Winners & Losers in the **Global App Economy**

mozilla

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Contents

List of figures

Preface

Preface
by Mark Surman – Executive Director, Mozilla Foundation

The Web has been a radical experiment in leveling the playing field. It has enabled multi-billion dollar titans like Google and Amazon to hatch from very modest beginnings into global brands serving people on all corners of the planet. On the open Web, there are virtually no gatekeepers preventing a new product or service from launching and competing for users. The result? Billions of dollars in economic opportunity and whole new galaxies of products and services.

But this open Web is in danger. The open publishing model of the Web is being challenged by a new publishing model: the app.

When the iPhone first launched in 2007, Apple offered no mechanism for third-party developers to publish apps. Only Apple could create native iPhone apps— others were encouraged to create mobile web apps that would leverage new web standards like HTML5. Within a year of the iPhone's very successful reception, Apple quickly realized the potential in creating a single, controlled distribution point for third-party content and services. In 2008, Apple announced a policy change: third-party developers could indeed create and sell native apps for the iPhone, but only after they'd been reviewed and approved by Apple— and only to be sold through a new, single gateway: the App Store.

The App Store offered definite advantages for developers, such as technical platform standardization, captive audiences and an easier way to monetize. For the first time, developers could count on a large number of users with similar devices and stored credit card numbers. In the early years of the App Store, it was not uncommon to hear of indie developers striking rich. The App Store also offered advantages to users: by curating apps and enforcing a bar for quality, Apple ensured a more approachable and higher quality app ecosystem. Anyone could confidently find and install software— "there's an app for that!" This model caught fire, was emulated by all other mobile platforms (most notably Android, through Google Play) and has generated billions of dollars in revenue for app providers.

In another light, though, the app model has been a major step backward for the Internet and a disaster for independent developers. It has given platform owners unprecedented control over how and when software is published and monetized. To meaningfully reach a massive scale of users, providers of Internet content and services must now agree to Apple or Google taking a standard 30% cut of revenues on app and in-app purchases. And Apple or Google can freely reject submissions to their app stores, providing an effective veto on any product or service that innovates in ways unfavorable to technology incumbents.

This change in the software distribution model of the Internet has been tinged with an international development concern, because the App has risen in parallel with the global growth of the smartphone. It's estimated that in the next 10 years, two billion more people will come online for the first time, many exclusively through their smartphones. In the emerging digital economies of South Asia and Sub-Saharan Africa, the App model will be the default, rather than the open publishing model of the Web. What will be the consequences for developers and the emerging digital ecosystems around the world?

There has been valuable research looking at the increasingly challenging economics of the app stores for small developers in North America and Europe. This is the first research to take a comparative development view on how well the global app economy serves developers and international trade flows— a timely and central question for those concerned with equitable digital development.

The economic benefits of the Internet are frequently touted in the contemporary development world, yet we are lacking in hard data. Working together, the internet technology community and the development community can ensure that local developers can take part in the economic transformation promised by the Internet. We can ensure these benefits are equitably distributed, create sustainable and lasting economic growth and are positively manifested in connected and newly-connected societies alike.

To begin, we must first figure out whether "business as usual" will serve these goals. And more importantly, we need data. This groundbreaking research by Caribou Digital for the Mozilla Foundation is the beginning of a long inquiry, and the first step toward shaping a more distributed, global Web that works for everyone.

Executive summary

Executive summary

The global app economy continues to grow rapidly, driven by increasing smartphone adoption, higher-speed wireless networks, and behavior changes in how users engage with digital content. Apps attract significant attention in part because they represent the first truly global market for digital goods, which can in principle be produced anywhere, distributed at almost no cost, and consumed wherever there is a network connection. The low barriers to entry and scalability of digital products thus offer the alluring promise of more accessible economic opportunities, especially to those producers typically marginalized either by socioeconomic status, geographic location, or both. Yet the app market, like all markets, is a socially constructed system with policies, architectures, and intrinsic biases that govern participation and outcomes. That this governance is largely defined by two firms, Apple and Google, whose platforms control the vast majority of the global market, further concentrates power in the industry and amplifies the effects of those policies and biases on app developers.

This research sought to investigate these dynamics through a descriptive study of supply side participation, value capture, and international trade in the global app economy, spurred by questions such as, Who is successfully making apps? Who is making money, and in what markets? How do the structure and design of the app stores affect value capture and trade? The resulting analysis is based on an original dataset of top-ranked apps and their developers across 37 national markets. For each national market, we recorded the 500 top-ranked apps in both the "Top Grossing" and "Top Downloads" categories, for both the iOS and Android platforms, and then performed a manual online search to identify the city and country location for the developer. This allowed us to not only see which countries are successfully developing apps, but also where those apps are being "exported" into other national markets worldwide, painting a picture of the global flow of app commerce. We then used a simplified power law curve to estimate value capture across all developers in our sample, showing the often stark difference between app production and app revenues. Finally, we aggregate estimated revenues on a national level in order to visualize in a series of Sankey diagrams which countries are capturing value out of which markets.

The analysis reveals that despite its egalitarian appeal, developer participation in the app economy is heavily skewed toward the largest and richest economies, with the United States, Japan, and China dominant. Because the app markets function as winner-take-all markets, the top-ranked apps in the most-lucrative markets earn multiple orders of magnitude more revenue than low-ranked apps in markets of the Global South. The result is that 95% of the estimated industry value is being captured by just the top 10 producing countries. For lower-income[1] countries, the outlook is relatively bleak: Most have very few developers, and even those who had significant numbers of developers—for example, India—earned very little revenue; as a group, the 19 lower-income countries in our sample earned an estimated 1% of global app economy revenues. Even the much-hyped "Silicon Savannah" of East Africa was mostly absent from the data.

Part of the challenge facing producers in lower-income countries is that their domestic markets are simply too low-value to sustain a local production ecosystem, forcing them to try to export to the larger and more competitive foreign markets. But there are structural barriers as well—for example, Google prohibits developers in dozens of low-income countries (including most of sub-Saharan Africa) from monetizing directly through its app store. Despite the challenges, standout performance from countries such as Vietnam and Turkey show that some lower-income countries can excel at domestic app production and local market ownership. We evaluate these high performers through country level comparisons and potential drivers of digital production, arguing that traditional contract IT outsourcing may be the most reliable path toward building local digital entrepreneurs and businesses. In sum, this research provides an in-depth analysis of the app economy, describing at multiple scales how the structures and market dynamics lead to highly skewed outcomes in participation and revenue, producing clear categories of winners and losers.

1 We use the World Bank income classifications, although for simplicity we use the term "lower-income" to encompass the categories "low-income," "lower-middle-income," and "upper-middle-income." We consider China part of the "high-income" group. (http://data.worldbank.org/about/country-and-lending-groups#Low_income).

Key findings and implications

Key findings and implications

Key findings

The most important findings of the data analysis are summarized here, followed by selected implications based on our interpretations of the results.

Most developers are located in high-income countries

The geography of where app developers are located is heavily skewed toward the economic powerhouses, with 81% of developers in high-income countries, which are also the most lucrative markets. The United States is still the dominant producer, but East Asia, fueled by China, has more developers than Western Europe.

95% of the estimated value in the app economy is captured by just 10 countries

The winner-take-all nature of app stores concentrates revenue, which skews value capture even more heavily toward the U.S. and other top producers. Even for those lower-income countries that do have a significant number of developers— e.g., India—the amount of value capture is disproportionally small to the number of developers participating. As a result, the 19 countries in the sample considered lower-income accounted for only 1% of total worldwide estimated value.

The much-hyped "Silicon Savannah" is mostly absent from the data

Apart from a modest showing from South Africa, the remaining Sub-Saharan countries (Kenya, Nigeria, Ghana, and Tanzania) were among the lowest performers in the study. In comparison, lower-income countries in Southeast Asia and Eastern Europe were much more successful, especially Vietnam, Turkey, and Belarus.

Language and spatial proximity influence app trade flows

Regional and international trade in apps shows patterns of influence by spatial proximity (e.g., Chinese apps are more popular in South Asia than in Latin America), though language may be more important (e.g., Spanish apps are more popular in Latin America than in Western Europe).

Developers in low-income countries struggle to export to the global stage

About one-third of developers in the sample appeared only in their domestic market, but this inability to export to other markets was much more pronounced for developers in lower-income countries, where 69% of developers were not able to export, compared to high-income countries, where only 29% of developers were not able to export. For comparison, only 3% of U.S. developers did not export.

Strong domestic production seems to substitute for U.S. content

The U.S. is the dominant producer in every market in the sample except for China, Japan, South Korea, and Taiwan. However, in most markets, strong demand for local apps was negatively correlated to demand for U.S. based apps. In other words, a greater market share of domestically produced apps results in a decrease in market share for U.S. based apps (this correlation did not hold for Chinese apps, the 2nd-most popular globally).

Key findings and implications
continued

Implications

We extend our analysis of the data with implications focused on the challenges facing digital producers in the Global South. We summarize these topics here, and then explore in much greater detail in the section "Discussion and implications."

The smallest markets will struggle to support local content

Many small markets in low-income countries don't seem to offer enough revenue potential to incentivize and support thriving domestic app production, and many probably never will. Developers of commercial content have to follow the money, which often means trying to export to more lucrative foreign markets instead of developing locally relevant content.

Contract IT outsourcing is more helpful than app contests and hackathons

The highest performing lower-income countries, including Vietnam, Turkey, and Belarus, have a history of contract IT outsourcing that has over time built up a population of experienced software developers. We believe this type of traditional economic capacity building is more effective than the app contests and superficial coding programs that often grab headlines.

Excluding developers from monetizing through the app stores constrains participation

Decisions by Google and Apple to prohibit developers in some countries from monetizing through the app store likely has a dampening effect on participation and value capture. Developers find workarounds, but these strategic business decisions demonstrate the power of software platforms—they can exclude entire nations based on lines of code.

Country-level app stores promote developer diversity, especially domestic producers

The segmentation of the global market into national app stores improves visibility of a wider variety of producers, and may therefore be a key driver of local content consumption. If current government proposals to eliminate such "geo-blocking" (for example, the EU's Digital Single Market initiative) result in a pan-European or single global app market, we believe it would have a negative effect on smaller, independent developers.

Winners & Losers
in the Global App Economy

Introduction

"Right now it's a flat world where everybody competes with everybody—everybody is treated equally in the app stores of the world."

— Julien Codorniou, director of global platform partnerships, Facebook[2]

The ongoing growth in smartphone and mobile internet penetration is feeding the rise of the global "app economy," the buying and selling of apps and other digital content for use on mobile devices. Understanding the app economy is important because of its growing economic significance—in 2014, app developers earned $17 billion in direct revenue[3] from the two major app stores, and almost twice as much in-app advertising revenue[4]—but also because it represents the first truly global commerce in completely digital goods, and therefore provides insight into how production and trade of digitized products and services may evolve in an increasingly globalized digital economy.

Because apps and other digital content can be produced, distributed, and consumed virtually anywhere there is a network connection, they open up new economic opportunities and business models. In principle, the low barriers to entry and absence of transportation costs for apps could lead to a more accessible and equitable market system, where producers from marginalized geographies and socioeconomic backgrounds can build products and sell them to consumers around the world, all without leaving their home. Proponents of this view often cite as a prime example "Flappy Bird," a simple gaming app built by independent Vietnamese developer Dong Nguyen that became a viral sensation globally, at one point earning its maker $55,000 a day in advertising revenue.[5] Of course, this pales in comparison to the leading app developer of 2014, Finland's Supercell, which was at one point earning over $2 million per day,[6] or Japan's Mixi, which was earning a reported $4.2 million per day with its game Monster Strike.[7] But the fact that Nguyen was an independent developer based in Hanoi, and not Helsinki, or Tokyo, lends credence to the idea that almost anyone can earn real money building apps.

Behind these headlines and hype is a massive and growing digital market, with hundreds of thousands of developers building millions of apps, all trying to take advantage of this new digital gold rush.[8] Yet studies have shown that the reality for most developers is far from glamorous, with 60% making less than $500/month from apps.[9] And a quick scan of the most popular titles in the app store—or even reviewing the apps on a few friends' phones—will reveal that there is a relatively small number of apps that are very popular and enjoy widespread, even global, adoption—the Facebooks and Twitters—and then a large number of less prominent apps that might only be popular with a small niche of users, or with no one at all.

This is significant, because the app economy is a "winner-take-all" market, where the top apps and top developers earn the vast majority of revenues, leaving the remainder to be fought over by a massive long tail of less successful developers.[10] The winner-take-all dynamic operates not only at the scale of the app and the firm, but also at the scale of the national market: The app stores are currently segmented into discrete national stores, which are in one sense contiguous—app developers can easily list their apps in every store on the planet—but show radically different properties in terms of revenues and downloads, with the top stores (e.g., Japan, United States, China, United Kingdom) recording two or even three orders of magnitude more

2 Lauren Davidson, "How Facebook Is Fuelling the Growth of the Super Start-Up," *The Telegraph*, August 9, 2015, http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/11790703/How-Facebook-is-fuelling-the-growth-of-the-super-start-up.html.

3 Revenue from app paid downloads or in-app purchases; Apple and Google reported payments of $10 billion and $7 billion, respectively, to developers in 2014 (also resulting in $7.3 billion to Apple and Google from their 30% commission).

4 eMarketer estimated $42 billion mobile ad spend globally in 2014, and ¾ of app spend is in-app ads (vs. mobile web) for U.S. market. http://www.emarketer.com/Article/Mobile-Ad-Spend-Top-100-Billion-Worldwide-2016-51-of-Digital-Market/1012299; http://www.emarketer.com/Article/Mobile-Will-Account-72-of-US-Digital-Ad-Spend-by-2019/1012258.

5 David Kushner, "The Flight of the Birdman: Flappy Bird Creator Dong Nguyen Speaks Out," *Rolling Stone*, accessed December 18, 2015, http://www.rollingstone.com/culture/news/the-flight-of-the-birdman-flappy-bird-creator-dong-nguyen-speaks-out-20140311?page=3.

6 Karsten Strauss, "The $2.4 Million-Per-Day Company: Supercell," *Forbes*, April 18, 2013, http://www.forbes.com/sites/karstenstrauss/2013/04/18/the-2-4-million-per-day-company-supercell/.

7 Craig Chapple, "Japanese Mobile Game Monster Strike Making $4.2m a Day," *Develop*, August 19, 2015, http://www.develop-online.net/news/japanese-mobile-game-monster-strike-making-4-2m-a-day/0210247.

8 Vision Mobile, "Developer Economics: Q3 2014," July 2014.

9 Vision Mobile, "Developer Megatrends: H1 2015," June 2015.

10 Chris Anderson, *The Long Tail: How Endless Choice Is Creating Unlimited Demand* (Random House, 2007).

Introduction
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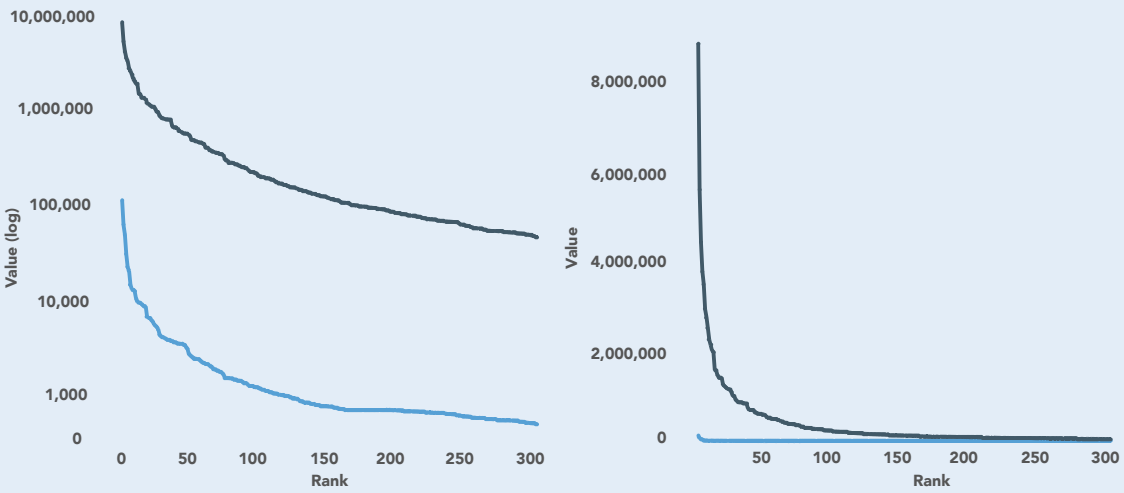


Figure 1.
Two hypothetical national markets showing the extreme differences between a high-value market (dark blue) and low-value market (light blue) and between top-ranked and lower-ranked apps. Shown on left in log scale, on right in standard scale. The standard scale shows more clearly the shape of a "winner-take-all" power law curve.

revenue and downloads than lower-ranked national stores. For example, 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 (see Figure 1). All of which means that there is extreme variability in app downloads and revenues globally, making apples to apples comparisons very difficult.

The app economy is thoroughly dominated by the proprietary platforms of Apple and Google.[11] The current duopoly in the smartphone industry has established itself with breathtaking speed—Android is the fastest growing technology platform in history, reaching 1 billion users in only 8 years[12]—and unprecedented global penetration—iOS and Android own 14.6% and 82.2%, respectively, of the global market, for a total market share of 96.8%.[13] This is an incredible concentration of power, symbolized by the fact that of the two firms' headquarters are only 9 miles apart in Silicon Valley, the most dominant technology hub of the computing age.

As the platform owners, Apple and Google set the rules of engagement for how end users, app developers, and other 3rd-party firms can interact with their systems and technologies, and thus exercise immense power in establishing the structure of "who does what" and "who gets what" in the industry. Each of the platforms operates as a two-sided market, whereby it strives to attract both app developers and end-users to join the platform and connect with each other through its app store. While these app stores are celebrated for their efficiency, reach, and egalitarian policies,[14] they are—like all market systems—socially constructed and thus shaped by the politics,

11 Although Google does make Android source code freely available as part of the Android Open Source Project, it has steadily eroded the functionality of the open-source operating system, primarily by pulling more and more critical features into the proprietary APIs of its own Google Play Services.

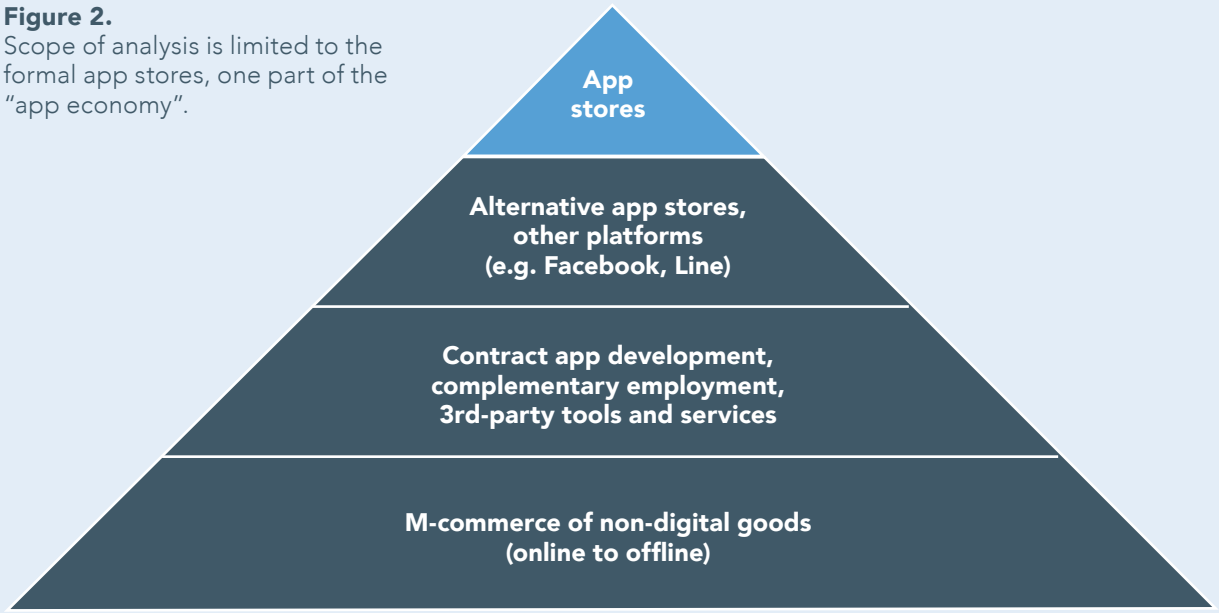
12 For an excellent summary, see Horace Dediu, "The Race to a billion—2012 Update," *Asymco*, January 16, 2013, http://www.asymco.com/2013/01/16/the-race-to-a-billion-2012-update/.

13 "Gartner Says Worldwide Smartphone Sales Recorded Slowest Growth Rate Since 2013," accessed December 21, 2015, http://www.gartner.com/newsroom/id/3115517.

14 For example, all app developers are charged the same amount (30% of revenues) for being on the platform. While this does result in consistent policy, some critics argue that a progressive fee structure that is more accommodating to small app developers would actually be more fair, e.g., http://blog.anylistapp.com/2015/02/open-letter-to-tim-cook-regarding-app-store-revenue-split/.

Introduction
continued

Figure 2.
Scope of analysis is limited to the formal app stores, one part of the "app economy".



technologies, and people involved. As this research shows, even apparently minor strategic platform decisions by Apple or Google can have very real, and sometimes unintended, ramifications for those trying to participate in the market.

The focus of this research is the app economy mediated by the app markets of Apple and Google, so it does not assess any revenue or commercial activity for the broader mobile industry, including contract app development, 3rd-party tools and services, or m-commerce (beyond in-app purchases, which are captured here). While this represents only one part of the overall industry, it is both the most dynamic and most important point of control for the industry, and thus drives much of the innovation, business models, and supporting activity in the broader ecosystem.[15] Previous research on the app economy includes work by the GSMA,[16] App Annie/MEF,[17] and the CTIA.[18] This study adds to the existing literature with an original analysis quantifying participation and value capture, tracing the geography of trade, and critically examining the role of the platform firms in shaping economic outcomes in the app economy.

15 Bryan Pon, Timo Seppälä, and Martin Kenney, "One Ring to Unite Them All: Convergence, the Smartphone, and the Cloud," *Journal of Industry*, Competition and Trade, 2014.

16 For example, the GSMA's "Mobile Economy" series.

17 App Annie and MEF, "Emerging Markets and Growth in the Global App Economy," 2014.

18 Michael Mandel and Judith Scherer, "The Geography of the App Economy," 2012.

Structure of report

The next section of this report explains our research methodology, followed by a background section providing more context on app developers and how the app stores function as digital markets, including some of the most relevant theoretical constructs from the literature. The section "Where are the developers?" explores the location of the developers in our sample, allowing us to map city and country location and reveal the heavy imbalance of participation, with the United States and China dominant.

But participation alone does not equal commercial success, and the following section, "Estimating value capture," tries to fill in the picture by estimating value capture using a simplified power law curve. The analysis reveals that revenue is even more heavily skewed toward the large industrialized economies than simple participation.

"Markets and patterns of trade" takes a regional and global perspective in tracing the flows of apps between countries, revealing clear patterns based on language and spatial proximity. The market share breakdown in each country also shows interesting trends – for instance, domestic app production seems to substitute for reliance on imported U.S. apps in many markes. In "Production in lower-income countries," we highlight two over-performing countries, Vietnam and Turkey, and explore some of the patterns in national-level indicators that seem to impact developer participation.

In the final section, "Discussion and implications," we tackle three topics that emerge from the research, offering some initial hypotheses and suggestions for further research. We first explore different possibilities for the drivers of digital production, contrasting East Africa with Southeast Asia and Eastern Europe. Next we reframe the discussion around local content as a driver for adoption by concentrating on commercial content, taking the perspective of an app developer in order to explore how (low-revenue) domestic markets may offer refuge while also trapping the producer. And finally, we discuss two examples of how the structure and design of the app market platforms are likely impacting participation and value capture: First, Google's lack of support for developers in dozens of countries—including much of Sub-Saharan Africa—prevents these developers from directly monetizing through the app store, undoubtedly dampening participation and value capture in some of the lowest-income markets. Secondly, and on the positive side, the national structure of both Apple's and Google's app stores results in increased diversity and visibility of app developers, especially smaller domestic producers who would otherwise be lost in a single global market.

Methodology

The app store analysis is built on an original dataset of top-ranked apps and their developers across 37 national markets. For each national market, a snapshot was taken in June 2015 from the App Annie website[19] of the 500 top-ranked apps in both the "Top Grossing" and "Top Downloads" categories,[20] for both the iOS and Android platforms, resulting in 2,000 app records per national market (Ghana and Tanzania have slightly fewer because there weren't 500 apps in the Top Grossing category). The result was approximately 74,000 records, which corresponded to 21,539 unique apps and 11,644 unique developers. For each developer a manual online search was conducted to identify the city and country location; for larger firms with multiple offices, the headquarters location was selected. This resulted in 8,441 developers with both a location of production and a location of consumption, and enabled us to trace the flows of apps from the country of origin to the country of consumption. For categorization purposes, we use the World Bank county income classifications,[21] though we consider China part of the high-income economy group.

We supplemented this quantitative data with a limited number of developer interviews and survey responses. The outreach was targeted specifically at developers from non-Top 10 markets in order to better understand their perspectives on the opportunities and barriers they face in the app economy. Although we eventually contacted thousands of developers via email, we saw a minimal (~1%) response rate, resulting in only 60 responses to the online survey, and 7 semi-structured interviews conducted over Skype. While the qualitative responses cannot be considered representative of the sample, we do use some quotations in the discussion section to provide context and add the voice of developers.

National markets covered in analysis:

Argentina	Australia	Belarus	Brazil	Canada	China
Colombia	Egypt	Finland	France	Germany	Ghana
Hong Kong	India	Indonesia	Israel	Italy	Japan
Kenya	Mexico	Nigeria	Pakistan	Peru	Philippines
Russia	South Africa	South Korea	Spain	Taiwan	Tanzania
Thailand	Turkey	Ukraine	United Kingdom	United States	Venezuela
Vietnam					

19 https://www.appannie.com/.

20 The "Top Grossing" category includes apps that monetize via paid downloads as well as via in-app purchases; these revenues pass through the app store and Google and Apple take their 30% cut. The "Top Downloads" category is made up of free downloads that monetize via advertising; these revenues are not captured by the app stores (unless using the platforms' ad networks, iAd and Admob).

21 http://data.worldbank.org/about/country-and-lending-groups.

Methodology
continued

There are limitations to this analysis. First, the intended scope includes only the most successful developers in the largest markets on the two dominant platforms, and therefore cannot capture all revenue or commercially successful developers. China is especially opaque to this analysis because it has banned Google services, including Google Play,[22] meaning that while China is an enormous market for Android, the vast majority of app downloads and revenue occur via 3rd-party app stores. As a result, the number of developers from China and other countries where Google Play is not dominant (e.g., India) are under-represented in the analysis (though iOS data for China should be valid). Secondly, because we find location data for only 72% of developers, there is a significant margin of error with the geographic analyses. This introduces at least a few potential forms of bias: First, the population of developers that could not be located is evenly distributed across the 37 markets except for China, Japan, and South Korea, which have a higher ratio of un-located developers. Because this is primarily the result of the language barrier, we assume that most of these un-located developers are domestic, and therefore, for these countries, the number of developers is likely underrepresented. Secondly, there are more un-located developers with lower-ranked (less popular) apps, primarily due to smaller, independent developers not having a formal online presence. This skews the results towards larger and more-established firms, though we don't find evidence of a geographical bias to the location of smaller vs. more established developers. And finally, because the app store data is not a time series, the results represent a snapshot and cannot capture changes over time.

22 Technically free apps, but not paid apps, are available to download from Google Play, but the reality is that there are hundreds of 3rd-party app stores for Android applications, and Google Play does not have significant marketshare. That may change as Google recently stated its intentions to re-enter the Chinese market: http://www.wsj.com/articles/google-negotiates-a-return-to-china-1441408051.

Background

The smartphone platforms of Apple and Google are based on their respective operating systems (OS), iOS and Android. Controlling the OS allows the firms to make granular decisions around how other firms engage with the platform, including issues such as hardware compatibility, access to APIs (application programming interfaces), and licensing fees. But platform control is increasingly exercised through other elements of the platform ecosystem, especially services and the app stores themselves. While invisible to the majority of end-users, changes in governance controls by the platform firm—for example, updating terms of service, modifying access to APIs, or prohibiting certain kinds of apps—force developers and other ecosystem actors to constantly adjust in order to stay in compliance, with virtually no voice or ability to affect the course of the governance.[23] As we discuss later in the report, this platform control can have a significant effect on outcomes for app developers.

Developers and apps

We use the term "developer" to refer to any individual or organization that develops mobile software applications, recognizing that there are wide variations in the composure of the actual entity that the term denotes. Ranging from the archetypical lone programmer in a garage, to large multinational corporations with tens of thousands of employees, the type of developer usually dictates the business objectives and type of app produced. For many independent and smaller organizations, the app may be a game or utility that they try to monetize directly, as the app is the business. Other firms may have apps that are only intended to drive traffic to their core products and services, and therefore are meant to complement other activities and not serve as a direct revenue source themselves.

App stores as digital markets

Apple initiated the app store model with its iTunes store,[24] which started selling music for its iPod music players in 2003, and extended that model with the App Store for iPhone in 2008, a year after the iPhone launched. Since then the fundamentals of Apple's app store have been copied by Google, Microsoft, Amazon, and others: 3rd-party developers pay a small licensing fee for access to the SDKs (software development kits) that allow them to build apps, which they can then list on the store on a consignment basis, earning 70% of any revenue earned, while the platform owner takes 30%.[25] All apps are subject to approval/rejection by the platform firm, which also sets the rules for engagement (e.g., prohibited content or app monetization models).

Importantly, Apple also set the precedence for establishing distinct app stores for each country it decides to enter. This allows it to adhere to different tax laws, content regulations, and copyright licensing for music and other media. For example, Australia and Belgium have shown indications of wanting to ban gambling apps,[26] and Apple banned apps related to the Dalai Lama in China.[27] This granularity also enables the platform owner to set differential pricing; in 2008 Apple had to backtrack in the face of EU Competition Commission pressure when it was revealed that it charged more for the same music in the U.K. compared to the rest of Europe.[28]

But the separation of the app stores has another important characteristic that affects developer participation: Each national app store features its own prominently displayed list of the "top ranked" apps in that market, which results in a broader range of apps being visible to users. This is significant, because with the two major stores boasting over 1 million apps each, the problem of app "discovery" has never been greater: While the number of apps available continues to grow rapidly, the number of apps that most people use has held relatively steady (recent reports found the average user in the U.S. only opens 24 apps per month,

23 For an analysis of 100 different governance changes to the iOS app store, see: Julia Manner et al., "Control Mechanisms in Platform-Based Service Marketplaces – Principles for Control Design and Implementation" (2013).

24 Though it was Japan's NTT Docomo's i-mode service that was probably the first to use a revenue-sharing model with digital content providers; for a case study see: Jeffrey L Funk, *The Mobile Internet: How Japan Dialed up and the West Disconnected* (ISI publications Kent, UK, 2001).

25 Google shares its 30% of revenue with other partners, including mobile operators.

26 "Belgium To Blacklist Free Poker Apps?," accessed December 21, 2015, http://www.pokernewsreport.com/belgium-to-blacklist-free-poker-apps-17274.

27 "Apple Censors Dalai Lama iPhone Apps in China | Macworld," accessed December 21, 2015, http://www.macworld.com/article/1145350/apple_china.html.

28 "Apple Drops iTunes Prices, EU Drops Antitrust Action | Computerworld," accessed December 18, 2015, http://www.computerworld.com/article/2538651/technology-law-regulation/apple-drops-itunes-prices--eu-drops-antitrust-action.html.

Background
continued

and 75% of active time is spent in only their top 4 apps[29]). Users find apps in all kinds of ways, but the vast majority of app installs come via browsing or searching within the app stores,[30] and an app's ranking influences how visible it is to users browsing and searching. Therefore for developers, breaking into the top-ranked list for a national market can be one of the best ways to increase downloads in what has become a hypercompetitive marketplace. Attaining a top ranking is so important that some developers will pay dearly to inflate their rankings through paid installs[31] or even buying their own app,[32] and there is a cottage industry of 3rd-party services providing a range of services, from legitimate optimization strategies[33] to unethical manual manipulation[34] and explicitly prohibited automated bot farms[35] in an ongoing cat-and-mouse game with the platform owners.

Although Apple maintains a tight grip on app distribution, and forbids the loading of apps from any 3rd-party stores,[36] Google is much more open with Android. As a result, there are hundreds of 3rd-party app stores around the world, many run by mobile operators, with varying levels of adoption. The largest of these are in China, where Google withdrew its services—including its app store—in 2010, opening the door for a wide range of domestic app stores to take its place.[37]

In the lowest-income countries, where high data costs and lower disposable income constrain web browsing and download behavior, much app discovery and distribution takes place via alternative channels. Research by Caribou Digital[38] has shown that in Ghana, Kenya, and Uganda, users often access 3rd-party stores such as Opera's app store (because they are familiar with the data-saving Opera browser) as well as 3rd-party aggregator sites such as Waptrick. But offline channels are also very common, with many users in the study installing apps provided by friends, or buying apps from offline vendors who then transfer the app (or music, or video) locally. The practice of "side-loading" using USB cables has been largely superseded by wireless technology, with most users now using Bluetooth or Wi-Fi connections to transfer the apps from device to device without accessing the network and thus data charges.[39] While offline distribution is not limited to Sub-Saharan Africa (for example, AppsDaily has built up a network of 7,000 physical kiosks in India to provide smartphone anti-virus, insurance, and app services for those users who prefer the in-person transaction[40]), it likely remains a very small percentage of industry revenues.

29 "Smartphones: So Many Apps, So Much Time," accessed December 18, 2015, http://www.nielsen.com/us/en/insights/news/2014/smartphones-so-many-apps--so-much-time.html; "Most People Use Only 4 Apps," Business Insider, http://www.businessinsider.com/chart-of-the-day-most-people-use-only-4-apps-2014-9?op=1.

30 Sarah Perez, "Roughly Half Of Users Are Finding Apps Via App Store Search, Says Study," *TechCrunch*, accessed December 21, 2015, http://social.techcrunch.com/2014/10/03/roughly-half-of-users-are-finding-apps-via-app-store-search-says-study/.

31 "Pay to Rank: Gaming the App Store in the Age of Flappy Bird | Ars Technica," accessed December 4, 2015, http://arstechnica.com/gaming/2014/02/pay-to-rank-gaming-the-app-store-in-the-age-of-flappy-bird/.

32 "A Chinese Secret: Why Mobile Publishers Are Spending Big Bucks on Their Own in-App Purchases | GamesBeat | Games | by Jeff Grubb," accessed December 18, 2015, http://venturebeat.com/2015/05/23/a-chinese-secret-why-mobile-publishers-are-spending-big-bucks-on-their-own-in-app-purchases/.

33 For example, see "Our Best App Store Optimization and Marketing Tips – Sensor Tower App Marketing Blog," accessed December 21, 2015, https://sensortower.com/blog/our-best-app-store-optimization-and-marketing-tips-for-app-developers.

34 "This Is How App Store Rankings Are Manipulated | The Verge," accessed December 4, 2015, http://www.theverge.com/2015/2/12/8024861/top-10-app-store-manipulation-photo.

35 "Apple Fights App Makers Who Try to Game the System – The New York Times," accessed December 4, 2015, http://bits.blogs.nytimes.com/2012/02/07/app-store/.

36 Some 3rd-party stores will list iOS apps, but are simply creating shortcuts, and simply link the user back into the official Apple App Store.

37 After a disagreement over censorship, Google withdrew its services from the mainland in 2010, and its search engine and other web properties are blocked by the "Great Firewall." However, in 2015 Google announced it is seeking to re-establish its app store in China. See "Google Aims for China Launch of Google Play App Store next Year: Sources," *Reuters*, November 20, 2015, http://www.reuters.com/article/us-alphabet-china-idUSKCN0T91K420151120.

38 Caribou Digital, *Digital Lives in Ghana, Kenya, and Uganda* (Farnham, Surrey, United Kingdom: Caribou Digital Publishing, 2015).

39 Especially popular in this study was the Flash Share app, renamed Xender, that comes pre-installed on many budget smartphones, including Tecno devices.

40 "AppsDaily Solutions Raises Rs 100 Crore Funding from Zodius Capital for Apps," accessed December 21, 2015, http://articles.economictimes.indiatimes.com/2015-03-31/news/60682167_1_new-apps-mobile-applications-android.

Background
continued

Winner-take-all

Industry analysts have shown that the app stores function as winner-take-all markets, where the most popular apps capture the majority of downloads and revenue, and less popular apps earn very little on a per app basis.[41] The degree to which this is true—i.e., how strongly skewed the distribution is—has important implications for the industry as a whole, as it describes in many ways the economics of developer participation. For example, one study of the app store rankings estimated that the #1 app earns 150x as much as the #250 app.[42] This high disparity supports other research that has shown most developers earn relatively very little from their apps—one estimate is that more than 60% of developers make $500 or less per month[43]—but there is little systematic analysis of the spatial dimension of this distribution, nor of the resulting aggregate impact on revenue capture.

Academic research into markets with highly skewed demand—often referred to as Pareto, or "80-20" distributions—was revived with Rosen's 1981 study of what he called "superstar" markets, where only a few top performers (he cites classical musicians as an example) earn the majority of industry revenues.[44] But the phenomenon has been gaining recent attention from businesses and researchers due to the impact of digitization and telecommunications technology on markets.[45] Digital and connected markets increase the efficiency on both the supply side—e.g., ability to host infinitely more product options, lower barriers to entry—and the demand side—e.g., reduced information asymmetry, lower search costs—leading to larger markets with more diverse offerings that can meet the needs of many niche interests, what Chris Anderson deemed the "long tail."[46]

The emergence of long tail markets seems to be a consumer benefit—research on online bookstores has shown that the increase in product options can lead consumers to engage with and purchase more niche products than they would otherwise, resulting in a net economic welfare benefit to consumers.[47] Yet other research has disputed the democratizing effect, showing that despite increased options—in one study, home video sales—consumers congregate on the most popular choices.[48]

Looking specifically at the app stores, there are two characteristics that are important to recognize. First, apps are cultural products similar to music and movies, and as such they are more likely to exhibit the "superstar" effects, where name recognition (think Hollywood movie stars) and a common desire for shared cultural understanding (think water cooler conversations about the latest TV show) drive people toward selections that are already popular, creating positively reinforcing cycles of popularity and adoption.[49] This latter point is similar to direct (same-side) network effects,[50] where the value of downloading Clash of Clans is higher for each additional user because of the increased ability or likelihood of being able to share experiences among other users of the game.

Secondly, the app stores, like all digital markets, are constrained by the human-computer interface. On the human side there are cognitive limitations: while digitization has allowed product catalogs to grow to millions

41 For example, see: http://www.canalys.com/newsroom/top-25-us-developers-account-half-app-revenue#.

42 Rajiv Garg and Rahul Telang, "Inferring App Demand from Publicly Available Data," *MIS Quarterly* 37, no. 4 (2013): 1253–64.

43 Vision Mobile, "Developer Megatrends:H1 2015."

44 Sherwin Rosen, "The Economics of Superstars," *The American Economic Review* 71, no. 5 (December 1981).

45 Erik Brynjolfsson, Yu Hu, and Michael D Smith, "Consumer Surplus in the Digital Economy: Estimating the Value of Increased Product Variety at Online Booksellers," *Management Science* 49, no. 11 (2003): 1580–96.; Robert H Frank and Philip J Cook, *The Winner-Take-All Society: Why the Few at the Top Get so Much More than the Rest of Us* (Random House, 2010).

46 Chris Anderson, *The Long Tail: How Endless Choice Is Creating Unlimited Demand*.

47 Erik Brynjolfsson, Hu, and Smith, "Consumer Surplus in the Digital Economy: Estimating the Value of Increased Product Variety at Online Booksellers."

48 Anita Elberse and Felix Oberholzer-Gee, *Superstars and Underdogs: An Examination of the Long Tail Phenomenon in Video Sales* (Division of Research, Harvard Business School, 2006), http://www.aeaweb.org/annual_mtg_papers/2007/0107_1015_1002.pdf.

49 Frank and Philip J. Cook, *The winner-take-all society: Why the few at the top get so much more than the rest of us*, New York: The Free Press, 1995.

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

Background
continued

"Whether faced with 1,000 or 1,000,000 choices, there is a limit to the cognitive load that users are willing or able to process, and they tend to employ other behavioral heuristics, such as top ranking lists or user reviews, to aid in the decision-making."

of items, our ability to process information and choices hasn't scaled accordingly. Miller's Law—named after the famous experiments by psychologist George Miller that identified 7 (plus/minus 2) as the number of objects a typical person can hold in short-term working memory—applies just as much today as it did in the 1950s.[51] On the computer side, even the largest screens have limited real estate, effectively constraining the number of choices or product options that a user can reasonably access. Clearly, browsing through page after page of app titles in order to view the entire 1.2 million catalog of either app store is an experience no one should have to endure. Combined, these two factors predictably result in user behavior that demonstrates a strong preference for top search results instead of scanning multiple pages.[52] Whether faced with 1,000 or 1,000,000 choices, there is a limit to the cognitive load that users are willing or able to process, and they tend to employ other behavioral heuristics, such as top ranking lists or user reviews, to aid in the decision-making.[53] In the context of the app stores, these interface dynamics mean that those apps that occupy prime virtual real estate, typically because they are popular and thus highly ranked, are the mostly likely to be seen and selected for download or purchase, creating a virtuous cycle that reinforces the popularity of the top apps.

National stores

Less well-known is that something approaching a winner-take-all dynamic applies at the scale of the national stores as well, with the top stores accounting for the vast majority of all global app revenues. Apple and Google do not release national store figures, but estimates indicate the top markets—usually seen as United States, Japan, China, and South Korea—have at least four times the revenue of the markets in Western Europe, and one to two orders of magnitude more revenue than even the biggest emerging markets such as Brazil and India.[54] While it doesn't give absolute figures, analytics firms App Annie ranked the top 10 markets for 2014, providing a clear way to weigh the top markets for each platform in relative terms (Figure 3). These store rankings clearly reveal the established market demographics for both platforms, as well as the realities of app store spending. First, for both platforms the top national markets in terms of revenue are simply the largest and most developed economies; these countries have robust mobile networks and larger middle-class populations that can spend discretionary income on digital content. In terms of downloads, the top countries on iOS are essentially the same, reflecting how the premium purchase price of the device limits its access to richer markets. For Android, on the other hand, significantly lower-cost devices enable usage in virtually all markets, and the huge populations of Brazil, India, Indonesia, and other emerging economies drive tremendous download volume when the price is right (free).

For the large emerging markets, their vast populations are adopting smartphones and data services at increasing rates, leading many analysts to predict that while these markets are still in their infancy in terms of revenue generation, the volume or scale they offer positions them as the most important markets for growth. The open question here is whether the emerging middle classes in these countries have sufficient income—and financial services infrastructure—to support the currently dominant app revenue models of in-app purchases and advertising.

51 George A. Miller, "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information," *Psychological Review* 63, no. 2 (1956).

52 Ashish Agarwal, Kartik Hosanagar, and Michael D. Smith, "Location, Location, Location: An Analysis of Profitability of Position in Online Advertising Markets," *Journal of Marketing Research*, n.d..

53 Alan L. Montgomery et al., "Designing a Better Shopbot," *Management Science* 50, no. 2 (2004): 189–206.

54 See, for example, Charles Arthur, "iOS v Android: App Revenues, Downloads and Country Breakdowns," *The Guardian*, December 4, 2012, sec. Technology, http://www.theguardian.com/technology/appsblog/2012/dec/04/ios-android-revenues-downloads-country.; App Annie, "App Annie Index: 2014 Retrospective," 2015.

Background
continued

Figure 3.
Top national app stores, by downloads and revenue.

Downloads			Revenue		
Rank	**Google Play**	**Apple App Store**	**Rank**	**Google Play**	**Apple App Store**
1	United States	United States	1	Japan	United States
2	Brazil	China	2	United States	Japan
3	India	Japan	3	South Korea	China
4	Russia	United Kingdom	4	Germany	United Kingdom
5	South Korea	Russia	5	Taiwan	Australia
6	Mexico	France	6	United Kingdom	Canada
7	Turkey	Canada	7	France	Germany
8	Indonesia	Germany	8	Hong Kong	France
9	Germany	Australia	9	Australia	Russia
10	Thailand	Italy	10	Russia	Italy

Source: App Annie (2014)

Where are the developers?

In order to understand who is benefiting most from the structure of the app markets, we conducted a geographical analysis of developer participation worldwide. The results show that despite claims of the digital app economy as a level playing field, the most successful developers are geographically concentrated, primarily in the largest cities of the wealthiest countries, but with important exceptions. In this section we analyze the spatial dimension of the app economy to reveal who is participating, and then use the winner-take-all dynamic of the app stores described in the previous section to model an estimated distribution of value capture among countries.

U.S. dominant, but East Asia rising

Compared to the PC era of software development, the mobile app landscape shows a clear shift in gravity away from the West and toward East Asia. The United States is still the leader, which is unsurprising given its dominant historical role in computing and software development, but Western Europe in particular seems to be playing a lesser role compared to the large Asian economies. This landscape is strikingly different from the PC software sector, where as recently as 2011, 70 of the top 100 packaged software companies globally were American. Of the remaining 30 firms, 19 were from Europe, 4 were from Japan, 1 was from China.[55] In the app economy, China (#2), South Korea (#4), and Japan (#6) have all become top-ranked countries in terms of commercially successful app developers (see Figure 4).

Part of this shift is simply an overall dispersion of software development due to lower barriers to entry—compared to PC software, app development has much lower licensing fees, powerful development tools, open-source code and resources, and, perhaps most importantly, easy global distribution not tied to longstanding software distribution channels—all of which assist independent developers worldwide to build and commercialize top-quality applications. For the Asian markets specifically, the rapid penetration of Android—especially in South Korea, where Android market share reached 85%—suggests that the open-source nature of the Android platform may have been a factor in fostering app development in the region. But the data show that almost half of the top developers globally—including Asia—develop for iOS only, or for both platforms.[56] The more likely explanation for the large number of developers in these countries is the rapid increase in demand for apps, as large middle-class populations and relatively fast wireless networks have spurred rapid smartphone adoption. Because of their singular languages and other cultural preferences, this demand is most easily met by local producers, which further helps spur domestic production. In fact, we see that in general, the highest revenue-generating markets produce the highest number of successful developers.

55 Patrick Melgarejo, "IDC: Worldwide Software 2012-2016 Forecast Summary," accessed October 7, 2015, http://s3.amazonaws.com/zanran_storage/www.bloomberg.com/ContentPages/2566616115.pdf.

56 Many of the highest-earning developers target the iOS platform exclusively or in addition to Android due to its higher ARPU (average revenue per user), which has historically been about double that of Android (though the gap is closing).

Where are the developers?
continued

Figure 4.
Top 20 countries by total developers.

Rank	Country	Developers	Rank	Country	Developers
1	United States	1,567	11	France	219
2	China	776	12	Israel	196
3	United Kingdom	456	13	Canada	191
4	South Korea	395	14	Turkey	183
5	Japan	351	15	Vietnam	173
6	Russia	321	16	Hong Kong	158
7	Germany	307	17	Australia	143
8	India	289	18	Brazil	138
9	Taiwan	256	19	Italy	137
10	Spain	239	20	Finland	116

Source: Author's calculations

Where are the developers?
continued

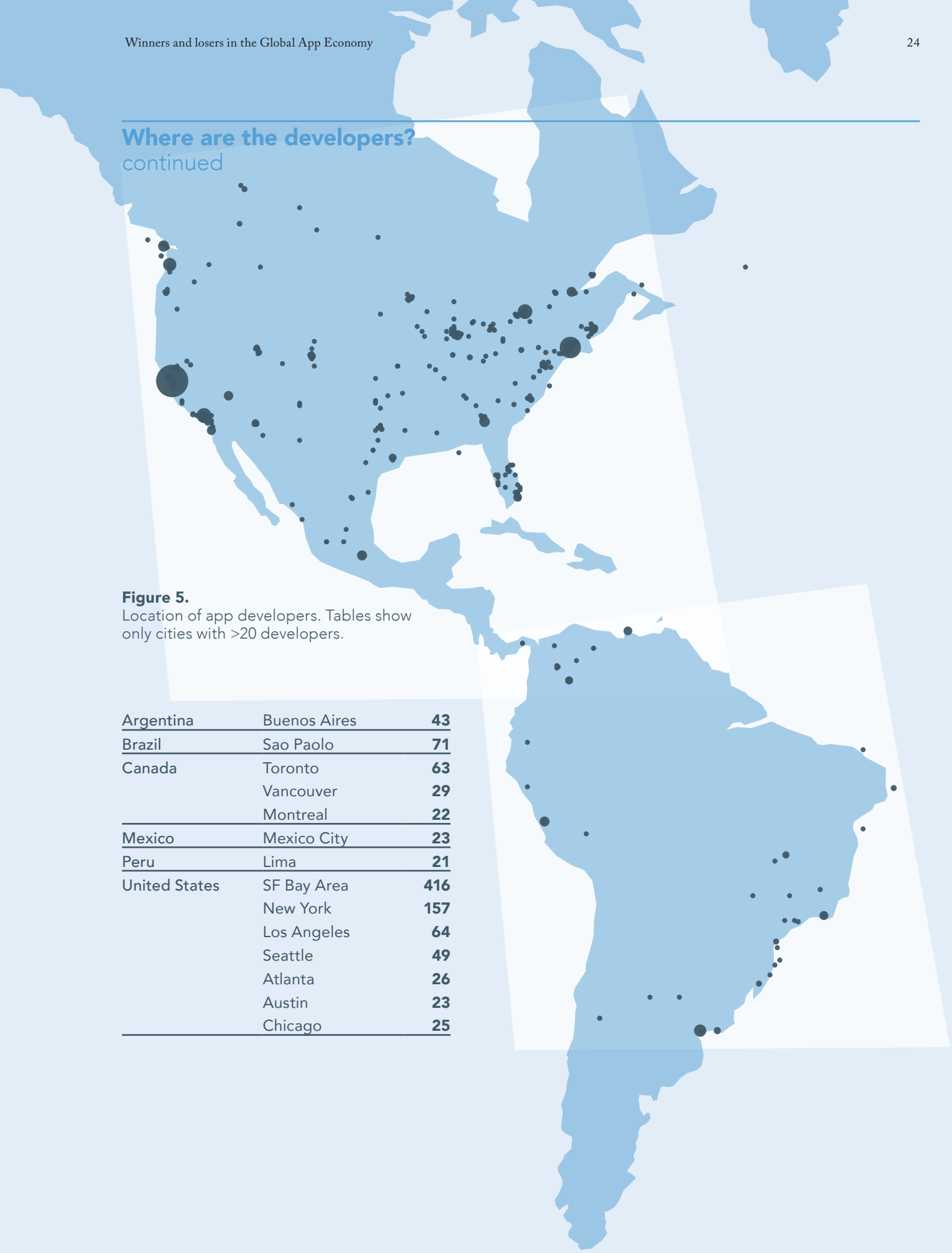
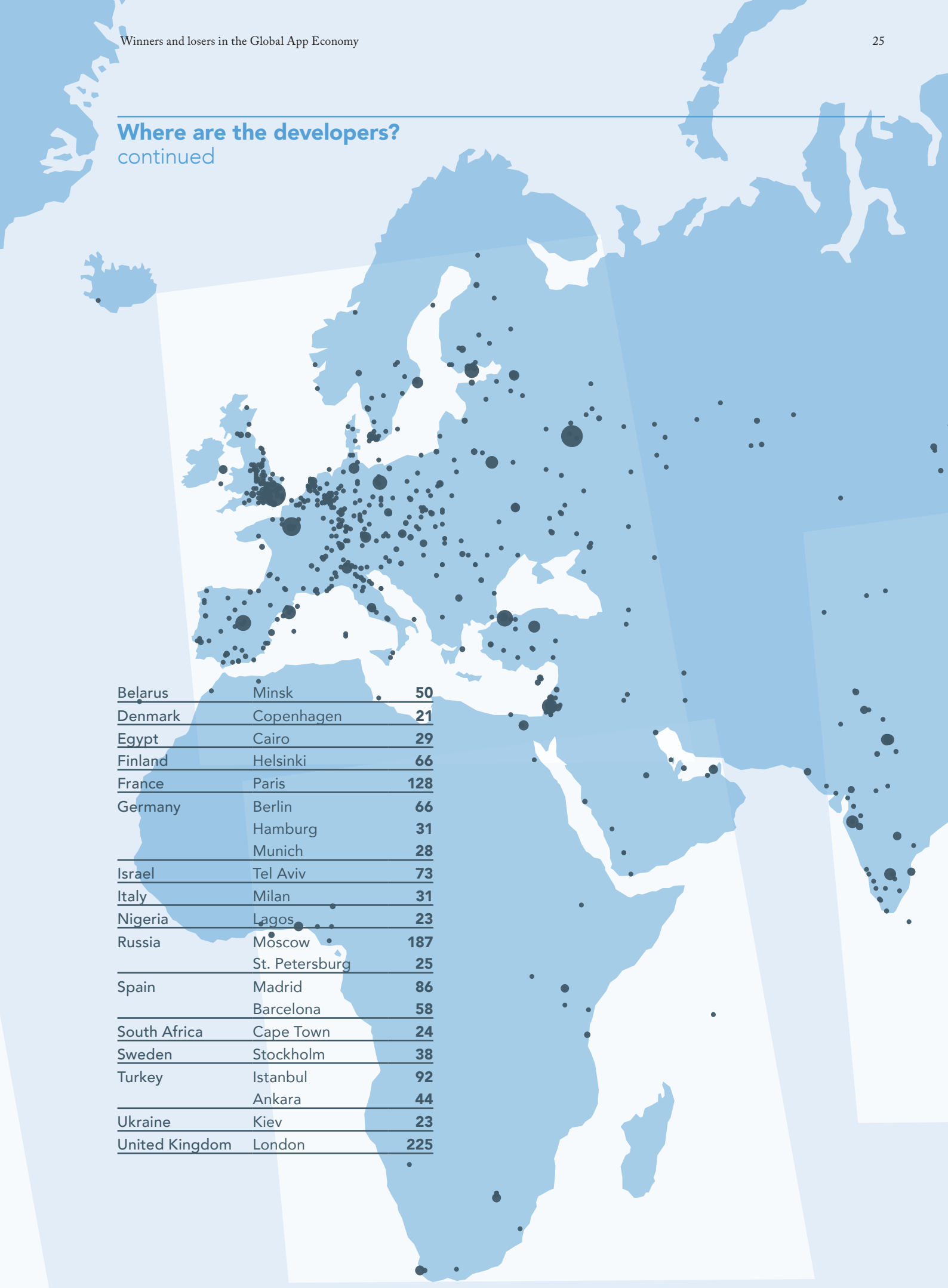


Figure 5.
Location of app developers. Tables show only cities with >20 developers.

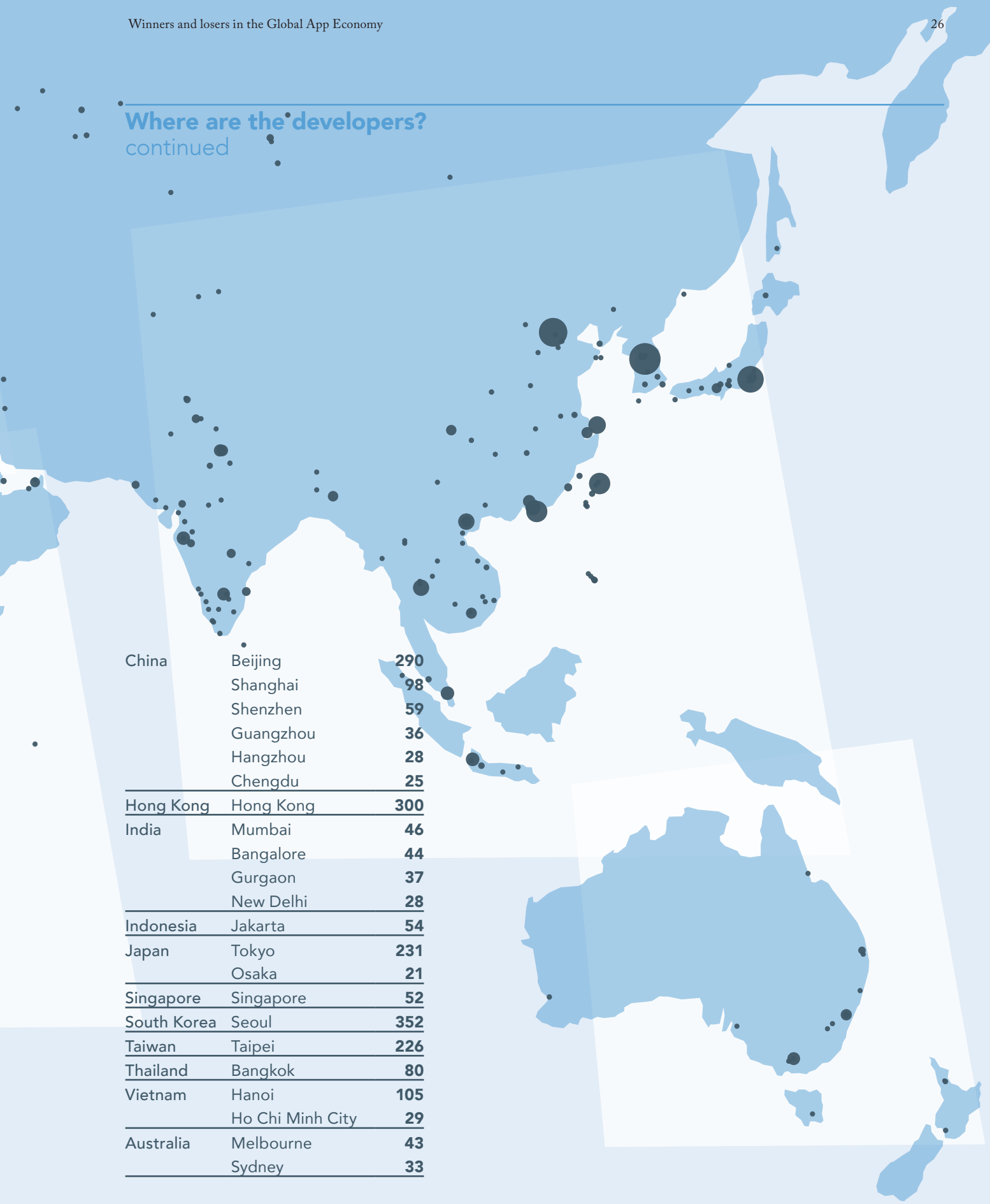
Argentina	Buenos Aires	**43**
Brazil	Sao Paolo	**71**
Canada	Toronto	**63**
	Vancouver	**29**
	Montreal	**22**
Mexico	Mexico City	**23**
Peru	Lima	**21**
United States	SF Bay Area	**416**
	New York	**157**
	Los Angeles	**64**
	Seattle	**49**
	Atlanta	**26**
	Austin	**23**
	Chicago	**25**

Where are the developers?
continued



Belarus	Minsk	50
Denmark	Copenhagen	21
Egypt	Cairo	29
Finland	Helsinki	66
France	Paris	128
Germany	Berlin	66
	Hamburg	31
	Munich	28
Israel	Tel Aviv	73
Italy	Milan	31
Nigeria	Lagos	23
Russia	Moscow	187
	St. Petersburg	25
Spain	Madrid	86
	Barcelona	58
South Africa	Cape Town	24
Sweden	Stockholm	38
Turkey	Istanbul	92
	Ankara	44
Ukraine	Kiev	23
United Kingdom	London	225

Where are the developers?
continued



China	Beijing	290
	Shanghai	98
	Shenzhen	59
	Guangzhou	36
	Hangzhou	28
	Chengdu	25
Hong Kong	Hong Kong	300
India	Mumbai	46
	Bangalore	44
	Gurgaon	37
	New Delhi	28
Indonesia	Jakarta	54
Japan	Tokyo	231
	Osaka	21
Singapore	Singapore	52
South Korea	Seoul	352
Taiwan	Taipei	226
Thailand	Bangkok	80
Vietnam	Hanoi	105
	Ho Chi Minh City	29
Australia	Melbourne	43
	Sydney	33

Where are the developers?
continued

App development clusters

To better understand any hot spots or app development "clusters" we also located developers at the level of the city. In this analysis, the major cities of East Asia and the San Francisco Bay Area (including Silicon Valley) top the list in absolute number of developers (see Figure 6). But measuring on a per capita basis, using the population of each metropolitan area, reveals a few standouts where app development seems highly concentrated: the San Francisco Bay Area is still tops, with 5x the concentration of developers as the average city, followed by Helsinki and then Hong Kong. Other high-performing cities Figure 6 with at least 20 developers were Gurgaon (India), Taipei, Minsk (Belarus), and Tel Aviv. Among the major Western European capitals, London performed best, but Paris and Berlin showed essentially average concentrations of developers. Again, because the sample population of developers is limited to commercially successful developers—those ranking in the top 500 in one of the national stores studied—there are many thousands of developers who are not represented in these data.

Figure 6.
Cities with highest concentration of commercially successful app developers. Among the 53 cities with >20 developers, mean per capita = 0.11.

Rank	Metro area	Country	# deveopers	Metro population	Per capita
1	SF Bay Area	United States	416	7,560,000	0.55
2	Helsinki	Finland	66	1,431,641	0.46
3	Hong Kong	Hong Kong	300	7,234,800	0.41
4	Gurgaon	India	37	902,112	0.41
5	Taipei	Taiwan	226	7,045,488	0.32
6	Minsk	Belarus	50	2,101,018	0.24
7	Tel Aviv	Israel	73	3,642,000	0.20
8	Stockholm	Sweden	38	2,213,528	0.17
9	London	United Kingdom	225	13,879,757	0.16
10	Hanoi	Vietnam	105	7,087,700	0.15
11	Seoul	South Korea	352	25,620,000	0.14
12	Beijing	China	290	21,148,000	0.14
13	Madrid	Spain	86	6,414,620	0.13
14	Seattle	United States	49	3,671,478	0.13
15	Berlin	Germany	66	5,145,576	0.13
16	Paris	France	128	11,978,363	0.11
17	Toronto	Canada	63	5,959,505	0.11
18	Barcelona	Spain	58	5,493,081	0.11
19	Copenhagen	Denmark	21	1,992,114	0.11
20	Melbourne	Australia	43	4,246,345	0.10

Source: Author's calculations

Estimating value capture

On their own, these numbers can be misleading—having lots of developers doesn't necessarily translate into economic value, as the winner-take-all dynamics of the app stores mean that the vast majority of developers don't earn significant revenue. Even among the developers in our sample—the most successful in the app stores—there are tremendous differences in downloads and revenues depending on the ranking of their app and the national market(s) that they're able to enter. In this section we combine the geography of developers with the app store power law curves to reveal more accurate estimates of value capture on a country basis.

Applying the power law curve

Because actual revenue figures for each app and app developer are not publicly available, we instead estimate value capture on a relative basis, taking as our unit of analysis the total theoretical revenue from the Apple App Store and Google Play across the 37 markets studied, and assigning each developer a percentage share of that total. To incorporate the winner-take-all dynamics of apps into our model, we follow a well-established empirical approach[57] and use sales rank data (i.e., app ranking) to estimate value (app revenue). Previous empirical studies on digital markets have derived estimates for the power law curve with coefficients ranging from -0.613[58] to -1.119.[59] The only study we are aware of that specifically modeled the app market found that the curve for iOS apps had a coefficient of -0.94.[60] Because we do not have data to estimate the shape of the curve, we follow this last study, but simplify to a coefficient of -1, which assigns a relative value to each app in the sample and results in a power law curve of form represented below in Figure 7,[61] and described in the calculation in Figure 8. For our simplified model, this means that we assign the #1 app equal to 1, and then discount each subsequent app by the reciprocal of its rank. This means the #2 app is valued at 1/2, #3 app is valued at 1/3, and so on.

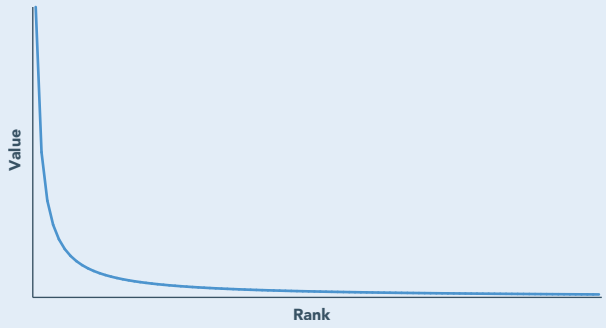


Figure 7.
Representation of sample power law curve.

57 For example, see Fernando Ferreira and Joel Waldfogel, "Pop Internationalism: Has Half a Century of World Music Trade Displaced Local Culture?," *The Economic Journal* 123, no. 569 (June 2013): 634–64, doi:10.1111/ecoj.12003; Judith Chevalier and Austan Goolsbee, "Measuring Prices and Price Competition Online: Amazon. Com and BarnesandNoble. Com," *Quantitative Marketing and Economics* 1, no. 2 (2003): 203–22; Brynjolfsson, Hu, and Smith, "Consumer Surplus in the Digital Economy: Estimating the Value of Increased Product Variety at Online Booksellers." *Management Science* 49, no. 11 (2003): 1580–96.

58 Erik Brynjolfsson, Yu Jeffrey Hu, and Michael D. Smith, "The Longer Tail: The Changing Shape of Amazon's Sales Distribution Curve," *Available at SSRN 1679991*, 2010, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1679991.

59 Chevalier and Goolsbee, "Measuring Prices and Price Competition Online."

60 Garg and Telang, "Inferring App Demand from Publicly Available Data."

61 This simplification has support in the literature, as Ferreira and Waldfogel (2013) also used a coefficient of -1 in their empirical analysis of global music sales.

Estimating value capture
continued

Figure 8.
Calculation for estimated power law curve.

$$sales = \beta\ (rank)^{-\alpha} + \epsilon$$

Where β and α are coefficients and ϵ is the error term

But in order to more accurately model the app economy we need to go further. Because the value of a #1 ranked app in the U.S. store may be 100x the value of the #1 app in the Philippines store, app ranking alone is insufficient to estimate value, and we need to include some measure of the value of each national market. Using a similar power law curve to model relative value for the national stores is probably less accurate than when used to model relative value of the apps, but the limited data on store revenues that is publicly available does suggest it is a reasonable approach.[62] Therefore we create two sets of national store value estimates, one each for iOS and Android, based on their relative rankings of the top 10 markets (see Figure 3 above).

Country profiles: Developers vs. value capture

As a result each instance of an app has a total value estimate based on its rank, national store, and platform, which we aggregate at the country level and visualize in Figure 9. To provide context to this analysis, we include in the chart the number of developers from each country; the result allows us to visualize which countries are capturing an outsized percentage of the total app store revenue compared to the number of developers they have.

The chart clearly shows the dominance of the U.S., which has 22% of the developers in the sample yet captures 36% of the value. The other two countries that significantly over-perform are Japan and Finland, while China and the U.K. are also high-performing. Because each national market has a disproportionate share of domestic production, it is not surprising that those national markets ranked in the top 10—and thus with higher market value indexes—do better on this scale. The significant outlier is Finland, which is not a top 10 market, yet commands an outsize share of overall value.

"Which means that if Supercell were a country, it would rank 5th in total value capture among all the countries in the sample; put another way, Supercell alone earns more than 28 of the countries in our sample, combined."

To explore the over-performing countries, we look at the actual developers and apps involved. For Finland, we can see that the vast majority of its value capture is due to one company—Supercell—and its top-ranked apps. If we exclude only two apps from the analysis, Clash of Clans and Hay Day, Finland's share of the total value drops from 7.5% to 0.5%. Which means that if Supercell were a country, it would rank 5th in total value capture among all the countries in the sample; put another way, Supercell alone earns more than 28 of the countries in our sample, combined. Similarly, Sweden's ratio drops in half, from 1.3% to 0.7%, if we exclude Spotify. And for the U.K., removing King.com from the analysis drops the country's share of total value from about 7% to around 2%. These examples reinforce the dramatic bias at the top end of winner-take-all markets, where a single app and developer in a country can account for multiples of all others combined.

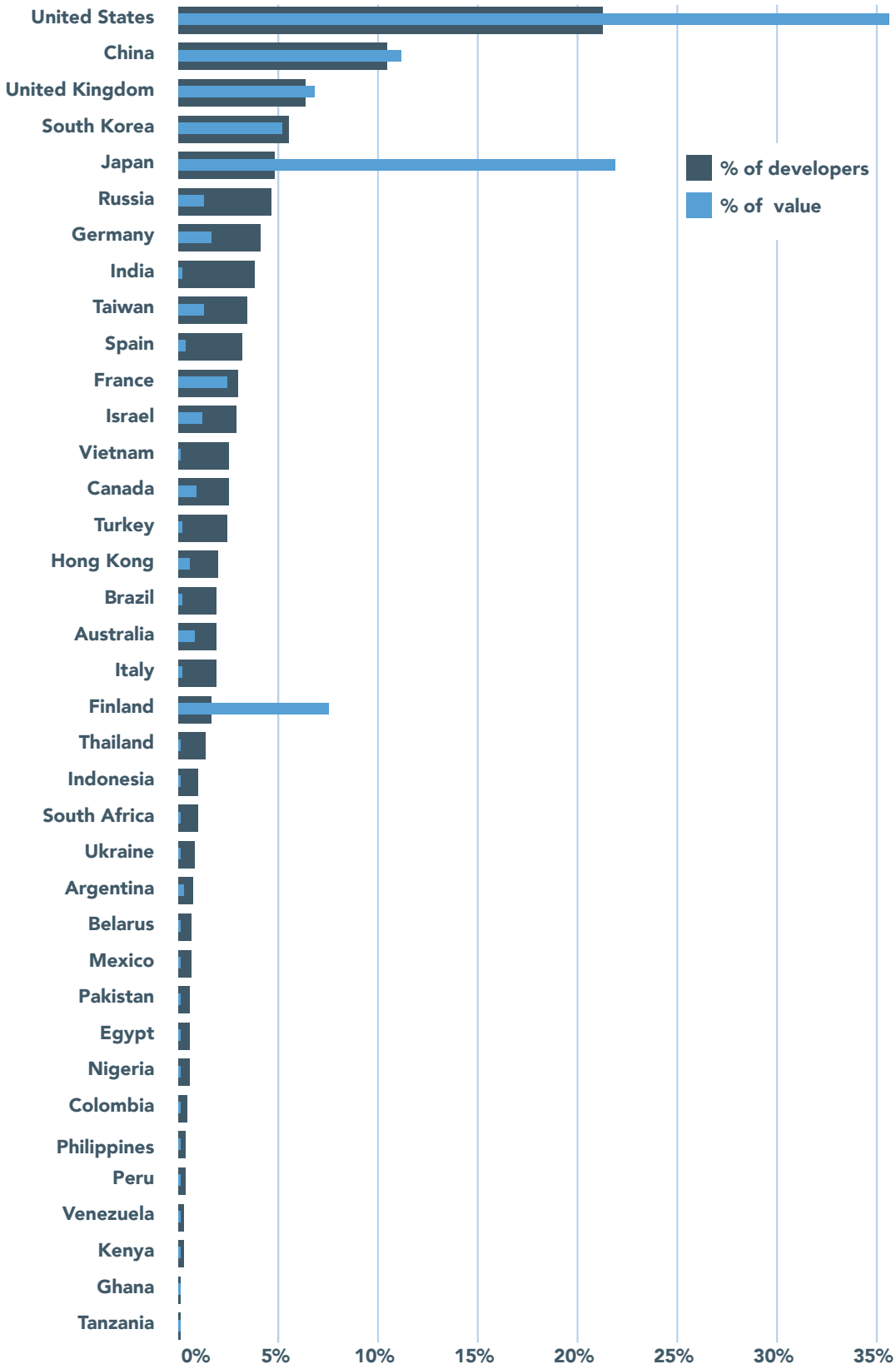
Also apparent from this data view is the diminished ratio of value capture by the lower-income economies. On the one hand, emerging markets that appear on this list show potential by ranking in the top 25 countries by number of developers. But it's clear that the revenue per developer is much smaller in the lower-income countries. Most of this effect is due to the weak value of their domestic markets—of the 87 developers hailing from Indonesia, 75 are only present in the domestic market, which is one of the weakest markets for revenue. As a result, very little direct economic value can be attributed to those developers; we explore this topic further in the "Discussion and implications" section. These data suggest caution when interpreting the presence of a large number of app developers in an emerging market, as simple quantity of developers does not necessarily correlate with direct economic benefit.

62 The variation in national store revenues is not due to the same winner-take-all dynamics—for example, users don't actually choose between app stores as options, so network effects are not relevant—but instead is due to vast differences in total population, smartphone penetration, per-capita income, and other factors in each market. However, publicly released data from App Annie shows that the top markets—e.g., U.S. and Japan—have revenues of approximately 4x those of Western Europe, and more than 100x those of Indonesia, Mexico, and others, which approximates a power law distribution. An additional constraint is that we only have ranking data for the top 10 markets, while the sample includes 37 markets. We accommodate for this by applying the power law coefficient to the top 10 markets, and then assign all markets outside of the top 10 the same value.

Estimating value capture
continued

Figure 9.
Relative share of developers and value capture across 37 markets.

Source: Author's calculations



Markets and patterns of trade

The breadth and geopolitical diversity of the 37 countries in the sample allows us to develop interesting aggregate metrics of regional market characteristics and trade patterns. We first analyze the market mix, or market share, in different regions as indicators of not only demand-side preferences, but also the capacity of a country to serve its own domestic market. Then we explore inter- and intra-regional trade in apps, taking the ability of a developer to sell into external national stores as the ability to "export" to those markets. Finally, we combine the trade measurements with the value capture estimates from the previous section to paint a global picture of the major flows of app store revenue around the world.

Local preferences, but United States dominates

All countries showed a preference for domestically produced apps, though the degree to which this manifested varied tremendously, ranging from 70% in Japan to 2% in many of the lower-income countries. While 2% market share seems very low, for many countries—e.g. Kenya, Colombia, Mexico, Nigeria, Peru, Philippines, Tanzania, and Venezuela—that couple of percentage points of market share in their home market represents the entire extent of their app market share, as they had virtually no presence in foreign markets.

Rather predictably, the United States dominates market share globally. U.S. apps represented on average 31% of the market across all foreign markets, ranging from a low of 16% in Japan to over 51% in Canada (U.S. developers controlled 65% of the U.S. market). In fact, only four countries in the sample—Japan, China, South Korea, and Taiwan—had a domestic market share higher than the U.S. share in their own market. This effect was visible on a regional level as well, some of which we can ascribe to spatial and cultural proximity, and others which are likely due to shared macroeconomic factors.

In Figure 10, the Latin American markets on the left show very similar market composition: High levels of U.S. apps, almost identical mix of other foreign apps, and small levels of domestic production, ranging from 2% in Venezuela to 6% in Argentina. The outlier in this group is Brazil, which shows significant domestic market share of 15%. In comparison, the markets in Western Europe show a much lower presence of U.S. apps, and correspondingly higher levels of domestic production, with all countries except for Italy owning over 15% of their national market.

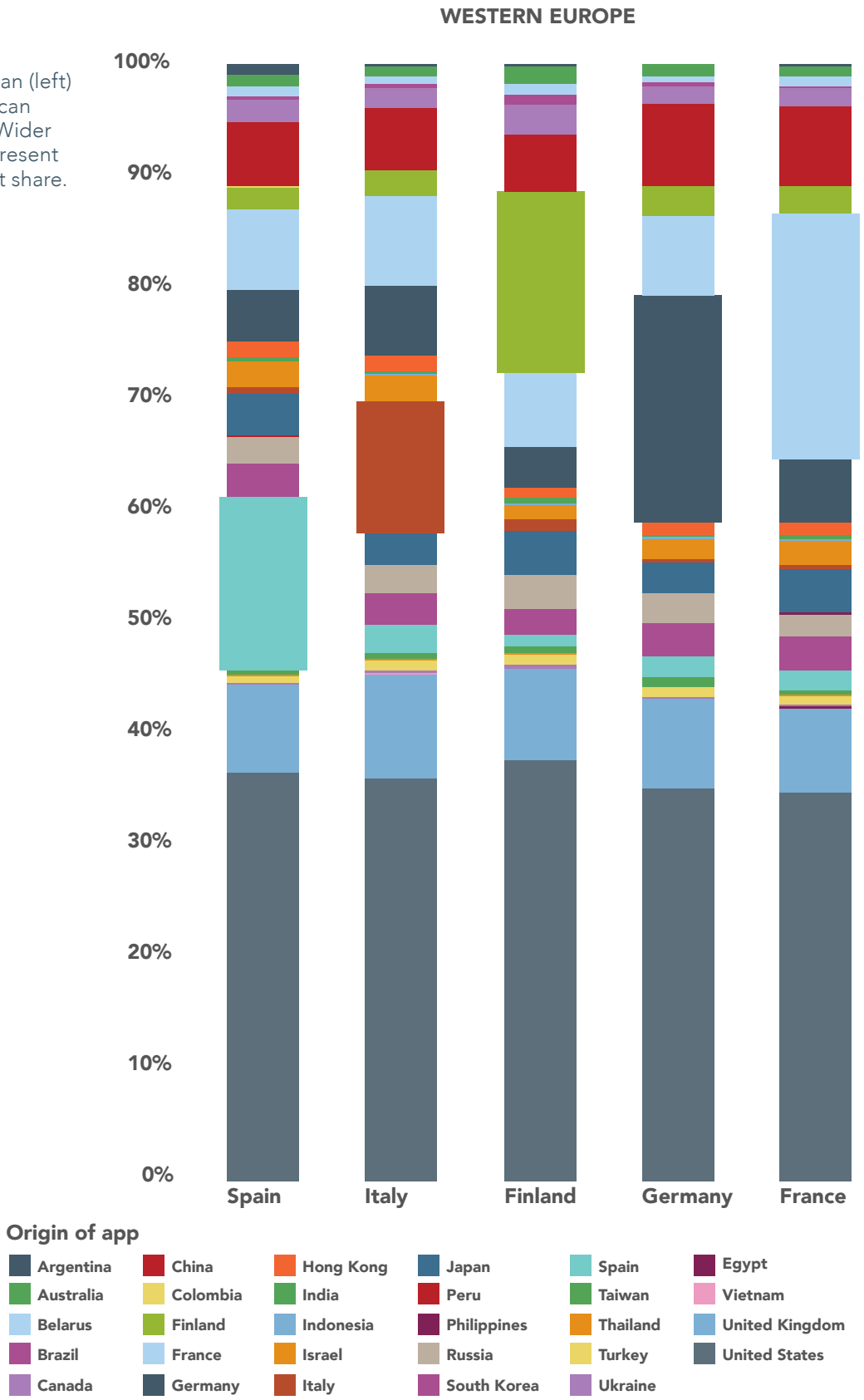
Language matters

These two same regions also provide clear examples of the importance of language and culture. In the European countries, France and Italy are spatially close to Spain, yet Spanish apps represent only about 2% of their markets. Across the Atlantic in Latin America, that market share doubles in the Spanish-speaking countries, which have around 4% Spanish apps. On the other hand, Brazilian developers are able to enter their non-Portuguese-speaking neighboring markets at about twice the rate of the European markets, suggesting that there are shared cultural preferences beyond language, at least in Latin America, that affect user demand.

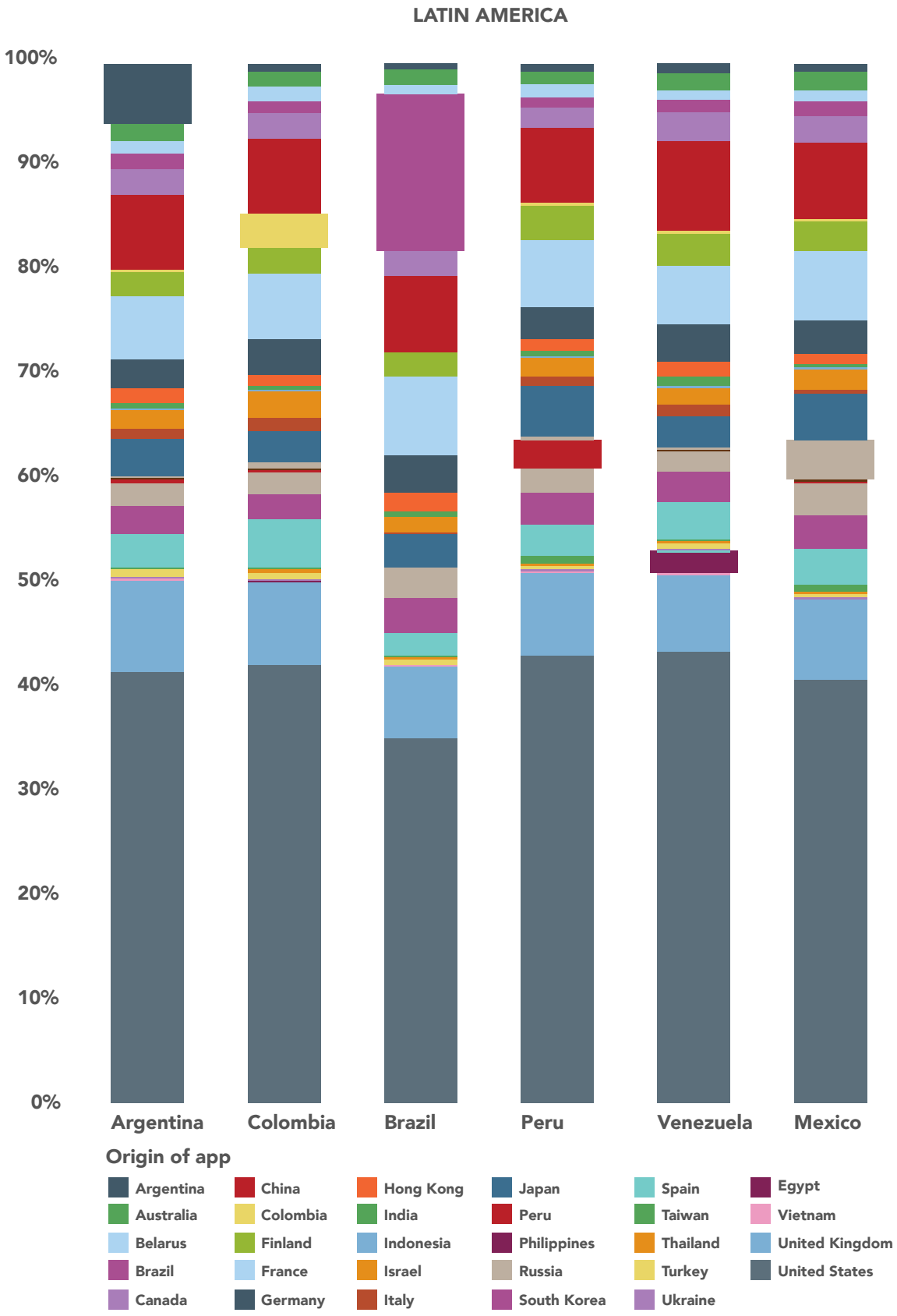
The role of English as the global *lingua franca* of business, and especially ICT, is no doubt a driver of the widespread popularity of U.S. and U.K. apps around the world. Unsurprisingly, U.S. and U.K. apps are most popular in markets where English is the only or primary official language. A less predictable finding was that the region with next-highest ratio of U.S. and U.K. apps was Sub-Saharan Africa, where Kenya, Nigeria, Ghana, South Africa, and Tanzania all showed over 50% market share of U.S.- and U.K.-based apps.

Markets and patterns of trade
continued

Figure 10.
Market share of Western European (left) and Latin American (right) markets. Wider bar sections represent domestic market share.



Markets and patterns of trade
continued



Markets and patterns of trade
continued

Distance matters—sometimes

As digital goods that have essentially zero transportation costs, apps are not subject to the same kind of distance-related constraints as physical goods. Therefore while economists have long ago established models for estimating the international trade of goods—for example, the gravity model, which at its most basic supposes that the amount of trade between any two countries is a function of their distance and their mass, which is often taken as GDP or population—we expect those models to require modifications in the age of digital products and services.[63] While a trade model is outside the scope of this analysis, the data do show evidence of both distance-defying effects, such as the global demand for U.S. apps, as well as indications of the strength of spatial proximity, such as the regional influence of China.

"China, Japan, and South Korea—three of the top markets and leading countries for developers—show almost no trade with each other, despite their close proximity"

In the Southeast Asian countries we can see a couple of patterns in this regard: Vietnam, Philippines, Indonesia, and Thailand are the top foreign markets for South Korean apps, and well above average for Chinese apps, showing a regional preference despite distinct national languages.[64] In sharp contrast, however, is one of the most striking patterns of trade in the data: China, Japan, and South Korea—three of the top markets and leading countries for developers—show almost no trade with each other, despite their close proximity. Taiwan is more moderate but still inwardly focused, while Hong Kong reflects a much more international profile. We explore the East Asian markets in more depth in the next section.

The Great Wall of East Asia

As shown clearly in Figure 11, the three large East Asian markets are very insular, and dominated by locally produced apps. Japan (70%), China (63%), and South Korea (61%) join the U.S. (58%) as the clear leaders in domestic production (the next highest countries, Taiwan and Russia, only reach 30%). There are several likely drivers of this: Firstly, all three Asian countries have distinct national languages and lower rates of English-speaking populations, making it more likely that the top apps will be in the local language and thus require translation/localization for any foreign firms, a significant barrier to entry. This is especially true in Japan and South Korea, whose linguistic sphere of influence is not as wide in the region as China's. Japan's mobile industry has always evolved somewhat independently of the rest of the global market, and therefore at multiple levels—the device and its functionality, the types of games and services, the technical network protocols—serving the Japanese customer has required deep knowledge of the local market.[65] As home to Samsung, the largest smartphone manufacturer worldwide, and the fastest mobile data networks in the world,[66] South Korea saw tremendous early growth in smartphone adoption—especially with the "phablet" form factor, which first found success in the South Korea market—and mobile internet usage, creating strong demand for apps. Finally, China is different in so many ways that it operates as its own unique ecosystem. State-sanctioned barriers to entry for foreign technology firms have helped China grow its own versions of the most popular ICT services; in the mobile space this is most readily visible by the exclusion of "certified" Android OS and Google services such as the Google Play store. Instead Chinese device manufacturers such as Xiaomi, Oppo, and Vivo are

63 For different applications of the gravity model to digital goods, see Ruth Garcia-Gavilanes, Daniele Quercia, and Alejandro Jaimes, "Cultural Dimensions in Twitter: Time, Individualism and Power," *Proc. of ICWSM* 13 (2013), http://www.aaai.org/ocs/index.php/ICWSM/ICWSM13/paper/viewPDFInterstitial/6102Ruth/6358.; Ferreira and Waldfogel, "Pop Internationalism."

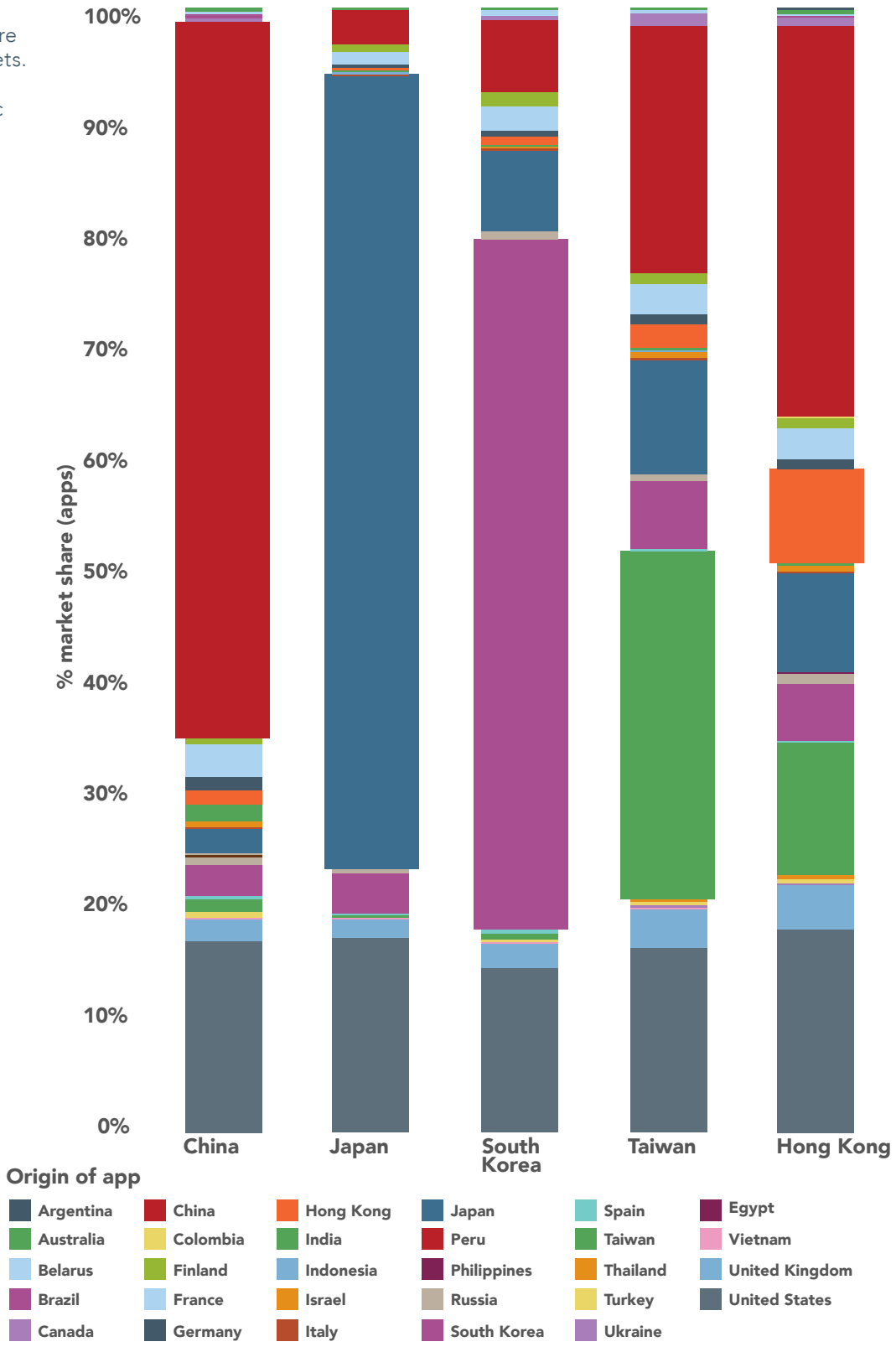
64 Of course, the Chinese diaspora, and thus language, is significant in much of the region.

65 Kenji Kushida describes the evolution of the Japanese telecom industry as a "Galapagos effect" due to its unique technologies and business structures that never gained traction in other markets, despite being some of the most advanced technologies available. See Kenji E Kushida, "Leading without Followers: How Politics and Market Dynamics Trapped Innovations in Japan's Domestic 'Galapagos' Telecommunications Sector," *Journal of Industry, Competition and Trade* 11, no. 3 (2011): 279–307.

66 "Akamai Releases Second Quarter 2015 State of the Internet Report | Akamai," accessed December 21, 2015, https://www.stateoftheinternet.com/resources-connectivity-2015-q2-state-of-the-internet-report.html.

Markets and patterns of trade
continued

Figure 11.
Percent market share of East Asian markets. Wider bar sections represent domestic market share.



Markets and patterns of trade
continued

churning out low-cost handsets with open-source Android, hundreds of 3rd-party app stores compete for market share, and popular services such as WeChat are operating as all-in-one platforms for communications, content, and services, creating an app market so different that a new cottage industry has grown out of helping foreign firms try to localize and distribute their apps in China.[67]

Constrained to local markets

Across the entire sample, one-third of developers only appear in their own domestic markets, meaning they aren't exporting beyond their borders. Some of these developers may only target their own market because of relevance (for example, a local transit app). But given that more markets typically means more revenue, for the majority of developers this likely signifies the presence of barriers to entering external markets. As discussed previously, language and culture are clearly important factors. But for the larger, more competitive markets, experience and resources also play a role—top developers typically use more tools, such as sophisticated user analytics, game engines, and cross-platform tools, and have more money to invest in marketing and paid installs to drive traffic and rankings.[68] For smaller, independent developers, these may be competitive barriers that are hard to overcome.

A more granular view of the data, summarized in Figure 12, supports this idea. On a country level, the ratio of developers who are constrained to their domestic market is only 29% for the high-income economies, compared to a full 69% for the lower-income economies, ranging from a low of only 3% in the U.S. to 100% in Ghana (which only has a few developers). The inability of lower-income developers to export has double the impact: First, because being limited to one market is generally less lucrative than being able to enter additional markets, but second, and most importantly, these producers are by definition in low-revenue markets, such that even if they are very highly ranked domestically, the revenue may not be sufficient for sustainable businesses. We return to this issue in the Discussion, "Supply vs. demand and the domestic market trap."

Local production displaces U.S. content

A key issue for policymakers in smaller markets is the degree to which domestic production is able to compete with foreign entrants, or framed differently, the amount of value being pulled out of a market by foreign imports. We would assume that, for apps, this would be a function of the amount of local app development, and the data do show a correlation between the number of developers a country has and the extent of its domestic market share, especially for the lower-income countries.

"There is strong evidence that a higher proportion of locally developed apps substitutes for a higher proportion of U.S. apps."

A related, but more interesting, pattern shown in Figure 13 is that increased consumption of local apps correlates to lower consumption of U.S. apps—on average, every 1% increase in domestic market share leads to a 0.35% decrease in U.S. market share (R^2=0.35, $p<0.01$). To a certain extent this is to be expected, as a larger share of domestic apps means market share of all other apps must decrease proportionally. But apps from the 2nd-most popular country, China, don't display the same sensitivity to changes in domestic market share. Thus while the data can't suggest causation in either direction, there is strong evidence that a higher proportion of locally developed apps substitutes for a higher proportion of U.S. apps.

67 "Yodo1 Raises $2 Million To Help Game Developers Enter China | TechCrunch," accessed December 21, 2015, http://techcrunch.com/2012/06/28/yodo1-raises-2-million-to-help-game-developers-enter-china/.

68 Vision Mobile, "State of the Developer Nation: Q1 2015" (Vision Mobile, February 2015).

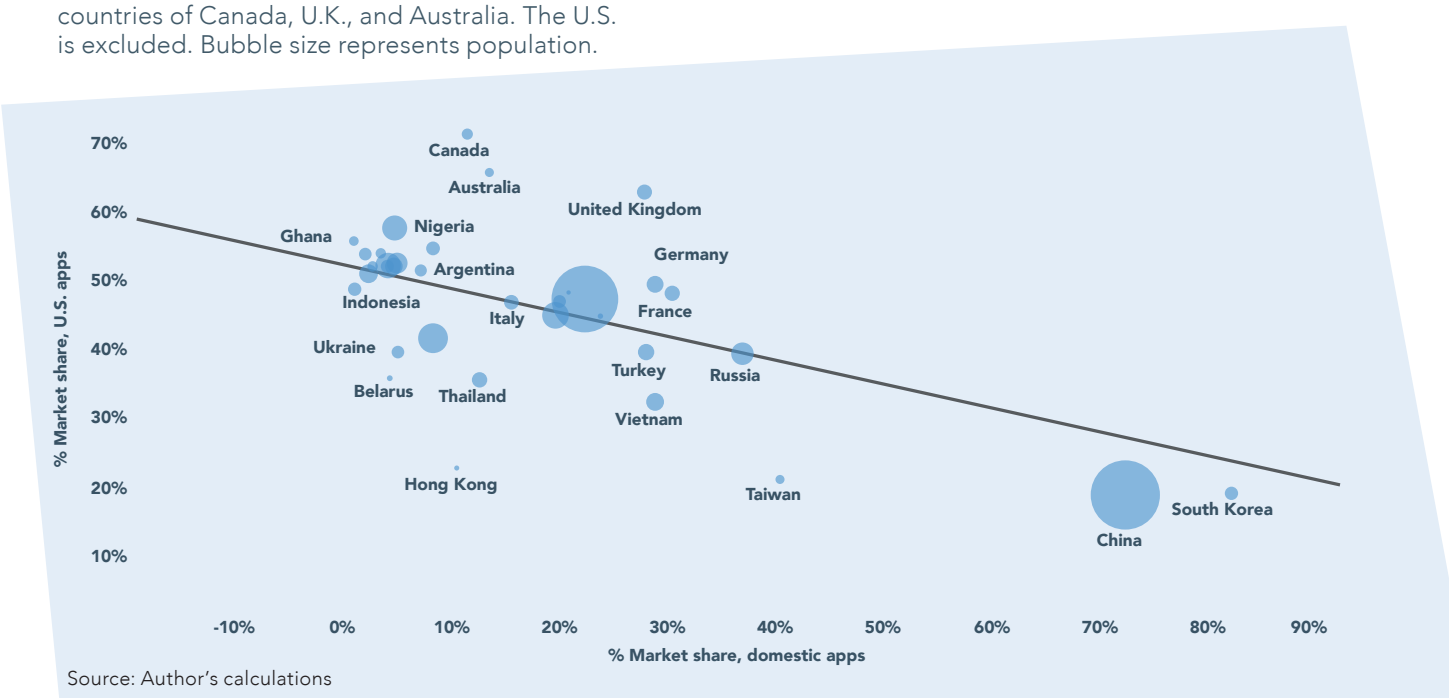
Markets and patterns of trade
continued

Figure 12.
Ratio of developers who are not able to export.

Metro area	Total developers	With app only in domestic market
All countries	7,634	37%
High-income countries	6,101	29%
Lower-income countries	1,533	69%

Source: Author's calculations

Figure 13.
Higher market share of domestic apps correlates with lower market share of U.S. apps (R^2=0.35, $p<0.01$). Outliers above the cluster are English-speaking countries of Canada, U.K., and Australia. The U.S. is excluded. Bubble size represents population.



Source: Author's calculations

Markets and patterns of trade
continued

Visualizing regional trade and value capture

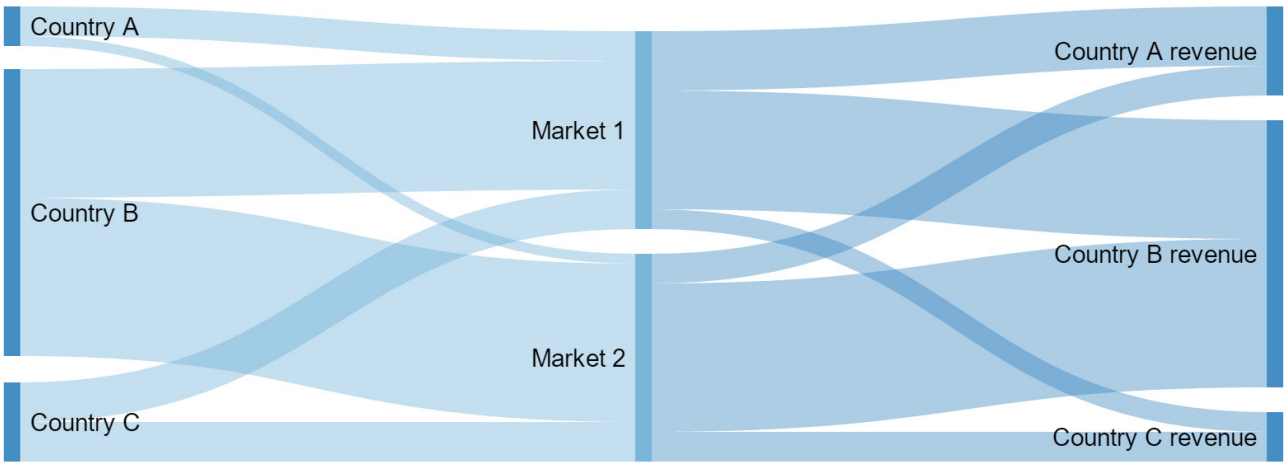
In this section we combine the patterns of import/export and estimated value to show aggregate flows of apps and revenue in a highly visual format. Using a series of Sankey diagrams, we show for each region the flows of apps into the markets and the flows of estimated revenue back out to the country of the developer. These visualizations allow us to easily see several dimensions within the data, including the producer diversity in each market, domestic market share, and total exports. Because the charts are organized primarily geographically, we can also see regional trade (or lack thereof) in a much more direct fashion. Perhaps most importantly, these charts also include the value capture side of the equation, and therefore show not only which countries are making and exporting lots of apps, but which countries are earning lots of revenue.

And by tracing the flows, it becomes apparent when there is a large differential between the two—e.g., few apps but lots of revenue—revealing especially strong or weak performance by producers from a country. For example, in virtually all regions and markets, Finland earns more revenue than expected given the number of apps it produces, which is primarily due to the very high ranking Supercell products.

While China is a larger producer and typically earns a concomitant amount of revenue, we can see that in the English-speaking regions it earns relatively little revenue given the number of titles it exports to those markets, indicating that it has more low-ranking apps compared to other regions.

As shown in the example below (Figure 14), the charts are to be read left-to-right. The left column is the origin country of the app developer, with the width of the flows representing the number of apps that were "exported" to the national markets shown in the middle column. The width of the flows on the right side represent estimated financial value being captured by each country, based on the rank of the app and rank of the national market (for details, see section "Estimating value capture"). For better clarity in the diagram, we omit flows of apps or revenue below a certain threshold (~1%), and we set all the national markets to the same size (the nodes in the middle column are not sized to represent the total value of the market). This latter modification sacrifices the ability to visually compare total value from different markets (e.g., U.S. vs. Brazil), but enables us to represent all markets in the same series of charts.

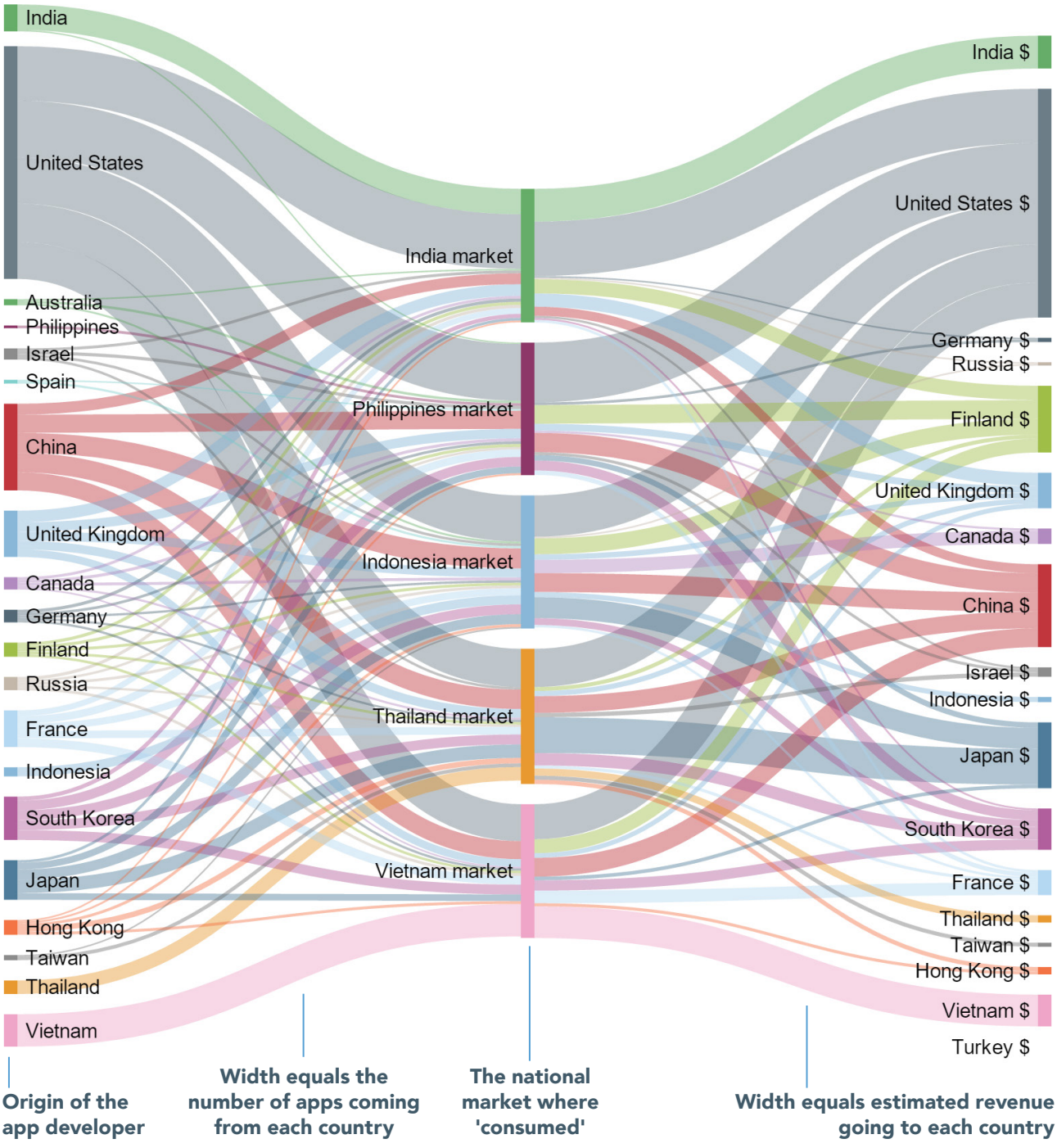
Figure 14.
Sample Sankey diagram. In this stylized example, developers from Country A represent about 15% of the apps in Market 1, but they extract about 30% of the estimated value for that market, meaning Country A developers have relatively few apps, but they are highly ranked.



Markets and patterns of trade
continued

Looking first at South Asia (Figure 15), we can see a few interesting patterns. The Philippines and Indonesia have almost no domestic production or market share, while Thailand has some domestic market share, but composed of low-ranking apps so value capture is low relative to input. India and Vietnam both do quite well with domestic production and owning a good percentage of their own market. In general, high input (number of apps) correlates to high output (estimated revenue), but Japan's activity in Thailand is a clear exception: you can see Japan captures a lot more value than you would expect given the number of apps it has there. This is most certainly the result of Line, which has had tremendous success in Thailand though less so in neighboring countries.[69]

Figure 15.
App market share and estimate valued capture: Southeast Asian markets.

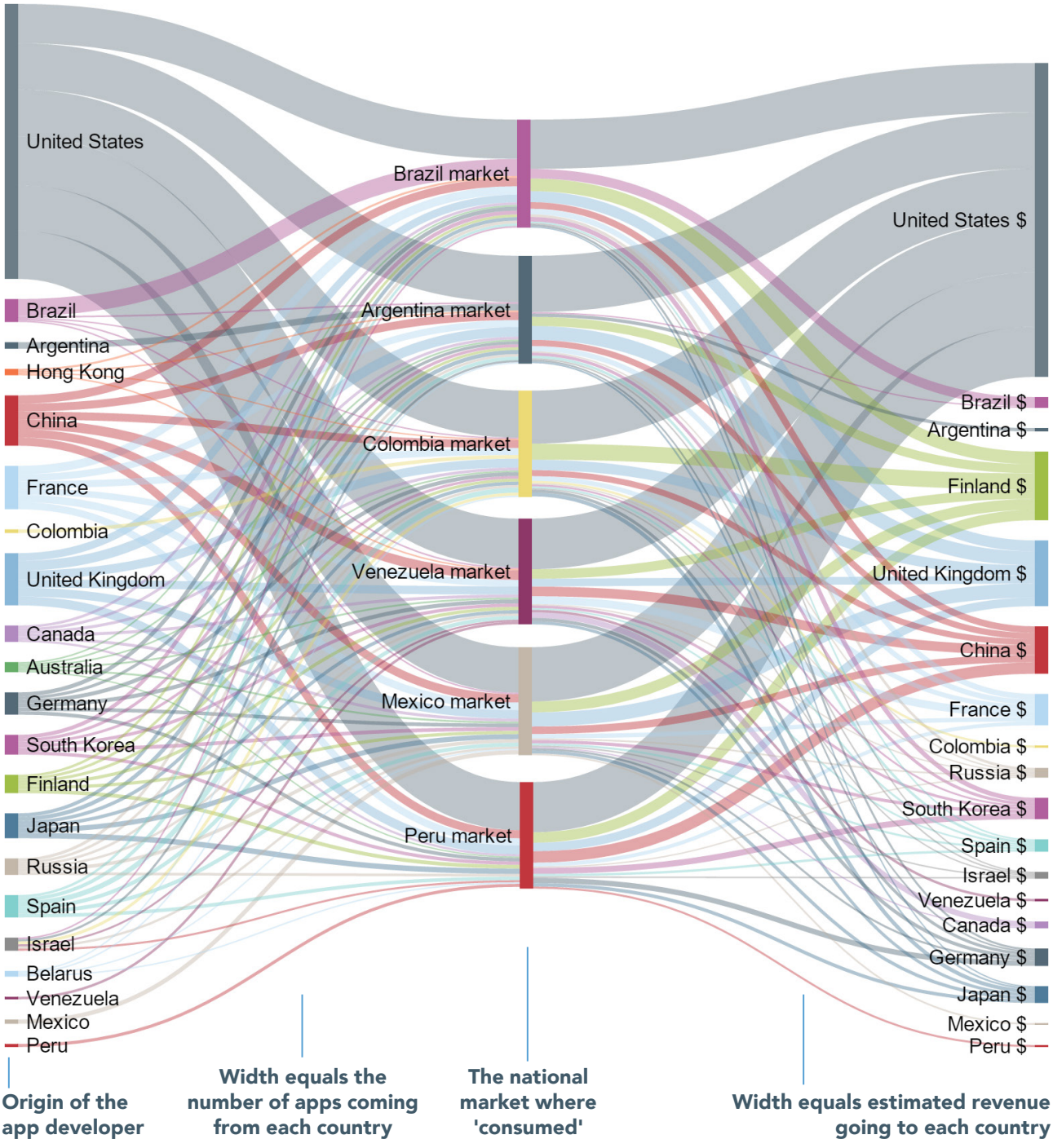


69 "As Growth Sputters, Line Doubles down on Thailand – tech01.us," accessed December 21, 2015, http://tech01.us/asia/as-growth-sputters-line-doubles-down-on-thailand-2015-11-27.

Markets and patterns of trade
continued

The Latin American market is characterized by weak domestic production, with Brazil the only country having any significant local app development. But the flow of revenue back to Brazil from its own market is smaller than the flow of apps going into it, which again means that although there were a good number of Brazilian-made apps in the Brazil market, most were low-ranking apps, and therefore earning lower revenue. Finland shows the opposite effect, where it only has a few apps, but they are very high-ranking. While the U.S. is dominant in every market, there doesn't seem to be any distance effect, as Mexico, with its shared border (and increasingly intermixed culture) shows similar demand for U.S. apps as do its peers further south.

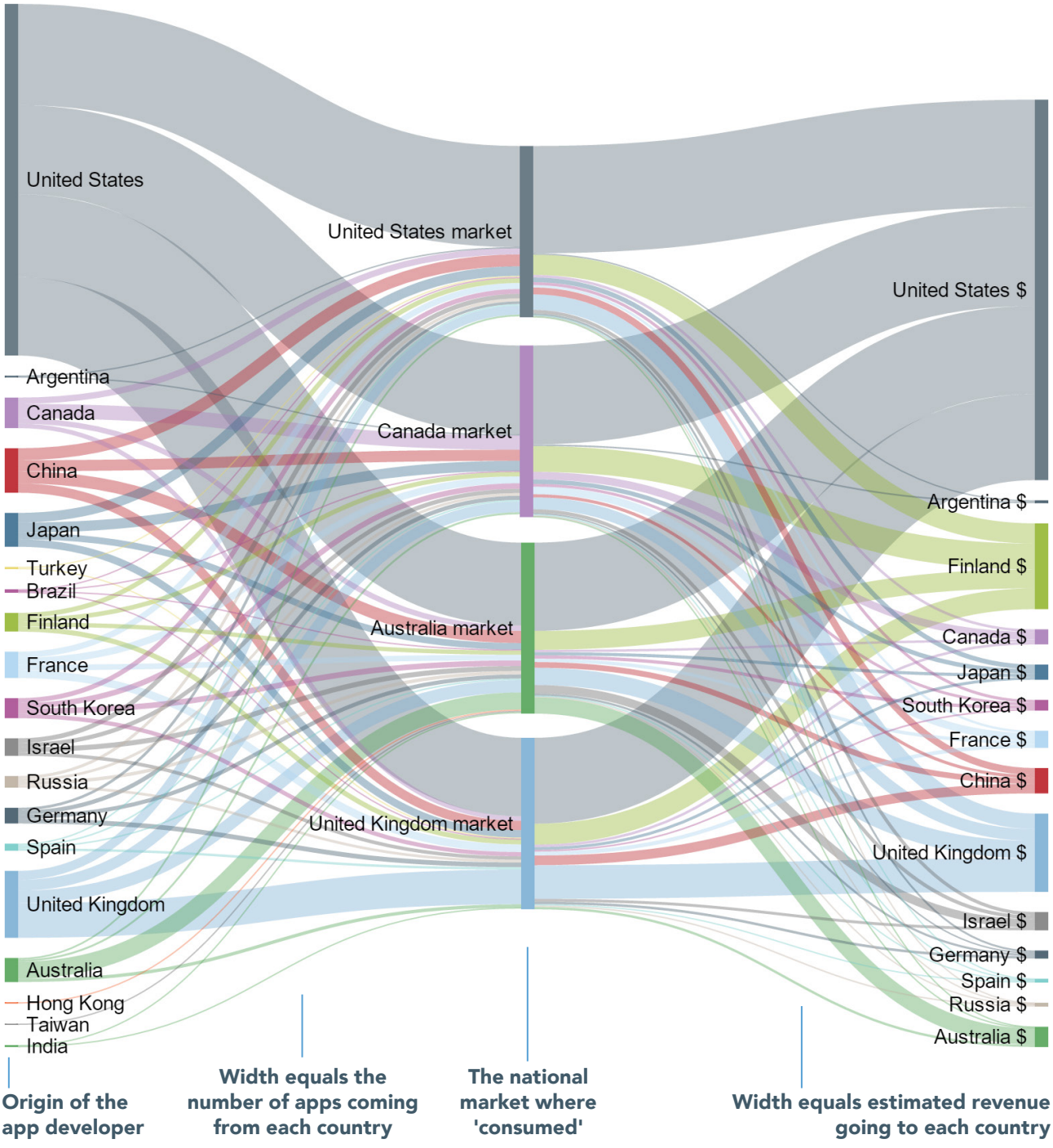
Figure 16.
App market share and estimate valued capture: Latin American markets.



Markets and patterns of trade
continued

The English-speaking countries are clearly dominated by the United States, which has the largest market share and also takes away a disproportionally high share of the value in each of the markets. Unsurprisingly, the U.K. also does well here. Notice that the East Asian countries, especially China and Japan, have a smaller presence in these markets, which is more likely due to language and culture than distance effects, as the trade balances among the four English-speaking markets—which are spread across the world—show no overt signs of proximity bias.

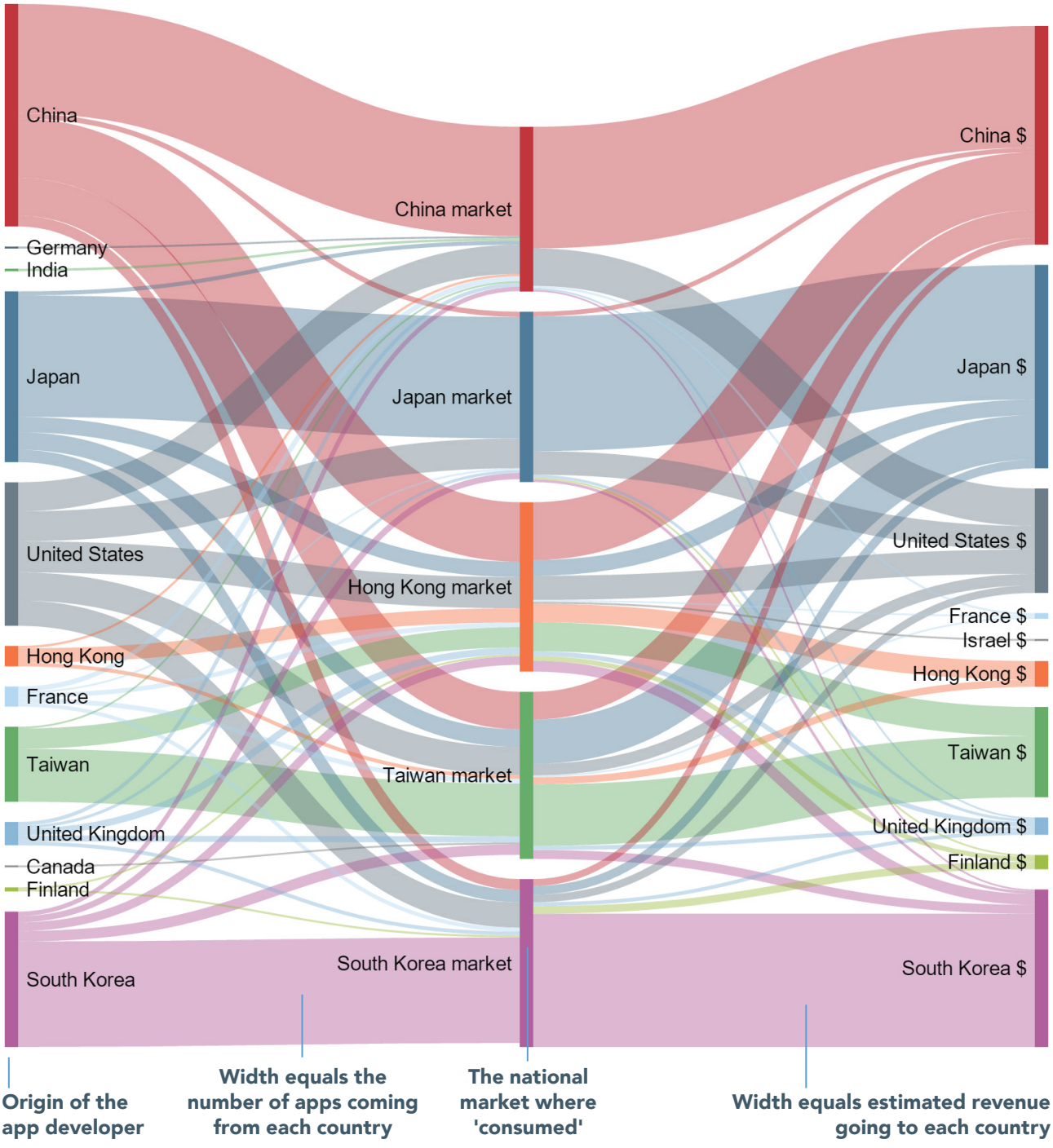
Figure 17.
App market share and estimate valued capture: English-dominant markets.



Markets and patterns of trade
continued

The East Asian markets have the highest barriers to entry for foreign developers, exhibiting what we call the "Great Wall of East Asia." The big three markets of Japan, China, and South Korea are among the top markets for revenues, and are dominated by local producers. Japan is especially insular, with 71% of its market controlled by Japanese developers. Surprisingly, however, the big three countries trade very little with each other, especially given their close spatial proximity. In fact, Japan and South Korea don't export much at all to other markets, despite Japan's strength in games and history of bringing video gaming culture to the world.[70]

Figure 18.
App market share and estimate valued capture: East Asian markets.

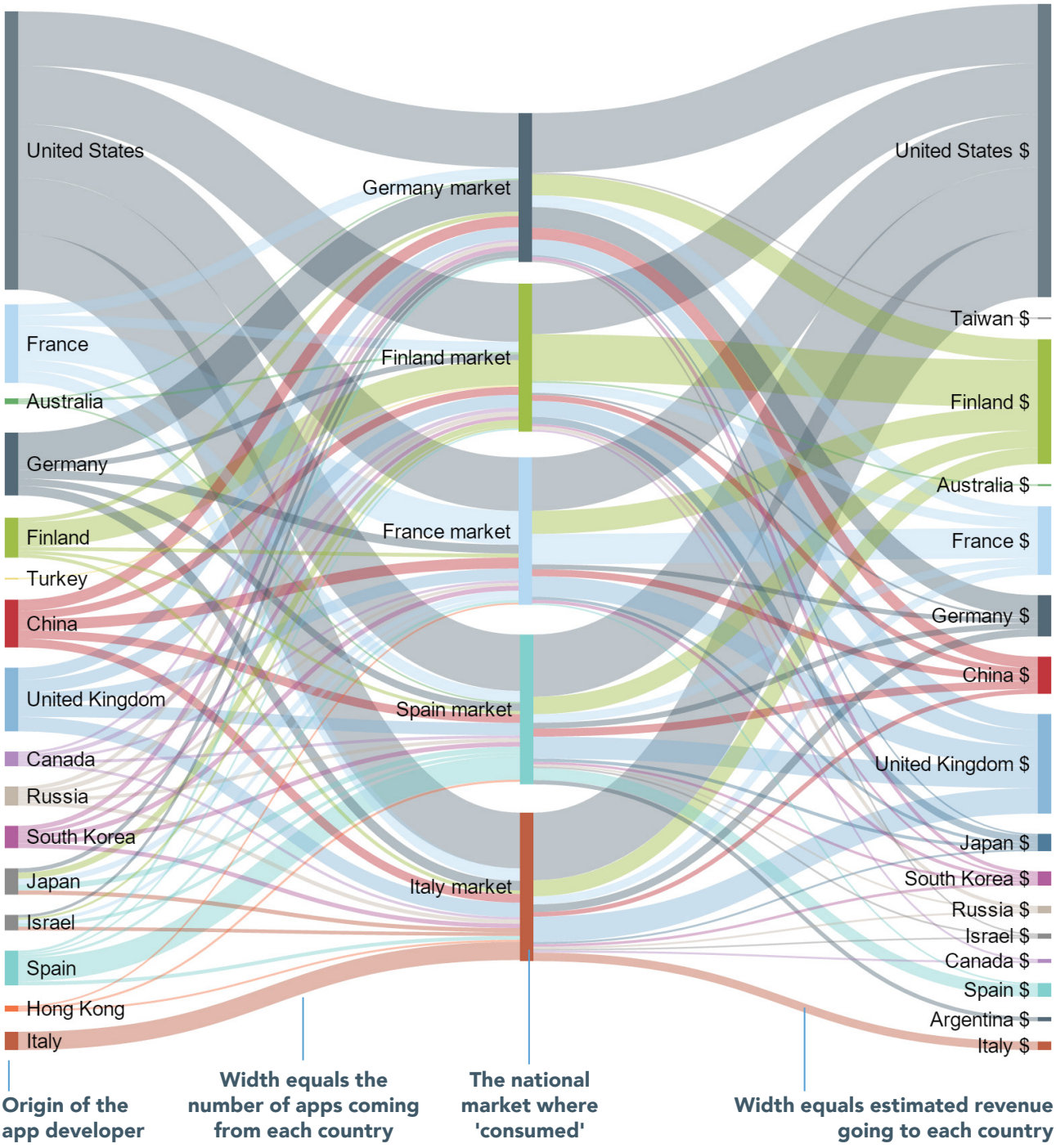


70 Jennifer Johns, "Video Games Production Networks: Value Capture, Power Relations and Embeddedness," *Journal of Economic Geography* 6, no. June 2005 (2006): 151–80, doi:10.1093/jeg/lbi001.

Markets and patterns of trade
continued

The markets in our sample from Western Europe showed more diversity in market share, with many trading partners. Unlike the East Asian countries, the close spatial proximity seems to support cross-border app trade, despite distinct languages; France is especially strong in exports. And all countries showed at least modest amounts of domestic production, led by France and Germany. Finland, which is strong in all regions, also does well on its home continent, capturing significant value from all of the markets studied. Although the bulk of Finland's revenues come from its top performers, especially Supercell, which are popular around the world, we can see that there are a significant number of other apps by Finnish developers that don't make it outside the their local market.

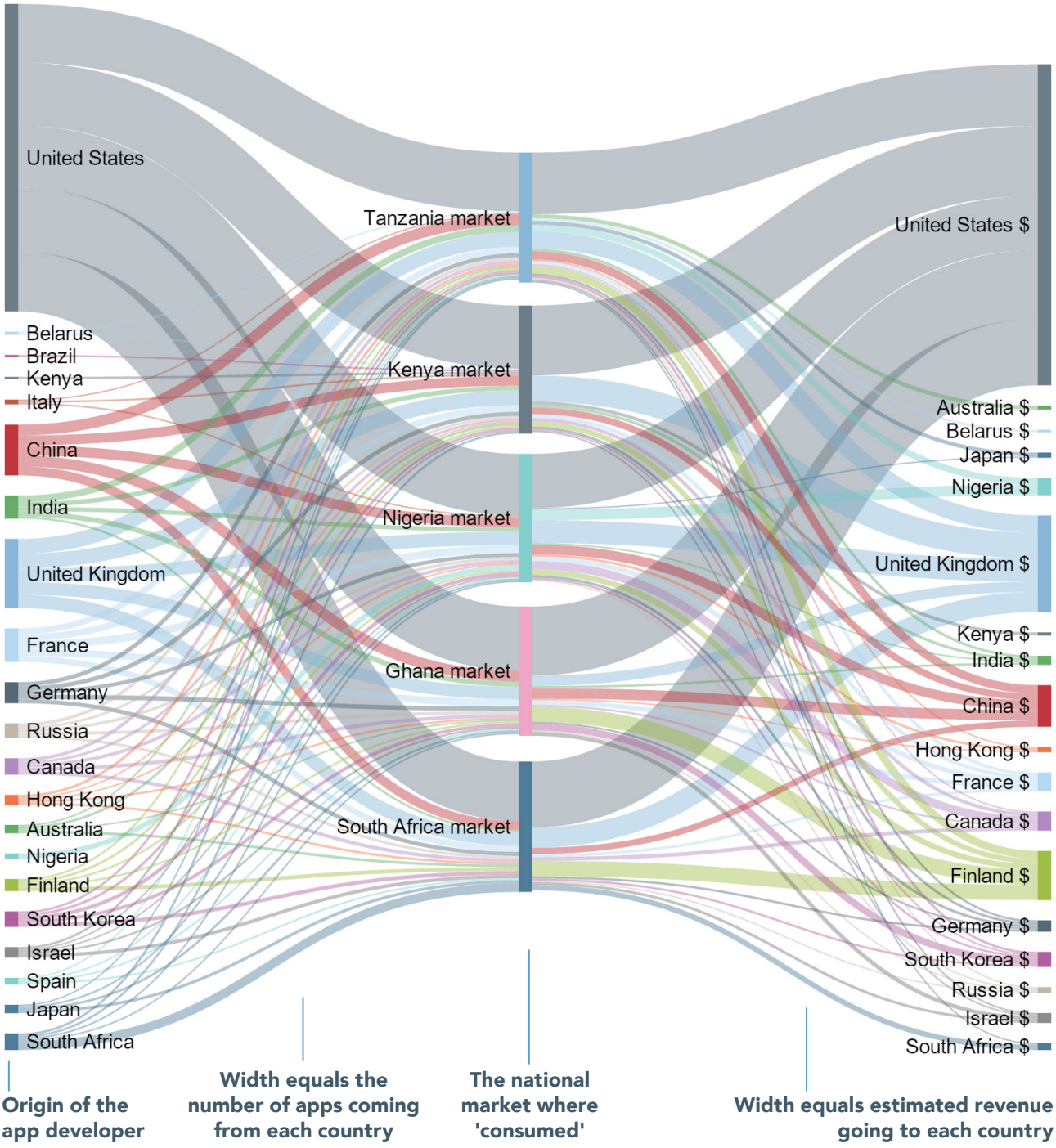
Figure 19.
App market share and estimate valued capture: Western Europe markets.



Markets and patterns of trade
continued

The countries in Sub-Saharan Africa all showed very similar patterns: the U.S. dominates market share, with almost no local app production. U.S. market share in this region was highest of all the non-English dominant regions. South Africa was the only country to register a modest number of developers, but the narrow width of its value flow indicates those apps were low-ranking.

Figure 20.
App market share and estimate valued capture: Sub-Saharan Africa markets.



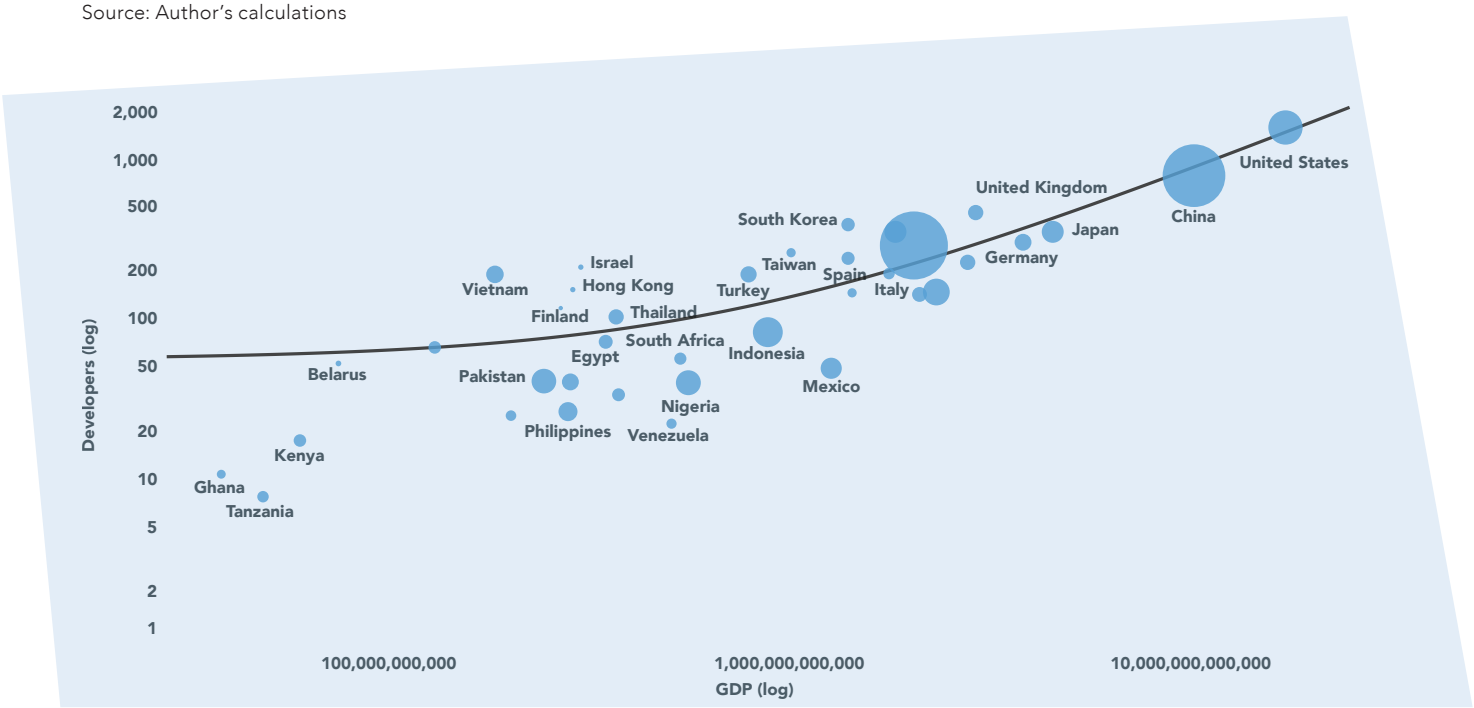
Production in lower-income countries

The data presented so far have shown that while some lower-income countries do have significant numbers of developers, those developers are capturing very small amounts of the overall total value. In this section we explore in greater depth the differences among the emerging market countries. Like any other knowledge or creative work, commercial success in the global app economy is the result of complex and intertwined socioeconomic and technical drivers, and these will vary based on demographics and institutional environments in each country. Previous research on noncommercial digital content production has identified some of these drivers, including broadband penetration and internet access costs.[71] Research on the business environment for digital entrepreneurship in Kenya found gaps in venture capital, the skills sets and experience of the entrepreneurs, and commercial partnerships, especially with mobile operators.[72]

While we highlight some correlations around national indicators and app development, we find that the most common socioeconomic measures offer only limited help in teasing out the different output performances we see in the data, especially among the emerging markets. The challenge is compounded by the small sample size and strongly skewed nature of the data (non-normal distributions). For example, the size of a country's population and economy are strongly correlated to the number of commercially successful app developers (Figure 22). This is mostly due to the fact that high-income countries tend to have larger and more experienced software industries, and also because these higher-revenue markets attract more developers. But in any case, the metric is skewed by the substantial weight of the U.S. and China as outliers.

Figure 21.
Larger economies have more developers.
(r^2=0.90, p=<0.01, log scale)

Source: Author's calculations



71 OECD, "The Relationship between Local Content, Internet Development, and Access Prices."

72 Marissa Drouillard, "Digital Entrepreneurship in Kenya 2014" (GSMA, Omidyar Network, UKAID, 2014), http://www.gsmaentrepreneurshipkenya.com/GSMA_KENYA-AR2014-060214-WEB-SINGLE-PGS.pdf.

Production in lower-income countries
continued

To focus our analysis on the lower-income countries, we take a view based on GDP per capita, and zoom in to the left side of the chart (Figure 22). On a per-capita basis, India and Brazil move down to only average performers, while Vietnam, Turkey, and Belarus are the standouts in this group, with 2.5, 2.8, and 6.1 developers per million population, respectively. If we look beyond these three, we see that Ukraine and Thailand are next highest-ranking, making Southeast Asia and Eastern Europe the strongest regions among the emerging markets. In contrast, Sub-Saharan Africa is very low (apart from South Africa), and the Latin American countries are also weak. Country-by-country analysis is outside the scope of this research, but we explore some of these differences in greater detail in the next section through a comparison of two high-performing countries in the sample, Vietnam and Turkey, with two of their country peers.

Spotlight on Vietnam and Turkey

Among the sample of lower-income countries, Vietnam and Turkey stand out both because they had relatively strong performances in our app economy analysis, and also because those performances were drastically different compared to other countries with ostensibly similar socioeconomic profiles. The chart below (Figure 23) shows all the lower-income countries in the sample with basic socioeconomic and infrastructure indicators in the left columns, and data from our analysis in the right columns.

On the national indicators selected, Vietnam has a very similar profile to its neighbor, the Philippines. They have similar GDP (total and per capita), population, and internet users. Yet in this study, Vietnam excels in comparison: it had 226 developers to 31 for the Philippines, a domestic market share of 21% vs. 2%, and estimated value capture almost 10 times higher. Turkey shows a similar pattern. Compared to Mexico, its GDP is almost identical (per capita, but lower overall) with almost 50 million fewer people. Turkey does have higher access rates for internet use, but only by a modest amount. But it has four times as many developers, five times the domestic market share, and 13 times the estimated value capture that Mexico does.

Figure 22.
Lower-income countries, on per capita basis (developers per million vs. GDP per capita). Bubble size represents population.

Source: Author's calculations

Production in lower-income countries
continued

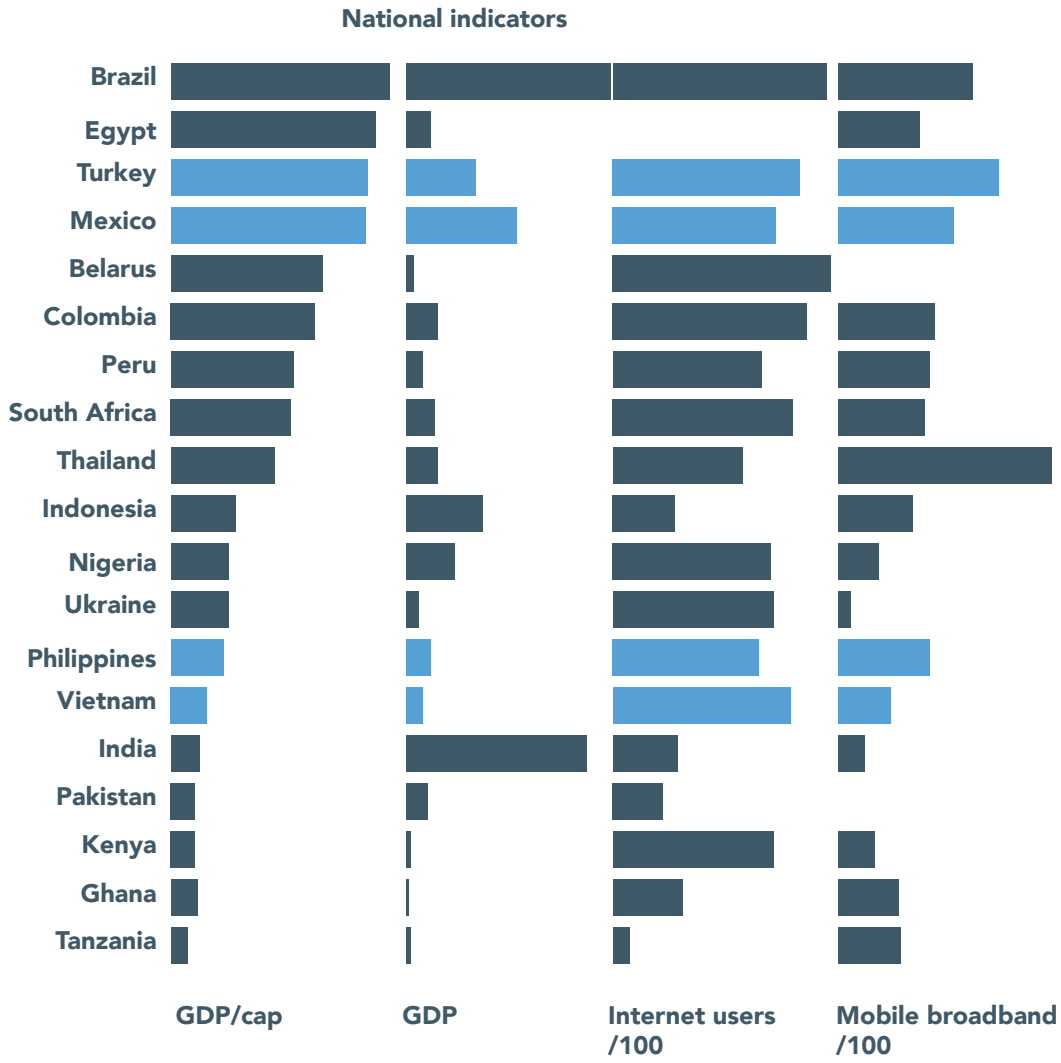


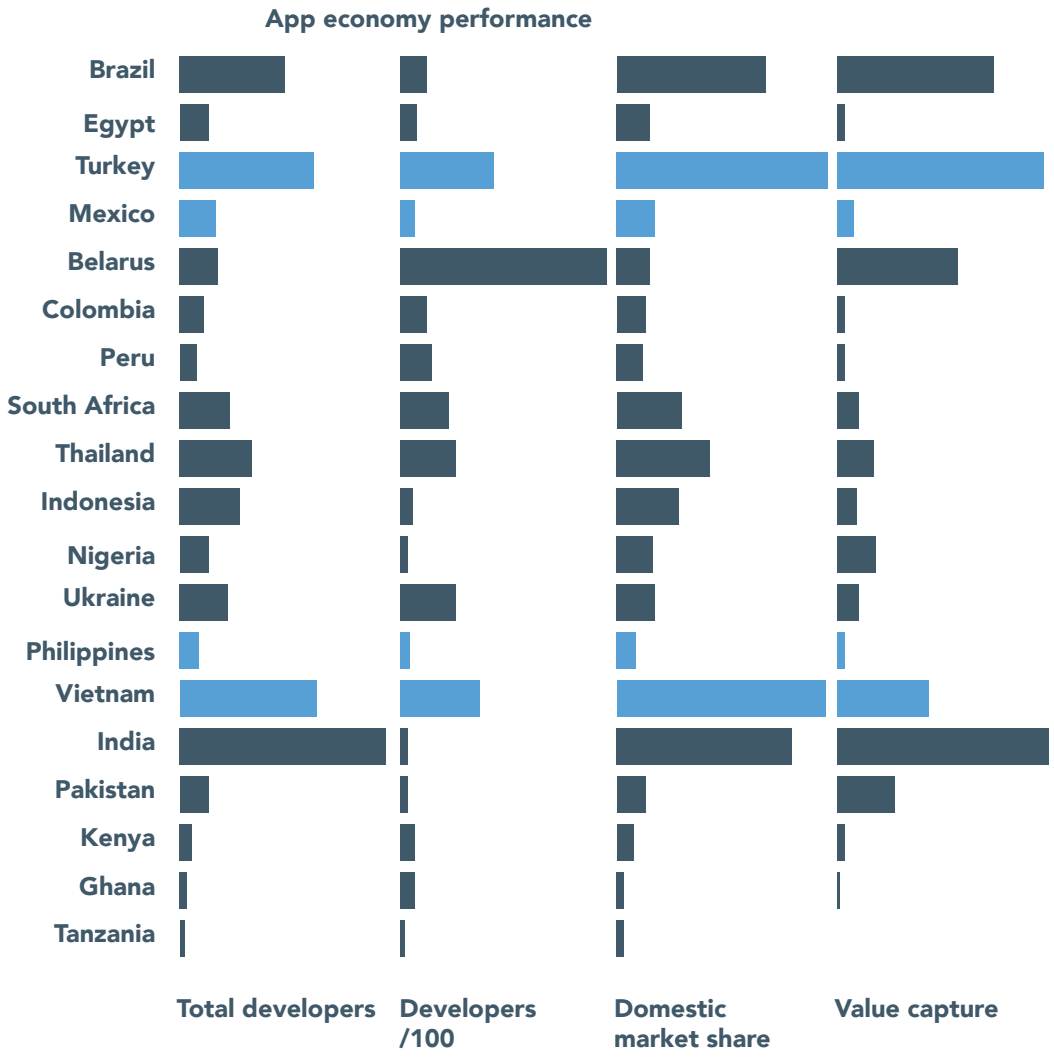
Figure 23. The lower-income countries with national indicators and data results. Outperforming countries Vietnam and Turkey are highlighted along with comparison countries, Philippines and Mexico, respectively. Each measure (columns) is represented as a relative value compared to all visible rows in the chart.

In both cases the national indicators don't provide much value in understanding what makes Vietnam and Turkey stand out. But if we look at the right side of the chart, we see interesting patterns in terms of domestic market share and local-language apps. This latter metric is a simple ratio of those apps that have a title that is in a local language. What is clear is that for our two comparison cases, higher numbers of developers correlate with higher domestic market share and higher ratios of local-language apps. The language factor may be the key to understanding this difference. Take Vietnam and the Philippines: Both have unique languages that are not shared with other countries. Yet we see dramatically different profiles in terms of domestic production for the domestic market. In the Vietnamese market, 17% of apps are listed in the Vietnamese language, while in the Philippines, only 1% are in Tagalog.

We hypothesize that this difference is due in part to the highly heterogeneous language mix in the Philippines compared to Vietnam, including a very large English-speaking population. Because so many Filipinos can read and speak English, the market is more open to foreign apps from the United States and other Western producers. On the other hand, the relative dominance of Vietnamese in Vietnam serves as a form of trade barrier, providing space for local producers to create Vietnamese language apps that

Production in lower-income countries
continued

Figure 23.
continued



can serve the non-English speaking population. As discussed in the section "The Great Wall of East Asia," this kind of linguistic and cultural barrier to foreign entrants is extremely strong in Japan, China, and South Korea, who thoroughly dominate their domestic markets. Though the effect is much less pronounced in Vietnam and Turkey, it is reasonable to believe that countries with unique, singular languages and sizeable populations have an advantage in regards to a protected domestic market. Extending the analysis to the other top performers, we see that Belarus, Thailand, and Ukraine all show similar patterns. They each have sizeable domestic market share (though not as high as Vietnam and Turkey) and very high ratios of apps in the local language.

Mexico, on the other hand, has a dominant language but shares it among most of Latin America and Spain, leading to a much diluted language barrier for the region, not just the country. We described the effect of language on trade earlier in the section "Language matters," where we show how apps from Spain are more popular in Latin American than neighboring European countries. And for Mexico and the other Latin American countries, the most popular markets for exports are overwhelmingly other Spanish-speaking nations. While the local language barrier is a phenomenon that we surface in our data, it is not the only, or even dominant, factor affecting digital production. We discuss ideas for other factors that may be even more important in the "Discussion and implications" section below.

Discussion and implications: Three themes

In the previous sections we have documented the unequal distribution of participation and value capture by app developers worldwide, and explored how market structures and platform design shape this distribution. In this section we discuss three key themes that have emerged from the research, but are beyond the scope of our current data and analysis. We thus offer a perspective and some hypotheses, including suggestions for further research to fully address these topics.

Digital drivers: App contests vs. contract IT outsourcing

We return to the topic of possible drivers of digital production in lower-income countries, and explore in more depth why we see such differences between, for example, Vietnam and Kenya. The lackluster performance by the latter is especially surprising given the amount of enthusiasm for the "Silicon Savannah" and mobile technology in East Africa. The establishment of the iHub co-working/ incubation center on Nairobi's Ngong Road has inspired and been the model for similar technology hubs across the continent,[73] and has become the focal point for technology investors, entrepreneurs, and digital businesses interested in the African ecosystem. Nairobi hosts innumerable app contests, hackathons, and coding schools, and Google's Eric Schmidt and Microsoft's Satya Nadella have both made a point of visiting.

Yet very few commercially successful apps were captured in our sample: Apart from a modest showing from South Africa (84 developers, or on a per capita basis, 1.5/million), the rest of the Sub-Saharan Africa countries barely registered in the data: Nigeria (43, 0.24/million), Kenya (20, 0.44/million), Ghana (11, 0.42/million), and Tanzania (8, 0.16/million) were among the lowest-scoring in the sample. Compared to the standouts of Vietnam (226, 2.5/million), Turkey (214, 2.8/million), and Belarus (58, 6.1/million), the African countries in the sample are clearly at a different stage of participation in the app economy.

Suggestions that the enthusiasm for a Silicon Savannah is overhyped are not new, and members of the African tech community have leveled their own criticisms at those perpetuating an inaccurate image.[74] Our analysis confirms the anecdotal observations by many in the community that question the usefulness of so many app contests when successes seem to be few and far between.[75] For example, Kennedy Kachwanya, a Kenyan blogger, writes:

"Kenya is full of winners, winners of all sort of competitions and challenges, but the pressing questions is, do winners end up being something beyond the winning. Having been on this industry for a while, I don't expect instant success but there is deafening silence about most of the winners to the extent that you would think that all their apps died straight after winning."[76]

Targeted, domain-specific programs aimed at enabling digital entrepreneurs in Kenya don't seem to be working, at least on a visible level in the global app market. There are some claims that donor funded programs are actually a negative force in this regard,[77] but additional research is needed to better understand how and why these initiatives aren't having the intended impact. However, it seems likely that high-profile app contests, hackathons, and sponsored coding events are too superficial, and don't lead to measurable results when the required foundation for sustainable businesses isn't in place.

Contrast the East Africa situation with Vietnam, Belarus, and Turkey, which are mostly absent from the app industry headlines but have become popular locations for contract IT outsourcing. For the foreign firm, contract outsourcing in emerging markets may be motivated by labor cost savings, accessible staffing for rapid and modular scale up, and the increased speed of development coming from multiple time

73 Tim Kelly, "Tech Hubs across Africa: Which Will Be the Legacy-Makers?," Text, *Information and Communications for Development*, (April 30, 2014), http://blogs.worldbank.org/ic4d/tech-hubs-across-africa-which-will-be-legacy-makers.

74 Bankole Oluwafemi, "Enough With The Digital High Fives – African Developers Need To Up Their Game -," *Bits*, accessed December 21, 2015, http://bits.ng/2012/09/enough-with-the-digital-high-fives-african-developers-need-to-up-their-game/.

75 "In Kenya, Apps Fizzle Out After Winning Competitions | TechPresident," accessed December 21, 2015, http://techpresident.com/news/wegov/24028/kenya-apps-fizzle-out-after-winning-competition.; Wayan Vota, "Which Are More Useless: Hackathons or App Contests?," *ICT Works*, accessed December 21, 2015, http://www.ictworks.org/2014/12/08/which-are-more-useless-hackathons-or-app-contests/.

76 "Safaricom Apps Development Challenge and Why The Quality Kenyan Apps Is Going Down – Kachwanya.com | Kenya Tech News," accessed December 21, 2015, http://www.kachwanya.com/2013/05/11/safaricom-apps-development-challenge-and-why-quality-kenyan-apps-is-going-down/. May 2013.

77 Nikolai Barnwell, from mobile incubator 88mph, told Wired magazine: "When you look at the infrastructure here [in Nairobi], we should be miles ahead. But there's so much fluff money, no hard talk, NGOs propping businesses up -- it kills it." http://www.wired.co.uk/news/archive/2014-06/10/silicon-savannah.

Discussion and implications: Three themes
continued

zones.[78] For the host country, contract IT work can help to build skills, experience, and professional networks within the local workforce, leading to domestic entrepreneurship as contract workers spin off their own ventures.[79]

In an interview, a developer in Belarus spoke to this phenomenon: "[A] big explosion starting in 2003 of outsourcing, so by 2007 there were already outsourcing companies in Belarus, everyone competing for developer talent, me included. Everyone out of college who can code, they work a few years, and they all think they're a senior developer and start their own outsourcing company. The government made tax incentives for contracting companies, and now probably half of all the top apps are made at least in part in Belarus."

In Vietnam, the IT outsourcing industry has seen dramatic growth in the last decade, averaging 25%-35% annually from 2002-2012 and reaching $2.3 billion in revenue in 2011, and boasts the largest IT outsourcing firm in the region, VPT Software.[80] It has seen significant investment from the likes of Microsoft, Samsung, and LG,[81] and has long been highly rated as a location for IT offshoring.[82]

When asked to explain the success of app developers in Vietnam, a globally ranked Thai developer we interviewed said that even though Thailand was considered a larger market, it "is dominated by developers from China, Japan, and [South] Korea, and the West. …The ecosystem for the developers in Vietnam is much better, they come from a background of low cost high talented developers. Many big companies in the past invested in Vietnam first such as Microsoft so the talent there, with these experiences, is much better than Thailand."

"Put simply, there are no shortcuts to sustainable industries, even in the get-rich-quick world of mobile apps."

We greatly over simplify when we generalize Kenya's nascent digital industry on a path of app contests and hackathons while Vietnam and countries in Eastern Europe are on paths of contract outsourcing, and there are many other factors we don't cover here, such as the impact of education and the business policy environment. But our argument is simply that in the emerging markets, more traditional capacity building through contract outsourcing may be a more reliable stepping stone to digital entrepreneurship than the more superficial activities such as app contests and hackathons. Put simply, there are no shortcuts to sustainable industries, even in the get-rich-quick world of mobile apps.

78 Abdul Wahid Khan and Siffat Ullah Khan, "Offshore Software Development Outsourcing Contract from Vendors' Perspective: A Systematic Literature Review Protocol," 2012.

79 Balaji Parthasarathy and Yuko Aoyama, "From Software Services to R&D Services: Local Entrepreneurship in the Software Industry in Bangalore, India," *Environment and Planning A* 38, no. 7 (2006): 1269–85, doi:10.1068/a38102.

80 "IT Industry Posts Annual Growth Rate of 25-35% according to VINASA," accessed December 21, 2015, http://kngt.blogspot.com/2012/04/it-industry-posts-annual-growth-rate-of.html.

81 "The Promise Of Outsourcing To Vietnam | TechCrunch," accessed December 21, 2015, http://techcrunch.com/2015/04/03/the-promise-of-outsourcing-to-vietnam/.

82 "Leading Offshore Services Locations in Asia/Pacific, 2015: Smaller Countries Gain Traction," accessed December 21, 2015, https://www.gartner.com/doc/2968518/leading-offshore-services-locations-asiapacific.

Discussion and implications: Three themes
continued

Supply vs. demand and the domestic market trap

There is a growing body of research on the role of relevant or "local" content in stimulating adoption of internet and ICTs in emerging markets.[83] Without digital content in the relevant language, on topics of interest, in a form that is accessible and affordable, there is less incentive for end-users to engage with the internet and digital technologies. Digital production requires an enabling environment, and previous work has found that internet infrastructure development—such as broadband penetration rates and international bandwidth per capita—is strongly correlated with local content production (in that study, web domains, Wikipedia articles, and blogs).[84]

"App developers in low-income countries will not deliberately target their domestic markets until they see enough potential revenue to make it worthwhile, creating a chicken-and-egg stalemate between supply and demand."

But it is important to distinguish between non-commercial content and commercial content, which can have very different drivers and incentives. Most of the former is now occurring via social channels such as Facebook, WeChat, Instagram, Line, and so on.[85] Given its social nature, this content can incentivize engagement with users, and result in a positively reinforcing cycle of increasing production and consumption within a given population (whether defined spatially, linguistically, or culturally).

But commercial content, including most apps, doesn't seem to have the same relationship between supply and demand. For the commercial developer, the financial objective constrains his or her options for the type of content to produce and the type of audience to target. Therefore while a developer may be most comfortable building apps or digital content for his or her local community—because of shared cultural, linguistic, or domain experiences—if there is limited potential revenue from that community, the developer will likely look to more lucrative markets. This perspective has been documented in previous studies,[86] and supported by multiple interview respondents. For example, an Indian developer of a radio app that is successful globally said, "We didn't focus much on the local market initially, because the advertising payout in E.U. and U.S. markets is so much better. In the developing countries volume is picking up gradually, but the ad market is in its infancy. Since we had to earn our bread and butter, our initial focus has been on markets where payout was better."

A Thai game developer we interviewed has a game ranked in 10 foreign markets, including the United States, such that less than 5% of its income came from the domestic Thai market. However, the developer has strategic marketing reasons for spending resources there: "Our home market is important in the sense that we do a lot of other business here—we promote the game, we try to position ourselves as major app developer. We spend some money, in Thailand we spend $50,000 because Thais didn't know that [our game] was a Thai company, so we started a campaign to increase awareness."

Therefore while non-commercial content may be the stimulus for end-user demand—the "build it and they will come" approach—commercial content has to follow the money. Which means that in general, app developers in low-income countries will not deliberately target their domestic markets until they see enough potential revenue to make it worthwhile, creating a chicken-and-egg stalemate between supply and demand in emerging markets.

83 See, for example, Mark Graham, "Warped Geographies of Development: The Internet and Theories of Economic Development," *Geography Compass* 2, no. 3 (2008): 771–89; Matthew Zook, "Old Hierarchies or New Networks of Centrality? The Global Geography of the Internet Content Market," *American Behavioral Scientist*, 2001, doi:10.1177/00027640121958113.; Mark Surman, Corina Gardner, and David Ascher, "Local Content, Smartphones, and Digital Inclusion," *MIT Innovations*, 2014, http://marksurman.commons.ca/wp-content/uploads/sites/2/Surman_Gardner_Ascher_2014_Innovations-Local_Content-Smartphones-Inclusion.pdf.; GSMA and Mozilla, "Approaches to Local Content Creation: Realising the Smartphone Opportunity," accessed December 21, 2015, http://draft-content.gsmaintelligence.com/AR/assets/11075629/GSMA%20Mozilla_Approaches%20to%20local%20content%20creation.pdf. 2015.

84 OECD, "The Relationship between Local Content, Internet Development, and Access Prices."

85 Of course, this content is monetized by the platform or service owner, but from the perspective of the user, it is typically non-commercial in nature.

86 For example, an Argentinean developer who had built a game app that reached #1 in the Argentinean market, expressed that even this level of local success was insufficient for their goals: "We wanted to try the [Argentinean] market, see how big it is, but it was so small that we didn't care anymore about it." In S. Wagner and M. Fernandez-Ardevol, "Local Content Production and the Political Economy of the Mobile App Industries in Argentina and Bolivia," *New Media & Society*, 2015, doi:10.1177/1461444815571112.

Discussion and implications: Three themes
continued

However, our cases of Vietnam and Turkey illustrate that this isn't always the case. Those countries have high numbers of developers and high levels of domestic market share. Importantly, they also have high ratios of apps in the local language, which supports the idea that there is healthy domestic demand driving the local market. As we described in the section "Spotlight on Vietnam and Turkey," we believe this means that for those countries with unique languages and sufficiently large and rich populations, language is a natural barrier to entry for foreign firms, providing a slightly more protected domestic market for local producers.

This seems a clear advantage for local developers, yet this language barrier is protecting, in most cases, a very low-revenue market. So if the local developers are focused only domestically—as evidenced by the language of their apps—it could mean that for these developers, they are stuck being "small fish in a small pool."[87] In our data, 76% of Vietnamese developers, and 79% of Turkish developers, only appeared in the rankings for their home market. As mentioned in the section "Constrained to local markets," developers in lower-income markets are twice as likely than their peers to be limited to their own domestic market. This raises the question: for these types of markets, which way does the local language barrier work—does it keep foreign firms from entering? Or does it hinder domestic producers from exporting to foreign markets?

Another way to frame the issue is whether small national markets can offer sufficient revenue to sustain a domestic app industry. Because so few users in lower-income countries have access to bank cards or other forms of digital payments, the vast majority of monetization is via advertising. But advertisers pay much less for ads in these markets—the developers and marketers we spoke with cited display advertising rates from 4x to 10x lower in the emerging markets compared to Tier 1 countries such as the U.S. and U.K., and even Facebook sees ARPUs of $0.94 in emerging markets vs. $10.49 for the U.S.[88] For nations with huge populations and growing economies, such as India, Brazil, and Indonesia, the sheer volume of app users may be enough to offset the lower advertising rates, at least temporarily. But with the growing popularity of ad blockers and data privacy concerns over ad targeting, the current advertising model on mobile may need to evolve in order to survive. Further research that explores advertising revenue models in lower-income markets would help to shed light on whether small markets for digital content will ever be sufficient to incentivize local production.

How platform design determines winners and losers

The power of the platform owners is most explicit in the structure and policies they define for all actors who seek to engage with their platform, and these design decisions have a direct impact on who can achieve commercial success on the platform. Some of these policies have relatively minor effects, such as the license pricing for app developers: For Apple's platform, developers must pay $99 per year (and have access to an iOS device), while Google charges only a one-time fee of $25. But other aspects of the platform design have substantial and widespread effects. In this section we explore two design choices and their ramifications: the inability for developers to monetize in all markets, and the increased diversity from the national store structure.

Every market shows a preference for locally produced apps. The intensity of the preference varies, but intuitively we can imagine that it is easier to develop products and content for an audience similar to oneself. As an independent Swedish developer wrote in a survey response, "Yes, it's much easier for us to reach out in our local market and we have more knowledge about the users, language and culture. Therefore the local market is more important and valuable for us."

But platform policies mean this reflexivity isn't available to all developers. As the smartphone platforms have pushed the web to smaller and smaller roles in favor of their own app stores, these stores have become the default source for apps, music, and other content. Yet Google only allows developers in certain countries to monetize their products through the Google Play app store: Developers who want to earn revenue from Android apps on the Google Play app store are required to set up a merchant account, which is what links their bank account to Google so that they can receive funds from the app store. However, Google merchant accounts are not available in 74 countries, with half of sub-Saharan Africa and much of Latin America excluded.[89] A Google employee described the process as "very complex and [involving] business negotiations between Google and the government of the countries in question. It can involve additionally complex subjects such as tax laws, currency

87 Richard B. Heeks, "International Perspectives: Software Strategies in Developing Countries," *Communications of the ACM* 42, no. 6 (June 1, 1999): 15–20, doi:10.1145/303849.303853.

88 Facebook quarterly earnings, Q3 2015. http://investor.fb.com/results.cfm.

89 Google web site. https://support.google.com/googleplay/android-developer/table/3539140?hl=en.

Discussion and implications: Three themes
continued

"Yet Google only allows developers in certain countries to monetize their products through the Google Play app store."

exchange, and export laws."[90] While not every developer is trying to directly commercialize her apps, it is reasonable to assume that the inability to monetize one's app directly through the app store is a deterrent for participation.[91]

Here the controlling logic of the dominant global platform sets policy that establishes boundaries of exclusion at the physical borders of the state; although one layer of the platform network is available—that is, the virtual marketplace and all services are available to end-users—the layer of developer engagement is prohibited, which likely results in a skewed adoption process. Because localized apps and content can drive adoption, the exclusion of local developers may in theory slow adoption of the platform by end-users in a recursive cycle.

The second platform dynamic has what we would argue is a net positive effect. The app store structure of discrete national markets was originally created by Apple in order to satisfy different copyright policies and regulations for music sales in iTunes, and has also allowed the app store owners to regulate content such as gambling apps on a per-country basis. This model has been adopted by Google and others, but has come under scrutiny. For example, in a case dating from 2008, Apple settled an antitrust suit by the European Commission over alleged price fixing of music tracks in its iTunes service, the predecessor to the App Store. The case was prompted by consumers in the U.K., who were paying slightly more for the same music track than in continental Europe; Apple eventually settled and agreed to align the pricing.[92]

Two initiatives in Europe are pertinent here. In 2014, the EU launched a new VAT (value added tax) initiative which sought to close the loophole enjoyed by Apple, Google, and other tech giants who house their regional headquarters in Luxembourg for lower tax rates. Unfortunately there is no threshold for small businesses, meaning independent app developers and other digital content business face onerous registration and paperwork if they sell their apps beyond their borders.[93] Even more importantly, the European Commission is currently pursuing a "digital single market" initiative that aims to eliminate geographically defined differences in digital product or service provisioning within its member states.[94] This ban on "geo-blocking" is often described with the example of eliminating costly roaming charges by mobile operators when users cross borders within the EU, and thus rightly receives positive support.

But applying this same principle to the app stores—eliminating the U.K. app store, France app store, etc. in favor of one global (or pan-European) app store— may have unintended consequences. As described in the section "App stores as digital markets," the discrete app stores create parallel, yet connected markets that are integrated into the global app store system, but feature their own top rankings and featured apps. Thus the limited virtual market real estate of each app store is more likely to highlight domestically popular apps and content, giving higher visibility (and thus downloads/revenue) to those producers. The market share analysis in this study confirms this preference for domestic apps in every market in the sample.

In response to our survey question of whether a single global market would help or hurt their business, the majority of app developers responded that it would hurt. A small developer in Jordan (6-10 employees) wrote, "Every market has it own uniqueness and this creates opportunities for small developers like us. If there were only one global market—it would have been dominated by few giant publishers. In this case it would be extremely difficult to stand out." Similarly, a developer from Mexico (2-5 employees) responded that, "It would hurt, because if you have just one and only ranking worldwide, you just see the biggest brands with a lot advertising budget."

90 Personal email communication, Google Developer support representative, March 12, 2015.

91 Bryan Pon, "Locating Digital Production: How Platforms Shape Participation in the Global App Economy," 2015; Michael Kende, "The Mobile App Divide" (Internet Society, 2015).

92 "Apple to Cut iTunes Prices in Britain to Settle Antitrust Lawsuit – The New York Times," accessed December 21, 2015, http://www.nytimes.com/2008/01/09/technology/09iht-apple.4.9110716.html.

93 "EU's New #VATMOSS Rules Could Create A #VATMESS For Startups | TechCrunch," accessed December 21, 2015, http://techcrunch.com/2014/11/25/eus-new-vatmoss-rules-could-create-a-vatmess-for-startups/.

94 "Digital Single Market – European Commission," accessed December 21, 2015, http://ec.europa.eu/priorities/digital-single-market/index_en.htm.

Discussion and implications: Three themes
continued

To estimate what the app stores would look like without the national markets, we model a single global app market based on our sample of 74,000 app positions across 37 markets. Specifically, we apply the power law coefficient described above to the ranking of each app, giving the #1-ranked app, for example, a value that is two orders of magnitude greater than the #100-ranked app. We then qualify that value based on which national market the app is ranked in by using App Annie's four different national market rankings: for iOS and Google Play, and for Top Grossing and Top Downloads. This gives each app a value based on its rankings and markets, and we simply sort for the top 500 apps in the two categories of Top Grossing and Top Downloads. The result, shown in Figure 23, suggests that there would be significantly less diversity in supply in this hypothetical global market—by these estimates, an approximately 20%-36% decrease in the diversity of developers in the top ranks. Across the 37 national markets, the average number of producers who were ranked in the 500 Top Grossing list was 49.3, the average in the Top Downloads list was 51.2. In the hypothetical global market, the Top Grossing list would be dominated by the large producers, with the United States, Japan, China, and South Korea taking a disproportionally higher ratio of the market. Developers from only 31 countries would be able to make it onto this list. Similarly, for the 500 Top Downloads, the diversity would also drop, with only 40 different producer countries listed.

"But applying this same principle to the app stores—eliminating the U.K. app store, France app store, etc. in favor of one global (or pan-European) app store may have unintended consequences."

Figure 24.
Number of countries that produce apps ranking in the Top 500. Hypothetical global market shows significantly less diversity in producers.

	Top grossing apps	Top downloads apps
Currently (across 37 stores)	49.3	51.2
Hypothetical global market	31	40

Conclusion

As the first truly global market for digital goods, the app economy offers important lessons for how digital markets and trade may evolve. Despite the lower barriers to entry and increased accessibility afforded by digital production and distribution, the economic landscape is currently heavily skewed in favor of the high-income economies, in multiple ways. Some of these effects—for example, the difficulty in designing products for foreign consumers and markets—are well-established phenomenon in the world of physical trade that are still relevant in the digital world. Other issues, including the structure of the app stores that constrains some developers while increasing visibility for others—are natively digital effects, based in algorithms and code, and controlled by the platform owners.

Collectively, the dynamics described in this report describe significant challenges to independent developers in lower-income economies. Firstly, they are in the minority, with the vast majority of the commercially successful developers located in the highest-revenue markets. Because all markets exhibit a preference for locally produced apps, those developers in the highest-revenue markets—which tend to be the most experienced and best resourced developers—enjoy significant advantages compared to the developer from Tanzania or Peru. Partly as a result, developers from the Global South are mostly constrained to their own, low-revenue markets, and collectively earn an estimated 1% of global app revenue.

There are signs that encourage an optimistic outlook. Despite not capturing much value, countries such as India, Brazil, Vietnam, Turkey, and Thailand have relatively large numbers of developers. The majority of these are only prominent in their own domestic market, but if those markets continue to grow, there is the potential for sustainable app businesses in these countries. Of course, this is not simply a supply-side issue—without financial payments infrastructure and a growing middle class, apps and other digital content will continue to be a niche market, and an ecosystem of digital production will fail to take root.

While there is a stark difference in app economy performance between the industrialized countries and the emerging economies, there is also wide variation among the latter. Unsurprisingly, simple macro-level indicators can't explain why Vietnam and Turkey do so well, while the Philippines and Mexico do relatively worse (and East Africa is almost invisible). But these diverging paths likely have more to do with a history of foreign investment and contract outsourcing of IT businesses, and less to do with app contests and hackathons. In any case, we could learn a lot from more in-depth case study research on the highest-performing countries.

The global app economy has the potential to offer new economic opportunities to a wide range of heretofore marginalized digital producers. But proclamations that "everyone is treated equally in the app stores of the world"[95] fail to acknowledge the very real institutional constraints faced by independent developers, especially those in lower-income countries. As more and more commercial activity is mediated by digital markets, it will become increasingly important to identify the structural factors driving economic outcomes, as only a deep understanding of these can mitigate highly skewed market returns and further concentration of power and wealth.

95 Julien Codorniou, director of global platform partnerships, Facebook. Quoted by Davidson, "How Facebook Is Fuelling the Growth of the Super Start-Up."

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