

Mobile Telecommunications and Economic Growth

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With thanks to Kalyan Dasgupta for marvellous assistance



Rolf: What do I do with my Horse Now?

**C :
Waverman**



"Come pick me up. This is going nowhere."

“People in the developing world are getting more access at an incredible rate- far faster than they got access to new technologies in the past . . . The Digital Divide is rapidly closing.” (World Bank, February 2005).



Images courtesy of Jon Stern.

Dr. Mo Ibrahim, Founder and Executive Chairman, Celtel

- Now Africa is the fastest growing region in the world for mobile phones
 - Sub Saharan Africa grew 67% last year compared with 10% in W. Europe
- Last year there were more new mobile phone customers in Africa than in North America



Welcome.
To Celtel country.

Africa's preferred network.



Making life better

Telecoms and Economic Development

- **Social overhead capital (SOC) is crucial for economic growth**
 - » Roads, Telephones, Electricity grids.
 - » **Communications network**- key part of SOC.
- **Development debate fails to prioritise communications- “Millennium Development Report” only mentions in passing.**
- **One very broad research question: how important is a good communications system for economic growth?**

Economic Impact of Communications Systems

- **Social scientists have studied the issue for years.**
- **Communications systems impact:**
 - » Organisation of business life.
 - » Organisation of household and community life.
 - » Productivity of firms and workers.
- **Communications systems**
 - » lower transaction costs,
 - » widen buyer and supplier networks.
- **Two-way networks (telecoms) more important than one-way networks (broadcasting).**

Capturing the Impact of Communications on Growth

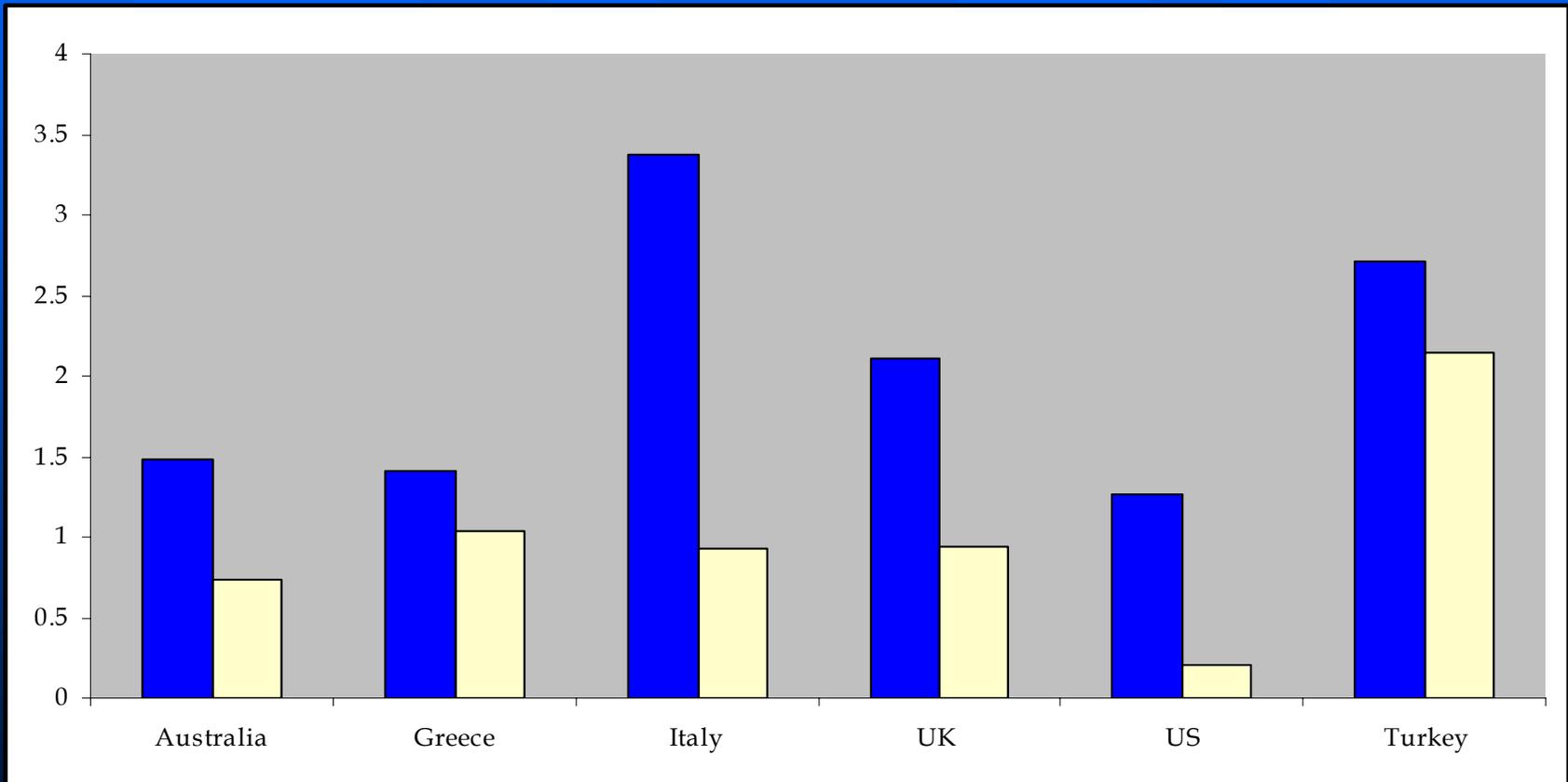
- Better communications networks → higher income.
- But: higher income → better communications networks!
- Problem of “causality” - how to disentangle two effects.

Roeller-Waverman: Fixed Line Growth Dividend in Developed Countries

- Roeller-Waverman (2001)
 - disentangles these effects
 - » multi equation model.
 - » controls for causality issue.
 - » fixed effects control for spurious correlation.
 - uses a “production function” approach.
 - shows substantial growth dividend from telecoms in OECD in 1970s and 1980s.

H. Roeller & L. Waverman.
American Economic Review Sept. 2001.

Compounded Annual Growth Rate (CAGR) (%) of GDP, and CAGR explained by Telecoms impact alone.



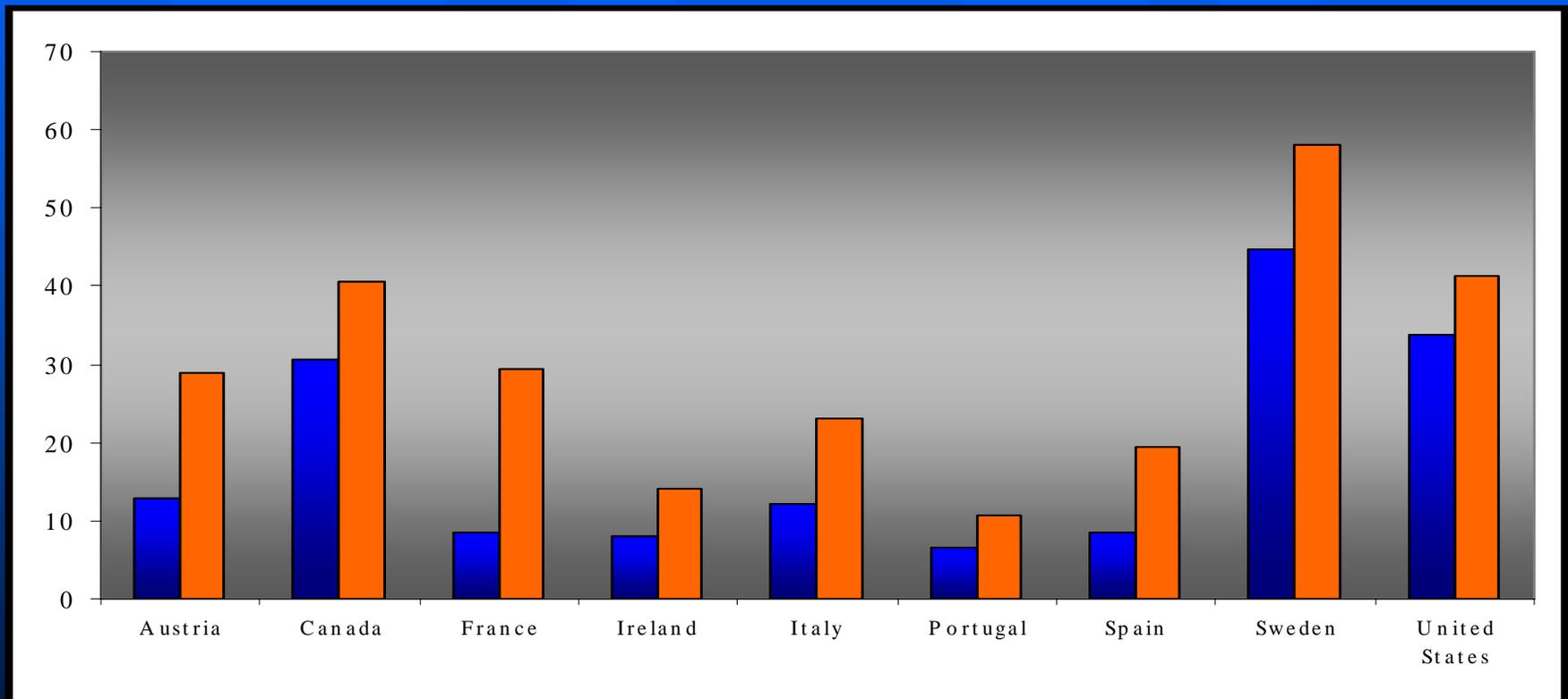
Blue bars show GDP growth, pale bars show telecom contribution estimated by fixed effects model.

Communications and Growth in Developing Countries

- Potential importance of good communications network:
 - » Widens markets, creates better information flow.
 - » Lowers transaction costs.
 - » Substitutes for costly physical transport.
- Transport costs significant in rural Africa.
- Fixed line deployment low and slow-to-grow in developing countries.
- But penetration was also low in France, Portugal and Italy in early 1970's.

Telecoms Penetration, Selected OECD Nations, 1970 and 1980

Penetration in some countries grew from very low levels in 1970-generated substantial growth in output.



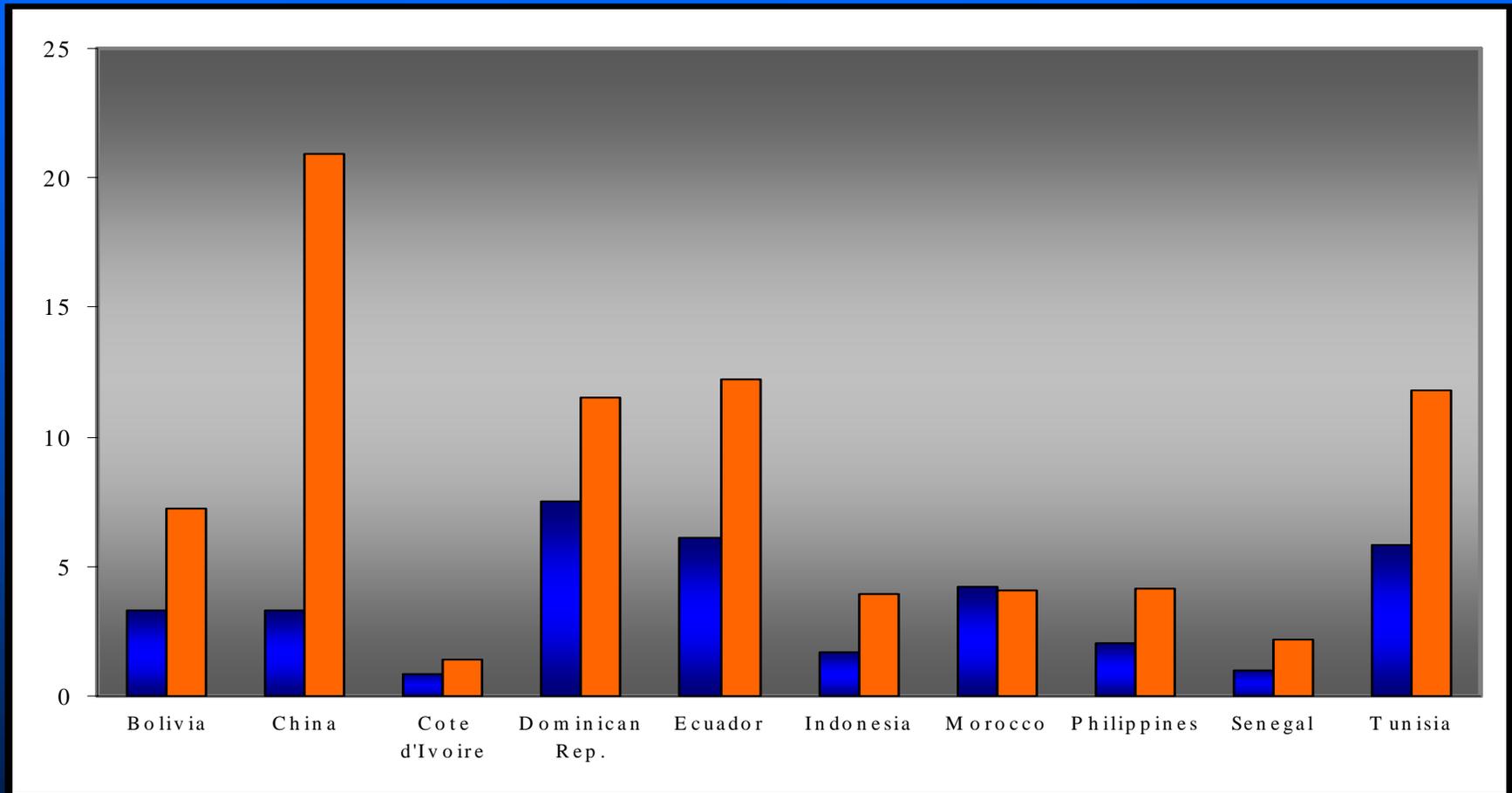
Blue bars show telecom penetration in 1970, orange bars show same in 1980.

Source: ITU.

The Impact of Mobiles in Developing Countries

- **Mobile penetration grew rapidly since 1995**
 - Much faster rollout of mobiles than fixed lines.
- **Current mobile penetration, on average, same as fixed penetration in France in 1970.**
 - Role of mobiles same as fixed lines in OECD in 1970s?
- **Econometric analysis must avoid “garbage in, garbage out.”**
 - Either mobiles explains ALL growth or NO impact.
 - Growth rate of mobiles per 100 population was 64% in 1996-2003, GDP growth was 2%.

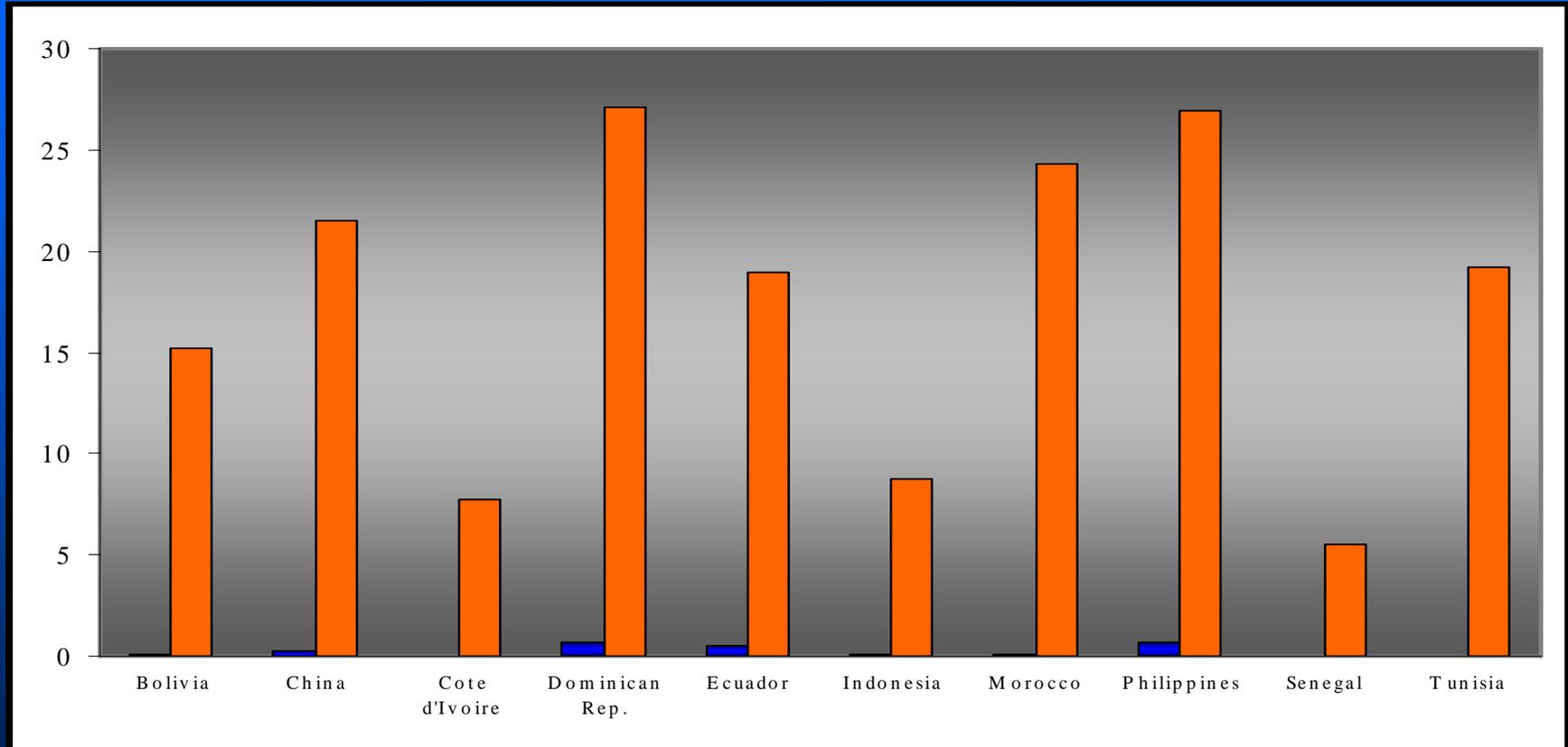
Growth in Fixed Line Penetration, Selected Developing Nations



Blue bars show fixed lines per 100 inhabitants in 1995, orange bars show same in 2003.

Source: ITU.

Growth in Mobile Penetration, 1995 to 2003, Selected Developing Nations



Blue bars represent mobiles per 100 population in 1995, orange bars show same in 2003.

Source: ITU.

Fuss, Meschi and Waverman (2005)

Sponsored by Vodafone and Leverhulme Trust: Estimates of Mobile Impact on Growth

- Similar Production Function Model as R-W 2001
- Endogenous Growth Model
 - Established literature
 - Ask which factors cause countries to differ in their long-term growth rates.
 - » *Did the endowment of fixed lines in 1980 predispose growth?*
 - » *Have mobile network deployments contributed to growth?*

Fuss, Meschi and Waverman: Production Function Model

- Use a modified version of Roeller-Waverman.
- Groups countries by level of indebtedness, uses measures of institutional quality- “Rule of Law.”
- Movers only a factor after 1996, limits time-series scope of study.

Production Function Model: Results

- 3 equation model endogenising demand and supply of mobile.
 - Careful handling of endogeneity
- “Output Equation” estimates based on 38 countries, 260 observations:

Variable	Coefficient	T-Statistic
Capital	0.776	13.79 (*)
Labour	0.204	3.91 (*)
Mobile Penetration	0.075	3.60 (*)

Production Function Model: Conclusions

- Demand equation also estimated: mobile penetration elastic with respect to income and price, with expected signs.
- Impact of mobiles is very high:
 - doubling mobile penetration from its average level of 8 percent leads to 10 percent increase in output.
- Estimates not robust.

Cross-Sectional Endogenous Growth Approach

- “Solow growth model”
 - convergence between rich and poor countries.
 - exogenous technical change determines growth rates.
- Endogenous growth literature- interaction between growth rate and factors such as human capital, R&D.
 - Poor countries grow faster than richer countries provided their human capital stock exceeds the level predicted by their per capita GDP. (Barro 1991)
 - Does Telecoms/Communications capital play a similar role to human capital in Barro’s growth regression?

Cross-Sectional Endogenous Growth Approach: Regression Model

- We regressed average growth in per capita GDP over the 1980 to 2003 period against:
 - » GDP per capita in 1980.
 - » Fixed telecom penetration in 1980.
 - » Average of investment share in GDP, 1980 to 2003.
 - » Average mobile telecom penetration from 1996 to 2003.
 - » Primary school completion rate in 1980.
- Used a 92-country sample of developing and developed countries.

Results from the Model

- 10 percent difference in mobile penetration levels **over the entire sample period** implies a 0.6 percent difference in growth rates between otherwise identical developing nations.
- Effect of mobiles is twice as large in developing countries as in developed ones.

Variable	Coefficient	T-Statistic
GDP80	-0.0025463	-3.68(*)
I/Y	0.0016998	4.67(*)
Fixed, 1980-HIGH	0.0005329	1.92
Fixed, 1980-LOW	-0.0002023	-0.32
Mobile –HIGH	0.0002924	1.99(*)
Mobile- LOW	0.0005942	2.46(*)
School, 1980	0.0002127	2.22(*)

Conclusions from Model

- **Mobiles important in the developing world: same role that fixed lines played in the OECD, 70's and 80's**
- **Level of fixed lines in 1980 impacted long-run growth for developed nations, not developing ones.**
 - Makes sense- extremely low fixed line penetration in developing countries.
- **Endogeneity?**
 - Hausman test rejects endogeneity of average level of mobile penetration.
- **Very strong and robust results- without imposing any assumptions on the data and with interesting interpretations.**

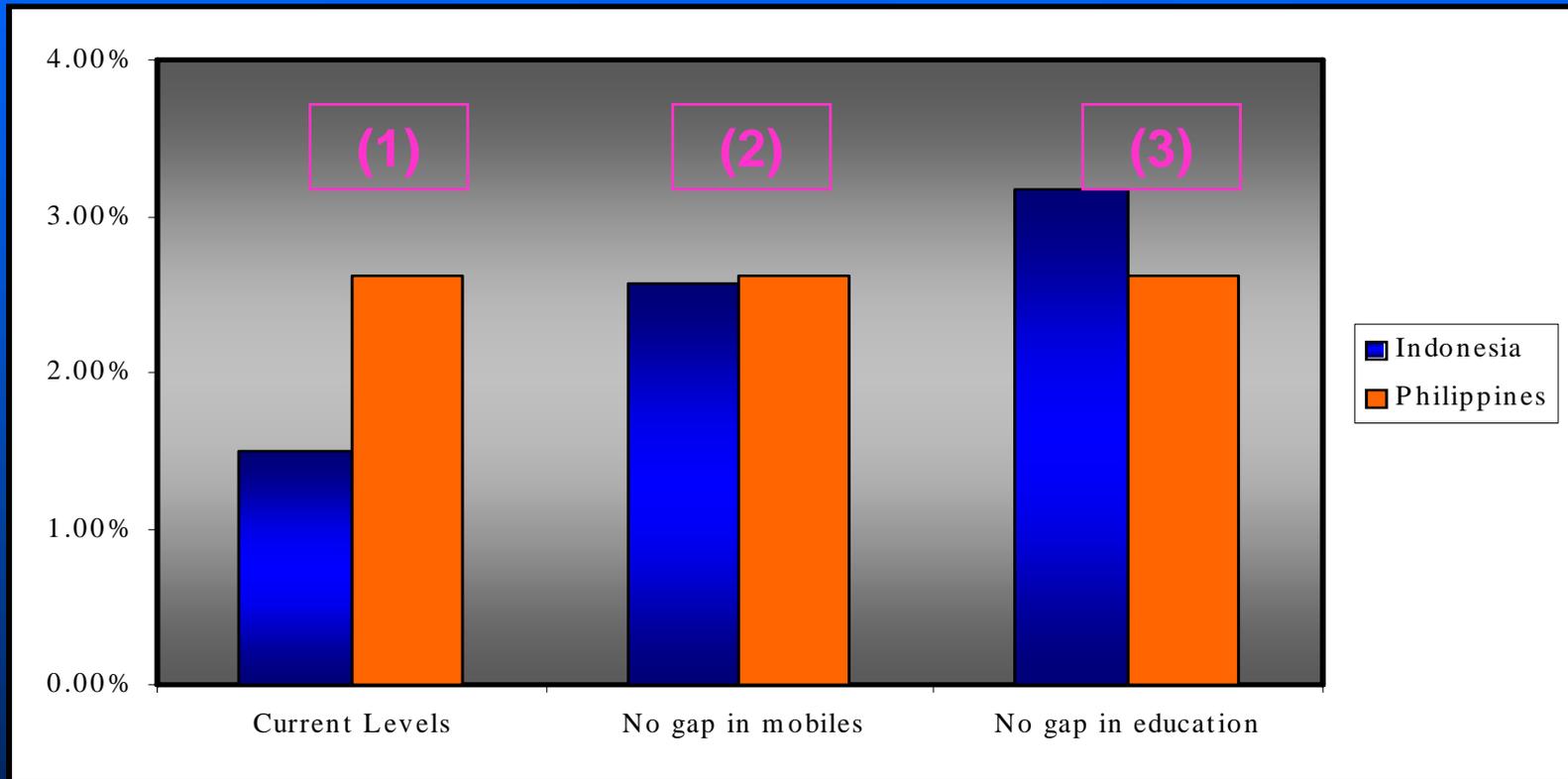
How Much Do Mobiles Matter?

- **African countries:**

- South Africa and Morocco have exceptional performance in mobiles rollout.
- Expect faster growth here, especially if political stability maintained.

- **Projecting model results onto the next quarter-century- comparison between Philippines and Indonesia.**

Indonesia Versus Philippines: Predicted Growth, 2003-26.



Predicted difference between Philippines and Indonesia growth rate, assuming (1) current levels of education and mobile, (2) if Indonesia matched Philippines in mobiles, and (3) if Indonesia matched Philippines in education.

Mobiles and the Development Debate

Mo Ibrahim, Celtel Founder:

“Fixed lines can never connect Africa: less than 1% in Sub Sahara Africa 100 years after development of the phone.”

What can business do?
Empower and develop Africans.”

Transport and Communications Sector is 6.3 percent of GDP in Uganda- this sector is growing fast and growth is due to telecoms alone.

African-owned and Africa-run mobile companies can thrive even in the poorest nations- but need good investment climate, rule of law, less corruption.

Strong pent-up demand for Mobiles- Celtel is making money serving the poorest countries in Africa!



	Population, millions	Mobiles, thousands	Mobiles/100	Population, millions	Mobiles, thousands	Mobiles/100
Algeria	31.8	1447	4.6	Guinea-Bissau	1.3	1
Egypt	70.2	5731	8.2	Kenya	31.7	1591
Libya	5.5	100	1.8	Lesotho	2.2	165
Morocco	30.1	7333	24.3	Liberia	3.4	2
Tunisia	9.9	1844	18.6	Madagascar	16.3	280
North Africa	147.5	16455	11.2	Malawi	10.5	135
South Africa	46.4	16860	36.4	Mali	10.9	250
Angola	14.4	250	1.7	Mauritania	2.8	300
Benin	7.0	236	3.4	Mauritius	1.2	463
Botswana	1.8	493	28.0	Mayotte	0.2	36
Burkina Faso	12.3	227	1.9	Mozambique	18.8	429
Burundi	7.1	64	0.9	Namibia	1.9	190
Cameroon	16.3	1077	6.6	Niger	12.3	24
Cape Verde	0.4	53	12.1	Nigeria	123.3	3149
Gen. African Rep.	4.1	13	0.3	Reunion	0.8	565
Chad	8.1	65	0.8	Rwanda	8.4	134
Comoros	0.8	2	0.3	S Tome & Principe	0.2	5
Congo	3.5	330	9.4	Senegal	10.4	783
Cote D'Ivoire	16.6	1236	7.4	Seychelles	0.1	55
DR Congo	52.8	1000	1.9	Sierra Leone	5.0	100
Djibouti	0.7	23	3.4	Somalia	10.3	40
Eq Guinea	0.5	42	7.6	Sudan	33.3	650
Ethiopia	69.4	98	0.1	Swaziland	1.0	88
Gabon	1.3	300	22.4	Tanzania	35.3	891
Gambia	1.4	130	9.5	Togo	5.0	200
Ghana	22.4	800	3.6	Uganda	25.6	776
Guinea	7.8	112	1.4	Zambia	11.2	150
				Zimbabwe	11.8	363
				Sub-Saharan	647.7	18363
				AFRICA	841.5	51678

Source: ITU African Telecommunication Indicators (2004)

Celtel is in neighbouring countries with the lowest penetration rates the lowest GDP per capita and the lowest GDP growth YET it is profitable

Celtel

- Shareholders include IFC/World Bank, Citigroup, AIG Infrastructure Fund.
- Cumulative capital expenditure of \$653 million.
- Sold recently to MTC-Kuwait for \$3.4 billion.
- Proves three points :
 - Investment in SOC provides huge growth dividends.
 - The Private Sector is crucial to development.
 - This is not ‘aid’ but great, novel business models.

Our Research Continues

- **Business stories like the success of Celtel and Orascom mirrors our macro analysis- mobile is moving even the poorest continent along.**
- **Our two current approaches:**
 - (1) Panel version of endogenous growth model.
 - (2) Collect data on institutional factors (e.g., political stability).
 - (3) Include regulatory/competition variables

A Model of Growth with Fixed Effects

- Constructed a panel data model by taking endogenous growth sample and dividing it into three periods- 1980-87, 1988-95, 1996-03.
- Use growth in each subperiod as dependent variable, and regress against the same set of variables, taken over the subperiods. Get three observations per country. (See Islam, QJE, 1995).
- Exploit panel data structure of this dataset- use fixed effects models.

Conclusion

- **Mobile sector is dynamic even in the poorest countries**
 - Emergence of firms like Celtel and Orascom
- **Mobiles unlike PCs and wireline networks are being rolled-out at a faster rate in developing countries than developed ones- closing the “digital divide.”**
- **Shows there are business models that prove two things :**
 - crucial role of communications systems as engines of growth.
 - crucial role of private sector.
- **But: right institutional climate, regulation and transparency are necessary to growth of this sector, and the Economy.**