. Var.	Telephone	EGC	Rail	Water	Sanitation	Roads
	1	2	3	4	5	6
Lagged dep.var.	0.27	0.83	0.19	-0.18	n.a.	0.54
	(2.35)	(6.85)	(1.08)	-(0.84)		(4.59)
GDP per capita	0.18	0.53	-0.28	-0.03	0.31	0.28
	(1.38)	(3.65)	-(2.23)	-(0.19)	(0.77)	(1.81)
Ag. Share of GDP	0.13	0.12	0.36	0.65	-0.12	0.00
	(0.84)	(0.78)	(2.02)	(2.40)	-(0.30)	(0.01)
Manuf. share of GDP	-0.23	0.00	0.23	0.23	0.13	0.29
	-(1.95)	-(0.03)	(1.46)	(0.77)	(0.35)	(1.77)
Year	0.04	0.00	-0.01	0.00	0.00	-0.00
	(5.50)	-(0.42)	-(1.58)	(0.39)	-(0.05)	-(0.72)
Bolivia	-0.68	0.83	n.a.	n.a.	n.a.	n.a.
	-(1.74)	(2.14)				
Brazil	-0.42	0.35	-1.64	0.10	-0.05	-0.17
	-(2.69)	(2.35)	-(5.19)	(0.60)	-(0.16)	-(1.16)
Chile	-0.27	0.53	-0.81	0.46	0.37	0.06
	-(1.37)	(2.63)	-(3.91)	(1.75)	(0.73)	(0.32)
Colombia	-0.24	0.65	-2.63	-0.20	0.50	-0.24
	-(0.84)	(2.57)	-(4.89)	-(0.57)	(0.57)	-(0.88)
Costa Rica	-0.07	0.48	-1.84	0.05	0.74	0.35
	-(0.26)	(2.31)	-(4.58)	(0.16)	(1.16)	(1.33)
Dom. Rep.	-0.65	0.75	-3.74	-0.35	0.59	0.76
	-(1.81)	(2.24)	-(4.53)	-(0.83)	(0.67)	(1.93)
Ecuador	-0.56	0.76	-2.51	-0.59	0.37	0.11
	-(1.80)	(2.36)	-(4.91)	-(1.48)	(0.43)	(0.46)
El Salvador	-1.29	0.47	-2.59	-0.88	0.59	-0.06
	-(3.40)	(1.45)	-(4.72)	-(1.90)	(0.63)	-(0.19)
Guatemala	-0.41	0.84	-2.09	0.16	0.33	1.08
	-(1.73)	(3.07)	-(4.60)	(0.43)	(0.44)	(4.49)
Jamaica	-0.38	0.47	-1.18	0.45	0.39	0.10
	-(2.26)	(2.77)	-(4.56)	(2.30)	(0.88)	(0.55)
Mexico	-0.31	0.38	-1.91	0.64	0.33	0.20
	-(1.29)	(1.80)	-(2.25)	(1.91)	(0.51)	(0.87)
Panama	-0.92	0.33	-2.25	0.36	0.57	-0.38
	-(3.79)	(1.65)	-(4.77)	(1.56)	(0.99)	-(2.00)
Paraguay	-1.13	0.91	-2.55	n.a.	0.20	0.07
	-(3.08)	(2.46)	-(4.65)		(0.18)	(0.24)
Peru	-0.64	0.40	n.a.	n.a.	n.a.	n.a.
	-(1.96)	(1.40)				
Trinidad	-0.05	0.55	n.a.	1.61	n.a.	n.a.
	-(0.21)	(2.45)		(3.36)		
Uruguay	0.05	0.26	-0.42	0.10	0.07	n.a.
	(0.34)	(1.82)	-(2.86)	(0.51)	(0.18)	
Venezuela	-0.20	0.55	-3.30	0.95	0.19	0.23
	-(1.32)	(3.01)	-(4.32)	(2.70)	(0.47)	(1.20)
Constant	-1.28	-4.86	1.85	2.61	1.39	-3.02
	-(0.98)	-(3.08)	(1.64)	(0.93)	(0.32)	-(1.98)
N	91	97	71	35	36	55
Adj. R2	0.97	0.93	0.98	0.88	0.61	0.97

All variables are in logs; t-statistics are in parenthesis. Dependant variables are per capita. Period covered is 1965-95, except for roads (1965-90.) Lagged dependant variable not used for sanitation because it would have reduced the sample too much. Argentina fixed effect dropped so that the constant is the Argentina intercept, and all country fixed effect should be understood as deviation from the Argentine intercept.

For all but water and sanitation, we obtain very high R^2, which is our goal given that we want to predict infrastructure values as best as possible. In the case of water and sanitation, the small number of observations makes inference difficult, and the limited degree of freedom implies a low degree of reliability of the results.

Projections

The World Bank offers projections for key macro variable up to 2005 which we use to estimate our infrastructure variables both for 2000 and 2005.[4] The country by country results are shown in Annex II, and table 4 below shows averages for Latin America, dividing the sample between lower middle income countries and upper middle income countries.

For telephone mainline per capita, our model performs reasonably well suggesting that mainline per capita should nearly double over the 1995-2005 period, and reach around 153 per 1000 person for LMICs and 255 for UMICs. For electricity, we predict an 18% total increase for LMICs, and 46% for UMICs, which would bring their respective installed capacity to 0.45 MW/1000 person and 0.82 MW/1000 person.

Table 4: Infrastructure stocks in Latin America, 1995-2005

	GDP Per capita	**Telephones** (mainlines/ 1000 person)	**Electricity** (KW of gen capacity/person)	**Paved Roads** (km/1000 person)	**Rail** (km/1000 person)	**Water** (% pop. w/ access)	**Sanitation** (% pop. w/ access)
1995							
LMIC	2040	80.20	0.38	0.70	0.34	62.09	69.85
UMIC	4923	135.04	0.56	1.12	0.48	78.50	72.75
2000							
LMIC	2139	105.92	0.42	0.67	0.38	63.53	68.18
UMIC	5515	183.79	0.66	1.12	0.41	67.84	78.64
2005							
LMIC	2253	152.69	0.45	0.65	0.32	54.57	67.31
UMIC	6496	254.76	0.82	1.18	0.37	65.49	82.62

Source: See Annex II. Per capita GDP and 1995 values for telephone, electricity, water and sanitation are from World Bank (2000). Own estimations using regressions from Table 1 and predicted values for explanatory variables

Our model performs poorly for roads and rail, perhaps because these variables are a lot less closely related to income per capita, our key explanatory variable. For roads per capita we show a small but steady *decline* in LMICs and a very small increase in UMICs. According to our predictions then, upper middle income Latin American countries would still only have about 1.18 km per 1,000 person by 2005 much less than the 2.32 world average for UMICs in 1990. These predictions may provide us with a lower bound estimate since they are not in fact too surprising: in the nineties roads per capita increased

[4] The SIMA online database, which contains the World Development Indicators (WDI), also includes "Regional databases" which contain predicted values for the main variables of the WDI. Coverage is uneven, however, mostly restricted to the larger countries.

at an annual rate of 0.1% in LMICs and 0.8% in UMICs. These rates, if applied to Latin America in the period 1995-05 would translate into figures for 2005 of 0.71 for LMICs and 1.21 km per 1,000 person for UMICs – similar to the results shown in Table 4.

In the case of rail, we show a decline in km of tracks per capita for both LMICs and UMICs, between 1995 and 2005. Again, this is not particularly surprising as rail construction has largely stopped in the last 20 years. With some exceptions such as Egypt, Venezuela, Guatemala, Saudi Arabia and Panama, few countries have increased their networks substantially enough to show an increase in rail per capita in the last two decades (see Annex 3, tables 1 and 2.) The implication, however, is not that no investment will be taking place in the rail sector, but rather that it is more likely to take the shape of upgrading and rehabilitation rather than of new construction. This is indeed what has been happening in a number of countries (Mexico, Brazil) already.

For water and sanitation, the available data is very poor – both in terms of quality and of coverage – particularly for water where the definition of what constitutes safe water changes over time and across countries. Our estimates, which show a decline in access to water, are not particularly trustworthy. In the case of sanitation, the estimates are only slightly more reliable.

In sum, our model performs well for telephones and power, but it can only offer lower bound estimates for roads, water and sanitation, and unreliable predictions for rail.

Implications for investment

From our projections for infrastructure stocks in 2005, we can derive the associated flow of required new investment. To do so we simply look at the total increase in stock needed, and price it using best practice prices taking into account associated network costs. This is particularly important notably in the case of power, where generating capacity is only a fraction of total infrastructure cost.

Table 5. Best practice costs of infrastructure

Sector	Unit cost
Power	$1,500 per kilowatt of generating capacity, including associated network costs
Roads	$200,000 per kilometer of two lane paved road
Railway	$900,000 per kilometer of rail line, including associated rolling stock
Sanitation	$ 1.5 per liter per day
Water	$1.00 per liter per day
Telecom	$1,000 per telephone mainline

In the case of water and sanitation, we need to transform the population coverage data we have into a daily consumption figure. Water consumption varies with income, and we follow Ingram and Fay (1994) using the following relationship to estimate demand for water:

$$\text{Ln (liters per day)} = 2.87 + 0.284 \ln(\text{PPP GDP per capita})^{5}$$

This is then multiplied by the number of people with access to water. For sanitation, we consider that it is equal to daily water use per capita, which is then multiplied by the number of people with access.

Our data covers a maximum of 18 countries representing 99.2% of Latin America's 1995 GDP. In the case of roads in 2005, our predictions are available only for 8 countries (which do represent 90% of the region's GDP), and for rail, it is much lower. To obtain a total for all of Latin America, we extrapolate using 1995 share of GDP.[6]

Since infrastructure data is not available for 2000, we estimated both 1995-2000 and 2000-2005 investment flows (Table 6.)

Table 6: Estimated required new investments in infrastructure, lower bound estimates, 1995-2005

	Annual investment flows			
	1995/2000		2000/2005	
	(Mn of $)	as % GDP	(Mn of $)	as % GDP
Telecommunications	4,174	0.22%	6,089	0.27%
Electricity	14,314	0.76%	22,042	0.99%
Paved roads	2,757	0.15%	1,823	0.08%
Railroads[a]	10,880	0.60%	4,887	0.23%
Water	2,325	0.12%	1,025	0.05%
Sanitation	7,352	0.38%	4,035	0.18%
Total, all sectors	41,802	2.23%	39,874	1.78%

a. The sample is so small as to be unrepresentative.

In the case of telecommunication, the investment required is between 0.2 and 0.3 % of GDP per annum. This estimate seems reasonable given that telecommunication is a relatively small share of overall infrastructure stocks, yet one that has been growing remarkably in recent years.

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[5] This was estimated using Summers and Heston GDP per capita, rather than the world Bank constant 1995 $ which we use elsewhere in the paper.

[6] $I_{LAC}^{1995-2000} = \frac{\sum_i I_{ik}^{95-00}}{w}$ *where* $w = \frac{\sum_i Y_i}{Y_{LAC}}$ for I, the infrastructure value; Y, GDP; the subscript i referring to country i, and the subscript k referring to infrastructure type k.

The power sector, on the other hand, requires much higher investments to allow for the network extensions presented in Table 4: $22 billion per annum on average over the period 2000/2005, or 1% of GDP. This number is not unreasonable. According to Easterly and Rebelo (1993) public investment in power and electricity in the eighties in developing countries represented close to 1.4% of GDP.[7]

In the case of roads, our estimates of 0.08% to 0.15% appear particularly low. Ingram and Fay (1994) estimated that on average, developing countries spend about 0.8% of GDP on roads – more than 10 time the amount we estimate in Table 6. This number, however, includes upgrading (lane expansion), the creation of expensive urban road system (e.g. ring roads…) and rehabilitation, while ours really only takes network expansion into account. Including rehabilitation would only increase investment needs by about $400 million p.a. to about 0.17% of GDP in 1995-00 and to 0.11% in 2000-2005, and thus remain on the low side. Even adding maintenance (about $2.6 billion per annum) would still only result in an estimate of about 0.3% of GDP[8]

Estimates for rail are unreliable since they are extrapolated from a very small sample (representing only 11 % of Latin America's GDP in 1995-2000 and less than 3% in 2000-5.) The reason for this very small sample is that for most countries we show a *decrease* in the stock of rail, and omit these observations rather than including negative investment flows. Our rail estimates are therefore clearly biased upwards.

Estimates for investment in water are once again very low – surely due to our poor ability to predict water coverage increases. However, they appear reasonable for sanitation, at somewhere between 0.18 and 0.38% of GDP. This compares reasonably with Easterly and Rebelo's (1993) finding that in the 1980s, public investment in water and sanitation in developing countries absorbed about 0.4% of GDP in middle income countries.

Given our low estimates on road, water and sanitation, it is not surprising that our overall investment estimates are low compared to similar calculation done elsewhere. According to the 1994 World Development Report, developing countries spend on average 4% of GDP on new investments in infrastructure. Traditionally, most of this was publicly funded: in the eighties for example, public investment in infrastructure was on average 4.3% of GDP in middle income countries (Easterly and Rebelo, 1993). In contrast, our estimates only add up to 1.8% to 2.2%.

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[7] At the time, most of the electricity sector in developing countries was in the public sector, so public investment would have represented the quasi totality of investment in electricity.

[8] In Latin America, specialists of the road sector estimate that about 15% of the network needs rehabilitation, costing about 35% of the value of the road to be rehabilitated ($70,000 per km.) Given the total road network for the region of about 388,000 km this suggests an investment need of about $4 billion or an average of $400 million per annum assuming this is spread over 10 years. In contrast, annual maintenance for roads averages about 4% of the replacement cost value of the road, which adds up to annual maintenance expenditure resource need of $2.6 billion. The assumption is that routine maintenance should average 1 to 1.5% of the construction cost of the road per annum, annualized periodic maintenance, 2.5 to 3.5% for an annual total of about 4%. This only applies to 85% of the road network since the other 15% of the network are in need of rehabilitation.

An alternative approach consists for roads to look at the resources needed to bring Latin America to the upper middle income country world average of 2.32 km per capita by 2005. The required average annual growth rate would be 8.04% per annum, which we apply to individual countries 1990 level of road infrastructure. Such growth would require annual investments of $11 billion for 1995-2000 and $17 billion for 2000-2005, equivalent to 0.65% and 0.87% of GDP respectively (Table 7).

A similar approach was used for water, where we looked at the amount of resources needed for all Latin American countries to reach a water coverage of 80% in 2005 and to keep countries that already had a higher coverage at their 1995 level. This would absorb an annual average of $2.3 billion for 1995-2000 and $2.6 billion for 2000-2005, equivalent to 0.13% and 0.15% of LAC's GDP respectively.

Table 7: Estimated required new investments in infrastructure, higher bound estimates, 1995-2005

	Annual investment flows			
	1995/2000		**2000/2005**	
	(Mn of $)	**as % GDP**	**(Mn of $)**	**as % GDP**
Telecommunications	4,174	0.22%	6,089	0.27%
Electricity	14,314	0.76%	22,042	0.99%
Paved roads	***11,524***	***0.65%***	***17,836***	***0.87%***
Railroads[a]	10,880	0.60%	4,887	0.23%
Water	***2,309***	***0.13%***	***2,604***	***0.15%***
Sanitation	7,352	0.38%	4,035	0.18%
Total	***50,553***	***2.74%***	***57,466***	***2.69%***

a. The sample is so small as to be unrepresentative.

Using these higher bound estimates produces more likely numbers, with investment in infrastructure at around 2.7%. This includes new investments but not rehabilitation and maintenance, and excludes ports and airports. It therefore compares reasonably well with the Easterly and Rebelo estimates of 4.3% of GDP (which includes some rehabilitation and maintenance) or with the WDR estimate of 4% (which included ports, canals, airports, irrigation and solid waste) particularly given the 25 to 30% decline in prices of telecommunication and electricity infrastructure.

In terms of the composition of infrastructure stocks, these predictions imply a radical shift in the composition of transportation infrastructure, with roads dominating and rail becoming half as important (table 8.) The share of telecommunication infrastructure is also expected to double, relative to its 1990 level.

Table 8: The composition of infrastructure stocks in Latin America in 2005

	Latin America 1990[a]	Latin America Projections for 2005
Power	40%	41%
Roads	13%	23%
Telecom	4%	8%
Sanitation	14%	12%
Rail	18%	8%
Water	11%	8%
Total value (US$ Billion)	569.5	1,155.2

a. These estimates use the prices given in Table 5 as opposed to the Ingram and Fay prices used in table 2. Thus the difference in stock composition between 1990 and 2005 as shown here is due to changes in the infrastructure stock rather than in prices. Notes: see table 2.

Our estimate of the total value of the infrastructure stocks also allows us to estimate the amounts needed for maintenance. In general, 2 to 4% of the replacement cost of the stock are needed annually (including routine and annualized periodic maintenance.) Thus, period, annual maintenance requirements should be around $35 billion.

Country report information on infrastructure investment needs

A few country reports are available that document infrastructure investment needs. However, this data is neither collected nor reported systematically. It is most readily available for transport (table 9.)

Table 9 Estimated investment needs in transportation infrastructure

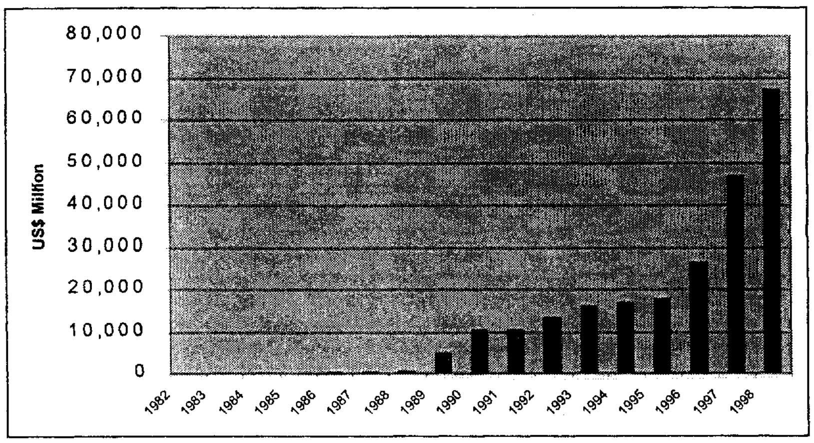
	Transport investment data available
Brazil	$32 billion needed
Peru	$ 0.7 to $1 billion per annum over the next 10 years
Mexico	Public investment in transport was $1.1 Bn in 1998
Chile	$11.3 billion needed

Together these 4 countries represent more than 60% of Latin America's GDP. Assuming the needs identified for Brazil and Chile are implemented over a 5 year period, and extrapolating from this sample to the rest of Latin America (using GDP shares), this suggests that annual investments in the order of $16 billion are needed annually for transport infrastructure. This is lower than our estimates for rail and road, which are of more than $22 billion annually over 2000-2005.

Financing infrastructure investment needs

The 1990s have seen a radical shift in thinking on how to fund infrastructure needs and involving the private sector. Private capital flows into infrastructure have grown from $14.8 million in 1982 (the first year in which such an investment was recorded in Latin America) to US$67,188 million in 1998.

Figure 2. The staggering growth of private capital flows for infrastructure in Latin America, 1982-98



Source: PPIAF data base

However, of the US$ 258 billion of private flows to infrastructure over the period, only 171 Billion constituted investment (new and rehabilitation) as opposed to divestiture payments. And in 1998, such investments amounted to only about US$35 billion, spread almost equally across greenfield, O&M or divestiture types of projects (table 10).

Table 10: Private capital flows in infrastructure in Latin America, 1998

Type of project	Investment[a]
Greenfield	12,308
O&M	12,508
Divestiture	10,181
Total	34,997

a. Either new or for the purpose of rehabilitation; excludes divestiture payments for the purchase of an asset. Source: PPIAF data base.

In 1998, nine tenth of the investment undertaken within divestiture types of projects occurred in telecom, which also dominated greenfield projects (56%.) Power accounted for most of the rest of greenfield projects (43%) while transport dominated O&M projects (98%). Overall, from 1982 to 1999, telecom attracted almost half of private sector investment, while energy absorbed about a third, followed by transport (20%.) Water was a distant fourth, attracting only about 4% of total investment flows (table 11).[9]

[9] Note that energy includes gas, whereas elsewhere in the paper we only included electricity when talking about "power."

Table 11. Private capital flow for infrastructure in Latin America, by sector, 1982-98

Sector	Private capital flow[a] (US$ Mn)	%
Energy	77,601	30.1%
Telecom	119,620	46.4%
Transport	49,600	19.2%
Water	11,045	4.3%
Total	**257,866**	**100%**

a. Includes divestiture payments as well as rehabilitation and new investments. Source: PPIAF data base.

Despite this shift, and the staggering development in private participation in infrastructure, it is unlikely that private funds will suffice to finance infrastructure financing needs for some time. Indeed, it is only in telecom, and possibly transport that private funding makes a substantial dent in needs (table 12). In the case of telecom, actual private investment includes investment in cellular lines, which our model does not take into account given how recent this shift is: the number of cellular lines increased by 73% in 1999 and will approach the number of wire lines in Latin America in 2001.

Table 12: Private capital is unlikely to cover infrastructure financing needs, except perhaps in telecommunications and transport

	Estimated investment need annual average 2000/2005 (US$ Mn)	Actual private investment[a] 1998 (US$ Mn)	Private investment as % estimated need[b]
Electricity/energy[c]	22,042	4,536	21%
Telecommunications	6,089	14,546	240%
Transport	22,723	12,366	54%
Water and sanitation	6,639	339	5%
Total	**57,466**	**34,997**	**61%**

a. Total is greater than sectoral sum because the sector to which operations belong could not always be identified. b. Note that this is an overestimation since "needed investment" only includes new investment while "private investment" includes rehabilitation. c. electricity only for estimated investment needs, but energy for private sector flows. Source: own estimates of needs and PPIAF data base.

Unfortunately, data is unavailable on public investment in infrastructure, current or planned, so it is impossible to estimate what the public sector response to these needs can or should be given current fiscal constraints.[10] Nevertheless, an idea of how much estimated needs represent relative to public investment can be given: *total* public fixed investment are only estimated to be around 2.4% of GDP in 2000 (as opposed to 4.4% ten

[10] The only available data is offered in Easterly and Rebelo (1993) and covers the 60s, 70s, and 80s. No similar effort at data collection on public expenditure on infrastructure has taken place since. The reason is that none of the public finance data bases (IMF Government Financial Statistics; UN data bases) reports public expenditure data in a way that allows to estimate public investment in infrastructure. The Easterly and Rebelo database was constructed from World Bank Country Public Expenditure Reviews following a painful and lengthy exercise of primary data collection.

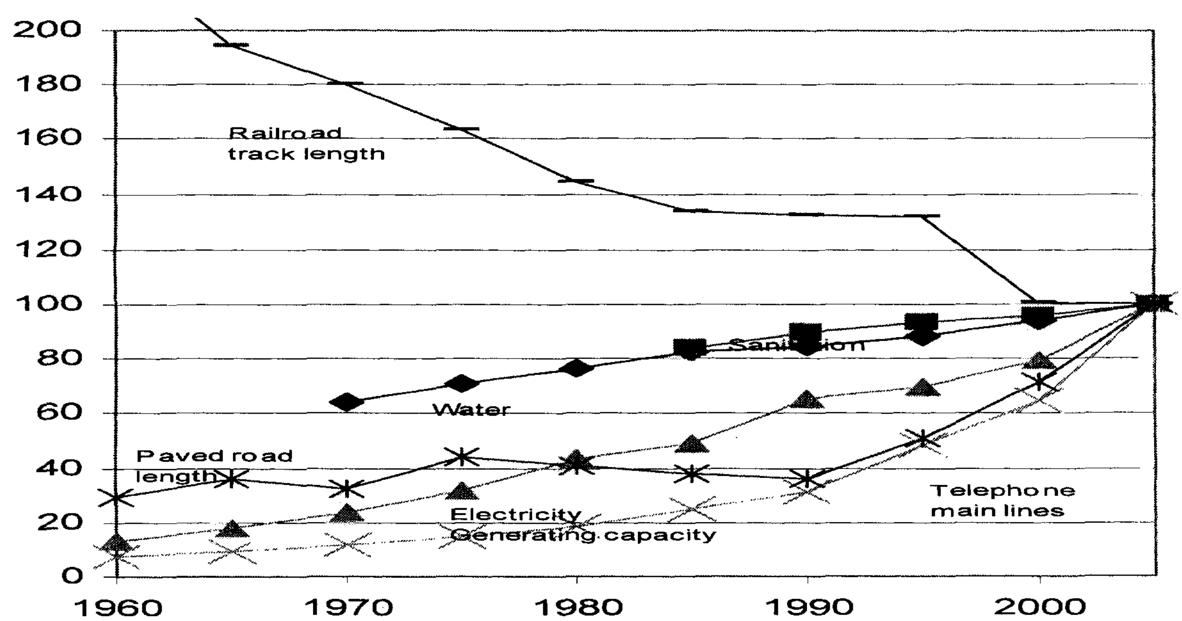
years ago) or about $37 billion.[11] This suggests that public investment flows would need to increase substantially in order to fund infrastructure needs, especially in the sectors less favored by private investors – or that investment in these sectors must somehow be made more attractive to private capital.

Conclusion

We developed a model to predict future demand for infrastructure, which performs reasonably well for telecommunication, power, and sanitation. For water, where the data is scarce, and transport infrastructure, which is less closely related to income per capita our estimates are less reliable, and we offer alternative estimates using information from other middle income countries. It should be noted that ours are estimates of *demand*, rather than some absolute measure of "*need*."

Overall we expect to see a doubling of telephone mainlines per capita and a steady increase in power infrastructure (figure 3.) In the case of transport, rail should continue its secular decline, while road infrastructure should expand steadily. We expect small increases in water and sanitation coverage.

Figure 3: Changing infrastructure stocks per capita, Latin America, 1960-2005



The investments needed should amount to about $57 billion per annum --or 2.66% of Latin America's GDP-- over 2000-2005. Most of it are for the power sector ($22 billion),

[11] Note this includes public investment in sectors other than infrastructure. Calculated from WDI as sum for Latin America of { (1-private investment as % GDFI)* GDP.} In the case of Mexico, private investment as % GDFI was given as 102%, so public GDFI was set to zero for Mexico.

followed by roads ($18 billion) and telecommunications ($6 billion.) This does not include rehabilitation (estimated for the road sector at about $400 million per annum) nor maintenance (approximately $35 billion per annum for all sectors.[12]) Estimates for ports and airports are not available, but since these types of infrastructure represent but a fraction of the total, it is unlikely that including them would change our total estimates.

Private financing for infrastructure has surged in recent years, representing about $35 billion for investment (exclusive of divestiture payments) in 1998. Overall, however, this has disproportionately favored telecommunications ($14 billion) and transport (12 billion.) Comparing investment needs with private sector flows, private investment have exceeded our predicted need for telecom, cover about half for roads, but are just a fraction of what is needed in power and water and sanitation. In the case of telecom, this can easily be explained by the fact that our model does not account for cellular lines (favored by private investors) which are should be as numerous as fixed lines by 2001.

No information is available on public investment in infrastructure. Nevertheless, the public sector's share of gross domestic fixed investment is only estimated to represent $37 billion in 2000. Given that not all of this is available for infrastructure financing, this suggest investment shortfalls particularly in the sectors of less interest to the private sector – unless public funding is increased or means are devised to make these sectors more appealing to private investors.

While our estimates compare reasonably well with what has been found elsewhere or in the past, they suffer from a number of limitation. Most severe, is the case of transport where models such as ours which focus on network expansion, rather than upgrading and modification, are insufficient to capture the changes that urbanization, increased trade, and globalization imply for the sector. Similarly, our model may be too backward looking to capture the massive transformation of the telecom sector, notably the explosion in mobile telephony.

This study is an interesting, albeit limited, first foray into trying to systematically estimate investment needs. Like many study of its kind, it is surely broadly accurate in the order of magnitude that it projects – notably concerning the inability of private investment to satisfy demand in the near future. This work would however greatly benefit from complementary studies, notably in transport, which could go more in depth into sectoral economics and capture the changes in the type of infrastructure services that may be needed.

[12] This is calculated at 3% of the average value of infrastructure stocks over the period 2000/2005.

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Annex I

Data source and description

Telephone, in number of main lines; **electricity generating capacity** in millions of watts; **rail track** length, in kilometers; and, **paved roads** length, in kilometers are from Canning (1998), available at: http://www.worldbank.org/html/dec/Publications/Workpapers/WPS1900series/wps1929/canning1.xls.

Safe water (defined as percentage of population with reasonable access to an adequate amount of safe water (including treated surface water and untreated but uncontaminated water such as from springs, sanitary wells, and protected boreholes); in urban areas this may be a public fountain or standpipe located no more than 200 m from the dwelling; in rural areas, the definition implies that members of the household do not have to spend a disproportionate part of the day fetching water; **Sanitation** (defined as percentage of population with at least adequate excreta disposal facilities that can effectively prevent human, animal and insect contact with excreta; suitable facilities range from simple but protected pit latrines to flush toilets with sewerage connection); **GDP** and GDP per capita, in constant 1995 dollars; **agriculture share** and **manufacture share** of gross domestic product, in percentage; **trade**, defined as export plus imports, as percentage of GDP; **total population**; **population density**, in number of people per square km; and **urban population**, in percentage are from the World Development Indicators database of the World Bank.

Predictions of infrastructure levels is done using the estimated parameters of the model and projections of the explanatory variables from the WDI and GDF for LAC region.

In the estimation of per capita consumption of water, Summer and Heston GDP per capita was used. For the 2000 and 2005, projections of this variable were obtained by applying the World Bank GDP per capita growth rate to the 1990 values of Summer and Heston GDP.

Annex II

Predicted infrastructure access per capita, by country lower bound estimates,

Country	Year	GDP per capita	Sanitation	Water	Rail	Road	Electricity	Telephone
Argentina	1995	8076	69	55	0.86	1.74	0.57	160
	2000	8194	79	54	0.77	1.62	0.59	232
	2005	9713	83	53	0.70	1.64	0.67	324
Bolivia	1995	906	41	60	1.80	0.31	0.11	47
	2000	982	35	81	2.07	0.33	0.12	68
	2005	.		.	.	.	.	.
Brazil	1995	4418	67	72	0.16	0.87	0.36	75
	2000	4543	60	59	0.14	0.80	0.44	114
	2005	5255	63	57	0.12	0.79	0.55	163
Chile	1995	4176	81	91	0.42	0.91	0.41	132
	2000	4846	91	68	0.37	0.99	0.60	166
	2005	5719	96	65	0.33	1.07	0.90	224
Colombia	1995	2089		63	0.07	0.36	0.31	110
	2000	2270	74	65	0.06	0.34	0.38	160
	2005	2620	78	63	0.06	0.34	0.49	221
Costa Rica	1995	2676	97	74	0.18	1.68	0.34	163
	2000	3219	108	73	0.14	1.60	0.42	216
	2005	.		.	.	.	.	.
Dom. Rep.	1995	1525	66	49	0.02		0.19	73
	2000	1992	82	47	0.01	.	0.25	87
	2005	2562	89	45	0.01	.	0.36	119
Ecuador	1995	1565	56	58	0.09	0.61	0.22	65
	2000	1413	61	46	0.08	0.63	0.24	82
	2005	1542	62	45	0.08	0.65	0.28	109
El Salvador	1995	1676		58	1.19	0.44	0.13	49
	2000	1720	46	54	1.50	0.50	0.12	71
	2005	1896	47	52	1.46	0.55	0.12	97
Guatemala	1995	1469	61	40	0.10	0.35	0.07	27
	2000	1570	68	44	0.08	0.35	0.08	38
	2005	.		.	.	.	.	.
Jamaica	1995	1658		38			0.48	119
	2000	1545	60	48	.	.	0.51	119
	2005	1601	60	48	.	.	0.55	150
Mexico	1995	3139	74	62	0.25	0.96	0.47	94
	2000	4618	100	67	0.19	1.08	0.58	120
o	2005	5391	107	64	0.16	1.21	0.73	160
Panama	1995	3005	76	95	0.11	0.86	0.36	116
	2000	3339	72	77	0.08	0.80	0.38	166
	2005	.		.	.	.	.	.
Paraguay	1995	1860			0.10		1.32	34
	2000	1729	48	81	0.09	.	1.53	48
	2005	.		.	.	.	.	.

Country	Year	GDP per capita	Sanitation	Water	Rail	Road	Electricity	Telephone
Peru	1995	2510	90	69	0.08	0.35	0.16	47
	2000	2668	97	71	0.08	0.35	0.16	54
	2005	.		.	.	.	.	.
Trin. &Tobago	1995	4122		93			0.88	160
	2000	4938	70	84	.	.	0.97	209
	2005	5807	71	81	.	.	1.14	298
Uruguay	1995	5607		98	0.70		0.64	195
	2000	5952	72	76	0.57	.	0.75	261
	2005	7090	76	73	0.51	.	0.92	360
Venezuela	1995	3537	72	79	0.02	1.36	0.91	113
	2000	3217	67	76	0.01	1.15	0.90	162
	2005	3296	68	75	0.01	1.05	0.89	220

Source: Per capita GDP and 1995 values for telephone, electricity, water and sanitation are from World Bank (2000). Own estimations using regressions from Table 1 and predicted values for explanatory variables

Annex III

Countries with increases in rail tracks

Table 1. Countries with increase in total rail tracks

		Increase in rail tracks	
country	Period	Km	As % existing network
Algeria	85-90	452	11.8%
Bolivia	85-90	73	2.0%
Botswana	90-95	175	24.6%
Brazil	85-90	429	1.4%
Brazil	80-85	118	0.4%
Bulgaria	80-85	30	0.7%
Chile	80-85	438	7.0%
Chile	85-90	112	1.7%
Denmark	80-85	21	0.7%
Ecuador	80-85	1	0.1%
Egypt, A	80-85	1326	29.9%
Egypt, A	90-95	59	1.2%
El Salvador	80-85	72	12.0%
Finland	90-95	13	0.2%
France	80-85	314	0.9%
Gabon	85-90	342	100.3%
Greece	85-90	23	0.9%
Guatemala	85-90	320	39.1%
Hungary	85-90	14	0.2%
Indonesia	80-85	64	1.0%
Iran, Is	90-95	485	10.0%
Iran, Is	85-90	280	6.1%
Ireland	90-95	10	0.5%
Israel	85-90	46	8.7%
Israel	80-85	12	2.3%
Japan	80-85	565	2.5%
Jordan	90-95	1	0.3%
Korea, R	90-95	10	0.3%
Malaysia	85-90	138	6.6%
Mexico	85-90	452	1.7%
Mexico	80-85	398	1.6%
Morocco	85-90	125	7.1%
Morocco	80-85	12	0.7%
New Zeal	85-90	50	1.2%
Panama	85-90	376	345.0%
Peru	80-85	60	2.9%
Peru	85-90	37	1.7%
Romania	85-90	156	1.4%
Romania	80-85	82	0.7%

		Increase in rail tracks	
country	Period	Km	As % existing network
Romania	90-95	28	0.2%
Saudi Arabia	80-85	815	141.2%
Saudi Arabia	90-95	27	2.0%
South Af	80-85	469	2.1%
Switzerland	80-85	34	0.7%
Thailand	85-90	126	3.4%
Tunisia	80-85	164	8.0%
Tunisia	85-90	59	2.7%
Turkey	90-95	119	1.4%
Turkey	85-90	30	0.4%
Turkey	80-85	3	0.0%
Uruguay	85-90	11	0.4%
USSR	80-85	3100	2.2%
USSR	85-90	2600	1.8%
Venezuela	85-90	122	43.6%
Venezuela	80-85	12	4.5%

Table 2. Countries with increase in km of rail per capita

		Increase in rail tracks per capita	
Country	year	As Km per Mn person	In %
Botswana	90 -95	38.51	6.9%
Denmark	80 -85	5.12	0.9%
Egypt, A	80 -85	14.42	14.2%
El Salvador	80 -85	9.19	6.9%
Gabon	85 -90	249.79	72.2%
Guatemala	85 -90	20.99	20.4%
Hungary	80 -85	8.23	1.1%
Hungary	85 -90	17.01	2.2%
Ireland	85 -90	7.66	1.4%
Panama	85 -90	151.95	302.1%
Romania	90 -95	9.19	1.9%
Saudi Arab	80 -85	49.97	83.2%
Venezuela	85 -90	4.28	26.2%

Annex IV

Estimates of infrastructure investment needs, by country

Country	Year	Sanitation	Water (low)	Water (high)	Rail	Road (low)	Road (high)	Electricity	Telephone
Argentina	1995-2000	1,667	223	925			9,109	4,618	4,502
	2000-2005	1,590	370	1,289		800	13,374	8,788	6,300
Bolivia	1995-2000		370	231	3,487	90	331	446	321
	2000-2005	-	-	-	-	-	-	-	-
Brazil	1995-2000			2,762			20,463	31,862	11,176
	2000-2005	5,100	1,600	4,593		1,600	32,222	50,832	15,700
Chile	1995-2000	895		293		396	1,630	6,582	943
	2000-2005	795	180	356		470	2,458	10,748	1,660
Colombia	1995-2000	-	1,090	1,356	140	328	2,411	10,770	4,291
	2000-2005	1,785	560	1,105		300	3,149	12,935	5,200
Costa Rica	1995-2000	187	29	48		(39)	737	565	294
	2000-2005	-	-	-	-	-	-	-	-
Dom. Rep.	1995-2000	608	85	224		-	-	1,380	267
.	2000-2005	465	68	246		-	-	2,361	520
Ecuador	1995-2000	290		355	47	199	968	1,138	438
	2000-2005	330	105	509	21	230	1,508	1,544	740
El Salvador	1995-2000	-	10	190	2,376	126	296	17	245
	2000-2005	122	55	245	600	134	457	104	338
Guatemala	1995-2000	352	140	231		52	500	357	222
	2000-2005	-	-	-	-	-	-	-	-
Jamaica	1995-2000	-	52	21	-	-	-	328	33
	2000-2005	18	12	21	-	-	-	314	148
Mexico	1995-2000	13,450	3,540	3,593		3,657	12,960	27,234	4,798
	2000-2005	7,800	1,400	3,187		4,700	20,805	43,210	8,200
Panama	1995-2000	32		47		1	359	235	255
	2000-2005	-	-	-	-	-	-	-	-
Paraguay	1995-2000	-	-	202	22	-	-	3,575	140
	2000-2005	-	-	-	-	-	-	-	-
Peru	1995-2000	1,030	369	596	10	147	1,213	745	436
	2000-2005	-	-	-	-	-	-	-	-
Trin. & Tobago	1995-2000	-		15	-	-	-	240	96
	2000-2005	44	17	32	-	-	-	615	207
Uruguay	1995-2000	-		36		-	-	880	377
	2000-2005	104	24	49		-	-	1,327	540
Venezuela	1995-2000	42	144	328			4,610	3,691	2,195
	2000-2005	630	380	487	5	50	7,072	4,020	2,960

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