'DIGITAL DEVELOPMENT' AS AN ALTERNATE PATH TO GROWTH FOR LDCS

By
Eric Frenkil

Submitted to
Central European University
Department of International Relations

In partial fulfilment of the requirements for the degree of Master of Arts

Supervisor: Professor Achim Kemmerling

Word Count: 17,235

Budapest, Hungary
2016

Abstract

For more than three decades, the prevailing wisdom on how poor nations should gain wealth has been to grow their industrial base to export more goods overseas. Yet for least-developed countries (LDCs), the path to industrialization is riddled with structural barriers. Faced with competition from Asian growth 'miracles,' the hurdle has steepened and export-led growth has come under new waves of scrutiny.

International financial institutions have begun to promote an alternative paradigm – investing in internet connectivity as a path to exporting services, rather than goods, on the global economy. In this thesis, I assess whether that emergent paradigm is a suitable alternative to export-led growth for LDCs. Drawing on interdisciplinary literature, I contextualize the two approaches within international relations and compare them along five criteria using qualitative and statistical methods. I present four theoretical frameworks for understanding the internet as an economic force and construct a measure using industry data that I call 'internet consumption per capita' to model usage intensity in 177 economies.

I find that digital development does not presently appear to be a suitable macroeconomic alternative for the bulk of LDCs, chiefly owing to limited market value and concentrations of wealth in relatively higher-income economies, although I suggest certain subcategories of LDCs for which this path may still prove preferable. These findings call for pause and policy reflectiveness among international institutions promoting digital development, questioning whether such a path will usher in 'digital dividends' or lead to another 'trip down the rabbit hole' for 48 LDCs.

Acknowledgements

This thesis would not have been possible without the academic guidance of Professor Achim Kemmerling, the keen insights and generosity afforded by my reviewers, Alex Etl and Sára Lafferton, the exceptional data and exhaustive proprietary research provided by Michael Owings at *TeleGeography*, the university's indefatigable interlibrary loan staff, the raw data shared by *Akamai Technologies* and the report on electronic labor shared by *Staffing Industry Analysts*. The thesis also benefited from the input of more than one dozen former colleagues and clients who lent their professional expertise. I owe a special gratitude to the CEU Department of International Relations for the funding and opportunity to join their international graduate cohort, and to my professors at both CEU and Beloit College, particularly Beth Dougherty, whose high expectations and detailed feedback helped me grow into a more discerning analyst. Finally, I would like to thank Máté Halmos, whose advice and friendship led me to attend CEU, Nóra Franczia, whose patience and warmth during the thesis writing period has been without comparison, and my parents for their love, encouragement and patience during life journeys that have taken me far away from home. Any remaining errors, omissions or oversights are mine alone.

Table of Contents

Introduction

Every so often, the core tenants of economic wisdom undergo a transformation. Rarely is this explained solely by the experience of one nation or the introduction of a single scholarly publication into the academic debate. Rather a complex interaction occurs between actors and their historical circumstances. This works to produce, defend and occasionally rewrite the core assumptions that shape economic policy.

For more than three decades, the prevailing wisdom on how poor nations should gain wealth has been to grow their industrial base to export more goods overseas.[1] The label of 'export miracle' has been favorably applied to no less than China,[2] Germany,[3] Mexico,[4] Turkey,[5] and a host of other emerging economies.[6] This broad paradigm is called, in various contexts, export-substitution, export-oriented industrialization or, more simply, export-led growth (ELG).[7] While the ELG approach may seem common sense to us now, its very commonality is what I seek to point out. ELG contradicted key aspects of what was once prevailing economic wisdom, namely import-substitution.[8] It did not take root at

[1] Jeffrey Frieden, *Global Capitalism: Its Fall and Rise in the Twentieth Century* (New York: WW Norton, 2006): 302-320, 422-423
[2] Noel Tracy, Thomas Chan and Zhu Wenhui, *China's Export Miracle: Origins, Results and Prospects* (London: Palgrave, 1999).
[3] Bernhard Rieger, "The 'Good German' Goes Global: The Volkswagen Beetle as an Icon in the Federal Republic," *History Workshop Journal* 68 (Autumn 2009), 22.
[4] James Cypher, "Developing Disarticulation within the Mexican Economy," *Latin American Perspectives* 28, no. 3 (May 2001), 12.
[5] Ismail Arslan and Sweder van Wijnbergen, "Export Incentives, Exchange Rate Policy and Export Growth in Turkey," *The Review of Economics and Statistics* 75, no. 1 (Feb 1993): 128-133.
[6] James Ang, Jakob Maden and Peter Robertson, "Export Performance of the Asian Miracle Economies: The Role of Innovation and Product Variety," *Canadian Journal of Economics* 48, no. 1 (February 2015): 273-309.
[7] Thomas Palley, "The Rise and Fall of Export-led Growth," *Investigación Económica* 72, no. 280 (2012): 141-161.
[8] James Cypher and James Dietz, "Strategy switching and industrial transformation," In *The Process of Economic Development, 3rd ed.* (New York: Routledge, 2009): 308-340.

any one moment but was, as we will see, the outcome of ideological change, policy experimentation and new configurations of power over international monetary institutions.

However many least-developed countries (LDCs) suffer from 'poverty traps'[9] and from being developmental latecomers, geographically isolated from centers of trade and production. For these economies, their ability to industrialize and export is limited. Yet the global rise of internet connectivity has led to a burgeoning alternative in economic development thinking, one that deviates from ELG and focuses instead on investment in internet access as a herald of 'digital dividends.' The internet's allure is that it permits LDCs to benefit from labor arbitrage by trading their services at a higher price in global markets at the same time that online outsourcing is becoming increasingly prevalent. Although it does not contradict the export emphasis of ELG, the new paradigm of 'digital development' shifts the export focus from goods to services. It has become a rising contender to the prevailing industrialization model.[10]

In this thesis, I assess the proposition that LDCs can overcome many of the key obstacles of ELG by trading services rather than tangible goods in the online economy. Shifting focus from selling tangible goods across shipping networks to selling intangible services across data cables raises an appealing if not perplexing dilemma for many of the 48 economies that the UN classifies as LDCs. Such countries have struggled to benefit from ELG and, due to fiscal constraints, are limited in their ability to simultaneously pursue

[9] Samuel Bowles, Steven Durlauf and Karla Hoff (eds.) *Poverty Traps* (Princeton, NJ: Princeton, 2006). As reiterated later, this term is contested but I am satisfied that enough elements of it are confirmed in the literature and I only draw on those elements throughout.

[10] The early years of this trend are detailed in Chrisanthi Avgerou, "The link between ICT and economic growth in the discourse of development," In *Organizational Information Systems in the Context of Globalization*, eds. Mikko Korpela et al., (New York: Springer, 2003): 373-386.

both strategies. It is paramount then that the two approaches be weighed comparatively to determine whether the new digital paradigm is more appropriate for LDCs.

Far from setting out to issue decisive judgments on four dozen economies in a single thesis, I aim to unpack the assumptions underlying digital development as an alternative paradigm to determine whether it can offer advantages where ELG has fallen short. I explore four ways in which the internet can be conceptualized as an economic force and investigate whether it offers comparable national growth potential while mitigating the challenges of poverty traps and industrial isolation. My aim is to construct an interdisciplinary body of evidence that advances our comparative understanding in reference to LDCs but applicable in a wider context.

Literature on digital development has been described as embryonic,[11] and I find it particularly sparse within international relations.[12] This is surprising in light of the discipline's broader attention directed at globalization[13] and its embedded institutions[14] which shape, and are shaped by, internet connectivity.[15] Just as other forms of telecommunications have been analyzed as instruments of statecraft,[16] I observe that the internet has sparked the founding of new institutions within the vanguard of international economic affairs: the World Bank, the International Monetary Fund and the World Trade

[11] This sentiment is confirmed by Vili Lehdonvirta, et al., "Online labour markets – leveling the playing field for international service markets?" Paper presented at Internet, Policy and Politics Conference (Oxford). September 2014.
[12] Nazli Choucri *Cyberpolitics in International Relations* (Cambridge, MA: MIT, 2012) attempts to integrate 'cyberspace' into the discipline however technology is surprisingly absent from the book despite its title.
[13] Ian Clark, *Globalization and International Relations Theory* (New York: Oxford University, 1999).
[14] Robert Keohane, "Governance in a Partially Globalized World," *American Political Science Review* 95, no. 1 (March 2001): 1-13.
[15] Bruce Kogut (ed.), *The Global Internet Economy* (Cambridge, MA: MIT, 2003).
[16] Robert Holt, *Radio Free Europe* (Minneapolis: University of Minnesota, 1958).

Organization. Meanwhile, LDC heads of state, such as Rwanda's Paul Kagame, are beginning to make broadband a bedrock of national economic development. With nearly thirty LDCs having already adopted a national broadband strategy, and three more underway,[17] we will observe that the technical has entered the realm of the political, its influence extending to international politics, political economy and economic geography.

As demonstrated by Joseph Lepgold and Miroslav Nincic, early works of the international relations discipline have "traditionally been intended to guide practice."[18] This thesis follows in that aspiration towards policy relevance by attempting to, as Lepgold puts it, "subsume under a coherent explanation a broad array of empirical phenomena"[19] with the purpose of reshaping the debate. I therefore take an inductive and interdisciplinary approach[20] by drawing heavily on economics, history and geography.

In the first chapter, I begin by establishing an analytic framework for comparing ELG and digital development. The emergence of ELG is placed in historical context to reveal it as a recent phenomenon that emerged as part of a global shift in economic ideology, and as a response to import-substitution. I describe challenges that contemporary LDCs face in pursuing such a strategy and then lay out four ways in which we can understand the economic trajectory of the internet – as a cyber-industrial revolution, as a new global economic geography, as a pervasive embedded tool and as a vehicle for

[17] Omitted countries include the DRC, Eritrea, Guinea-Bissau, Haiti, Kiribati, Laos, Mali, Mauritania, Myanmar, São Tomé and Príncipe, Senegal, Somalia, South Sudan, Timor-Leste, Tuvalu and Yemen (http://bit.ly/1NPWBQf). Sierra Leone, Solomon Islands, Togo are developing such a policy.
[18] Joseph Lepgold and Miroslav Nincic, *Beyond the Ivory Tower: International Relations Theory and the Issue of Policy Relevance* (New York: Columbia University, 2001), 2.
[19] Joseph Lepgold, "Is Anyone Listening? International Relations Theory and the Problem of Policy Relevance," *Political Science Quarterly* 113, no. 1 (Spring 1998): 43-62.
[20] Geoffrey Roberts, "History, Theory and the Narrative Turn in IR," *Review of International Studies* 32, no. 4 (October 2006): 703-714.

economic liberalization. The synthesis of these four approaches offers a much-needed historical and political economy perspective on the internet as an economic force.

In the second chapter, I lay out a research design to evaluate digital development as an alternative paradigm, focusing on the last decade as the period of its greatest diffusion among LDCs. I establish five criteria to assess whether digital development can offer advantages in bypassing structural obstacles inhibiting many poor countries from pursuing ELG, and whether it demonstrates sufficient market potential and observed economic impact to serve as the basis for national economic growth. Those criteria are assessed in chapter three by reviewing prior scholarship, presenting descriptive statistics and regression analysis and employing deductive reasoning. The focus remains decidedly fixed on digital development as the lesser-studied paradigm, privileging data and perspectives on low-income countries so as not to draw conclusions from unsuitable models for LDCs. Data is drawn from *TeleGeography*, the *ICT Indicators Database*, the *World Bank*, and the *Quality of Government Institute*.

The thesis ultimately finds that digital development is not able to stand as a viable alternative paradigm for the majority of LDCs at the present time, although there may be certain exceptions among countries with greater initial connectivity, commitment to digital infrastructure, numbers of non-resident citizens abroad or – simply – those that are landlocked and hardly able to export. It contributes to the literature by offering a novel methodology for modeling 'internet consumption,' synthesizing four theoretical notions of the internet as an economic force and bringing interdisciplinary perspectives into the study of the subject within the international relations discipline.

Considering the manner in which economic development thinking has evolved, I argue that the emergence and application of digital development is, like ELG, the outcome of a particular narrative informed yet unimpeded by evidence.[21] This points not only to a fruitful area for academic exploration but to an urgent need to study whether this economic norm, if pursued in earnest by specific LDC economies, would usher in 'digital dividends'[22] or lead to another 'trip down the rabbit hole.'[23]

[21] As I demonstrate in chapter three, the evidence is largely ungeneralizable to LDCs.
[22] World Bank, *World Development Report: Digital Dividends* (Washington, DC: IBRD/World Bank, 2016).
[23] Bruce Abramson, "Down the Rabbit Hole," In *Digital Phoenix: Why the Information Economy Collapsed and How It Will Rise Again* (Cambridge, MA: MIT, 2006): 241-272.

Chapter 1: Analytic Framework

Chapter one is divided into two parts. In the first part, I frame export-led growth (ELG) as the product of a sweeping ideological shift towards trade openness among international economic institutions, informed by a limited number of 'miracle' cases. This demonstrates the malleability of economic thinking to historical circumstances and suggests a need for more cautious consideration of future transformations – in this case, digital development. I show some of the key challenges that LDCs face in pursuing ELG, establishing comparative criteria through which we can dissect digital development.

In the second part, I lay out a working definition for digital development and present four theoretical models for thinking about the internet as an economically-relevant force. The internet itself is an indifferent technology; only by interacting with broader societal, political and economic systems does it begin to have an impact. By attaching the internet to broader theories of technology and economics, we can avoid treating it as *sui generis*, considering its trajectory through history and political economy. Those lessons will be reexamined in the final discussion of the thesis as a theoretical context for drawing conclusions and setting a research agenda.

1.1 Export-Led Growth

The intellectual ancestry of export-led growth (ELG) can be observed as early as the 18th century, when Adam Smith cited trade as the cause for "considerable variations in the progress of opulence."[24] Tracing that lineage is far from our scope here, however I

[24] Adam Smith, *The Wealth of Nations* (1776).

briefly exhibit how the ELG norm grew from political and economic trends that were confined to specific regions and eras but expanded to explain a much broader array of economic phenomena. This shows a level of 'policy entrepreneurship' that undermines ELG as fixed economic truth, cautioning us to be more circumspect in our assessment of other paradigms such as digital development. By distilling some key challenges that LDCs face in pursuing ELG, we can operationalize three of the five criteria to assess whether digital development is preferable for LDC economies.

1.1.1 Industrial Growth as Doctrine

Export-led growth (ELG) is not a static concept but a 'broad church' that developed in modern history. It can be defined as a set of policy actions aimed at increasing the production and export of manufactures in exchange for foreign capital. While many variants exists, the model proposed by US political advisor Walt Rostow has been labelled the "most influential single theory of development" and much of macroeconomic policy today is derivative.[25] His *stages of economic growth* suggest that all countries pass through five phases, from traditional society to mass consumption. The salient point for our purposes is an eventual shift in labor and expenditure from agriculture to industry.[26]

ELG policies have three basic tenants: openness to trade, attracting foreign investment and producing exportable goods.[27] Although it is presently the dominant paradigm, economists in the Global South once looked to autarky, or national self-

[25] John Harriss, "Development Theories," In *International Development: Ideas, Experience, and Prospects*, eds. Bruce Currie-Alder et al. (Oxford: Oxford University, 2014): 40.
[26] Walt Rostow, *The Stages of Economic Growth: A Non-Communist Manifesto* (Cambridge: Cambridge University, 1960)
[27] Frieden, *Global Capitalism*, 422-423.

sufficiency, for growth in the middle part of the 20th century. This strategy, known as import-substitution, dominated economic policy from WWII until the 1973 oil crisis, which is to say that developing countries used subsidies, protectionist measures and investment to recreate manufactured imports domestically.[28]

This was during the heyday of decolonization and coincided with the promotion of economic development on the post-WWII reconstruction agenda. It also became ideologically intertwined with the Cold War, leading to champions of both Marxist and capitalist approaches. What the two ideological poles tended to agree on was that poorer countries ought to have higher incomes and that growth was a self-perpetuating force once achieved.[29] Whether through trade or import-substitution, the underlying necessity of industrialization was never seriously on trial.

Countries turned to ELG through several geopolitical shifts. A US recession, attributed to interest rate hikes after the 1979 oil price shock, reduced demand for commodity exports worldwide. Many developing countries relied on those incomes to service fresh debts, igniting rampant inflation and severely reducing state capacity. Simultaneously, a trio of powerful anti-Communist conservative leaders - Ronald Reagan, Margaret Thatcher and Helmut Kohl[30] - came to power and wielded tremendous influence over the IMF and World Bank. Free markets began to replace states as the focus of macroeconomic policy.[31]

[28] Frieden, *Global Capitalism*, 302-320, 422-423.
[29] Ian Goldin, "Evolution of Development Thinking," In *The Princeton Encyclopedia of the World Economy, Vol I*, eds. Kenneth Reinert et al. (Princeton: Princeton University, 2009): 366.
[30] While German capitalism was still highly regulated, Kohl lent support for supply-side policies.
[31] Goldin, "Evolution of Development Thinking," 368-369.

Simultaneously, a different economic story was playing out in the East Asian economies of Hong Kong, South Korea, Singapore and Taiwan. Rather than pursuing import-substitution, these states invested heavily in subsidies and incentives for exporting manufactures overseas. This was partially driven by the necessity of earning foreign currency to pay for goods that they needed to import. However what began with rudimentary manufacturing grew into heavy industrial development. During the debt crisis of 1982, the 'Asian Tigers' were more resilient than other developing countries in that they were far better prepared to service their debts by rapidly increasing exports.[32]

In development thinking, the 'Asian miracles' were part of the narrative that justified ELG for developing countries. Yet scholars now believe that their successes were due to other factors,[33] suggesting "nothing miraculous" when considering their initially low levels of income inequality.[34] One Korea scholar found the model not only morally and economically objectionable but contrary to the one promoted by the World Bank.[35] Despite this, and despite that ELG contradicted development theory at the time, ELG's three basic tenants soon spread to nearly every country in the Global South,[36] promising the benefits of comparative advantage for the North and expanded market access for the South.[37]

The International Monetary Fund and World Bank heavily promoted ELG by including trade reforms among other structural adjustment provisions when many

[32] Frieden, *Global Capitalism*, 319, 422-423.
[33] Palley, "The Rise and Fall of Export-Led Growth," 142; Martin Paldam, "Economic freedom and the success of the Asian tigers: an essay on controversy," *European Journal of Political Economy* 19, no. 3 (September 2003): 475.
[34] Dani Rodrik, "King Kong Meets Godzilla: The World Bank and The East Asian Miracle," CEPR Discussion Paper 944 (April 1994), summary.
[35] Eric Toussaint, "South Korea: The Miracle Unmasked," *Economic and Political Weekly* 41, no. 39 (Fall 2006): 4211.
[36] Frieden, *Global Capitalism*, 422-423.
[37] Palley, "The Rise and Fall of Export-Led Growth," 143.

developing countries sought loans after the oil shocks of the 1970s. In the 1990s, large multinationals strengthened ELG's foothold by fastening trade theory to corporate globalization, beginning with an expansion of the General Agreement on Tariffs and Trade, leading to the North American Free Trade Agreement in 1994 and the World Trade Organization in 1996. The reforms were adopted by Mexico in the 1990s and by China the following decade,[38] launching two major entrants into the competitive business of export manufacturing.

1.1.2 Structural Barriers for LDCs

Beyond what has already been said about the 'Asian miracle' economies, further doubt has been cast on export-led growth (ELG) by prominent economists such as Ha-Joon Chang, who argues that protectionism was key to every success story of industrialization.[39] There are many other contestations of the model.[40] Additionally, there are broader critiques on the very notion of economic growth as the focus of development and on the implications of the word 'development' itself.[41] In the context of least-developed countries (LDCs), however, I zoom in on structural barriers that inhibit them from pursuing ELG successfully, distilling these down to three basic categories.

[38] Ibid., 141-161.
[39] Ha-Joon Chang, *Kicking Away the Ladder: Development Strategy in Historical Perspective* (New York: Anthem, 2003).
[40] The applicability of the Tiger' model was reviewed in the 1990s by Joseph Stiglitz, "Some Lessons from the East Asian Miracle," *Research Observer* 11, no. 2 (August 1996): 151-177. A colorful illustration is featured in Andrew Schrank, "Foreign Investors, 'Flying Geese,' and the Limits to Export-Led Industrialization in the Dominican Republic," *Theory and Society* 32, no. 4 (August 2003): 415-443.
[41] Henry Veltmeyer (ed.), *The Critical Development Studies Handbook: Tools for Change* (Halifax: Fernwood Publishing, 2011); Aram Ziai, "The discourse of 'development' and why the concept should be abandoned," *Development in Practice* 23, no. 1 (2013): 123-136.

The first is over-reliance on consumption by advanced economies, which Thomas Palley suggests may be "artificially strong, fueled by rising debt and asset price inflation" leading to debt saturation among many consumers in advanced economies.[42] In other words, he suggests that demand for exports may have been at unsustainable levels for an extended period of time. The verifiability of this is subject to forecasting grand swings in the economy and can only be authenticated with time. Its salience could also be mitigated by evidence that South-South trade is growing.[43] Nevertheless, it presents a long-term structural risk that must be considered.

The second structural barrier consists of 'poverty traps' associated with the work of economist Jeffrey Sachs and others.[44] To distill the elements most closely related to this thesis, LDCs face impediments to industrialization because their governments lack the means to collect sufficient taxes and/or overcome losses to debt and corruption in order to finance public goods and infrastructure. Closely related, their focus on regime maintenance, rent collection and patronage may preclude infrastructure and investment readiness from emerging as priorities. This can coincide with economic sanctions or other trade restrictions that make market entry increasingly difficult. Furthermore, human capital may be weak due to economic, health-related and institutional impediments to education.[45]

[42] Palley, "The Rise and Fall of Export-Led Growth," 152.
[43] Çiğdem Akın and Ayhan Kose, "Changing Nature of North-South Linkages: Stylized Facts and Explanations," IMF Working Paper 07/280 (December 2007).
[44] For example, Bowles, Durlauf and Hoff, *Poverty Traps*.
[45] Jeffrey Sachs, *The End of Poverty: Economic Possibilities for Our Time* (New York: Penguin, 2005).

Although the 'poverty trap' notion is disputed by other prominent economists,[46] I draw only on elements that are well-supported by the literature.[47]

The third structural barrier is the 'beggar-thy-neighbor' critique[48] that there are too many countries competing to pursue the same strategy, and that earlier entrants have structural advantages over newcomers. As Paul Krugman and Anthony Venables demonstrate, labor costs become secondary factors for foreign investors below a certain threshold, upstaged by considerations about 'economies of agglomeration' in which inputs to production are geographically convenient.[49] Paul Collier characterizes the global market as "now far more hostile to new entrants," noting that costs are higher where there is cheaper labor yet no other firms. He argues convincingly that Asian economies have captured many of the cost-competitive manufacturing and service sector opportunities, with a strong agglomeration effect and plenty of surplus 'low-enough-cost labor.'[50] Even as these economies see wages rising, other regional players such as Cambodia and Bangladesh are able to step in. Additionally, when raw labor costs remain the dominant consideration, investment can easily wander to lower-cost destinations, producing a 'race

[46] For example, William Easterly, "Reliving the 1950s: the big push, poverty traps, and takeoffs in economic development," *Journal of Economic Growth* 11, no. 4 (December 2006): 289-318.
[47] Pierre-Richard Agénor, "Fiscal Policy and Endogenous Growth with Public Infrastructure," *Oxford Economic Papers* 60, no. 1 (January 2008): 57-87; Attiya Javid and Umaima Arif, "Analysis of Revenue Potential and Revenue Effort in Developing Asian Countries," *The Pakistan Development Review* 51, no. 4 (Winter 2012): 365-379; Augustin Fosu, "The Impact of External Debt on Economic Growth in Sub-Saharan Africa," *Journal of Economic Development* 21, no. 1 (June 1996): 93-118.
[48] Robert Blecker and Arslan Razmi, "Export-led Growth, Real Exchange Rates and the Fallacy of Composition," In *Handbook of Alternative Theories of Economic Growth*, ed. Mark Setterfield (Cheltenham, UK: Edward Elgar, 2010): 379-396. Inspired by Joan Robinson, "Beggar-my-neighbour remedies for unemployment," *In Essays in the Theory of Employment* (London: Macmillan, 1937): 210-230.
[49] Paul Krugman and Anthony Venables, "Globalization and the Inequality of Nations," Industriens Utredningsinstitut Working Paper 430 (1995).
[50] Paul Collier, *The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done About It* (Oxford: Oxford University, 2007), 6 and 82-86.

to the bottom' whereby direct competition among developing countries erodes much of their potential gain from labor arbitrage.[51]

Taken together, it is understandable that not all countries have been able to follow the 'Asian Tiger' model.[52] Just as confidence in import-substitution weakened in the late 1970s, the global recession of 2008 revealed a debt-saturated, fiscally-restrained and aging set of economies in the North. These circumstances render ELG "collectively impossible" for LDCs.[53] There is a desire for an alternative approach and digital development is picking up intellectual steam. However perhaps the greatest lesson to take from this short, stylized narration is to exercise the modesty exemplified by economic historian Ronald Hartzell, who frankly admits: "The main conclusion, obviously, is that we know very little about what I have been writing."[54] While countries must have some economic policy, they may be served by understanding just how little we know about the underlying paradigm.

1.2 Representations of Digital Development

If export-led growth rose in part on a wave of optimism, that pales in comparison to the "often evangelical zeal" that permeates assessments of the *transformative* power of digital growth.[55] As early as 1996, the World Bank wrote that "all countries must adjust urgently… or suffer exclusion from the global community and suffer disadvantages in the

[51] Palley, "The Rise and Fall of Export-Led Growth," 147.
[52] This is only a limited treatment of structural barriers that LDCs face. The impact of international trade agreements is effectively developed in Robert Wade, "What strategies are viable for developing countries today? The World Trade Organization and the shrinking of 'development space,'" *Review of International Political Economy* 10, no. 4 (November 2003): 621-644.
[53] Palley, "The Rise and Fall of Export-Led Growth," 151-152.
[54] Ronald Hartwell, *The Industrial Revolution and Economic Growth* (London: Methuen & Co, 1971), 224.
[55] Neil Selwyn, "Reconsidering Political and Popular Understandings of the Digital Divide," *New Media & Society* 6, no. 3 (2004): 342.

competitiveness of their goods and services."[56] Twenty years later, it reiterated that "we must take advantage of this rapid technological change."[57]

What is digital development? I define it as a set of policies to expand and deepen internet access aimed at four distinct and often conflated objectives. The first two objectives – e-governance[58] and social inclusion[59] – do not directly concern this thesis although they have some economic bearing if, say, a country enables firms to access business services more easily online or enables workers to telecommute from remote regions. However these are only tangential to the thesis because, while they may bear economic externalities, their focus is not primarily an economic one.

Therefore we can shift focus to the two economic objectives of digital development. The first is increasing sales of intangible services online. This includes entrepreneurial or freelance activities, or any other work conducted for geographically-remote consumers and employers without manufacturing or shipping physical products. For example, an online shop that sells watches would not be part of the digital economy per se, but if they earned income from advertisements on their website, this part would qualify. For another example, an employee who works from home and offers consulting services would only be working in the digital economy insofar as their work is conducted with clients they do not intend to meet in person. Demarcating the digital economy involves gray territory but this workable

[56] Eduardo Talero and Philip Gaudette, *Harnessing Information for Development* (Wash.,, DC: IBRD/World Bank, 1996), 9.
[57] World Bank, *World Development Report: Digital Dividends*, xiii.
[58] See Frank Bannister and Regina Connolly, "Defining e-Governance," *e-Service Journal* 8, no. 2 (Winter 2012): 3-25.
[59] This is similar to an emerging term in development parlance called Information and Communications Technology for Development, or ICT4D. See, for example, Shailendra Bisht, Vishal Mishra and Sanjay Fuloria, "Measuring Accessibility for Inclusive Development: A Census Based Index," *Social Indicators Research* 98, no. 1 (August 2010): 167-181.

approximation will be extended upon measuring the size of the digital economy in chapter three.

The second pertinent objective is increasing competitiveness through technological augmentation. This describes improvements in the functioning of firms in terms of quality, efficiency or bundling of products, and may be part of either the digital or 'analog' economy. For example, a warehouse with internet connectivity will be better able to liaise with customers, track inventory and automate services compared with an offline competitor. This logic can be amplified to the country level.

The augmentation objective differs from that of the digital economy in subtle but important ways. Consider that a language instructor participates in the *digital* economy when delivering lessons or selling course content. The *augmentation* element is expressed in using online accounting services and email to communicate with customers. Thus, the two objectives can coexist, and they frequently do. For our purposes, then, digital development refers to engaging in the digital economy and to utilizing the internet as a tool to augment efficiency and competitiveness.

The above is a presupposition of how digital development is understood in policy, for which a broad definition based on objectives, rather than mechanisms, can suffice. However we have still said little about the mechanisms that translate internet connectivity into economic growth. Considering the relative infancy of the commercial internet, especially for LDCs, I will introduce four theoretical perspectives that help us contextualize its impact beyond a dynamic yet limited track record. These perspectives will guide my final analysis in the conclusion.

1.2.1 Cyber-Industrial Revolution

The internet, along with its associated technologies, has been declared the basis for a new industrial revolution,[60] anticipated by sociologist Daniel Bell in the 1970s as a 'post-industrial society' in which services generate more wealth than manufacturing,[61] an irreversible phenomenon.[62] In such a society, highly-skilled technical and scientific information workers emerge as the leading class.[63]

While Bell's formulation refers more broadly to an information age, other scholars are very explicit in asserting that "today the *Internet* is at the heart of a third industrial revolution."[64] Bradford Smith writes that the emergence of affordable computing power, advanced software and high-capacity communication did not drive substantial improvements in living standards or productivity. Rather he attributes "unprecedented productivity gains" to the emergence of the World Wide Web, which allowed people to publish text and multimedia online, leading to an exponential rise in internet growth that began four years later and has not tapered. Unlike sector-specific innovations such as the jet propulsion engine, the internet permeates all sectors of production. Consistent and rampant declines in the cost of data processing and data transit have enabled smaller actors

[60] Joseph Nye, "The Information Revolution and the Paradox of American Power," *Proceedings of the American Society of International Law* 97 (April 2003): 67-75; Terutomo Ozawa, Sergio Castello and Ronnie Phillips, "The Internet Revolution, the 'McLuhan' Stage of Catch-up, and Institutional Reforms in Asia," *Journal of Economic Issues* 35, no. 2 (June 2001): 289-298; or Poh-Kam Wong, "Leveraging the Global Information Revolution for Economic Development: Singapore's Evolving Information Industry Strategy," *Information Systems Research* 9, no. 4 (December 1998): 323-341.

[61] Daniel Bell, *The Coming of Post-Industrial Society: A Venture in Social Forecasting* (New York: Harper, 1974).

[62] Daniel Bell, "The third technological revolution: and its possible socioeconomic consequences," *Dissent* 36, no. 2 (1989): 164.

[63] Kristopher Robison and Edward Crenshaw, "Post-Industrial transformations and cyber-space: a cross-national analysis of Internet development," *Social Science Research* 31, no. 3 (2002): 335.

[64] Bradford Smith, "The Third Industrial Revolution: Law and Policy for the Internet," *Recueil Des Cours* 282 (2001): 230. Emphasis added.

to play a role in the online economy. This means that its impact can be felt not only in the service sector but in manufacturing and agriculture as well.[65]

But what exactly is an industrial revolution in economic terms? Economic historian Joel Mokyr describes a "complete reorganization of production, consumption, locational patterns, international relations … and almost every aspect of the human condition." Technology provides a 'wave of gadgets' 'at the core of everything.' As Mokyr points out, binary-coded machines were even introduced to technologize the process of weaving fabric in the early 19th century. Yet one aspect of the human condition was not quite revolutionized: income per capita. Comparing 1760 and 1800, average income rose by a paltry 8% and only a further 16% in the ensuing three decades. Rapid growth sectors did exist, yet these were modest employers compared to the relatively unaffected domains of agriculture, construction, shipbuilding, and so on.[66] Wider impacts emerged much later.

It is easy to see how Mokyr's depiction reflects the present-day reality of what has been termed a 'digital revolution.' Online outsourcing, as discussed in chapter three, is but one factor that reorganizes production, while international relations has adapted to new methods of communication, new topics such as cybersecurity and new institutions of internet governance. There is certainly a wave of gadgets to be found. However it is less apparent whether new human geographies have been constructed – a claim which I explore below – and whether productivity has fundamentally changed. Perhaps this could explain the oft-cited quote which became known as the Solow Paradox:

> What everyone feels to have been a technological revolution, a drastic change in our productive lives, has been accompanied everywhere, including Japan, by a

[65] Ibid., 331-337.
[66] Joel Mokyr, "Industrial Revolution," In *The Oxford Encyclopedia of Economic History, Vol. I*, ed. Joel Mokyr (New York: Oxford University Press, 2003): 49-56. Calculations my own.

> slowing down of productivity growth, not by a step up. *You can see the computer age everywhere but in the productivity statistics.*[67]

If indeed the digital revolution is comparable to an industrial revolution, we may be surprised to find that income growth is limited to those few sectors most directly attached to technological change, at least for the foreseeable future.

1.2.2 New Economic Geography

"The ink is electricity," wrote *The Baltimore Sun* in 1844 when Samuel Morse sent a telegraph between Baltimore and Washington, the paper declaring that "time and space has been completely annihilated."[68] It is often tempting to think that today's internet has transcended physical cables traipsed across land and sea. Yet like telegraphs and pneumatic tubes, the internet remains largely connected through physical pipes in the ground. Since pre-Napoleonic flag signaling,[69] communication has developed to compress economic distances in tandem with increasingly globalized networks of trade.

The duality of being omnipresent and still geographically tethered plays into our understanding of the internet's economic geography.[70] It helps us contextualize 'cyber-optimistic' claims about technology. Below, I describe the process of digital globalization, how it may reinforce existing relationships of commerce and power, and what we can learn from that duality for this thesis.

[67] Robert Solow, "We'd Better Watch Out," *The New York Times*, July 12, 1987, p. 36. Emphasis added.
[68] Rebecca Rosen, "'Time and Space Has Been Completed Annihilated': Tech writing from an earlier era," *The Atlantic*. February 14, 2012, http://theatln.tc/1SHPjLd (Accessed December 26, 2015).
[69] Daniel Headrick, "Information and Communication Technology," In *The Oxford Encyclopedia of Economic History, Vol. I*, ed. Joel Mokyr (New York: Oxford University Press, 2003): 72.
[70] Thomas Malone and Robert Laubacher, "The Dawn of the E-Lance Economy," *Harvard Business Review* 76, no. 5 (Fall 1998): 144-53, 189.

Like the telegraph, the internet has evoked romanticized depictions of a post-geographic world with "cybernauts cruising the Matrix"[71] and "the end of distance."[72] More sobered accounts describe digital growth as a primary driver of economic globalization in the late 20th century. Political economist Gary Gereffi, to whom we will soon return, postulates that the internet's economic impact could be as great as that of steamships, railroads and the automobile. This extends well beyond simple trade to the fundamental integration of previously-dispersed networks of production.[73] The laying of transoceanic cables sets the stage for offshoring business functions to countries where labor can be found at a steep discount as a result of tremendous reductions in the cost of communications.[74] In the 1930s, a fifteen-minute coast-to-coast call across the US cost more than half a day's wages.[75] Now it is rare that such a conversation would bear marginal expenses at all.[76]

However reducing barriers to trade and communication does not necessarily magnetize the concentration of commerce and power towards least-developed countries; indeed what was once termed human extensibility[77] may even reinforce these clusters and deepen inequalities. Even in sectors such as software development and financial services,

[71] Michael Gruber, "Digital Archaeology," *Wired Magazine* 1, no. 5 (May 1993): 114.
[72] Kogut, *The Global Internet Economy*, 1-2.
[73] Gary Gereffi, "Shifting Governance Structures in Global Commodity Chains, with Special Reference to the Internet," *American Behavioral Scientist* 44, no. 10 (June 2001): 1616-1617.
[74] Jeffrey Frankel, "Globalization of the Economy," In *Governance in a Globalizing World*, eds. Joseph Nye and John Donahue (Washington, DC: Brookings, 2005): 54.
[75] Calculated using averages of tax filer incomes in 1933 according to IRS statistics and interstate prices in Tracy Waldon and James Lande, "Reference Book of Rates Price Indices and Household Expenditures for Telephone Service," FCC (March 1997).
[76] Due to anti-monopolistic regulation, public investment and technological convergence as detailed in Barney Warf, "Geographies of global telephony in the age of the internet," *Geoforum* 45 (2013): 219-229.
[77] Donald Janelle, "Measuring Human Extensibility in a Shrinking World," *The Journal of Geography* 72, no. 5 (May 1973): 8-15.

in which shipping costs are negligible, an agglomeration effect can be observed whereby firms cluster together geographically to conduct face-to-face meetings, draw on nearby business services and recruiting specialized labor. This helps explain why Manhattan remains a financial hub and Silicon Valley a technology hub despite the significant premium that firms in both areas take on to procure land and labor, contrasting with the urban obsolescence that cyber-optimists once predicted.[78]

Interconnectivity is most concentrated where commercial relations are already dense. Serviced by more competitors, these routes become cheaper as well.[79] Elites on different continents become even better-connected, turning to leading international players rather than local ones.[80] Moreover, distance remains a predictor of cultural, linguistic, historical and political ties, all of which predetermine economic preferences.[81] Venture capital, for instance, opts for local companies within local social and business networks.[82] Even online sales diminish on auction platforms with every unit of distance between buyer and seller.[83]

Simultaneously, as we will see, Gereffi theorizes that the internet may lead to changes in business organization through its ability to reach consumers with an

[78] Frances Cairncross, *The Death of Distance: How the Communications Revolution Will Change Our Lives* (Boston: HBS, 1997). My approach follows more from the critical perspective of Linda Main, "The global information infrastructure: empowerment or imperialism?" *Third World Quarterly* 22, no. 1 (2001): 83-97.
[79] Edward Malecki and Hu Wei, "A Wired World: The Evolving Geography of Submarine Cable and the Shift to Asia," *Annals of the Association of American Geographers* 99, no. 2 (Apr 2009): 363-372.
[80] Barney Warf, "Telecommunications and Economic Space," In *A Companion to Economic Geography*, eds. Eric Sheppard and Trevor Barnes (Oxford: Blackwell, 2000): 492.
[81] Frankel, "Globalization of the Economy," 54.
[82] Matthew Zook, "'Grounded Capital: Venture Financing and the Geography of the Internet Industry 1994–2000,"' *Journal of Economic Geography* 2, no. 2 (2002): 151–177.
[83] Ali Hortaçsu, Asís Martínez-Jerez and Jason Douglas, "The Geography of Trade in Online Transactions: Evidence from eBay and MercadoLibre," *American Economic Journal: Microeconomics* 1, no. 1 (February 2009): 53-74.

unprecedented scale and efficiency while substituting information for inventory based on individual customer demands. He predicts the rise of infomediary-driven commodity chains, citing America Online and Yahoo, although Google and Facebook would be more fitting today, which retain an advantage in access to customers, particularly information regarding their purchasing habits, thereby digitizing commerce.[84] We can witness this shift already in progress; the relative ratio of e-commerce to retail sales in the United States has grown at an annualized rate of 17% since the turn of the millennium.[85] This indicates a displacement of mainstay industries.

1.2.3 General Purpose Technology

In the long history of invention, what makes one technology more important than any other? What distinguishes a monumental technological advance from a mundane gadget? That is the question theorists who discuss general purpose technologies (GPTs) attempt to answer, exploring select technologies that carve out such an impact that they defined multi-decade economic zeitgeists. Timothy Bresnahan and Manuel Trajtenberg list such examples as the steam engine, electrification and the semiconductor, which can each be situated within a genealogy of other enabling technologies and derive their benefit not only from their direct utility, but from ancillary innovations in production.[86]

The shift of factory work from the steam engine to electrification provides an excellent example. Previously, the factory itself was organized such that all activity

[84] Gereffi, "Shifting Governance Structures in Global Commodity Chains," 1616-1637.
[85] *Y-Charts*, "US E-Commerce Sales as Percent of Retail Sales Summary." Accessed May 5, 2016. http://bit.ly/1VKPA63. Calculated based on 690% growth relative to retail sales, annualized for 1999-2015.
[86] Timothy Bresnahan and Manuel Trajtenberg, "General Purpose Technologies: 'Engines of Growth?'," NBER Working Paper 4148 (August 1992), 1-2.

emanated from mammoth steam engines, with functions requiring the greatest torque located in closest proximity. Factory floors could be quite chaotic since the sequence of activities was not the primary organizing principle of work architecture. Electrification therefore not only provided a new energy source; it allowed for energy to be decentralized and fragmented, inducing a fundamental restructuring of the factory floor. This latter effect was theorized by technology economists as "a wide and pervasive contribution to productivity growth"[87] across a wide range of industries.[88]

What makes this concept distinct from an industrial revolution is that GPTs are not an *era* per se but rather a technological *agent*. Through Boyan Jovanovic and Peter Rousseau's interpretation, there are three criteria that distinguish a GPT from other technologies. First, the technology should spread to most sectors, precluding such examples as the jet propulsion engine which may revolutionize air travel but fails to permeate many other spheres. Second, the technology should improve and become more efficient over time. And third, the technology should bring new products or processes within reach for innovators and industrialists.[89]

Since electrification is a textbook GPT, the two economists use it comparatively to examine information technology. In both cases, they find that productivity growth *declined* compared with prior decades. Instead, an increased share of investment from newer rather than older firms could be observed, as well as a higher rate of registered patents and trademarks. The only notable differences observed between the eras were faster innovation

[87] Nathan Rosenberg, *Inside the Black Box Technology and Economics* (Cambridge: Cambridge University, 1982), 77-78.
[88] Bresnahan and Trajtenberg, "General Purpose Technologies," 3.
[89] Boyan Jovanovic and Peter Rousseau, "General Purpose Technologies," In *Handbook of Economic Growth, Vol 1B*, eds. Philippe Aghion and Steven Durlauf (Warsaw: Elsevier, 2005): 1185.

from information technology despite a slower adoption rate than that of electrification. They conclude decisively that "electrification and IT adoption are manifestations of the same force at work, namely the introduction of a GPT."[90]

The fact that information technology is considered a GPT does not necessarily mean that the internet itself can be assigned the same label. A recent World Bank study asserted that the internet was indeed a GPT, however it employed a spurious methodology by choosing firm productivity as a dependent variable,[91] while stating explicitly that GPTs "take time to affect economic performance," thus undermining its theoretical aim.[92]

Returning to the three criteria to perform a heuristic analysis, we can avoid the focus on productivity. Certainly the internet permeates most economic sectors and has improved over time to provide for more data-intensive communication at lower prices. Industry research shows that the cost to transport data has consistently declined worldwide year-over-year.[93] New products and processes are constantly emerging from internet connectivity. According to the Jovanovic-Rousseau and Bresnahan-Trajtenberg criteria, the answer is very clear that the internet can be properly considered a GPT.

This informs our analysis by suggesting that, if the internet is a GPT, then we can anticipate a lag in its productivity impact and perhaps even a *counter*-effect. In the case of electrification, most factories remained unelectrified until four decades after the first central power station was constructed[94] and nine decades after the technology was

[90] Ibid., 1186-1187.
[91] Similar argumentation can be found in Kenneth Carlaw and Richard Lipsey, "Externalities, technological complementarities and sustained economic growth," *Research Policy* 31, no. 8/9 (2002): 1305-1315.
[92] George Clarke, Christine Qiang and Lixin Xu, "The Internet as a General-Purpose Technology: Firm-Level Evidence from around the World," *World Bank*. Policy Research Working Paper 7192 (February 2015).
[93] TeleGeography, "IP Transit Pricing Trends," *Global Internet Geography*. Accessed May 5, 2016.
[94] Paul David, "The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox," *The American Economic Review* 80, no. 2 (May 1990): 356-357.

discovered. Yet perhaps the clock has already started ticking since the commercial internet was launched nearly a quarter of a century ago.[95] In that case, productivity may be a slowly rising tide, flowing through fiber optic cables.

1.2.4 Liberalizing Force of Political Economy

While national governments certainly play a role in providing and, in many cases, restricting or monitoring access to the internet, the technology's transnational nature challenges governments to adapt in a number of important ways. In *Networks and States*, political economist Milton Mueller describes such mechanisms, characterizing the internet as a "largely accidental and temporary escape from traditional institutional mechanisms of control."[96] This has been made apparent in media reports about large patches of traffic being momentarily diverted to distant countries through routing hacks or errors.[97]

It must be understood that the original purpose of the internet was to make military communication networks resilient to nuclear attack.[98] Thus the internet's vast collection of interconnected networks are intentionally designed to attempt communication through alternative paths when any specific node goes offline.[99] Certainly licenses, infrastructure and regulation are the purview of the state, however the wider system is at least partially impervious to political borders. Data traffics through a method called 'packet switching' in which any given transmission is dissected and sent across multiple channels before being

[95] *The Economist*, "Elementary, my dear Watson: How information technology can boost economic growth," September 21, 2000. Accessed May 4, 2016. http://www.economist.com/node/375504.
[96] Milton Mueller, "A Battle for the Soul of the Internet," In *Networks and States: The Global Politics of Internet Governance*, (Cambridge, MA: MIT Press, 2010): 5.
[97] Andrea Peterson, "Researchers say U.S. Internet traffic was re-routed through Belarus. That's a problem," *The Washington Post*. November 20, 2013. Accessed May 19, 2016. <http://wapo.st/1YFrCY6>.
[98] Choucri, *Cyberpolitics in International Relations*, 51.
[99] Matthew Prince, "The Relative Cost of Bandwidth around the World," CloudFlare Blog. Posted 26 Aug 2014. Accessed Feb 7, 2016. <http://bit.ly/1Z82VDI>

reassembled for the end user, making the internet faster by simultaneously drawing on the capacity of a multitude of networks.[100] Policing the internet is therefore a difficult feat requiring state capacities atypical of least-developed countries, so that exercising control may be limited to taking the entire system offline.

Consequently, borderless communication is the *modus operandi* of the internet; data does not traverse across borders but across networks. Messages are produced on a mass scale, creating such an aggregate amount of traffic that governments find it difficult to monitor.[101] This has the effect of providing so many alternate paths to outside information that closed societies may succumb to more permissive policies while limiting policing to priority topics and targets. Economically, this means an enhanced ability for workers and entrepreneurs to build ties with foreign markets and audiences.[102]

1.3 Putting the Concepts Together

This chapter has offered working definitions for the two major paradigms: export-led growth (ELG) and digital development. Both paradigms are export-oriented, though they diverge on exporting goods versus services. Although digital development has an augmentation objective that does not require exporting to foreign markets, least-developed countries (LDCs) realistically have limited domestic economies by virtue of being LDCs and will most likely continue to rely on external markets. The major difference is that ELG requires industrialization while digital development can exist with low capital endowment.

[100] Janet Abbate, "Government, Business, and the Making of the Internet," *The Business History Review* 75,no. 1 (Spring 2001): 151.
[101] Mueller, "A Battle for the Soul of the Internet," 5.
[102] For a more detailed treatment of the subject, see Philip Steinberg and Stephen McDowell, "Global Communication and the post-statism of cyberspace: a spatial constructivist view," *Review of International Political Economy* 10, no. 2 (May 2003): 196-221.

Our brief exploration of the ELG norm shows how the basic underpinnings of economic thought can be shaped by politics and by circumstances that may not be fully generalizable. We can see one present overreliance on limited case studies in the World Bank's 2016 *World Development Report*, which rests its assumptions about the impact of mobile money on no less than forty references to the Kenyan *M-Pesa* model,[103] a model which failed soon after when attempted in another institutional environment.[104] Patient, sober inquiry is needed to test how an emerging paradigm performs in different contexts. As Bruce Kogut captured elegantly: "If the Internet was a cultural and economic wave, it broke upon very different national shores."[105]

Finally, as I have proposed four economic conceptions of the internet, it is valuable to synthesize their implications so that they can be referred to succinctly in the conclusion. First, if the internet has indeed sparked a new industrial revolution, then the literature suggests that we would expect a complete reorganization of economic life but that productivity gains, employment growth and whole-of-economy effects might not occur until much later. If the internet is to be considered a general purpose technology (GPT), meanwhile, then we would expect productivity gains to be several decades 'late,' with productivity growth perhaps even slowing in the interim. Both the industrial revolution and GPT hypothesis carry pessimistic prospects for the early years of internet diffusion. What

[103] World Bank, *World Development Report*.
[104] Lerato Mbele, "Why M-Pesa failed in South Africa," *BBC News*. Accessed May 19, 2016. May 11, 2016. <http://www.bbc.com/news/world-africa-36260348>.
[105] Kogut, *The Global Internet Economy*, 5.

remains unclear is whether this lag has already passed, considering that the internet was launched decades prior, and just how relevant a measure productivity should be deemed.[106]

Turning to the notion of the internet as a new economic geography, there was once a cyber-optimistic expectation that geographic permissibility would 'equalize' international wealth. Instead, the literature suggests that slashing the transaction cost of communications may function to reproduce and deepen existing geographies of inequality through causal mechanisms such as the informational economies of scale of Gereffi's 'infomediaries.' [107] Perhaps the fourth notion, that of the internet as a force that delinks political and informational borders, will serve to accelerate this process. We will return to these considerations in the conclusion.

[106] See Andrea De Michelis, Marcello Estevão, and Beth Wilson, "Productivity or Employment: Is It a Choice?" IMF Working Paper 13/97 (May 2013).
[107] David Francis, "Human Cloud Landscape: 2015 Update," Confidential Report. *Staffing Industry Analysts*. July 22, 2015.

Chapter 2: Research Design

What makes a strategy such as digital development preferable to another? Chiefly that it improves upon the shortcomings of the one that came before it and that it satisfies the requirements of the task at hand. In chapter one, we described three types of structural factors that inhibit the pursuit of export-led growth (ELG). These include over-reliance on consumption by advanced economies (SF-1, "trade dependence"), endemic financial and governance challenges (SF-2, "state deficiency") and over-competition (SF-3, "crowding"). These will serve as the first three criteria for comparison.

In addition, we will need to know whether digital development displays enough potential to serve as the basis for national economic growth. I disaggregated this into the size of the online economy (SF-4, "scale") and the observed marginal economic impact (SF-5, "impact"). This chapter lays out a structure for investigating the driving question of the thesis by specifying how we will assess these factors for digital development.

2.1 General Approach

Considering the diversity of the five criteria identified above, diverse methods are needed to conduct the investigation that follows in chapter three. This includes reviewing scholarship, calculating descriptive statistics and regression models and using deductive reasoning. The focus remains decidedly fixed on digital development. That is to say that export-led growth has been explored in thousands of academic articles and this thesis does not attempt to engage in a critical analysis of that paradigm beyond the literature review in chapter one. Instead I attempt to explore the digital alternative. Additionally, I make an

effort to privilege data and perspectives on low-income countries as not to draw conclusions from unsuitable models for least-developed countries (LDCs).

Four regression models are presented throughout chapter three, each of which draws on internet connectivity as an independent variable. One simple way to define connectivity would be the percentage of internet users in each country, an easily-found measure that has been frequently employed. However I reject this approach on the basis that it tallies people with the most rudimentary levels of access without capturing the underlying extent of usage. More precisely, it measures "individuals who have used the Internet from any location in the last 12 months."[108] If we consider the analogy of electricity, for instance, there are substantive differences in intensity of usage. Taking the pair of Nepal and South Africa as an illustrative example, 76% and 83% of each country's respective population had access to electricity in 2010. However the average South African consumed *44 times* more kilowatt-hours than the average Nepali. This suggests that some South Africans may have derived far greater economic utility from that access.[109]

Table 1 shows a positive correlation between basic access and the number of broadband subscriptions per 100 people in LDCs. However the ratio between those figures varies widely. For example, compared with Myanmar, Equatorial Guinea exhibits over ten times the level of simple access. Yet the former country actually had 1.6 times more broadband subscriptions. Therefore the Burmese were likely engaging in more data-

[108] United Nations, *Core ICT Indicators: Partnership on Measuring ICT for Development* (~2006) <http://bit.ly/1hVw8dG>.
[109] World Bank, *World Development Indicators*. Accessed May 12, 2016. <http://data.worldbank.org/data-catalog/world-development-indicators>.

intensive activities online than were Equato Guineans. And research suggests that stronger connections are linked to GDP growth, particularly in low-income countries.[110]

Table 1: Ratio of Internet Users to Broadband Subscriptions in LDCs [111]

Country	Diffusion	BB Subs	Ratio
Bhutan	29.9%	18.32	1.6
Sao Tome & Princ.	23.0%	7.65	3.0
Sudan	22.7%	25.57	0.9
Yemen	20.0%	4.33	4.6
Angola	19.1%	12.46	1.5
Equatorial Guinea	**16.4%**	**0.46**	**35.3**
Uganda	16.2%	9.92	1.6
Zambia	15.4%	0.78	19.8
Gambia, The	14.0%	2.53	5.5
Nepal	13.3%	14.43	0.9
Senegal	13.1%	14.85	0.9
Laos	12.5%	2.64	4.7
Djibouti	9.5%	3.35	2.8
Burkina Faso	9.1%	9.03	1.0
Rwanda	9.0%	5.86	1.5
Cambodia	6.8%	9.78	0.7
Bangladesh	6.6%	2.87	2.3
Comoros	6.5%	0.18	36.7
Mauritania	6.2%	5.55	1.1
Afghanistan	5.9%	1.25	4.7
Mozambique	5.4%	2.18	2.5
Malawi	5.1%	3.95	1.3
Lesotho	5.0%	7.51	0.7
Benin	4.9%	0.41	11.9
Togo	4.5%	1.57	2.9
Tanzania	4.4%	2.81	1.6
Mali	3.5%	1.86	1.9
Liberia	3.2%	1.85	1.7
Guinea-Bissau	3.1%	0.09	36.4
CAR (2012)	3.0%	0.01	224.4
Madagascar	3.0%	3.24	0.9
Chad	2.3%	0.11	20.1
Ethiopia	1.9%	5.04	0.4
Niger	1.7%	0.32	5.4
Guinea	1.6%	1.28	1.2
Myanmar	**1.6%**	**1.21**	**1.3**
Somalia (2012)	1.4%	0.53	2.6
Burundi (2012)	1.2%	0.01	123.6
Eritrea	0.9%	0.00	390.4

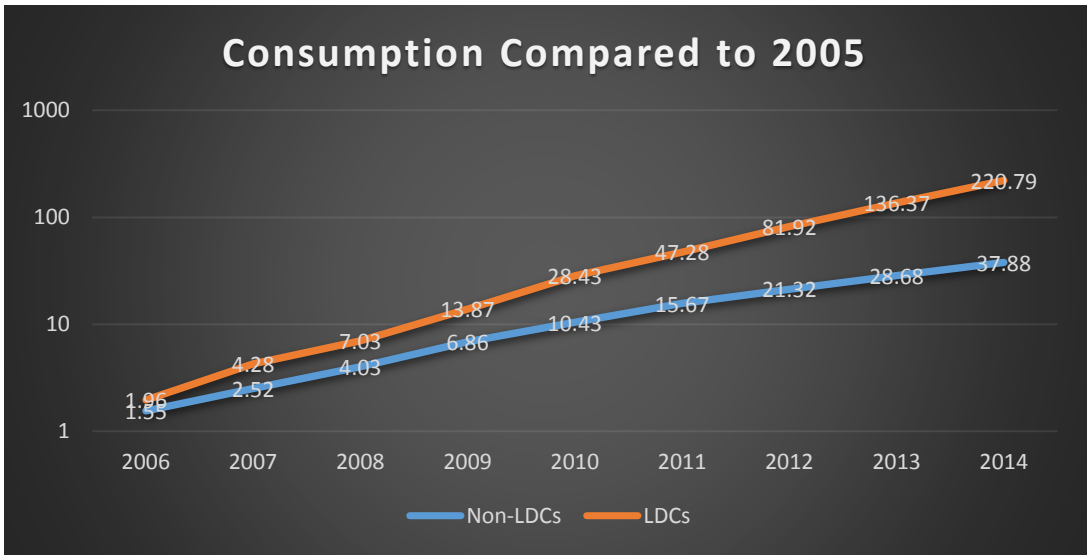
[110] Chatchai Kongaut, Ibrahim Kholilul and Erik Bohlin, "The economic impact of broadband speed: Comparing between higher and lower income countries." *European Investment Bank Institute*. Sept 2014.
[111] All data collected from the International Telecommunication Union's ICT Indicators Database for 2013 unless otherwise indicated. 'Diffusion' refers to percentage of individuals using the Internet. 'BB Subs' refers to combined active fixed-broadband and mobile-broadband subscriptions per 100 inhabitants.

Regression Statistics	
0.4745	R Square
39	Observations
0.0003	P-value

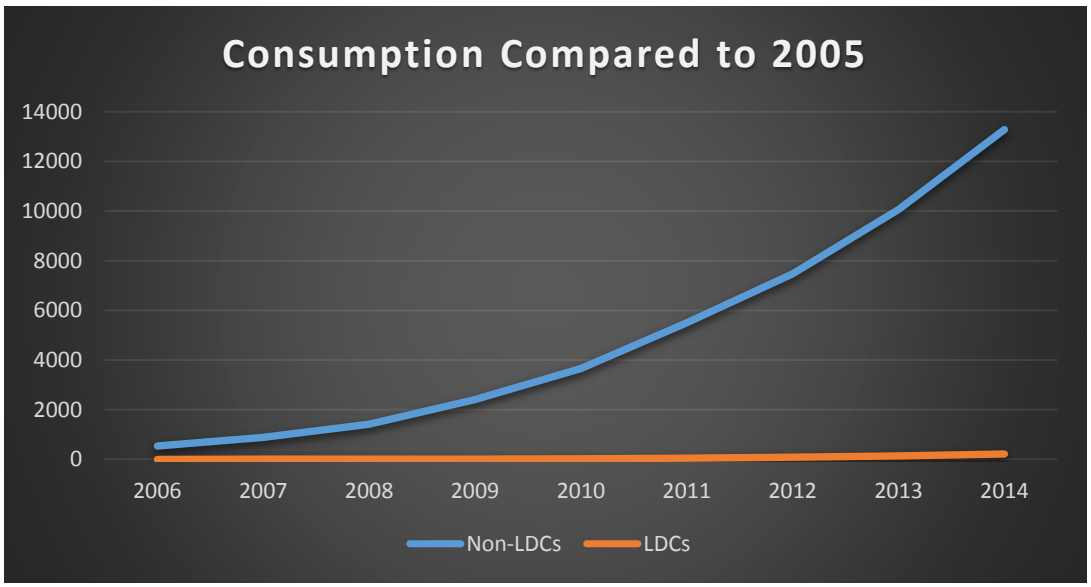
Instead, by drawing on proprietary data from telecommunications research firm *TeleGeography*, I assemble another measure for connectivity that I term 'internet consumption per capita.' This estimates how much data travels in and out of a given country based on the 95th percentile highest-traffic five-minute interval in the month of April each year.[112] This measure avoids certain anomalies, such as denial-of-service attacks, that lead to artificially-high peaks. The benefit is that, like a spot price, it incorporates a multitude of factors which may impact intensity of usage: affordability, infrastructure, institutions, demographics, human capital and so on. A non-technical explanation of this measure is provided in the appendix.

Using international consumption per capita, we can see a far more dynamic depiction of internet usage in just two charts. The first chart below show the population-weighted[113] growth of consumption. By using a separate index for LDCs and non-LDCs expressed as multiples of respective 2005 baselines, we can see that LDCs are 'winning' with annualized consumption growth of 82% compared to 50% for other countries.

[112] Measurement decisions are those of *TeleGeography*.
[113] Consumption in each subset calculated as the sum of each country weighted by its population.



However the second chart shows identical data but with one small adjustment. Rather than calculating the indices expressed in terms of their *separate* 2005 baselines, I put them together by displaying them both using the same *LDC* baseline from 2005. This shows that, despite higher LDC growth in consumption, there is a dramatic contrast in the intensity of usage since non-LDCs were 'consuming' more than 350 times the data of LDCs in 2005. If annualized growth continued at its current level, LDCs would remain behind until 2035 (and population saturation makes this rather unlikely).



This is not a perfect measure. For one, it does not incorporate domestic traffic. National political or even sporting events could have a distorting effect in the month of April. And it doesn't account for temporary outages in service or electricity, provided that access remains in place for more than 5% of the month. Furthermore, data collection depends on reporting from more than 500 international providers, requiring some reliance on estimation. Therefore the measure must be interpreted in a qualified way. Nevertheless, it is a far more effective metric at measuring the 'amount' of internet used and presents a new methodology for comparing intensity of usage.

2.2 Detailed Methodology

Chapter three proceeds in five parts, corresponding with the five structural factors used to assess digital development as an alternative to export-led growth (ELG). The first part assesses trade reliance on advanced economies (SF-1). I begin by offering quantitative evidence on the association between connectivity, as defined above, and exports as a share of GDP. This is conducted using World Bank data for all available countries and then for available least-developed countries (LDCs) for 2005-2010 and 2010-2014 changes, before being retested for robustness against GNI per capita. Export shares are used because more detailed data could not be accessed to isolate exports going to high-income countries versus other economies. This regression method and the others that follow are not intended to identify causality per se but rather illustrative evidence that can be interpreted in the context of broader findings. For that reason, I proceed to consider the direction of purchasing flows between North and South on a major online labor market. I then examine literature

suggesting that increased South-South trade is lessening dependence on the North, porentially ameliorating this structural factor.

Part two assesses state deficiency (SF-2) through two regression-based approaches that mirror the one described above, using identical independent and control variables but focusing instead on World Bank data on the share of government non-grant revenue[114] to GDP as a proxy of fiscal strength, and on the Corruptions Perceptions Index published by Transparency International. I then put forward a logical argument regarding how state deficiency impacts actors pursuing exports through ELG versus digital development.

Part three assesses over-crowding (SF-3) among similar countries pursuing similar development strategies, in addition to the challenge of competing outside of the low-cost Asian hub of industrial agglomeration. This is more difficult to assess empirically because the sectoral focus of the online economy is somewhat nebulous. Therefore I work theoretically through Michael Shafer's sector theory[115] to characterize the online economy as a sector with a low barrier to entry operating within the constraints of Gereffi's oligopolistic infomediaries. I also bring in literature on 'liabilities of foreignness' in order to show how specific types of online work have formal and informal institutional barriers.

Part four assesses whether the online economy is large enough (SF-4) to sustain national economic growth for LDCs. I offer two comparative benchmarks: the current value of goods exports and the difference between current per capita incomes and those needed to attain middle-income status. From there, I review market size and trend estimations in a proprietary report issued by *Staffing Industry Analysts* that offers a global

[114] This includes the total of all cash receipts of government revenue excluding most foreign assistance.
[115] Michael Shafer, *Winners and Losers: How Sectors Shape the Development Prospects of States* (Ithaca: Cornell University, 1994).

overview of the online economy and its key 'infomediaries.'[116] I then turn to a comprehensive report on the mobile app economy published by *Caribou Digital* to explore entrepreneurship as opposed to hired labor.[117]

Finally, part five assesses the observed economic impact (SF-5) of digital development through a review of selected World Bank findings. Mindful of the critiques raised in the analytic framework of this thesis, I pay special attention to the country cases used by the scholars of these studies for drawing inferences. Along the lines of models previously described, I then use a simple regression to explore the link between connectivity and GNI.

2.3 Limitations

In addition to the minor limitations of the connectivity and export variables already noted, as well as the fact that the statistical methods are designed for correlation and not causation, other limitations should be noted here as well. As suggested in the analytic framework and elsewhere in the broader literature,[118] there is often a latency effect that delays the onset of the economic impact of technology; complex systems are slow to permeate cultural and economic institutions. By using data spanning multiple years, I try to mitigate this issue, however proper econometric analysis using lagged panel data would require methodological considerations beyond the scope of the thesis.

[116] David Francis, "Human Cloud Landscape: 2015 Update," Confidential Report. *Staffing Industry Analysts*. July 22, 2015.
[117] Bryan Pon, *Winners & Losers in the Global App Economy* (Farnham, UK: Caribou Digital, 2016). Though similarly titled, this bears no apparent relationship to Shafer (1994), cited earlier.
[118] Robert Kauffman and Ajay Kumar, "Impact of Information and Communication Technologies on Country Development: Accounting for Area Interrelationships," *International Journal of Electronic Commerce* 13, no. 1 (Fall 2008): 11-58.

Additionally there is a network effect described in the literature[119] which suggests that the value of a technology accelerates exponentially as its usage increases. This value capture is not reflected in the data partially because the rates of consumption are so low for least-developed countries (LDCs) that it is unclear whether such an analysis would be appropriate. However further studies exploring more data-rich systems such as social networks may consider categorizing countries using both basic access and consumption per capita according to a matrix with two high-to-low axes, constructing four quadrants.

From a critical theory perspective, there are those who may call into question my conflation of economic growth and development[120] and my usage of 'development' as a concept.[121] There are a host of critical development studies perspectives[122] that can level challenges against various assumptions in the inquiry, in addition to certain scholars within the world-systems tradition who question whether broad swaths of states can change their position within the world-economy.[123] Still others question the merits of the capitalist system on which this endeavor is based.[124] While a proper reply to those schools cannot be mounted in the space provided, I acknowledge the limitations of any rationalist-positivist approach and point out that my inquiry is predicated on the assumption that material deprivation is a relevant, prevalent and economic concern *for LDCs*. Regarding the

[119] Carl Shapiro and Hal Varian, *Information Rules: A Strategic Guide to the Network Economy* (Harvard Business Press, 1999).
[120] Chang, *Kicking Away the Ladder*.
[121] Gilbert Rist, *The History of Development: From Western Origins to Global Faith* (London: ZED, 1997).
[122] Rachel Silvey and Katharina Rankin, "Development geography: Critical development studies and political geographic imaginaries," *Progress in Human Geography* 35, no. 5 (2010): 696-704.
[123] Immanuel Wallerstein, "Dependence in an interdependent world: the limited possibilities of transformation within the capitalist world-economy," In *The Capitalist World-Economy* (Washington, DC: Cambridge, 1979): 66-67.
[124] Douglas Dowd (ed.), *Understanding Capitalism: Critical Analysis from Karl Marx to Amartya Sen* (Sterling, VA: Pluto, 2002).

socially-constituted institutions and structures that I analyze, I borrow from the Copenhagen School of Security Studies to point out that "even the socially constituted is often sedimented as structure and becomes so relatively stable as practice that one must do analysis also on the basis that it continues."[125]

Additionally, three policy-oriented limitations should be noted. First, the paradigms discussed are subject to wide variations in implementation. Perhaps our analysis is limited by the fact that policymakers and their agents have yet to figure out how to implement effectively.[126] Similarly, although the two paradigms are comparatively analyzed, they do not exist in a zero-sum environment where no policy actions can accomplish both ends. I compare them on the basis that many policy actions in pursuit of each strategy – particularly the construction of large industrial facilities – are specific to one or the other; the economic development decisions of LDCs carry opportunity costs.

Finally, I acknowledge that examining a set of 48 economies is a clunky maneuver as these economies exhibit diversity in many categories of analysis. Intensive research would need to be conducted on any one case to examine applicability and explanatory power in the context of national institutions. My intention instead is to offer an interdisciplinary body of evidence that advances comparative understanding of the two paradigms so that case-specific research can be completed while taking the theories and factors that I present into account.[127]

[125] Barry Buzan, Ole Wæver and Jaap de Wilde, *Security: A New Framework for Analysis* (London: Lynne Rienner, 1998), 35.
[126] Lant Pritchett, Michael Woolcock, and Matt Andrews, "Capability Traps? The Mechanisms of Persistent Implementation Failure," *Center for Global Development* Working Paper 234 (December 2010).
[127] For simplicity, I refer to all economies as 'countries.' No stance on sovereign borders should be implied.

Chapter 3: Empirical Investigation

This chapter investigates the five criteria introduced in chapter two to assess the suitability of digital development as an alternative to export-led growth for least-developed countries (LDCs). As may be expected, LDCs have among the lowest levels of internet consumption in the world. Table 2 displays that data ranked against 177 countries to establish a context for the regression studies where this measure of connectivity is used.

Table 2: Global Rank in Internet Consumption Per Capita

Country Name	2005	2014
Bhutan	119	96
Sao Tome & Princ.	120	101
Equatorial Guinea	138	118
Senegal	106	122
Gambia	129	126
Cambodia	136	129
Laos	132	133
Angola	156	135
Mauritania	146	137
Haiti	147	138
Sudan	123	139
Tanzania	155	140
Yemen	115	143
Zambia	166	144
Nepal	164	145
Mozambique	152	146
Comoros	141	149
Guinea-Bissau	163	150
Somalia	176	151
Uganda	142	152
Rwanda	157	155
Togo	139	156
Benin	128	157
Sierra Leone	154	158
Afghanistan	151	159
Myanmar	174	160
Bangladesh	165	161
Guinea	160	162
Mali	171	163
Lesotho	140	164
Burkina Faso	167	166
Malawi	172	167

Madagascar	161	168
Liberia	145	169
Burundi	168	170
Ethiopia	175	171
Niger	177	173
Chad	170	175
CAR	158	176
Eritrea	159	177

3.1 Trade Dependence

Since the 1980s, high-income countries have experienced a systemic loss of manufacturing jobs to lower-cost destinations, with information technology jobs increasingly outsourced as well. While offshoring is a loss for workers in the Global North, firms in the South term it less pejoratively as *inshoring* – the *im*migration of employment. Entire business processes are being outsourced, particularly software programming; a survey found 86% of firms already outsourcing software development as early as 2003, more than three times the rate for call centers. Industry best practices may actually benefit least-developed countries (LDCs) by encouraging companies to diversify among a geographic portfolio, hedging against country risk while also leaving room for experimentation.[128]

While this broader trend is promising for LDCs regarding distribution of labor, we can recall that one of the chief risks of export-led growth (ELG) cited by Palley is a dependence on consumption by high-income economies, which he argues have been unnaturally high-performing in a manner unlikely to persist.[129] Therefore this section assesses whether digital development correlates with an increased export reliance, whether

[128] Georg Erber and Aida Sayed-Ahmed, "Offshore Outsourcing: A Global Shift in the Present IT Industry," *Intereconomics* 40, no. 2 (March/April 2005): 100-112.
[129] Palley, "The Rise and Fall of Export-Led Growth," 141-161.

the geography of online trade is dependent on high-income economies and whether there is indeed an emerging trend of South-South trade that could mitigate the export reliance problem altogether, as suggested by Akın and Kose.[130]

I use country-level multivariate regression to test for the effect of changes in internet consumption per capita (independent variable as defined in chapter two) on changes in the contribution of exports to gross domestic product. This is used for the periods 2005-2010 and 2010-2014 for each of two populations of countries: all countries for which appropriate data exists and all countries from that set that are presently on the United Nations list of LDCs. Each model is initially run as a simple regression and then I examine robustness by introducing changes in gross national income per capita (Atlas Method, current US dollars) over the same period. This leads to a total of eight trials.

Table 3: Internet Connectivity and Export Share of GDP

	R Square	*Adjusted R*	*Observations*	*Coefficient Export Ratio*	*Coefficient GNI p.c.*
World, '05-'10	0.0034	-0.0028	163	0.5302	n/a
	0.1007	0.0895	163	1.4044	***2.1520
World, '10-'14	0.0080	0.0011	145	-0.4694	n/a
	0.0540	0.0406	145	-0.0721	**1.2625
LDCs, '05-'10	0.1261	0.0996	35	*2.0143	n/a
	0.1269	0.0723	35	*2.0103	0.1719
LDCs, '10-'14	0.0204	-0.0134	21	-0.5356	n/a
	0.0363	0.0363	21	-0.0377	0.7974
				* p < 0.05	** p < 0.01	*** p < 0.001

In both periods, I fail to detect a statistically-significant world-level correlation, either before or after testing for robustness. Among LDCs, there is a robust and statistically-significant correlation for the period 2005-2010 however this fails to appear

[130] Akın and Kose, "Changing Nature of North-South Linkages."

for the latter period. The low n-values suggest that the correlation may only be missing due to limited data, however we must consider that the coefficient in the latter period bears little resemblance to the former.

Therefore I understand the data to suggest the presence of an exogenous factor that was present in the first period but not the latter. Three causal mechanisms might be at play. The first is that a wave of increased trade liberalization increased competition among services providers that drove down prices for consumers, amplifying consumption. The second is that firms relocated services to LDCs as a result of the 2008 global downturn leading to increased exports and a relative burst in communications involving only limited local employment. The third is a casual mechanism in the reverse, that internet connectivity may have been introduced to LDCs during a confined period and led to a new wave of export opportunities, primarily among existing merchants. In any case, the data fails to detect a linear relationship between connectivity and export share of GDP beyond the 2005-2010 period and this negates it for the purposes of our forward-looking analysis.

In a study of more than 60,000 transactions conducted in the *oDesk* labor market in 2013, eighteen of the top twenty countries by total expenditure were high-income,[131] the exceptions being Malaysia and India, ranked fifteen and nineteen respectively. Together, they comprise barely over 1% of US expenditure. Among the LDCs, Bangladesh captures the sixth position for the value of its labor provided. Most of the earning countries were low-income as might be expected. [132]

[131] World Bank, "Country and Lending Groups." Accessed May 15, 2016. http://bit.do/b2tsa.
[132] Vili Lehdonvirta, et al., "Online labour markets – leveling the playing field for international service markets?" Paper presented at Internet, Policy and Politics Conference (Oxford). September 2014.

The graphic below shows the leading purchasing countries for the full year of 2014 on *oDesk* and *Elance*, which later merged to become *UpWork*, confirming the concentration among high-income countries for hiring activity.[133] This is significant because *UpWork* is by far the largest online remote platform by total spend, eclipsing the next six competitors in that category as identified in 2015 by *Staffing Industry Analysts*.[134] We can take from these findings that spending in this context primarily emanates from the North to the South, reproducing trade dependency.

While the traditional view of North-South trade involves the South trading primary commodities and labor-intensive manufactured goods for capital-intensive goods in the

[133] UpWork, "Online Work Report." Accessed May 15, 2016. http://elance-odesk.com/online-work-report-global.
[134] Francis, "Human Cloud Landscape," 5.

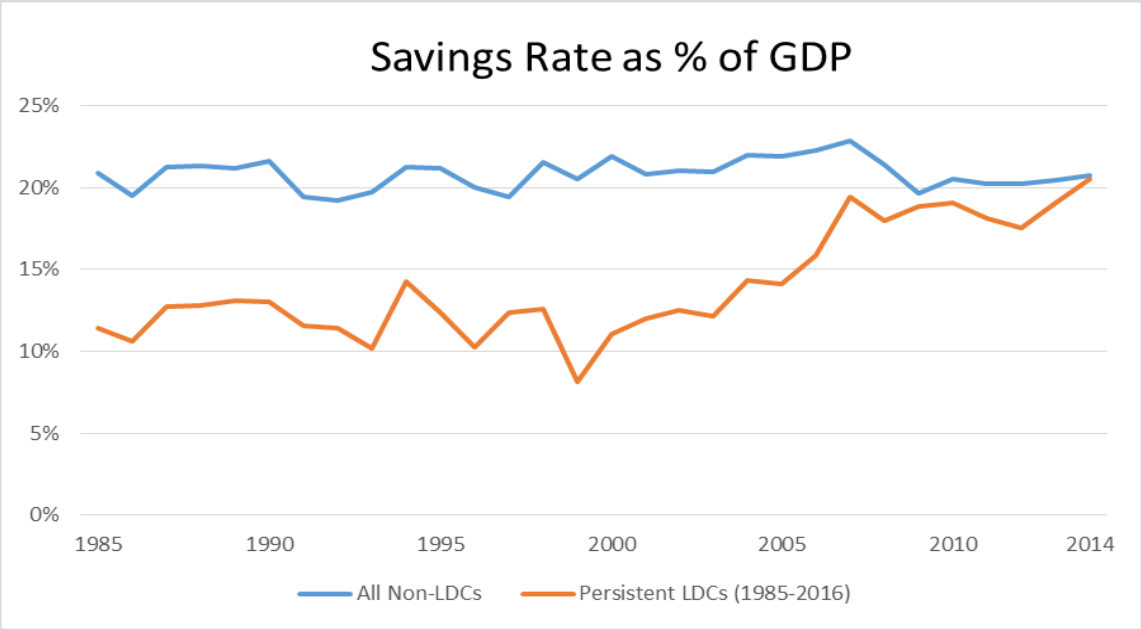
North, developing countries are increasingly taking on capital-intensive production.[135] This is a structural change that enables increased South-South barter in light of a generalized "slowdown in the growth of the North," leading to integration of South-South production networks that generate higher employment and more competitive prices.[136] Some scholars have even suggested that continued growth in China and India despite weaker economic indicators in the North suggests a 'decoupling' of emerging markets.[137]

Two economists reviewed growth linkages between the China-India pair and low-income Asia for the period 1970-2009. They found an increasing demand from China for a range of agricultural and textile commodities, minerals, furniture, chemical products, animal skins and manufactures in the region. This was not observed in the Indian case but they noted similar potential should India further integrate into regional production networks.[138] This suggests that ELG may be overcoming trade dependency on its own, and that India may still accelerate intra-regional demand beyond what has already been witnessed. However this only serves the Asian LDCs, including Bangladesh, Bhutan, Cambodia, Laos, Myanmar, Nepal and Timor-Leste. The 41 others are less likely to derive direct benefits from such a development.[139]

Another argument undermining trade dependency stems from studies showing that emerging markets have high savings rates that diminish dependence on foreign finance.[140]

[135] Michael Chui et al., "North-South Models of Growth and Trade," *Journal of Economic Surveys* 16, no. 2 (December 2002), 124.
[136] Rashmi Banga and Dinesh Kumar, "Can China and India be Growth Drivers for Developing Asia?" *European Journal of Development Research* 25, no. 3 (2013): 367.
[137] Ayhan Kose, Christopher Ortrok and Eswar Prasad, "Global Business Cycles: Convergence or Decouple?" *International Economic Review* 53, no. 2 (May 2012): 522.
[138] Banga and Kumar, "Can China and India be Growth Drivers for Developing Asia," 367-384.
[139] The island nations of Kiribati, the Solomon Islands, Tuvalu and Vanuatu are just outside of Pacific trading routes.
[140] Kose, Ortrok and Prasad, "Global Business Cycles," 536.

But do LDCs have a high savings rate? I test this by comparing the median savings rate, expressed as a percentage of GDP, between non-LDCs and the 33 countries continuously labelled LDCs since 1985.[141] There does appear to be a convergence in the savings rate, however this is but one of many variables. The takeaway is that, while trade dependence remains relevant, in coming years it may be moderated to an extent by South-South trade and greater savings among LDCs, increasing domestic investment capacities.



This section considered ELG and digital development on the basis of trade dependency. I found evidence of dependency for digital development in the online labor market. If connectivity does lead to a change in export orientation, it was not detected in the data for the most recent period. On the other hand, there is evidence of convergence in the saving rates of LDCs which could finance greater capital investment without involvement from the North, although this alone is but one indicator. Growth from China

[141] World Bank, *World Development Indicators*.

and India can sustain regional demand, and for Asian LDCs this suggests a reward for pursuing ELG.

3.2 State Deficiency

In *The End of Poverty*, Jeffrey Sachs describes governance failures and fiscal traps endemic to least-developed countries (LDCs). Governance failures chiefly include corruption and economic mismanagement while fiscal traps stem from an inability to tax an impoverished population, from a bureaucracy that is ill-equipped or too corrupt to do so and from the burden of servicing debts from loans taken out in prior decades. This prevents investment in public goods and services such as infrastructure and basic health.[142]

These deficiencies plague the export-led growth (ELG) model throughout the export production cycle. They limit the human capital of the workforce by inhibiting education, erode investment by creating regulatory obstacles, syphon the budget for critical infrastructure projects and perpetuate obstacles to exporting goods. For rough evidence on whether digital development might fare better in such conditions, I examine how connectivity affects government revenue and corruption before discussing the political economy of the online economy.

The regression analysis in Table 4 explores how changes in internet consumption per capita impact changes in the ratio of non-grant public revenue to gross domestic product. This is used for the periods 2005-2008 and 2008-2011.[143] As before, a global and LDC-limited population are contrasted with a simple regression and then tested for

[142] Sachs, *The End of Poverty*, 59-60. Contestation described earlier.
[143] The periods used here differ due to limited data.

robustness against changes in GNI. In all eight tests, I fail to detect a relationship between internet consumption and government revenue, either before or after testing for robustness.

Table 4: Internet Connectivity and Government Revenue

	R Square	*Adjusted R*	*Observations*	*Coefficient Govt. Rev.*	*Coefficient GNI p.c.*
World, '05-'08	0.0001	-0.0094	107	-0.0008	n/a
	0.0760	0.0583	107	-0.0012	**1.7582
World, '08-'11	0.0307	-0.0439	15	-0.0196	n/a
	0.0859	-0.0664	15	-0.0116	1.6030
LDCs, '05-'08	0.0010	-0.0082	111	0.0024	n/a
	0.0010	-0.0175	111	0.0023	0.0253
LDCs, '08-'11	0.0845	0.0191	16	0.0625	n/a
	0.0851	-0.0556	16	0.0659	-0.2851
				* p < 0.05	** p < 0.01	*** p < 0.001

I then move to examining corruption as a proxy for state deficiency. Table 5 shows the regression results for how connectivity impacts Transparency International's Corruption Perceptions Index, returning to the periods 2005-2010 and 2010-2014 for the same eight tests as in the earlier models. Initially there appears to be a positive correlation for the most recent period at the world level, however this is fully mitigated by the robustness test. In other words, we fail to detect a relationship between connectivity and perceived corruption for the periods indicated.

Table 5: Internet Connectivity and Perceptions of Corruption

	R Square	*Adjusted R*	*Observations*	*Coefficient CPI*	*Coefficient GNI p.c.*
World, '05-'10	0.0034	-0.0036	145	0.0407	n/a
	0.0900	0.0772	145	0.0014	***2.0182
World, '10-'14	0.0338	0.0272	147	*0.1026	n/a
	0.0794	0.0666	147	0.0808	**1.1557
LDCs, '05-'10	0.0004	-0.0367	29	-0.0127	n/a
	0.0189	-0.0566	29	-0.0216	1.0845
LDCs, '10-'14	0.0065	-0.0227	36	-0.0512	n/a
	0.0611	0.0042	36	-0.0685	1.3964
				* p < 0.05 ** p < 0.01 *** p < 0.001	

These results should be interpreted cautiously because government revenue and perceptions of corruption are but two proxies for state deficiency. However the data suggests that, at least so far as these measures are concerned – and subject to verification by future studies – connectivity does not appear to alter state deficiencies while, conversely, deficiencies do not appear to inhibit the intensity of internet usage. But can the online *economy* function independently as well? Just how affected is it by state deficiencies when compared with ELG?

This is a question for which there is little precedent, and there are scholars who advise against attributing to the internet the anarchic metaphor of a lawless, ungoverned 'Western frontier.'[144] There is some nascent evidence that governance matters. For example, business scholars found that US outsourcing of complex services to India would multiply if India improved its rule of law.[145] Perhaps regulatory quality is one area in which

[144] Alfred Yen, "Western Frontier or Feudal Society? Metaphors and Perceptions of Cyberspace," *Berkeley Technology Law Journal* 17, no. 4 (Fall 2002): 1207-1263.
[145] Runjuan Liu, Dorothee Feils and Barry Scholnick, "Why are different services outsourced to different countries?" *Journal of International Business Studies* 42, no. 5 (2011): 568.

governance counts for facilitating investment. As we can see in Table 6, this is one measure in which all but Rwanda are in the bottom half of the global ranking.

Table 6: Comparative Regulatory Quality in 2014 [146]

Country	Rank	World	Country	Rank	World
Rwanda	1	41%	Yemen	24	78%
Senegal	2	54%	Laos	25	79%
Burkina Faso	3	57%	Nepal	26	79%
Tanzania	4	59%	Tuvalu	27	81%
Vanuatu	5	60%	Bangladesh	28	82%
Uganda	6	61%	Kiribati	29	83%
Mozambique	7	62%	Angola	30	83%
Cambodia	8	63%	Ethiopia	31	84%
Lesotho	9	64%	Bhutan	32	85%
Gambia, The	10	66%	Haiti	33	86%
Benin	11	67%	Guinea	34	88%
Zambia	12	68%	Solomon Islds.	35	88%
Djibouti	13	69%	Afghanistan	36	88%
Mali	14	69%	Comoros	37	89%
Niger	15	72%	Chad	38	89%
Malawi	16	73%	Guinea-Bissau	39	92%
Mauritania	17	73%	Congo, DR	40	92%
Madagascar	18	74%	Sudan	41	93%
Sao Tome and Pri	19	75%	Myanmar	42	94%
Burundi	20	75%	CAR	43	94%
Sierra Leone	21	76%	Equat. Guinea	44	95%
Togo	22	77%	Somalia	45	99%
Liberia	23	77%	Eritrea	46	99%

Certainly many aspects of the online economy are impacted by state deficiencies. I concede, based on personal experience and interviews,[147] that some basic issues matter,

[146] World Bank, "The Worldwide Governance Indicators, 2015." Published September 25, 2015. <http://www.govindicators.org>. Data collected from survey institutes, think tanks, NGOs, IOs, and private sector firms. Rank is among LDCs and percentage is compared with all 209 countries listed for 2014.
[147] Background research interviews with freelancers in Ethiopia, Somaliland and Tunisia, January 2016.

such as electricity, affordability, quality of access and the ability to efficiently transact funds. However I argue that the online economy, and with it digital development, are less reliant on factors such as corruption, state fiscal health and regulatory quality. This is because the level of involvement with the government is far less than the numerous processes involved in export-oriented production; commerce can be conducted online without securing construction permits, registering property or transferring physical goods in and out of sovereign space. Therefore, I take the view that ELG is more affected by state deficiencies, which are common among LDCs. This may be especially true for the one-third of LDCs which are also landlocked states and therefore must deal with other governments in regions where LDCs are to be found.[148]

3.3 Over-Crowding

In chapter one, we discussed the 'beggar-thy-neighbor'[149] problem of overcrowding due to countries simultaneously pursuing the same export-oriented growth (ELG) strategy. This is confounded by agglomeration of production networks in Asia, which development economist Paul Collier captures as a recent phenomenon:

> There was a moment – roughly the decade of the 1980s – when the wage gap was sufficiently wide that any low-wage developing country could break into global markets as long as it was not stuck in one of the traps. During the 1990s this opportunity receded because Asia was building agglomerations of manufactures and services. These agglomerations became fabulously competitive; low wages combined with scale economies. Neither the rich countries nor the bottom billion could compete. The rich countries did not have low wages and the bottom billion, which had low wages, did not have the agglomeration. They had missed the boat.[150]

[148] Landlocked LDCs include Afghanistan, Bhutan, Burkina Faso, Burundi, the Central African Republic, Chad, Ethiopia, Laos, Lesotho, Malawi, Mali, Nepal, Niger, Rwanda, South Sudan, Uganda and Zambia.
[149] Blecker and Razmi, "Export-led Growth," 379-396. Inspired by Robinson, "Beggar-my-neighbour remedies for unemployment," 210-230.
[150] Collier, *The Bottom Billion*, 84-85.

In this section, I consider whether overcrowding is likely to permeate the online economy by adapting Michael Shafer's sector theory,[151] quite similar to Harold Innis's staple theory,[152] to assess whether barriers to entry will prevent overcrowding. This deviates from the core of Shafer's work which emphasizes how leading sectors constrain the ability of states to meet the demands of economic development through industrial restructuring. Nevertheless, his text contains theoretical insights which can be adapted for our purposes and furthered by Gary Gereffi's notion of 'infomediaries.'[153]

In Shafer's framework, the leading sector of an economy is differentiated by whether it is high/high or low/low. A high/high sector has high barriers to entry, inflexible production cycles, large sunk costs in facilities, infrastructure and workforce training, and an oligopolistic structure in which several large, sophisticated firms dominate and collude as an industry. In contrast, a low/low sector is marked by low barriers to entry, dexterity in adapting to market signals, high levels of competition, thin profit margins, and many small, geographically-dispersed firms led by isolated businesspeople employing diverse, largely unskilled workers in conditions marked by poor labor protections and low political clout. In this latter environment, small firms in the South are more competitive vis-à-vis multinational corporations because, among other reasons, low/low sectors do not require major capital investment and can expand or retract production more easily.[154]

I do not use this formula to discuss economic restructuring as Shafer intended, although such an analysis in the novel context of digital development would be interesting

[151] Shafer, *Winners and Losers*.
[152] Melville Watkins, "A Staple Theory of Economic Growth," *The Canadian Journal of Economics and Political Science* 29, no. 2 (May 1963): 141-158.
[153] Gereffi, "Shifting Governance Structures in Global Commodity Chains," 1616-1637.
[154] Shafer, *Winners and Losers*.

in its own right. Shafer himself wrote in the early 1990s that "sectoral analysis does fine with …stable sectors such as mining and estate crops, but it will need refining if it is to embrace the computer, telecommunications, and … other rapidly changing industries."[155] Instead, I consider whether the digital economy is a high/high or low/low sector in order to uncover what type of competition may be expected.

One perspective can be drawn from network theory, briefly referenced in chapter two.[156] This is the notion that the value of a network increases exponentially rather than geometrically as each new node interacts with an increasing number of others. The most apparent examples of this are social networks, which become useful by becoming ubiquitous, leading increasingly reluctant users to acquiesce by joining their peers.

Network theory also teaches us that the cost of switching an entire user base over to a new network increases with size,[157] increasing barriers to competition so that large early investments may be needed to quickly capture a new user base. However these networks do not exhibit two of Shafer's high/high qualities: inflexible production cycles and complex facilities. They more closely resemble Gereffi's 'infomediaries;' a new type of commodity chain built on direct access to customer data where several key firms collude and control "strategic entry points to the internet."[158]

Yet infomediaries are concentrated in the Global North, and thus LDC revenue from the online economy primarily lies in outsourcing from wealthy economies (as demonstrated in chapter one and more fully in the coming section). This involves routine,

[155] Ibid., 250.
[156] Shapiro and Varian, *Information Rules*.
[157] Kauffman and Kumar, "Impact of ICTs on Country Development," 11-58.
[158] Gereffi, "Shifting Governance Structures in Global Commodity Chains," 1616-1637

less complex services typical of low/low-type work.[159] One explanation for this, following from Douglass North's work on how institutions constrain economic interactions,[160] is called the 'liability of foreignness.' This was suggested in the 1970s[161] and then expanded in the 1990s[162] in business literature and applied to outsourcing to show how differences in societal institutions create gaps in trust between workers and managers.[163] These include formal and informal rules,[164] along with linguistic barriers.[165] Consequently, LDCs are less likely to receive complex, higher-skilled work involving proprietary information and wider discretion in judgement.[166]

For these reasons, I argue that the online economy may be understood – from the perspective of LDCs – as predominantly low/low, with many small, geographically-disperse firms led by isolated entrepreneurs and lone workers with a constrained ability to organize. Low barriers to entry in an increasingly connected world facilitate the participation of many, mostly achieving only modest incomes.

However these firms function within the constraints of web traffic channeled by formidable infomediaries from the Global North that exhibit certain high/high

[159] Liu, Feils and Scholnick, "Why are different services outsourced to different countries," 561.
[160] Douglass North, *Institutions, Institutional Change and Economic Performance* (New York: Cambridge University, 1990).
[161] Stephen Hymer, *The International Operations of National Firms: A Study of Direct Foreign Investment* (Cambridge, MA: MIT, 1976), 34-35.
[162] Srilata Zaheer, "Overcoming the Liability of Foreignness," *Academy of Management Journal* 38, no. 2 (April 1995): 341-363.
[163] Mikelle Calhoun, "Unpacking the liability of foreignness: identifying culturally driven external and internal sources of liability for the foreign subsidiary," *Journal of International Management* 8, no. 3 (2002): 301–321.
[164] Rogers Hollingsworth, "Doing institutional analysis: implications for the study of innovations." *Review of International Political Economy* 7, no. 4 (2000): 595–644.
[165] Andrei Kuznetsov and Olga Kuznetsova, "Building professional discourse in emerging markets: language, context and the challenge of sensemaking," *Journal of International Business Studies* 45, no. 5 (2014): 583–599.
[166] Liu, Feils and Scholnick, "Why are different services outsourced to different countries," 560.

characteristics. In other words, I suggest that the online economy, as it will likely be encountered by LDCs, is governed by large infomediaries which direct low/low-type work to disparate and highly price-competitive firms in the Global South. The implication is that we can expect an overcrowding of the online economy by small players in the South, especially as internet connectivity expands among LDCs.

3.4 Market Opportunity

The question remains whether the size of the online economy can sustain a large influx of newly-connected workers from the Global South. First, it is useful to set some benchmarks. One logical aim of economic development is to raise national incomes to the middle-income category, presently a threshold of $1,045 per capita per annum.[167] By identifying the gap in incomes for 26 LDCs below that threshold and factoring in population, the gulf stands at $195 billion each year for a cohort with 2.75% annualized population growth.[168] That goal would be a highly optimistic target. Another comparative benchmark would be the present value of goods exported from those countries, or what I estimate at approximately $45 billion.[169] These numbers provide us with rough guideposts for understanding the scale of the online economy in comparative perspective.

By assessing market scale, we simultaneously sharpen our definition of the market itself. This can be applied to usages of the terms 'online economy' and 'digital economy'

[167] World Bank, "New Country Classifications," Accessed May 17, 2016. <http://data.worldbank.org/news/new-country-classifications-2015>.
[168] Author's own calculations using data from the World Bank's 2014 World Development Indicators database. Economies assessed include: Afghanistan, Benin, Burkina Faso, Burundi, Cambodia, CAR, Chad, Comoros, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Liberia, Madagascar, Malawi, Mali, Mozambique, Nepal, Niger, Rwanda, Sierra Leone, Tanzania, Togo and Uganda. Population growth is weighted and annualized over five years.
[169] The figure is $43.2 billion excluding CAR, Chad and Eritrea, then adjusted by the same ratio of their collective populations to those of the larger group. This is only intended to be a rough estimation.

throughout the thesis. I begin with a proprietary report compiled by *Staffing Industry Analysts* (*SIA*) that studied over 250 infomediaries in the online economy. *SIA* segments the 'human cloud' into four categories - online staffing, freelancer management systems, online services and crowdsourcing. We exclude job boards as they do not involve the completion of work tasks. Additionally, I only refer to figures relevant to *remote* work.[170]

Online staffing (e.g, *UpWork, Freelancer, Zhubajie*) involves a direct legal relationship between purchaser and worker, typically a one-to-one relationship. There is also a nascent freelancer management segment growing out of this market (e.g., *UpWork Enterprise*, *Gigwalk Enterprise*) that offers corporations and large firms a management platform for their distributed workers, which may include freelancers but also consultants and nontraditional employees. The remote segment of the combined online staffing market is estimated at $2.22-2.78 billion for the year 2014. [171]

Online services (e.g., *LiveOps*, *Handy*, *One Hour Translation*) feature teams of freelancers assembled by the provider to carry out specialized services such as coding or translation. The remote segment of this market is estimated at $0.28-0.60 billion. Crowdsourcing, estimated at $0.26 to 0.45 billion, involves disaggregating tasks to a 'crowd' of paid or otherwise incentivized workers, either through piecemeal compensation (e.g., *Amazon Mechanical Turk*, *CrowdFlowe*r) or a challenge model (e.g., *GigBucks*, *Challenge.gov*). [172] There is a similar Chinese 'witkey' model (e.g., *WitKey*, *Taskcn*, *K68*) where complex tasks are assigned monetary incentives for challenge winners. Even low-

[170] Francis, "Human Cloud Landscape."
[171] Ibid.
[172] Ibid.

value incentives are found to garner a high response rates, with the number of responses uncorrelated to the number of proposals submitted.[173]

The report estimates the total remote 'human cloud' segment at $2.76 to 3.83 billion in 2014 expenditure, with $1.77 billion coming from the top one dozen firms. [174] Although *SIA* describes the sector as growing, "still in its infancy," and durable to swings in venture capital investment,[175] even their highest estimates value the market at a paltry 8.4% of my estimates for exports from the 26 LDCs below the medium-income threshold. Furthermore, considering competition and structural challenges, it is unlikely that those funds would accrue heavily to LDCs relative to other countries.

Yet another, larger segment of the digital economy – mobile applications – consists of entrepreneurship rather than hired labor. For that, I turn to a report by *Caribou Digital* which anticipates rapid growth in the global app economy. This market is priced at $17 billion from Apple and Google stores in 2014 which, their headquarters located just nine miles apart, comprise 97% of total market share. Therefore we can adjust the total to $17.5 billion for direct revenue alone, excluding $42 billion in mobile advertisements.[176]

However an estimated 95% of value is captured by the top ten countries, with more than 80% of developers in high-income economies. There is also a 'superstar' effect. The report captures this inequality between the US and the Philippines:

[173] Jiang Yang, Lada Adamic and Mark Ackerman, "Competing to Share Expertise: the Taskcn Knowledge Sharing Community," *Proceedings of the Second International Conference on Weblogs and Social Media*. (March/April 2008): 161-168.
[174] Francis, "Human Cloud Landscape."
[175] Yang, Adamic and Ackerman, "Competing to Share Expertise," 161-168.
[176] Pon, *Winners & Losers in the Global App Economy*.

> The #300-ranked app in the Philippines might earn only 1% as much as the #1-ranked app, yet that #1-ranked app in the Philippines might only earn 1% as much as the #1-ranked app in the United States.[177]

The challenges for low-income countries begin with the fact that domestic markets do not offer enough revenue to serve as a springboard for international competition. Globally, many aspiring apps begin in the smaller pond of domestic app stores where developers can deploy linguistic and cultural advantages to gain an initial footing. In these economies, apps are often shared offline using USB cables to avoid costs and data charges. Two-thirds of developers among lower-income economies report being unable to export, compared with only 3% in the US. This low-revenue environment, being ill-equipped to sustain incubation, functions as a domestic market trap.[178] Even worse, my own research shows that *every single LDC except for Yemen* is restricted from registering for Google merchant accounts which are needed to collect revenue,[179] perhaps due to regulatory challenges and low market potential that discourages pursuing country-level agreements where legacy systems may require major overhauls. This extend to subsidiaries such as *YouTube* as well.

The figures above do not incorporate contract app development, third-party services, brand revenue and the individual firms and entrepreneurs working through direct relationships rather than infomediaries. In the rise of Indian outsourcing, direct contact with 'non-resident Indians' routed many contracts through to communities of origin.[180] Similar diasporic activity remains to be studied in earnest among LDCs, many of which have

[177] Ibid., 12.
[178] Ibid.
[179] *Google*, "Supported locations for developer & merchant registration," Accessed May 21, 2016. <http://support.google.com/googleplay/android-developer/table/3539140>.
[180] Rafiq Dossani and Martin Kenney, "'Lift and Shift': Moving the Back Office to India," *Information Technologies and International Development* 1, no. 2 (Winter 2003): 21-37. The 2013 Indian migrant stock was only 1.1% of the population but its size permits wider access to foreign market opportunities.

substantial migrant stocks as shown in Table 7 below. Additionally, KPMG valued the 2013 global outsourcing industry at $952 billion and much of that work may still digitize.[181] However the approximately $60 billion market presented, even if it grows rapidly, is not accruing substantially to low-income countries. To quote sociologist Manuel Castells, "The information age does not have to be the age of stepped-up inequality, polarisation and social exclusion. But for the moment it is."[182]

Table 7: Migrant Stocks in LDCs as Share of Total Population [183]

Country	Migrants	Share	Country	Migrants	Share
Tuvalu	3,880	39%	Bangladesh	7,572,135	5%
Sao Tome & Princ.	36,115	20%	Benin	486,756	5%
Laos	1,294,218	20%	Gambia	70,966	4%
Somalia	1,920,875	19%	Senegal	540,363	4%
Afghanistan	5,632,196	18%	Burundi	378,797	4%
Equatorial Guinea	126,069	16%	Mauritania	136,270	4%
Lesotho	323,988	16%	Guinea	398,475	3%
Comoros	111,182	15%	Vanuatu	8,408	3%
Haiti	1,377,674	13%	Rwanda	345,824	3%
Bhutan	90,797	12%	Chad	403,850	3%
Burkina Faso	1,642,594	10%	Mozambique	727,389	3%
Liberia	370,453	9%	Angola	518,711	2%
Eritrea	387,410	8%	South Sudan	759,057	2%
Cambodia	1,118,878	7%	DRC	1,306,026	2%
CAR	342,019	7%	Malawi	287,469	2%
Nepal	1,986,203	7%	Djibouti	14,888	2%
Togo	461,101	7%	Niger	290,330	2%
Myanmar	3,139,596	6%	Zambia	231,208	2%
Sierra Leone	336,003	5%	Uganda	406,193	1%
Mali	895,684	5%	Ethiopia	749,139	1%
Guinea-Bissau	91,216	5%	Madagascar	166,886	1%
Yemen, Rep.	1,268,940	5%	Solomon Islands	3,044	1%
Kiribati	5,367	5%	Tanzania	250,086	0%

[181] Phil Ferscht and Jamie Snowdon, "State of the Outsourcing Industry 2013: Executive Findings," *KPMG*. April 2013. <http://bit.ly/1GGxHi3>.
[182] Manuel Castells, "An Introduction to the Information Age," *City* 2, no. 7 (2007): 7.
[183] Migration and Remittances Factbook 2016, which includes new bilateral data on migration stocks", World Bank (www.worldbank.org/prospects/migrationandremittances).

3.5 Economic Impact

The World Bank writes that broadband "deserves a central role in country development and competitiveness strategies,"[184] however, while its researchers are careful to note limitations in detailed reports, their statistical findings from countries in the Global North are often loosely appropriated. For example, several studies were summarized to estimate spillover effect of broadband installation jobs, estimating that each position led to 2.5-4.0 new jobs. However the studies only considered Germany, Switzerland, the United Kingdom and the United States.[185] Similarly, in a report entitled *Transforming Arab Economies*, World Bank scholars assert that 75% of the internet's benefits are captured by the 'analog' economy.[186] However this is based on a *KPMG* survey that examined twelve economies, almost entirely from the Global North. None are Arab economies.[187]

This is not to dismiss economic impacts of digital development, but rather to question the practice of relying on statistics from the North in promoting the strategy. There is a similar need to be modest and transparent about how data is derived. The World Bank published that developing countries see "about a 1.38% increase for each 10% increase in penetration."[188] However this was based on an unpublished paper; while I could not obtain the original data, the International Telecommunication Union found that the figure was

[184] Christine Qiang, Carlo Rossotto and Kaoru Kimura, "Economic Impacts of Broadband," in *Information and Communications for Development: Extending Reach and Increasing Impact* (Washington, DC: IBRD/World Bank, 2009), 35.
[185] Tim Kelly and Carlo Rossotto, *Broadband Strategies Handbook*, Washington, DC: IBRD/World Bank, 2012), 9.
[186] World Bank, *Transforming Arab Economies: Towards Knowledge and Innovation-Driven Development Strategies*, (Washington, DC: IBRD/World Bank, 2014), 98.
[187] Matthieu du Rausas, et al., *Internet matters: The Net's sweeping impact on growth, jobs, and prosperity* (New York: McKinsey & Co., 2011), 53. Those economies include Canada, China, France, Germany, India, Italy, Japan, Russia, South Korea, Sweden the UK, and the US.
[188] The World Bank, *Information and Communications for Development: Extending Reach and Increasing Impact* (Washington, DC: IBRD/World Bank, 2009), 45.

greatly overestimated, failing to control for where countries were located.[189] These and other studies demonstrate that the current state of knowledge does not adequately address low-income countries, particularly LDCs. What is more concerning is that this is not widely acknowledged.

For independent evidence, I conduct a simple regression analysis in Table 8 below to test for the impact of changes in connectivity on GNI per capita over time, as used in my prior quantitative examinations. We should expect to see a link between the variables if connectivity does in fact lead to growth. The limitations described in chapter two still apply, and admittedly the sample size for LDCs is only 37-38 countries. Yet the correlation observed for the world population does not extend to LDCs. This calls into question the very premise of digital development as an economic growth engine. More empirical research is needed to confirm or challenge the validity of this evidence.

Table 8: Internet Connectivity and Income Per Capita

	R Square	*Adjusted R*	*Observations*	*Coefficient GNI p.c.*
World, '05-'10	0.0798	0.0743	169	***1.8592
World, '10-'14	0.0630	0.0569	158	*1.3877
LDCs, '05-'10	0.0171	-0.0102	38	0.8643
LDCs, '10-'14	0.0549	0.0279	37	1.4512
		* p < 0.05	** p < 0.01	*** p < 0.001

[189] International Telecommunication Union (ITU), *Impact of Broadband on the Economy: Research to Date and Policy Issues* (Geneva: ITU, 2012), 5.

Conclusion

This thesis comparatively explored 'digital development' as an alternative macroeconomic paradigm to export-led growth (ELG) for least-developed countries (LDCs). While not rejecting ELG, I raised questions as to its generalizability from a limited number of empirical cases, and on the influence of ideological and political factors. I also recognized structural impediments inhibiting LDCs from successfully achieving ELG.

After exploring four contours of how the internet can be conceptualized as an economic force, several lessons emerged. Industrial revolutions before the digital age displayed growth only in sectors closely related to technological change, while gains in productivity and employment growth occurred much later. Similarly, general purpose technologies have been marked by decades-long lags in productivity growth. Should the internet align with either category, it would be difficult to pinpoint precisely when such benefits would be expected to accrue. This renders any definitive pessimism as to the long-term economic impacts of digital development premature.

Additionally, we can gather that the near-total elimination of communication costs functions to reinforce clusters of commerce and power, deepening geographies of inequality, even as new possibilities for economic development are created. Global connectivity may be expanding access for small players in LDCs by making international communication harder to govern through traditional political borders, yet even these interactions are not immune to many formal and informal institutional factors.

After assessing the value of digital development as an alternative paradigm using five criteria in reference to LDCs, the results do not lend much credence to optimism. Trade

dependency on the North persists within the largest online labor market, while overcrowding will likely continue to be a challenge. Instead, Asian LDCs that are able to industrialize may find entry points into regional production networks and, potentially, increased Chinese and Indian demand. However lower barriers to entry provide a compelling motive for landlocked and geographically-remote LDCs, especially those far from Asian centers of agglomeration.

In assessing the scale of the digital economy, aggregate valuations appear to be larger than those of existing goods exported by the lowest-income LDCs, and growing. Yet that wealth is not accruing to LDCs in compelling magnitudes, and a lack of global *financial* connectivity locks nearly all LDCs out of major digital business segments, curtailing their opportunities relative to competitors who lack such constraints.

The internet may provide social goods, access to new markets and enhanced competitiveness in the 'analog' economy. It may well be a general purpose technology ushering in a new industrial revolution. Who knows what the long-run will bring should network effects increase returns to connectivity in the South, especially as LDCs cross new thresholds of access and human capital adapts at the national and microeconomic level?

Moreover, it is possible that policymakers have yet to identify effective paths to implementation for digital development, or that the decade when it takes off in earnest for LDCs has yet to arrive. Besides, highly-connected and steadfast leaders within the pack, such as Rwanda and Bhutan, could be explored independently; I make no claim to dismiss digital development as a strategy for all 48 individual LDC economies. It may even be that island nations like Tuvalu or São Tomé and Príncipe will benefit from proportionally-high

numbers of citizens overseas, or Afghanistan and Bangladesh will gain from millions of non-resident nationals opting to send work back to their communities of origin.

That said, it does not appear that digital development is today a suitable alternative to export-led growth for the bulk of least-developed countries, even if many small firms may carve out modest shares of the pie. While I see digital development as more resilient to state deficiencies than export-led growth, both are subject to perpetuating trade dependence on the North while leading to 'beggar-thy-neighbor' competition in the South. More importantly, the market share is simply not large enough to sustain growth for many nations simultaneously. This does not appear likely to change in the medium-term.

In lieu of 'great leaps' of technological investment, I suggest that governments consider three low-hanging policies so that citizens have a better chance of digital-economic inclusion even if digital development does not feature prominently as a bedrock of national economic policy. This includes reducing regulatory burdens on electronic commerce, opening telecommunications markets to competition to drive better conditions for consumers, and gradually mandating infrastructure-sharing so that service providers are not duplicating connection lines at the local level.

The critical takeaway of the thesis is that LDCs cannot confidently proceed with digital development based on the statistics and figures commonly cited. More research is needed to assess the subcategories and country cases that may yet benefit from digital development as a primary strategy. Until then, digital development should be subsumed as part of a broader, balanced approach, equal among a plethora of other economic priorities. There are 48 least-developed countries seeking what Walt Whitman Rostow would have called 'takeoff.' The emerging economic common sense just might be leading them astray.

Bibliography

Abbate, Janet. "Government, Business, and the Making of the Internet." *The Business History Review* 75,no. 1 (Spring 2001): 147-176.

Abramson, Bruce. *Digital Phoenix: Why the Information Economy Collapsed and How It Will Rise Again* (Cambridge, MA: MIT, 2006).

Agénor, Pierre-Richard. "Fiscal Policy and Endogenous Growth with Public Infrastructure." *Oxford Economic Papers* 60, no. 1 (January 2008): 57-87.

Akın, Çiğdem and Ayhan Kose. "Changing Nature of North-South Linkages: Stylized Facts and Explanations." IMF Working Paper 07/280 (December 2007).

Ang, James, Jakob Maden and Peter Robertson. "Export Performance of the Asian Miracle Economies: The Role of Innovation and Product Variety." *Canadian Journal of Economics* 48, no. 1 (February 2015): 273-309.

Arslan, Ismail and Sweder van Wijnbergen. "Export Incentives, Exchange Rate Policy and Export Growth in Turkey." *The Review of Economics and Statistics* 75, no. 1 (Feb 1993): 128-133.

Avgerou, Chrisanthi. "The link between ICT and economic growth in the discourse of development." In *Organizational Information Systems in the Context of Globalization*, eds. Mikko Korpela, Ramiro Montealegre and Angeliki Poulymenakou (New York: Springer, 2003): 373-386.

Banga, Rashmi and Dinesh Kumar. "Can China and India be Growth Drivers for Developing Asia?" *European Journal of Development Research* 25, no. 3 (2013): 367-384.

Bannister, Frank and Regina Connolly. "Defining e-Governance." *e-Service Journal* 8, no. 2 (Winter 2012): 3-25.

Bell, Daniel. *The Coming of Post-Industrial Society: A Venture in Social Forecasting* (New York: Harper, 1974).

———. "The third technological revolution: and its possible socioeconomic consequences." *Dissent* 36, no. 2 (1989): 164-176.

Bisht, Shailendra, Vishal Mishra and Sanjay Fuloria. "Measuring Accessibility for Inclusive Development: A Census Based Index." *Social Indicators Research* 98, no. 1 (August 2010): 167-181.

Blecker, Robert and Arslan Razmi. "Export-led Growth, Real Exchange Rates and the Fallacy of Composition." In *Handbook of Alternative Theories of Economic Growth*, ed. Mark Setterfield (Cheltenham, UK: Edward Elgar, 2010): 379-396.

Bowles, Samuel, Steven Durlauf and Karla Hoff (eds.) *Poverty Traps* (Princeton: Princeton, 2006).

Bresnahan, Timothy and Manuel Trajtenberg. "General Purpose Technologies: 'Engines of Growth?'" NBER Working Paper 4148 (August 1992).

Buzan, Barry, Ole Wæver and Jaap de Wilde. *Security: A New Framework for Analysis* (London: Lynne Rienner, 1998).

Cairncross, Frances. *The Death of Distance: How the Communications Revolution Will Change Our Lives* (Boston: HBS, 1997).

Calhoun, Mikelle. "Unpacking the liability of foreignness: identifying culturally driven external and internal sources of liability for the foreign subsidiary." *Journal of International Management* 8, no. 3 (2002): 301–321.

Carlaw, Kenneth and Richard Lipsey. "Externalities, technological complementarities and sustained economic growth." *Research Policy* 31, no. 8/9 (2002): 1305-1315.

Castells, Manuel. "An Introduction to the Information Age." *City* 2, no. 7 (2007): 6-16.

Chang, Ha-Joon. *Kicking Away the Ladder: Development Strategy in Historical Perspective* (New York: Anthem, 2003).

Choucri, Nazli. *Cyberpolitics in International Relations* (Cambridge, MA: MIT, 2012).

Chui, Michael, Paul Levine, Syed Murshed and Joseph Pearlman. "North-South Models of Growth and Trade." *Journal of Economic Surveys* 16, no. 2 (December 2002), 123-165.

Clark, Ian. *Globalization and International Relations Theory* (New York: Oxford University, 1999).

Clarke, George, Christine Qiang and Lixin Xu. "The Internet as a General-Purpose Technology: Firm-Level Evidence from around the World." *World Bank*. Policy Research Working Paper 7192 (February 2015).

Collier, Paul. *The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done About It* (Oxford: Oxford University, 2007).

Crandall, Robert. “Broadband Communications.” In *Handbook of Telecommunications Economics, Vol. 2*. eds. Sumit Majumdar, Ingo Vogelsang and Martin Cave (Amsterdam: Elsevier, 2005): 156-191.

Cypher, James. “Developing Disarticulation within the Mexican Economy.” *Latin American Perspectives* 28, no. 3 (May 2001), 12.

Cypher, James and James Dietz. "Strategy switching and industrial transformation," In *The Process of Economic Development, 3rd ed*. (New York: Routledge, 2009): 308-340.

David, Paul. "The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox." *The American Economic Review* 80, no. 2 (May 1990): 356-357.

Dossani, Rafiq and Martin Kenney. "'Lift and Shift': Moving the Back Office to India." *Information Technologies and International Development* 1, no. 2 (Winter 2003): 21-37.

Dowd, Douglas (ed.). *Understanding Capitalism: Critical Analysis from Karl Marx to Amartya Sen* (Sterling, VA: Pluto, 2002).

Easterly, William. “Reliving the 1950s: the big push, poverty traps, and takeoffs in economic development.” *Journal of Economic Growth* 11, no. 4 (December 2006): 289-318.

The Economist. “Elementary, my dear Watson: How information technology can boost economic growth.” September 21, 2000. Accessed May 4, 2016. <http://www.economist.com/node/375504.>

Erber, Georg and Aida Sayed-Ahmed. “Offshore Outsourcing: A Global Shift in the Present IT Industry.” *Intereconomics* 40, no. 2 (March/April 2005): 100-112.

Ferscht, Phil and Jamie Snowdon. "State of the Outsourcing Industry 2013: Executive Findings." *KPMG*. April 2013. <http://bit.ly/1GGxHi3>.

Fosu, Augustin. "The Impact of External Debt on Economic Growth in Sub-Saharan Africa." *Journal of Economic Development* 21, no. 1 (June 1996): 93-118.

Francis, David. "Human Cloud Landscape: 2015 Update." Confidential Report. *Staffing Industry Analysts*. July 22, 2015.

Frankel, Jeffrey. “Globalization of the Economy.” In *Governance in a Globalizing World*. Joseph Nye and John Donahue (eds.) (Washington, DC: Brookings, 2005): 45-71.

Frieden, Jeffrey. *Global Capitalism: Its Fall and Rise in the Twentieth Century* (New York: WW Norton, 2006).

Gereffi, Gary. "Shifting Governance Structures in Global Commodity Chains, with Special Reference to the Internet." *American Behavioral Scientist* 44, no. 10 (June 2001): 1616-1637.

Goldin, Ian. "Evolution of Development Thinking." In *The Princeton Encyclopedia of the World Economy, Vol I*. eds. Reinert, Kenneth, Ramkishen Rajan, Amy Glass and Lewis Davis. (Princeton: Princeton University, 2009): 366-373.

Google. "Supported locations for developer & merchant registration." Accessed May 21, 2016. <http://support.google.com/googleplay/android-developer/table/3539140>.

Greenstein, Shane. "Internet Infrastructure." In The Oxford Handbook of the Digital Economy. eds. Martin Peitz and Joel Waldfogel (New York: Oxford, 2013): 3-33.

Gruber, Michael. "Digital Archaeology." *Wired Magazine* 1, no. 5 (May 1993): 114.

Harriss, John. "Development Theories," In *International Development: Ideas, Experience, and Prospects*. eds. Bruce Currie-Alder et al. (Oxford: Oxford University, 2014): 35-49.

Hartwell, Ronald. *The Industrial Revolution and Economic Growth* (London: Methuen & Co, 1971).

Headrick, Daniel. "Information and Communication Technology." In *The Oxford Encyclopedia of Economic History, Vol. I*. ed. Joel Mokyr (New York: Oxford University Press, 2003): 70-77.

Hollingsworth, Rogers. "Doing institutional analysis: implications for the study of innovations." *Review of International Political Economy* 7, no. 4 (2000): 595–644.

Holt, Robert. *Radio Free Europe* (Minneapolis: University of Minnesota, 1958).

Hortaçsu, Ali, Asís Martínez-Jerez and Jason Douglas. "The Geography of Trade in Online Transactions: Evidence from eBay and MercadoLibre." *American Economic Journal: Microeconomics* 1, no. 1 (February 2009): 53-74.

Hymer, Stephen. *The International Operations of National Firms: A Study of Direct Foreign Investment* (Cambridge, MA: MIT, 1976).

International Telecommunication Union, *Impact of Broadband on the Economy: Research to Date and Policy Issues* (Geneva: ITU, 2012).

Janelle, Donald. "Measuring Human Extensibility in a Shrinking World." *The Journal of Geography* 72, no. 5 (May 1973): 8-15.

Javid, Attiya and Umaima Arif. "Analysis of Revenue Potential and Revenue Effort in Developing Asian Countries." *The Pakistan Development Review* 51, no. 4 (Winter 2012): 365-379.

Jovanovic, Boyan and Peter Rousseau. "General Purpose Technologies," In *Handbook of Economic Growth, Vol 1B*, eds. Philippe Aghion and Steven Durlauf (Warsaw: Elsevier, 2005): 1182-1224.

Kauffman, Robert and Ajay Kumar. "Impact of Information and Communication Technologies on Country Development: Accounting for Area Interrelationships." *International Journal of Electronic Commerce* 13, no. 1 (Fall 2008): 11-58.

Kelly, Tim and Carlo Rossotto. *Broadband Strategies Handbook*, Washington, DC: IBRD/World Bank, 2012).

Keohane, Robert. "Governance in a Partially Globalized World." *American Political Science Review* 95, no. 1 (March 2001): 1-13.

Kogut Bruce (ed.). *The Global Internet Economy* (Cambridge, MA: MIT, 2003).

Kongaut, Chatchai, Ibrahim Kholilul and Erik Bohlin. "The economic impact of broadband speed: Comparing between higher and lower income countries." *European Investment Bank Institute*. Sept 2014.

Kose, Ayhan, Christopher Ortrok and Eswar Prasad. "Global Business Cycles: Convergence or Decouple?" *International Economic Review* 53, no. 2 (May 2012): 511-538.

Krugman, Paul and Anthony Venables. "Globalization and the Inequality of Nations." Industriens Utredningsinstitut Working Paper 430 (1995).

Kuznetsov, Andrei and Olga Kuznetsova. "Building professional discourse in emerging markets: language, context and the challenge of sensemaking." *Journal of International Business Studies* 45, no. 5 (2014): 583–599.

Lehdonvirta, Vili, Helena Barnard, Mark Graham and Isis Hjorth. "Online labour markets – leveling the playing field for international service markets?" Paper presented at Internet, Policy and Politics Conference (Oxford). September 2014.

Lepgold, Joseph. "Is Anyone Listening? International Relations Theory and the Problem of Policy Relevance." *Political Science Quarterly* 113, no. 1 (Spring 1998): 43-62.

Lepgold, Joseph and Miroslav Nincic. *Beyond the Ivory Tower: International Relations Theory and the Issue of Policy Relevance* (New York: Columbia University, 2001).

Liu, Runjuan, Dorothee Feils and Barry Scholnick. "Why are different services outsourced to different countries?" *Journal of International Business Studies* 42, no. 5 (2011): 558-571.

Main, Linda. "The global information infrastructure: empowerment or imperialism?" *Third World Quarterly* 22, no. 1 (2001): 83-97.

Malecki, Edward and Hu Wei. "A Wired World: The Evolving Geography of Submarine Cable and the Shift to Asia." *Annals of the Association of American Geographers* 99, no. 2 (Apr 2009): 360-382.

Malone, Thomas and Robert Laubacher. "The Dawn of the E-Lance Economy." *Harvard Business Review* 76, no. 5 (Fall 1998): 144-53, 189.

Mbele, Lerato. "Why M-Pesa failed in South Africa." *BBC News*. Accessed May 19, 2016. May 11, 2016. <http://www.bbc.com/news/world-africa-36260348>.

de Michelis, Andrea, Marcello Estevão, and Beth Wilson. "Productivity or Employment: Is It a Choice?" IMF Working Paper 13/97 (May 2013).

Mokyr, Joel. "Industrial Revolution." In *The Oxford Encyclopedia of Economic History, Vol. I*. ed. Joel Mokyr (New York: Oxford University Press, 2003): 49-56.

Mueller, Milton. *Networks and States: The Global Politics of Internet Governance* (Cambridge, MA: MIT Press, 2010).

North, Douglass. *Institutions, Institutional Change and Economic Performance* (New York: Cambridge University, 1990).

Nye, Joseph. "The Information Revolution and the Paradox of American Power." *Proceedings of the American Society of International Law* 97 (April 2003): 67-75.

Ozawa, Terutomo, Sergio Castello and Ronnie Phillips. "The Internet Revolution, the 'McLuhan' Stage of Catch-up, and Institutional Reforms in Asia." *Journal of Economic Issues* 35, no. 2 (June 2001): 289-298.

Paldam, Martin. "Economic freedom and the success of the Asian tigers: an essay on controversy." *European Journal of Political Economy* 19, no. 3 (September 2003): 453–477.

Palley, Thomas. "The Rise and Fall of Export-Led Growth." *Investigación Económica* 72, no. 280 (2012): 141-161.

Peña-López, Ismael. *Measuring Digital Development for Policy-making: Models, Stages, Characteristics and Causes*. PhD dissertation, Universitat Oberta De Catalunya, 2009.

Peterson, Andrea. "Researchers say U.S. Internet traffic was re-routed through Belarus. That's a problem." *The Washington Post*. November 20, 2013. Accessed May 19, 2016. <http://wapo.st/1YFrCY6>.

Pon, Bryan. *Winners & Losers in the Global App Economy* (Farnham, UK: Caribou Digital, 2016).

Prince, Matthew. "The Relative Cost of Bandwidth around the World." CloudFlare Blog. Posted 26 Aug 2014. Accessed Feb 7, 2016. <https://blog.cloudflare.com/the-relative-cost-of-bandwidth-around-the-world>

Pritchett, Lant, Michael Woolcock, and Matt Andrews. "Capability Traps? The Mechanisms of Persistent Implementation Failure." *Center for Global Development* Working Paper 234 (December 2010).

Qiang, Christine, Carlo Rossotto and Kaoru Kimura. "Economic Impacts of Broadband." in *Information and Communications for Development: Extending Reach and Increasing Impact* (Washington, DC: IBRD/World Bank, 2009).

du Rausas, Matthieu, James Manyika, Eric Hazen, Jacques Bughin, Michael Chui and Rémi Said. *Internet matters: The Net's sweeping impact on growth, jobs, and prosperity* (New York: McKinsey & Co., 2011).

Rieger, Bernhard. "The 'Good German' Goes Global: The Volkswagen Beetle as an Icon in the Federal Republic." *History Workshop Journal* 68, no. 1 (Autumn 2009), 3-26.

Rist, Gilbert, *The History of Development: From Western Origins to Global Faith* (London: ZED, 1997).

Roberts, Geoffrey. "History, Theory and the Narrative Turn in IR." *Review of International Studies* 32, no. 4 (October 2006): 703-714.

Robinson, Joan. "Beggar-my-neighbour remedies for unemployment." *In Essays in the Theory of Employment* (London: Macmillan, 1937): 210-230.

Robison, Kristopher and Edward Crenshaw. "Post-Industrial transformations and cyber-space: a cross-national analysis of Internet development." *Social Science Research* 31, no. 3 (2002): 334-363.

Rodrik, Dani. "King Kong Meets Godzilla: The World Bank and The East Asian Miracle." CEPR Discussion Paper 944 (April 1994), summary.

Rosen, Rebecca. "'Time and Space Has Been Completed Annihilated': Tech writing from an earlier era." *The Atlantic*. February 14, 2012. http://theatln.tc/1SHPjLd (Accessed December 26, 2015).

Rosenberg, Nathan. *Inside the Black Box Technology and Economics* (Cambridge: Cambridge University, 1982).

Rostow, Walt. *The Stages of Economic Growth: A Non-Communist Manifesto* (Cambridge: Cambridge University, 1960).

Sachs, Jeffrey. *The End of Poverty: Economic Possibilities for Our Time* (New York: Penguin, 2005).

Schrank, Andrew. "Foreign Investors, 'Flying Geese,' and the Limits to Export-Led Industrialization in the Dominican Republic," *Theory and Society* 32, no. 4 (August 2003): 415-443.

Selwyn, Neil. "Reconsidering Political and Popular Understandings of the Digital Divide." *New Media & Society* 6, no. 3 (2004): 341-362.

Shafer, Michael. *Winners and Losers: How Sectors Shape the Development Prospects of States* (Ithaca: Cornell University, 1994).

Shapiro, Carl and Hal Varian. *Information Rules: A Strategic Guide to the Network Economy* (Harvard Business Press, 1999).

Silvey, Rachel and Katharina Rankin. "Development geography: Critical development studies and political geographic imaginaries." *Progress in Human Geography* 35, no. 5 (2010): 696-704.

Smith, Adam. *The Wealth of Nations* (1776).

Smith, Bradford. "The Third Industrial Revolution: Law and Policy for the Internet." *Recueil Des Cours* 282 (2001): 229-464.

Solow, Robert. "We'd Better Watch Out." *The New York Times*, July 12, 1987, p. 36.

Steinberg, Philip and Stephen McDowell. "Global Communication and the post-statism of cyberspace: a spatial constructivist view." *Review of International Political Economy* 10, no. 2 (May 2003): 196-221.

Stiglitz, Joseph. "Some Lessons from the East Asian Miracle," *Research Observer* 11, no. 2 (August 1996): 151-177.

Talero, Eduardo and Philip Gaudette. *Harnessing Information for Development* (Washington, DC: IBRD/World Bank, 1996).

TeleGeography. "IP Transit Pricing Trends." *Global Internet Geography*. Accessed May 5, 2016.

Toussaint, Eric. "South Korea: The Miracle Unmasked." *Economic and Political Weekly* 41, no. 39 (Fall 2006): 4211-4219..

Tracy, Noel, Thomas Chan and Zhu Wenhui. *China's Export Miracle: Origins, Results and Prospects* (London: Palgrave, 1999).

United Nations. *Core ICT Indicators: Partnership on Measuring ICT for Development* (~2006) <http://bit.ly/1hVw8dG>.

UpWork. "Online Work Report." Accessed May 15, 2016. <http://elance-odesk.com/online-work-report-global>.

Veltmeyer, Henry (ed.). *The Critical Development Studies Handbook: Tools for Change* (Halifax: Fernwood Publishing, 2011).

Wade, Robert. "What strategies are viable for developing countries today? The World Trade Organization and the shrinking of 'development space.'" *Review of International Political Economy* 10, no. 4 (November 2003): 621-644.

Waldon, Tracy and James Lande. "Reference Book of Rates Price Indices and Household Expenditures for Telephone Service." *Federal Communications Commission* (March 1997).

Wallerstein, Immanuel. *The Capitalist World-Economy* (Washington, DC: Cambridge, 1979).

Warf, Barney. "Geographies of global telephony in the age of the internet." Geoforum 45 (2013): 219-229.

———. "Telecommunications and Economic Space." In *A Companion to Economic Geography*. Eric Sheppard and Trevor Barnes (eds.). (Oxford: Blackwell, 2000): 484-498.

Watkins, Melville. "A Staple Theory of Economic Growth." *The Canadian Journal of Economics and Political Science* 29, no. 2 (May 1963): 141-158.

Wong, Poh-Kam. "Leveraging the Global Information Revolution for Economic Development: Singapore's Evolving Information Industry Strategy." *Information Systems Research* 9, no. 4 (December 1998): 323-341.

World Bank. "Country and Lending Groups." Accessed May 15, 2016. http://bit.do/b2tsa.

———. *Information and Communications for Development: Extending Reach and Increasing Impact* (Washington, DC: IBRD/World Bank, 2009).

———. "New Country Classifications." Accessed May 17, 2016. <http://data.worldbank.org/news/new-country-classifications-2015>.

———. *Transforming Arab Economies: Towards Knowledge and Innovation-Driven Development Strategies* (Washington, DC: IBRD/World Bank, 2014).

———. *World Development Indicators Database*. Accessed May 12, 2016. <http://data.worldbank.org/data-catalog/world-development-indicators>.

———. *World Development Report: Digital Dividends* (Washington, DC: IBRD/World Bank, 2016).

———. "Worldwide Governance Indicators, 2015." Published September 25, 2015. <http://www.govindicators.org>.

Yang, Jiang, Lada Adamic and Mark Ackerman. "Competing to Share Expertise: the Taskcn Knowledge Sharing Community." *Proceedings of the Second International Conference on Weblogs and Social Media*. (March/April 2008): 161-168.

Y-Charts. "US E-Commerce Sales as Percent of Retail Sales Summary." Accessed May 5, 2016. http://bit.ly/1VKPA63.

Yen, Alfred. "Western Frontier or Feudal Society? Metaphors and Perceptions of Cyberspace." *Berkeley Technology Law Journal* 17, no. 4 (Fall 2002): 1207-1263.

Zaheer, Srilata. "Overcoming the Liability of Foreignness." *Academy of Management Journal* 38, no. 2 (April 1995): 341-363.

Ziai, Aram. "The discourse of 'development' and why the concept should be abandoned." *Development in Practice* 23, no. 1 (2013): 123-136.

Zook, Matthew. "'Grounded Capital: Venture Financing and the Geography of the Internet Industry 1994–2000.'" *Journal of Economic Geography* 2, no. 2 (2002): 151–177.

Appendix: Guide to Internet Consumption Per Capita

In chapter two, I offered a new measure of internet connectivity. An entire PhD dissertation could be devoted to the different ways in which connectivity is measured; indeed, such a dissertation already exists.[190] Nearly all measurement approaches are indices, meaning that they collect a basket of basic indicators and weigh them to create country-level scores and rankings. These are helpful for policymakers to make sense of countries in a broader comparative sense and to visualize gaps at the country-level. They also guide researchers in studying which factors complement or subvert connectivity from achieving a desired outcome. Despite the potpourri of indices, however, very little effort is directed at innovating on, rather than reweighting, the basic measurements underneath.

My approach, what is referred to as 'internet consumption per capita,' is explained in the body of the thesis using the analogy of electricity. Readers new to the subject will benefit from a 'bridge' explanation that, while outside the substance of the thesis, may help to more intuitively understand what the new measure actually does and does not achieve, and why. This appendix is supplemental to the thesis, attempting to provide additional clarity to a non-technical reader.

Most existing studies define internet access or usage by the percentage of people who have used (or, in the case of internet access, *could have used*) the internet at any point, through any medium and for any length of time in the prior twelve months. This indicator

[190] Ismael Peña-López, *Measuring Digital Development for Policy-making: Models, Stages, Characteristics and Causes*, PhD disseration, Universitat Oberta De Catalunya, 2009.

has found its way into many national broadband strategies in the parlance of 'universal access.' However *universal* access does not mean *useful* access.

There are country cases (e.g., Malaysia) where telecom CEOs have expressed to policymakers that broader access at an equal price can actually deplete the level of service for a network. Although it has become cheaper to increase total network capacity, the amount of data demanded by each user is increasing as well.[191] In the 1990s, for instance, live web video consisted of one frame updating every 10-90 seconds. That standard has now become thirty frames per second, requiring far more data to accomplish the same task. Each frame also now has a far higher quality, and 360-degree videos are starting to emerge.

In other words, simply maintaining *X* service requires regular upgrades of infrastructure so that more data can pass through to *Y* users, often without an increase in revenue. Therefore universal access policies can have a distorting effect on the measure of what I call 'simple access.' I personally have found myself able to download entire films in a matter of seconds in one country, and struggling for hours to send a basic text email on a building rooftop in another. No distinction is made between these scenarios in simple access, and I point out in chapter two that, as we might expect, higher quality access increases the propensity of a user to find, create and sustain profitable activities online.

This is problematic in many ways, not least of which is that – as shown in chapter three – much of the data on the economic impacts of internet connectivity are derived from higher-income countries where statistics are more widely collected. A marginal increase in

[191] For academic scholarship on this subject, see Robert Crandall, "Broadband Communications," In *Handbook of Telecommunications Economics, Vol. 2*, eds. Sumit Majumdar, Ingo Vogelsang and Martin Cave (Amsterdam: Elsevier, 2005): 156-191; Shane Greenstein, "Internet Infrastructure," In *The Oxford Handbook of the Digital Economy*, eds. Martin Peitz and Joel Waldfogel (New York: Oxford, 2013): 3-33.

simple access in a well-connected country logically entails more of an advantage at engaging in revenue-generating activities than the same increase in a poorly-connected country. One Ethiopian freelancer interviewed in background research found it difficult to afford the constant connectivity he needed to respond quickly enough to notifications of new work opportunities, interview requests and follow-up questions, attributing this as a key issue inhibiting his ability to compete with freelancers from better-connected countries.[192] Yet his access would be tallied as equivalent to that of a user in Silicon Valley.

As mentioned above, lower statistical capacities in the Global South make it difficult to measure how much data is consumed by end users. One improvement would be to use the International Telecommunication Union's statistics on the total number of active broadband subscriptions in a country in their *ICT Indicators Database*. Here, the term 'broadband' simply means that the connection can communicate at least 256 kilobits of data (kbps) each second when operating at maximum speed, although different sources use different thresholds. Though this could be operationalized, it remains far from ideal. Some connections serve individual users while others can serve entire organizations, forcing us to deal with confounding issues such as firm size. More important for the study of LDCs, however, is that shades of gray below the threshold are rendered invisible. Certainly 250 kbps is far preferably to 2 kbps.

Fortunately, there is a telecom research firm called *TeleGeography* that expends a considerable amount of time and resources collecting data for major players in the industry. Although their services are priced for large corporations, they graciously agreed to furnish

[192] Personal interview with Kamil from Ethiopia, January 25, 2016.

access to data through a non-disclosure agreement to be used in a portfolio of research projects spanning academic and humanitarian objectives.

For those unfamiliar with how internet technology functions above the user level, a brief passage from an industry blog may be useful as background knowledge:

> The Internet is a vast network made up of a collection of smaller networks. … At the core of the Internet are a handful of very large transit providers that all peer with one another. This group of approximately twelve companies are known as Tier 1 network providers. Whether directly or indirectly, every ISP (Internet Service Provider) around the world connects with one of these Tier 1 providers. And, since the Tier 1 providers are all interconnected themselves, from any point on the network you should be able to reach any other point. That's what makes the Internet the Internet: it's a huge group of networks that are all interconnected.[193]

Although this 'Tier 1' explanation might imply a higher level of centralization than what exists today, this is a useful way of thinking about the internet in a global sense. There are physical oceanic and terrestrial cables that 'pipe' the internet to and from any given country through internet exchanges like those in Tier 1. These can be considered almost like switchboard operators for internet data. Even 'wireless' internet is typically connecting to a source that is tethered to the ground. The exception is satellite, which is now primarily relegated to remote, austere environments due to its prohibitive costs and signal delays.[194]

The data set that I draw on to model connectivity in the thesis is called 'Peak International Internet Traffic by Country.' This captures the amount of data entering and leaving a country through its international oceanic and terrestrial cables. I am drawing on historical country-level data going back to 2005. *TeleGeography* collects this information primarily through direct agreements with leading service providers around the world, using

[193] Prince, "The Relative Cost of Bandwidth."
[194] Malecki and Wei, "A Wired World," 364.

statistical methods (to which I am not privy) to account for gaps and discrepancies. Since the early days of the internet, it has been standard procedure in the industry to set prices for 'wholesale' data access to service providers using usage rates at the 95th percentile each month. This means that, were one to calculate the amount of data passing through a connection for every five-minute interval in a given month, the top 5% of intervals would be disregarded and the subsequent interval would be invoiced.[195] Therefore it is a data point commonly collected and documented by providers as part of their routine commerce.

Each year, *TeleGeography* provides that measure at the country-level using the April statistic. I simply divided those figures by population for each country for each year in the historical data and employed it as an independent variable to represent the level of internet traffic within a country. Chapter two discusses limitations which I will not repeat here other than to reiterate that this only measures *international* traffic and does not account for domestic traffic. I view this as only a minor problem in this particular thesis when we consider that that LDCs have small domestic economies, meaning that economically-relevant traffic is more likely international. However linguistically-distinct countries that produce much of their own content may be somewhat underrepresented. As far as I am aware, this measure has not been created elsewhere in this or in any similar form. It may be enhanced in the future by factoring in each country's ratio of domestic to international traffic, which *TeleGeography* has already begun to collect for many countries, but this would require data from more economies, particularly in the South, over a longer horizon.

[195] Based on background research with a telecom industry consultant. Apparently this has been modified in many cases owing to data warehouses scheduling massive transfers of data in a manner that narrowly avoids the 5% threshold.