GRIPS Discussion Paper 18-09

# Domestic Value Added of Chinese Brand Mobile Phones

Yuqing Xing
Yuzhen He

September 2018


National Graduate Institute for Policy Studies
7-22-1 Roppongi, Minato-ku,
Tokyo, Japan 106-8677

# Domestic Value Added of Chinese Brand Mobile Phones

Yuqing Xing

National Graduate Institute for Policy Studies
Tokyo, Japan

yuqing_xing@grips.ac.jp

Yuzhen He

University of International Business and Economics

Beijing, China

**Abstract**

In this paper, we evaluate the domestic value added of Chinese brand mobile phones using the teardown data of two sample phones: Xiaomi MIX 2 and OPPO R11s. For calculation of the distribution of value added by country, we adopt two benchmarks: production cost and retail price. In terms of the production cost of the sample phones, which consists of bill of materials, manufacturing cost and royalty, Chinese domestic value added embedded in the MIX 2 is 15.4% and 16.7% in the R11s. The teardown analysis reveals that no indigenous Chinese firms are involved in the manufacture of the printed circuit board assembly, which explains the relatively low Chinese domestic value added. Using retail price to measure total value added, we find that the domestic value added of the MIX 2 to be 41.7% while that of the R11s to be 45.3%. The cost of retail services and gross marginal profits contribute most to the increase, which implies that nurturing mobile phone brands has not only enabled the Chinese mobile phone industry to move up ladder of value chains, but also to improve domestic value added.

Key Words: GVCs, mobile phones, value added, China.
JEL： L63, F23,

## 1. Introduction

China has emerged as the largest producer and exporter of mobile phones in the world. Its entry into the WTO and its outsourcing activities for world leading mobile phone makers drastically strengthened that trend. All major global mobile phone vendors have either used substantial production facilities in China or outsourced their production to original equipment manufacturers (OEM) in China for marketing in both the Chinese domestic and the international market. Since Apple, the world's most profitable mobile phone manufacturer, launched the first generation iPhone, it has taken the advantage of low production costs in China and used the country as its exclusive assembly base. Similarly, Samsung, the No.1 mobile phone maker in the world, assembled over 60% of its mobile phones in China before it started to relocate the production facilities to Vietnam in reaction to rising Chinese wages (Lee and Lim, 2018).

Participation in global value chains (GVCs) for the assembly of mobile phones for foreign multinational enterprises has presented local Chinese firms with an excellent opportunity to learn about the design and marketing of mobile phones, the sourcing of necessary modules, and the nature of technology frontiers and trends. In recent years, indigenous Chinese phone manufacturers have gradually narrowed technology gap with foreign competitors, which dominated the Chinese local market before. A number of local brands, notably Huawei, Xiaomi and OPPO, have emerged as more and more popular, among both Chinese and foreign users. These local original brand manufacturers (OBM) are competing head to head with foreign makers in the Chinese home market and are gaining market share at the expense of their foreign rivals. Samsung was almost edged out of the Chinese market by local OBMs; its market share fell below one percent in the second quarter of 2018(The Investor, 2018). In the global market, Chinese brands Huawei, OPPO and vivo took three of the top five places for mobile phone shipments (IDC, 2017).

This significant achievement by the Chinese mobile phone industry is a success story where global value chains enable developing country firms (which have no comparative advantage in information communication technology (ICT) products) to enter the fast growing ICT market, acquire new knowledge and eventually turn into viable competitors of multinational enterprises. The modularization of mobile phone manufacturing has substantially lowered entry barriers for latecomers. Massive investment in research and development and experience accumulated

through learning by doing are no long prerequisites for new firms to join mobile phone industry (Ke and Hioka, 2016). Taking advantage of GVCs, Chinese OBMs have focused on marketing and brand development and gradually established their own value chains, in which they organize production, designate parts suppliers, market products and build relations with suppliers via brand power.

Chinese brand mobile phones run on the Android operating system licensed by Google. These phones depend on critical technologies owned by foreign multinational companies, so Chinese mobile phone OBMs have to outsource core technological components from foreign MNEs. Typically, chipsets, which integrate CPU and memory chips and determine the technological standards and major functionalities of mobile phones, are sourced from lead platform companies such as Qualcomm, an American company, and MTK, a Taiwanese company specializing in providing chipsets for Chinese firms manufacturing low-end mobile phones (Liu, Wu and Lai, 2015). Chinese OBMs are very frank about their reliance on foreign technology. For instance, the statement "Designed by OPPO Assembled in China," an imitation of "Designed by Apple in California Assembled in China," is printed in the back of all OPPO phones. This clearly specifies the approach of OPPO company in its phone production process.

All mobile phones produced by Chinese OBMs are made of parts and components supplied by various firms located in China, Japan, Korea, US and other countries. Foreign suppliers are involved in the production of Chinese brand mobile phones and contribute substantially to the whole value added of those phones. Value added of economic activities is the source of national incomes. Domestic value added measures the contribution to a national economy of goods produced via GVCs. In the age of GVCs, domestic value added embedded in exports is particularly important for properly evaluating bilateral trade balances. Products manufactured and traded via GVCs contain a substantial amount of foreign value added and the gross value of exports can give rise to serious distortions of calculations of bilateral trade balances (Xing and Detert, 2010). In addition, two important issues in research on GVCs are: who captures value added and how much is captured. The distribution of value added by firms along GVCs also indicates the relative power of these firms in the governance of value chains. Basically, lead firms tend to capture a larger slice of value added than captive firms, because they have monopolistic control over brands and core technologies.

The Chinese mobile phone industry basically started with the assembly of mobile phones for foreign companies. It is estimated that in 2009 China captured a mere 3.6% of the value added of the iPhone 3G (Xing and Deter, 2010). In both the domestic and the international market, Chinese brand mobile phones are generally priced lowered than those of globally recognized brands. It is stipulated that Chinese brand mobile phones tend to adopt more domestically produced parts and components than do globally recognized phones assembled in China. An interesting question is whether the domestic value added embedded in Chinese brand mobile phones is significantly higher than that in popular international brands assembled in China, such as Apple and Samsung.

In this paper, we investigate two cases of domestic value added in Chinese brand mobile phones, based on the teardown data of selected models. Teardown data contain rich information about suppliers and prices of major parts and components (Sun and Grimes, 2016). By identifying the country of origin of each component, we can gain a basic understanding of what tasks and which segments of mobile phone manufacturing involve indigenous Chinese firms: that could proxy the technological capacity of the Chinese mobile phone industry. Examining the domestic value added of Chinese brand mobiles can shed light on the status of technological upgrading of Chinese firms along the value chains of mobile phone industry.

We assess the domestic value added of two models, Xiaomi MIX2 and OPPO R11s. Both phones were introduced to the Chinese market in late 2017 and remain popular among Chinese consumers today. Our analysis calculates the domestic value added of the Xiaomi MIX2 to be 15.4% and that of the OPPO R11s to be 16.7%, if only the bill of materials, manufacturing cost and royalty are considered. Except printed circuit boards (PCB), all parts and components embedded in the printed circuit board assembly (PCBA) of the sample phones are made by foreign companies (mainly Qualcomm, Samsung and a few Japanese companies). This explains why the domestic value added is relatively low. Indigenous Chinese firms are mainly involved in manufacturing functional parts, such as displays, batteries, finger print modules and covers. All packing materials are produced by local Chinese suppliers. Similar to iPhones, Xiaomi and OPPO phones are assembled by local Chinese original electronic manufacturers (OEM).

Besides the production cost, defined as the sum of the bill of materials, manufacturing cost and royalty in this study, the total value added of mobile phones sold in the Chinese market also

includes the value added of retail services, gross marginal profits and taxes. Taking these items into account, the domestic value added of the MIX2 is estimated at 41.7% of the retail price, while that of the R11s 45.3%. Hence, China actually captures the largest share of the value added among all the countries involved in the value chains. To a large extent, gross marginal profits and retail services together contributes most to domestic value added. Our teardown analysis shows that the gross marginal profit and the retail service make up 21.6% of the MIX 2's total value added and 23.52% of the OPPO R11s', suggesting that brand ownership not only helps the Chinese mobile phone industry move into high value added segments of value chains, but also significantly raises the domestic value added of Chinese mobile phones.

In the following sections, we first briefly review the dynamic growth of the Chinese mobile phone industry. This is followed by a detailed analysis of the domestic value added of the Xiaomi MIX2 and the OPPO R11s. The final section will summarize major findings of the paper.

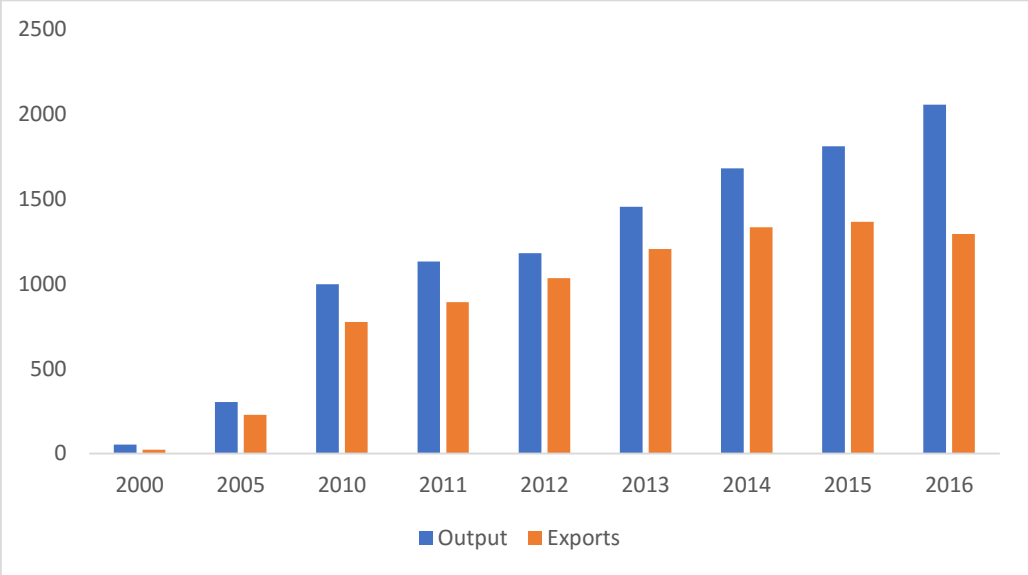
## 2. Rise of Chinese Brand Mobile Phones

The rise of the Chinese mobile phone industry has been very impressive. In less than twenty years, the Chinese mobile phone industry emerged as the largest mobile phone producer and exporter in the world. This is a success story in which China took advantage of GVCs to gain entry to the global market, promote industrialization and catch up with developed nations by building up massive ICT production capacity. The rapid development of the industry and the clusters formed by parts suppliers have nurtured indigenous firms with internationally recognized brands, (such as Huawei, OPPO and Xiaomi) significantly accelerated China's industrialization, and generated a huge amount of employment.

Initially the scale of China's mobile phone output and export was relatively small. In 2000, China produced 52.5 million mobile handsets, of which 22.8 million, or about 43% of the total, was shipped to overseas markets. Since then, that production has grown exponentially. By 2010, the annual output of mobile phones in China rose to more than twenty times that for 2000, surging to 998.3 million. The export of mobile phones grew even faster than the production, jumping to 776 million in 2000, making China the No.1 exporter in the world. During the period 2000–2010, intense competition and continuous technological innovations resulted in the reshuffle of global lead firms in mobile phone industry. Motorola, the inventor of the mobile phone, exited the sector and sold its mobile phone business to the Chinese company Lenovo;

Nokia filed bankruptcy; and Apple and Samsung have emerged as the new lead firms, dominating the global market. The growth momentum of China's mobile phone industry, however, was not disrupted. In 2016, annual output reached a new milestone, exceeding the 2.0 billion mark, with annual export volume surging to 1.3 billion (Figure 1).

**Figure 1. Chinese Output and Export of Mobile Phones**




Sources: UNCOMTRDE and China Statistics Bureau

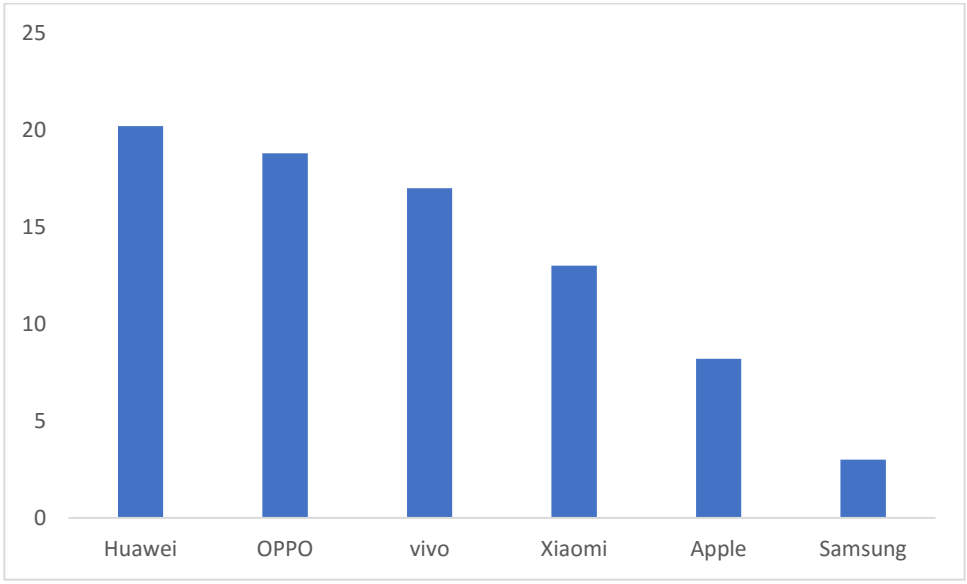
Sturgeon and Kawakami (2010) ascribed the unprecedented achievement of the Chinese mobile phone industry to three trends: (1) a worldwide boom in mobile phone demand; (2) the rise of China as the primary location for mobile phone production; and (3) the emergence of China as the largest single market for mobile phones. From their analysis of the growth and evolution of China's mobile phone industry, Imai and Shiu (2007) concluded that the capability building of Chinese indigenous firms and the rise of independent design houses as a result of competition with Taiwan and Korean rivals led to the expansion of China's mobile phone export.

Surging output volume represents the quantitative dimension of China's success in building its mobile phone production capacity. Another important dimension of that success lies in the brand development by indigenous Chinese firms. Building brands enables Chinese firms to move to upper levels of value chains and eventually establish their own value chains globally, thus increasing the Chinese share of domestic value added. In addition to manufacturing handsets for foreign OBMs, the Chinese mobile phone industry has successfully nurtured a few

mobile phone brands, which are now able to compete with foreign branded mobile phones in both the home and foreign countries. Huawei, OPPO, vivo and Xiaomi, the most famous Chinese mobile phone brands, are recognized and preferred by the majority of Chinese consumers. Despite the dominance of Apple and Samsung in the market outside China, in the home market (the largest mobile phone market in the world) Chinese brands have become mainstream.

According to Counterpoint (2017), in Q2 of 2017 Chinese brands captured 87% of the Chinese smartphone market, led by Huawei with 20%. The top 4 smartphone brands in terms of shipments Huawei, OPPO, vivo and Xiaomi, were all local brands; together they accounted for 57.3% of the market. Those four local brands all experienced an increase in market share over the previous year. Apple retained a mere 8.2% of the market. Samsung saw its share drop by 4 percentage points, to 3% (Figure 2). Back in 2000, local brands together accounted for a mere 10.4% of the Chinese mobile phone market (Imai and Shiu, 2007). Chinese OBMs successfully eroded the market share of their foreign rivals and reversed the dominance completely.

**Figure 2. OBMs Market Shares in Chinese Smartphone Market in Q2 2017**



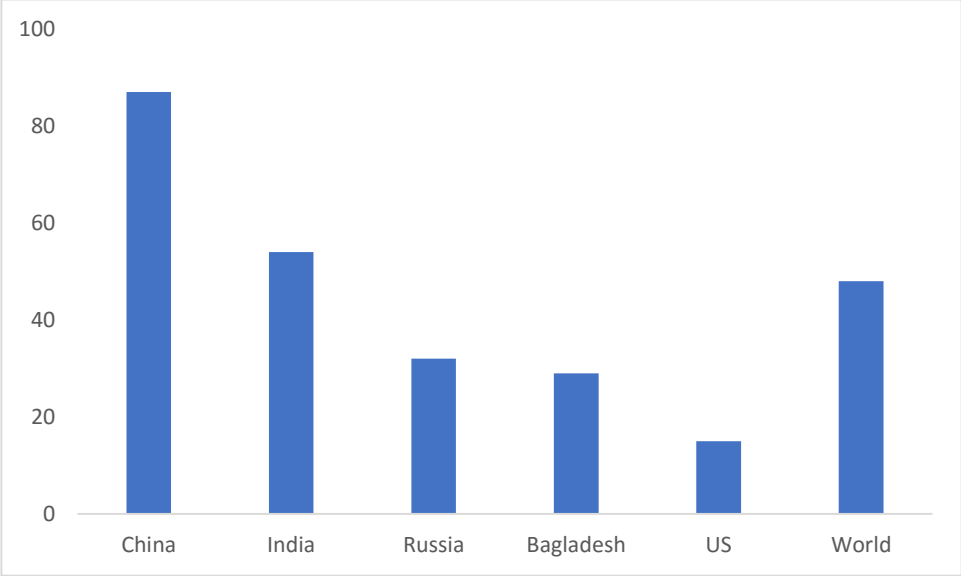

Source： Counterpoint (2017a)

Riding on their success in the home market, Chinese OBMs started to sell mobile phones with their own brands in the global market. Mobile phones marketed under Chinese brands have gradually increased their presence and market share in geographically dispersed foreign markets. A few Chinese brands have emerged as well-known global brands, especially in

emerging markets. Globally, 48% of smartphones were Chinese brands (Counterpoint, 2017b). China is the largest mobile phone market and Chinese consumers represent roughly one third of the global market. The dominance of Chinese OBMs in the home clearly contributes s their global status.

Chinese OBMs have been aggressively advertising their phones in emerging markets, where low-income population is a ready market for Chinese brand mobile phones, which are generally cheaper than iPhones. For instance, in India, Chinese phone makers, including Xiaomi, OPPO, vivo and Lenovo, now account for 54% of the smartphone market share. Xiaomi has arisen as the most successful Chinese brand in India, surpassing Samsung and turning into the most popular smartphone brand (Counterpoint, 2018b). The relatively low price of Chinese brand mobile phones is very attractive to low income consumers, who constitute the majority of mobile phone users in India. In Russia, Chinese brand smartphones captured 32% of market share, with Huawei as the top seller (Russian Search marketing, 2018). In Bangladesh in 2017, Chinese brands gained 29% of smartphone market share (Counterpoint, 2017c).

**Figure 3. Market Share of Chinese Brand Smartphones in 2017**




Sources: Various reports of Counterpoint

Chinese brand smartphones have even penetrated markets of high-income countries, where consumers are typically brand-oriented and prefer phones with the most advanced technologies and new features. Compared with emerging economies, entry into high-income countries is much more challenging for Chinese firms. The presence of Chinese OBMs in US mobile phone

market, the second largest after China, remains very limited. ZTE, China's second largest maker of telecom equipment, was the most successful among Chinese makers, obtaining 12% of US smartphone market share in Q3 2017. China Huaxin and Lenovo sell their phones under acquired foreign brands Alcatel and Motorola with 4% and 5% share respectively (counterpoint, 2018d). However, the recent sanction imposed on ZTE by the Trump administration has put the survival of the company in questions.

### 3. Domestic Value Added of the Xiaomi Phone

Xiaomi, a Chinese electronics company founded in 2010, mainly manufactures mobile phones and smart hardware and software, and provides internet services to consumers. It initially entered the market in 2011 with the launch of three products: MIUI (an Android-based user interface online platform), Mi Talk (instant messaging software), and Mi phones. For years Xiaomi has focused on manufacturing smartphones; (Mi Community, 2018). The company has achieved the success by pioneering online flash sales, pricing its products relatively low, and cultivating loyal consumers called "Mi Fans," who enthusiastically give feedback on product design, technology and commercials (Dong and Zhang, 2016).

In 2017 Xiaomi shipped about 91.41 million smartphones, earning revenue of RMB 114.624 billion. In March 2018, Xiaomi was operating in 74 countries and regions, with about 36.2% of its revenue coming from overseas markets (Xiaomi, 2018). Xiaomi's largest foreign market is India, where feature phones are widely adopted. Xiaomi surpassed Samsung to become the top smartphone seller in India in the last quarter of 2017 (IDC, 2018). Emerging as the fourth largest smartphone seller in Europe in Q1 2018, Xiaomi is actively exploring markets including France, Italy and Spain (Canalys, 2018).

Xiaomi offers two series of smartphones: Mi phones and Redmi phones. Mi targets middle and high-end consumers with their in-house design and manufacturing factories, while Redmi is more affordable, with design by ODMs and assembly by third party EMS. Around 80% of Xiaomi's shipments in 2017 were ordered from local ODMs Wingtech, Huaqin and Longcheer (Li, 2018). The average price of Xiaomi smartphones sold in 2017 was RMB 881.3, lower than that of Huawei, OPPO and VIVO products. Actually 75% of Xiaomi's smartphone shipments, most of which are Redmi phones, are priced at less than RMB1,299 (Xiaomi, 2018).

Xiaomi rolled out the MIX 2 in the second half of 2017 to replace Mi Note series as its new flagship handset. We choose the MIX 2 as a sample for examining the domestic value added of high-end Chinese brand mobile phones. In the following analysis, we classify all parts and components into three groups: (1) PCBA; (2) functional parts; and (3) packaging materials. PCBA typically consists of a CPU, memory cards, power management modules, wifi IC chips, sensors, a PCB and other electronic components; Functional parts consist of display, cameras, speakers, antenna, rim, covers and other necessary components; and packing materials consist of a box, manual and charger.

**Table 1. Xiaomi MIX 2: Bill of Materials, Manufacturing Cost and Royalty**

| Components | Manufacturers | Cost |
|---|---|---|
| **PCBA** | | **$209.72** |
| CPU： Snapdragon 835 | Qualcomm | $62.56 |
| NAND flash memory: 6 GB | Hynix | $46 |
| DRAM 64 GB | Samsung | $24 |
| Others | TDK, Muruta, Infineon, etc. | $77.16 |
| **Function parts** | | **$113.89** |
| Display: 5.99inch 1080x2160 | JDI | $33.85 |
| camera | SONY | $20 |
| Metal rim | BIYADI Electronics | $18.46 |
| Battery | SCUD | $6.15 |
| Ceramic back cover | Three-Circle | $12.31 |
| Others | Q-tech, AAC, O-Film, etc. | $23.12 |
| **Packaging materials** | Chinese firms | **$7.77** |
| **Manufacturing** | Chinese firms | **$4.62** |
| **Royalty** | | **$10.92** |
| **Grant total** | | **$346.92** |

Sources: teardown data provided by the authors' technical supporting team

The teardown data reveals that the MIX 2 is powered by the top-end Qualcomm Snapdragon 835 processor, which costs $62.56, making it the most expensive part in the PCBA. It is installed with a 6 GB NAND flash memory, supplied by the Korean company Hynix and costs $46. The 64 GB Dynamic random access memory, produced by Samsung is priced at $24; the power management module is outsourced from Qualcomm. The high-density PCB is manufactured by the Taiwanese company COMPEQ. The rest of the parts and components of the PCBA are made by TDK, Murata and other foreign companies. The total cost of the PCBA is estimated at $209.72. Our teardown exercise reveals s that no indigenous Chinese companies

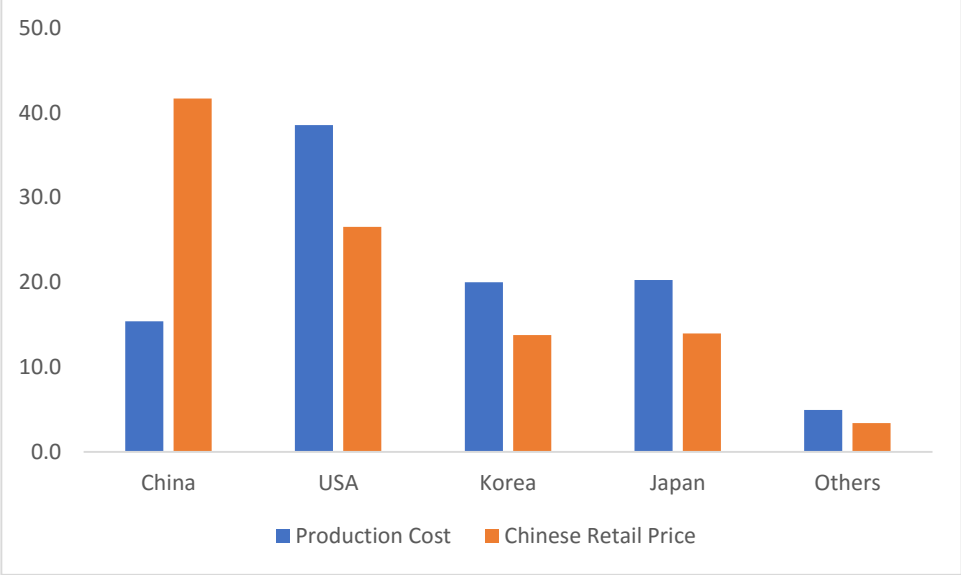
were involved in the production of the MIX2's PCBA. Hence, Chinese companies contributed zero to the value added of the PCBA, which suggests that the Chinese mobile phone industry has not developed sufficient technology capacity to supply PCBA parts and components. Table 1 lists the bill of materials, manufacture cost and the royalty of the MIX2.

With regards to functional parts, the Xiaomi MIX 2 features a 5.99 inch 1080x2160 pixel display produced by Japan Device Inc. The display costs about $33.85, accounting for 30% of the total cost of the functional parts. BIYADI Electronics, a subsidiary of China's largest maker of electronic vehicles BIYADI, supplies the metal rim, which costs about $18.46. Chinese battery company SCUD provides the battery at $6.15. Xiaomi MIX2 has a ceramic back cover made by Chinese company Chouzhou Three-Circle, priced at $12.31. O-film, a Chinese company specializing in optoelectronics products and listed in the Shenzhen Stock Market, supplies the fingerprint module installed in the phone. The functional parts together cost a total of $113.89. The Chinese companies' involvement in the supply of the functional parts is significant, making up more than one third of the cost of the functional category. This suggests that Chinese companies have developed capacity for producing functional parts that can meet the standard of Xiaomi's high-end phones. Those companies' products can serve as competitive substitute for those of foreign rivals at least in terms of of Xiaomi. All packing materials, including the box, manual and charger are manufactured by local Chinese firms and cost $7.77 in total. Assembling the Xiaomi MIX 2 costs roughly $4.62 per phone. We estimate that the royalty paid to Qualcomm per MIX 2 is $10.92.

In sum, the total production cost of a MIX 2, which consists of the bill of materials, manufacturing cost and royalty is estimated at $346.92, of which Chinese companies contribute $53.9. The production cost proxies the total value added of producing one MIX2. Using the production cost as a benchmark, we calculate that the domestic value added embedded in the Xiaomi MIX2 is a mere 15.4% with most of the value added attributed to foreign countries. Specifically, the US contributes 38.6% of the value added, the highest among all counties involved in the value chain of the Xiaomi MIX 2, followed by Japan at 20.3% and Korea at 20.0%. Compared with those three foreign countries, China added the least value in the production process of MIX2. As illustrated by the teardown data (Table 1), Chinese companies are only involved in supplying functional parts and packing materials, and in assembling the phone. No indigenous Chinese companies were employed in the manufacture of any parts

embedded in the PCBA of the MIX 2. This explains the relatively low Chinese domestic value added.

**Figure 4. The Distribution of the Value Added of the Xiaomi MIX 2 by Country (%)**




Sources: teardown data provided by the authors' technical supporting team.

Besides production cost, the value of Xiaomi MIX 2 sold in the Chinese market contains the cost of the retail service, the tax paid to the Chinese government and the gross marginal profit pocketed by Xiaomi. Hence, the retail value of the MIX 2 represents its whole value added, generated from production to retailing. In 2017, the Xiaomi MIX 2 sold in the Chinese market at RMB 3299 yuan. We take the retail price as the quantitative measure of the whole value added of the MIX2. Clearly, the value added of the retail service, the tax and the marginal profit all belong to the value added of the Chinese economy. Taking into account of these items, the domestic value added of the Xiaomi MIX 2 is estimated at 41.7% of retail value. In spite of the substantial increase in the domestic value added, foreign countries still account for more than half of the whole value added of the MIX 2. In particular, for each Xiaomi MIX 2 sold in the Chinese market, the U.S. gains 26.6% of the retail value, for Japan and Korea, 14.0% and 13.8% respectively.

Examining the MIX 2 teardown data and tax information, we found that gross marginal profit and retail service value together explains 21.64% of the whole value added. These two factors contribute most to the domestic value added, indicating that brand ownership by Xiaomi greatly enhances the value added captured by China in the GVC led by Xiaomi, despite the fact that

the Chinese mobile phone industry does not have technological capacity to manufacture core IC chips and other components embedded in the PCBA. This also suggests that moving up to the ladder of mobile phone value chains is not a linear process. Firms in developing countries can target high value added segments according to their comparative advantage. The large Chinese market definitely helps Xiaomi to successfully promote its brand domestically and internationally. Xiaomi uses its own online services or Mi stores to sell smartphones. 21.64% approximately measures the gross margin of the MIX 2 sold from Xiaomi's retail channels. Figure 4 presents s the distribution of value added of the Xiaomi MIX 2 by country in terms of retail prices and production cost.

## 4. Domestic Value Added of the OPPO Phone

The following is an analysis of the domestic value added of OPPO mobile phones. OPPO smartphones have achieved widespread popularity among young people by providing an excellent selfie experience. For advertising, OPPO's use of celebrity endorsements and sponsorship by entertainment and sports sectors have greatly enhanced its global sales. The firm has been marketing via its offline retailer networks, but it recently has begun to sell online (The Economic Times, 2017a). OPPO product lines include the Find series, priced above RMB 4500; the R series, priced between RMB 2500 and 3000; and the A series, priced around RMB 1000. In China, Xiaomi focuses on promoting its core models, mid-range phones within the most popular price band. According to Counterpoint Research, OPPO's mid-range model, the OPPO R9s, was the best-selling model in the Chinese market in 2017, with the OPPO A57 and R11 also among the top 10 best-selling models (Yan, 2018)

OPPO at present operates in over 30 countries including China, Southeast Asia, South Asia, the Middle East and Africa. It began its international operations in Thailand in 2009 (Pandaily, 2018). Just like Xiaomi in emerging markets, OPPO also produces locally. It set up its first Indian factory in Greater Noida and produced in India to avoid import taxes. That factory costs an investment of RMB 2.2 billion (The Economic Times, 2017b). In January 2018, OPPO targeted the Japanese market, delivering the R11s (OPPO news, 2018a). In June, the company established a presence in Paris with the launch of the Find X (OPPO news, 2018b), becoming the third Chinese OBM to seek new growth potential in the mobile phone market of Europe, following Huawei and Xiaomi. OPPO's entry into Japan and Europe exemplifies its strategy of relying on mid- and high-end phones to open the doors to developed markets. According to

IHS Markit, OPPO shipped 117.6 million units of smartphones in 2017 and held fourth position among global players, after Samsung, Apple and Huawei.

OPPO unveiled its flagship smartphone R11s in November 2017, strengthening its presence in the premium smartphone sector. The OPPO R11s is powered by a mid-range Snapdragon 660 processor, which costs $28, coupled with an embedded multi-chip package (eMCP) by Samsung. The eMCP is a hybrid memory device with the combined benefits of NAND flash and DRAM. eMCP costs $56 with 64 GB NAND and 32 GB DRAM combined memory. The total cost of the R11s PCBA is estimated at $120.94. Similar to the Xiaomi MIX 2, our teardown experiment finds no indigenous Chinese firms involved in making components of the PCBA. We do not think this is a coincidence. Rather, it further confirms the above assessment that the Chinese mobile industry has not yet been able to manufacture or supply PCBA qualified components. The technological gap between Chinese firms and foreign firms remains. It is worth emphasizing that main suppliers of the R11s PCBA include Qualcomm, Samsung, TDK, Muruta and other foreign companies, almost identical to the suppliers of the Xiaomi MIX 2. The same group of foreign companies are dominating the supply of PCAB components in the Chinese market.

The R11s features a 6.1-inch full screen Samsung AMOLED display with a 19:9 aspect ratio, which reflects OPPO's catch-up efforts in the full screen market. The display, at $52.86, is the most expensive among the functional parts of the R11s. AI beautifying technology is implemented in the dual camera, which supports 16 and 20 megapixels (MP): it collects 254 facial feature points to allow the camera to automatically generate the best selfie for the user. Japanese company SONY manufactures the dual camera at a cost of $43.08, even more expensive than the CUP of the phone. The front camera, designed for selfies and made by Samsung, has 20 MP and costs $13.08. OPPO markets its mobiles as "camera phones". In this strategy, OPP differentiates itself from its rivals. The expensive and sophisticated cameras demonstrate that the R11s is indeed a camera phone.

Our teardown analysis identifies a few Chinese firms are involved in manufacturing the functional parts of the R11s. The finger print module is sourced from O-film. The battery module is manufactured by Sunwada, a leading Chinese li-ion battery maker. The Sunwoda battery supports VOOC flash charging: according to OPPO a five-minute flash charge can support 2 hours' talking on the phone. It costs $4.6. Shenzhen Everwin Precision Technology

supplies many of the mechanical components, such as the metal rim, the back cover and various buttons and camera lenses. The total cost of the functional parts is estimated at $154.77.

All of the packing materials of the R11s including the charger of the R11s are manufactured by Chinese companies at a cost of $13.63. Assembly of one OPPO R11s costs $3.85, slightly lower than for the Xiaomi MIX 2. We calculate that the royalty paid to Qualcomm per OPPO R11s is $9.53, lower than what Xiaomi pays for the MIX2 because the OPPO R11s' bill of materials and manufacturing cost are lower than those of the MIX2. Adding the bill of materials, manufacturing cost and the royalty yields the total production cost of the OPPO R11s $302.72, of which indigenous Chinese companies account for $50.63, about 16.7% of total production cost. This is China's domestic value added embedded in the R11s, if only the production stages are considered. Table 2 presents the teardown data of the OPPO R11s.

**Table 2. OPPO R11s: Bill of Materials, Manufacturing Cost and Royalty**

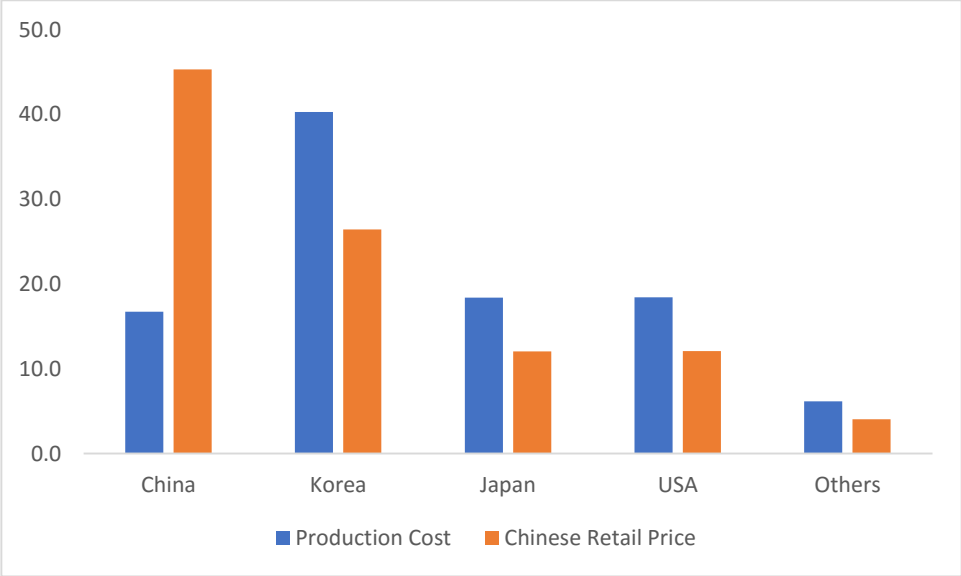
| Components | Manufacturers | Unit Cost |
|---|---|---|
| **PCBA** | | **$120.94** |
| CPU: Snapdragon 660 | Qualcomm | $28 |
| Memory eMCP | Samsung | $56 |
| Other | TDK, Muruta, Yageo, etc. | $36.94 |
| **Function parts** | | **$154.77** |
| Display: 6.01 inch 1080x2160 pixels | Samsung | $52.86 |
| Dual camera | SONY | $43.08 |
| Metal rim, back cover and others | Everwin Precision | $22.31 |
| Front camera | Samsung | $13.08 |
| Battery | Sunwada | $4.62 |
| Other | Q-tech, AAC, O-Film, etc. | $18.82 |
| **Packaging materials** | Chinese firms | **$13.63** |
| **Manufacturing** | Chinese firms | **$3.85** |
| **Royalty** | Qualcomm | **$9.53** |
| **Grand total** | | **$302.72** |

Sources: the teardown data provided by the authors' technical supporting team.

Similar to the case of the MIX 2, the relatively low domestic value added in value added within the R11s is mainly due to the fact that there are no Chinese firms involved in the production of the key PBCA components, which determines the technological advancement of mobile phones. It is worth emphasizing that Korean company Samsung gains the most from the R11s. It manufactures the eMCP, the AMOLED display and the front camera for the manufacture of

the R11s. Altogether, Korea contributes $121.92, about 40.3% of the total value added based on the production cost, the largest share among all the countries involved in the production of the R11s. As mentioned earlier, the share of Samsung mobile phones fell below 1% in the Chinese market. It seems that Samsung has retreated from the Chinese market. The extensive presence of Samsung in the OPPO R11s, however, indicates that Samsung remains a major player in the market. As OPPO phones become more and more popular in both China and abroad, Samsung's sales automatically rise. The teardown data of the MIX 2 reveals that Samsung 64 GB DRAM is used in the pone. Besides Qualcomm, which provides CPUs to both the MIX 2 and the OPPOS R11s, Samsung benefits most from the success of both Xiaomi and OPPO. As a whole, All Japanese companies involved in the production of the R11s contribute $55.69 to unit value added. American companies including Qualcomm add $55.85, about 18.5% of the production cost.

**Figure 5. The Value Added Distribution of OPPO R11s by Country (%)**




Sources: the teardown data provided by the authors' technical supporting team.

We purchased the OPPO R11s in Shenzhen in the December 2017 for RMB 2999. The retail price includes total value added of the R11s, which consists of not only production cost, but also the value added of the retail service, the tax collected by the Chinese government and the gross profit earned by OPPO. Taking into consideration retail service, tax and gross profit, China captures $209 value added in the R11s, about 45.3% of retail price. That represents the total domestic value added embedded in the R11s. Obviously, the domestic value added

measured by retail price is much higher than by production cost. The gross marginal profit and the cost of retail service are the largest source of the domestic value added. The two factors together make up 23.52% of retail price, higher than that of the Xiaomi MIX 2. Most of OPPO phones are sold through third party retailors. We have no information on the retailors' gross margin. Using retail price as a benchmark, we find that 26.4% of the R11s' value added is attributed to Korea and 12% to both Japan and the US. Again, brand ownership significantly lifts the domestic value added embedded in Chinese brand mobile phones. Figure 5 shows the value added distributions of the R11s by country for two different measures.

## 5. Concluding Remarks

Chinese mobile phone manufacturers have been very successful in promoting their own brands both domestically and overseas. Thanks to the global value chains of mobile phone industry, Chinese mobile phone OBMs have been able to power their phones with the most advanced CPUs and memory ICs, outsourced from leading manufacturers such as Qualcomm and Samsung; this has helped to gradually narrow the technological gap with leading international brands such as Apple and Samsung. To assess the domestic value added of Chinese brand mobile phones, we choose two popular models: Xiaomi MIX2 and OPPO R11s for our teardown experiments. The MIX2 is a high-end smartphone while the R11s represents mid-range phone s in the Chinese market. The analysis was accomplished by applying the teardown data of the two sample phones.

We employ two benchmarks: production costs and retail price, to calculate the distribution of value added by country. In terms of production cost, which consists of bill of materials, manufacturing cost and royalty, China's domestic value added embedded in the MIX 2 is 15.4% and 16.7% in the R11s. For both models, the domestic value added is mainly generated by the manufacture of functional parts and packing materials, as well as assembly of the phones. The production of the PCBAs, which primarily determine the technological specifications of smartphones, is dominated by companies from the US, Korea and Japan. These three countries contributed most of the foreign value added: 38.6% of the MIX 2's value added is attributed to the US. Japan and Korea each account for 20%. In the case of the R11s, Korea accounts for 40.3% of value added, the largest share. No indigenous Chinese firms are involved in the manufacture of the PCBAs, which indicates that the technological capacity of Chinese firms to

produce core components continues to lag behind that of leading foreign firms. This explains the relatively low Chinese domestic value added.

In addition to the production costs, the value added of retail services, taxes and gross marginal profits are also part of the total value added of Chinese brand mobile phones sold in China. Taking into account these items, the domestic value added of the MIX 2 is 41.7% while that of the R11s is 45.3%. The gross marginal profits earned by Xiaomi and OPPO and the cost of retail services perform a significant role in driving up the shares of the domestic value added.

The success of Xiaomi and OPPO implies upgrading along GVCs is not a linear process. It is not necessary for firms starting with low value added tasks of GVCs to upgrade by following the sequence of GVCs' tasks. Both Xiaomi and OPPO have no technology capacity to produce either CUPs or NAND memory. However, taking advantage of GVCs, they have emerged as top global brands by focusing on brand development, product design and marketing, and outsourcing core modules and components from foreign firms specializing in the production of these products. Nurturing mobile phone brands has not only enabled the Chinese mobile phone industry to move up ladder of value chains, but also to improve domestic value added. The extensive presence of foreign firms in the manufacture of both Xiaomi and OPPO phones indicates that GVCs have integrated both Chinese and foreign companies together. The technology innovations of foreign firms have significantly enhanced the competitiveness of Chinese mobile phone brands, while the success of those Chinese brands has substantially expanded the markets of foreign companies.

**References**


Canalys, May 2018, Smartphone shipments fall 6.3% in Europe in Q1 2018. https://www.canalys.com/newsroom/smartphone-shipments-fall-63-europe-q1-2018

Counterpoint (2018a), "China smartphone market share: by quarter," https://www.counterpointresearch.com/china-smartphone-share/

Counterpoint (2018b), "India smartphone market share: by quarter," https://www.counterpointresearch.com/india-smartphone-share/

Counterpoint (2017a), "Domestic brands captured 87% of the Chinese smartphone market in Q2 2017," https://www.counterpointresearch.com/domestic-brands-captured-87-of-the-chinese-smartphone-market-in-q2-2017/

Counterpoint (2017b), "Q2 2017: Chinese brands now contributing to almost half of global smartphone shipments, " https://www.counterpointresearch.com/q2-2017-chinese-brands-now-contributing-to-almost-half-of-global-smartphone-shipments/

Counterpoint (2017c), "Chinese smartphone brands now have 29% market share in Bangladesh," https://www.counterpointresearch.com/chinese-smartphone-brands-now-29-market-share-bangladesh/

Counterpoint (2017d), "US market Smartphone Share 2016-2017Q3. https://www.counterpointresearch.com/north-american-market-smartphone-share-2016-2017-q3/

Jielin Dong, Yanli Zhang, 2016, When Customers Become Fans, MIT Sloan Management Review. Vol. 57, No. 2 Reprint #57217 http://mitsmr.com/1NlECh2

Ke, D and Hioki, S. (2016), "A study of technology platform-driven global value chains," Interim report for industrial organization in China: Theory building and analysis of new dimensons, IDE-JETRO, 2016

IDC (2018) India Smartphone Market Finishes Strong with 124 Million Total Shipment Units in 2017 After a Brief Slowdown in 2016, says IDC. https://www.idc.com/getdoc.jsp?containerId=prAP43569518

IDC (2017), Smartphone Vendor, https://www.idc.com/promo/smartphone-market-share/vendo

Imai, K. and Shiu, J. (2007), "A divergent path of industrial upgrading: emergence and evolution of the mobile handset industry in China," IDE discussion paper, No. 125.2007.10

Lee, J. and Lim, H. (2018). *Mobile Asia: Capitalisms, Value Chains and Mobile Telecommunication in Asia*. Seoul: Seoul National University Press.

Chuli Li (2018), The Report of ODM Market in 2018, https://zhuanlan.zhihu.com/p/33306607

Liu, X., Wu, Y. and Lai, G. (2015), "Strategic transformation of Shanzhai firms: evidence from a Chinese case," International Journal of Technology, Policy and Management, Vol. 15(1): 77-93

OPPO news (2018a), OPPO's Press Conference in Japan , https://www.OPPO.com/cn/blogs/179.html

OPPO news (2018b), The Release of OPPO Find X and the Announcement for Entering into the European Market https://www.OPPO.com/cn/blogs/188.html

Russian Search Marketing (2018), Russian Smartphone Market, https://russiansearchmarketing.com/russian-smartphone-market/

The Investor (2018), "Samsung's market share in China falls below 1% in Q2," http://www.theinvestor.co.kr/view.php?ud=20180803000152

Sturgeon, T.J. and Kawakami, M. (2010), "Global value Chains in the electronics industry: was the crisis a window of opportunity for developing countries?", Policy Research Working Paper, No. 5417, the World Bank.

Sun, Y. and Grimes, S (2016), "China's increasing participation in ICT's global value chains: a firm level analysis," Telecommunications Policy, Vol. 40(2-3): 210-224.

The Economic Times, Jun 20, 2017a, after toppling Apple in China, OPPO eyes world market. https://telecom.economictimes.indiatimes.com/news/after-toppling-apple-in-china-OPPO-eyes-world-market/59249258?redirect=1

The Economic Times, 2017b, OPPO gets green nod to set up manufacturing unit in Noida. https://economictimes.indiatimes.com/tech/hardware/OPPO-gets-green-nod-to-set-up-manufacturing-unit-in-noida/articleshow/62006240.cms

Xing, Y and Detert, N. (2010), "How the iPhone widens the US trade deficit with PRC", working paper No. 257, ADB Institute.

Xiaomi (2018), Xiaomi IPO Prospectus, 2018 http://www.hkexnews.hk/listedco/listconews/SEHK/2018/0709/LTN20180709051_C.pdf

James Yan, January 15 2018a, Counterpoint, China Smartphone Market 2017: Top 10 Best-selling Models. https://www.counterpointresearch.com/china-smartphone-market-2017-top-10-hot-sale-models