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Topics *New developments in India's digital payments*

India has seen rapid growth in digital payments due to UPI services. Recently, new services extending from UPI have been introduced to further spread digital payments by reaching out to those who had been left behind.

■ The growth of digital payments through UPI

The Indian government has been promoting digitalization in various areas as it sees digital technologies as a critical tool to catch up on social and economic development and bring economic prosperity to its people. In particular, the digitalization of finance is being prioritized in the hope of boosting the efficiency of economic activities and enhancing national welfare through cashless payments and improving the financial base of individuals and SMEs (small and medium-sized enterprises) through financial inclusion.

India's approach to digitalizing finance has been for the central government to develop a standardized digital infrastructure and release it to the public and private sectors. Of the various types of infrastructure developed, the one that has achieved significant effects is UPI, or Unified Payments Interface.

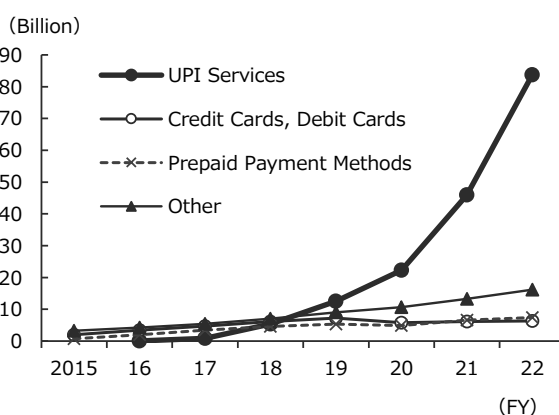
UPI is an interoperable electronic money transfer system that enables instant payment between bank accounts through smartphones 24 hours a day, seven days a week. The system, which is one of the most advanced in the world, was developed by the National Payments Corporation of India (NPCI) in 2016 and released to private operators. This led to the launch of a series of digital payment services using the system, which quickly became more popular than payments using credit cards, debit cards, and prepaid payment methods (e.g., electronic money) (see chart on the right). While UPI payments only account for 21% of retail payments in value terms since the payments are mostly for small amounts, they account for as much as 73% in terms of the number of transactions (FY2022). In addition to these developments, the abolition of high-denomination bank notes in November 2016 and a rise in the preference for presentless and contactless transactions due to the outbreak of the COVID-19 pandemic in 2020 provided a tailwind for digital payments in India, which expanded 7.8-fold in terms of the transaction volume and 1.5-fold in terms of value over the past five years (FY2017 to FY2022).

The first and foremost factor for the popularity of UPI services in India is the increase in the number of people who can use this service due to a rise in smartphone and bank account holders. In addition, the Indian people favored the services' ease of sending money effortlessly and instantly at any time. People felt secured of being able to receive money transfers without having to give out his/her bank account number by creating and linking a virtual payment address with the account number. They also appreciated the convenience of being able to use the services for payments at physical stores by combining them with a QR code. The fact that there are no fees is also a large part of the services' appeal.

■ Addressing those left out of digital payments

Although digital payments expanded significantly in India due to UPI, the room for growth remains large. According to the results of a survey by the World Bank, the percentage of people who "made or received an electronic money transfer" rose from 22% in 2014 to 29% in 2017 and 35% in 2021. However, the percentage has yet to reach half the population. The reasons for this include the fact that nearly 40% of the 1.2 billion people who use a mobile phone still use a feature phone and that there are a certain number of areas with poor internet connection and people unconnected to the internet, especially in rural areas. Under

<Number of Digital Retail Payments in India>



Source: JRI, based on Reserve Bank of India

Note 1: The fiscal year is from April to March next year.

Note 2: UPI (Unified Payments Interface) was introduced in 2016.

Note 3: "Other" includes NEFT (National Electronic Funds Transfer), IMPS (Immediate Payment Service), NACH (National Automated Clearing House), and RTGS (Real-Time Gross Settlement).

these circumstances, the NPCI introduced new services extending from UPI, UPI 123Pay and UPI Lite, to encourage those left out of digital payments.

UPI 123Pay (introduced in March 2022) is a money transfer service through feature phones instead of smartphones and can be used without internet connection. It features four types of use. For example, in the automated voice response type, the user calls the designated phone number and follows the automated voice instructions to register. When making a money transfer, the user also calls the phone number and follows the instructions on the screen.

UPI Lite (introduced in September 2022) is a new, face-to-face, offline payment service. It is intended for use in places with no or inadequate internet connection. Offline payments are payments completed without communicating with payment processing centers or where the transaction records are processed afterwards. For instant money transfers like UPI, money can be transferred even without sufficient funds in the bank account if the transaction is processed offline. Therefore, online processing is standard from the perspective of preventing misuse. Various measures have been incorporated in UPI Lite to enable safe offline processing. For example, while the ordinary UPI transfers money from users' bank accounts, UPI Lite adopts a method where the users transfer funds from their bank account to the UPI app on their smartphone when they have an internet connection and then make remittances from there.

The development of UPI 123Pay and UPI Lite was aimed at overcoming issues relating to internet connection and smartphone ownership, which were deemed hindrances to the widespread use of digital payments. These services are unique in that they combine a cutting-edge method, namely UPI, and low-tech methods that, in some ways, go back in time, such as automated voice guidance through the phone and offline payments.

■ **Non-linear “leapfrogging”**

Emerging countries have often been noted for “leapfrogging,” which is skipping the intermediary development stage to adopt cutting-edge technologies, products, and services. India's UPI initiatives, however, adopt a double-linear approach of introducing “leapfrog” policies while occasionally going backward technologically. Although, neither UPI 123Pay nor UPI Lite is a return to analog in the sense that they do not handle cash but stick to a cashless system. Faced with the reality of their users, they incorporate older technologies, but those technologies are digital. These initiatives give us a glimpse into the Indian government's commitment to promoting financial digitalization, even in small steps.

(Kaori Iwasaki)

Topics *China's semiconductor industry faces a rocky road ahead*

China's semiconductor industry remains sluggish. This is not only because of the downturn in the tech cycle but also due to the impact of tighter U.S. restrictions on semiconductor-related exports to China. Semiconductor production in China may remain weak even if global semiconductor demand recovers.

■ The semiconductor market in a cyclical downturn

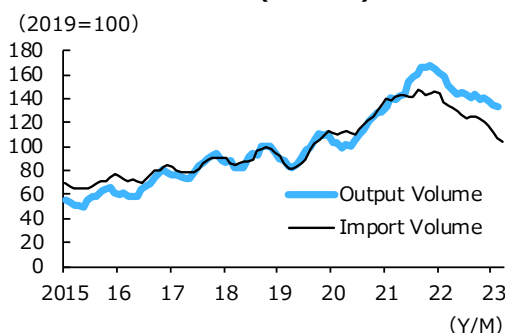
The semiconductor market faces an inventory buildup due to sluggish global demand for high-tech products such as PCs and smartphones. One of the factors behind the slow demand is the shift of demand from products using semiconductors to food and other services, as the digitalization trend that accelerated due to the pandemic and the demand from people staying at home faded out. This has led to the continuous decline of semiconductor production in China from its peak in late 2021. There is no sign of recovery even after early 2022 when factory utilization rates dropped sharply due to strict activity restriction by China's zero-COVID policy.

Global semiconductor production is expected to pick up as inventory adjustments progress and the tech cycle tips upward. However, it must be noted that the tightening of U.S. restrictions on semiconductor-related exports to China adds structural downward pressure on production in China. Thus, the road to recovery is more challenging than in other countries.

■ U.S. restrictions on chip-related exports likely continue to put downward pressure on the semiconductor market in China

Amid the intensifying conflict between the U.S. and China, the U.S. has been tightening its restrictions against China in recent years to hinder the expansion of China's semiconductor production capacity. In 2022, the U.S. government increased its pressure on China's semiconductor industry by enacting the CHIPS and Science Act and tightening the control of semiconductor-related exports to China.

<Semiconductor Output and Imports in China (Volume)>



<Recent Regulations on China's Semiconductor Industry by the U.S>

2019	<ul style="list-style-type: none"> ◆ Blocking the exports of advanced semiconductor manufacturing equipment from the Netherlands <ul style="list-style-type: none"> - The U.S. government appealed to the Wassenaar Arrangement that control exports potentially related to military uses in order to block the exports of Dutch ASML's advanced EUV to China.
2020	<ul style="list-style-type: none"> ◆ Imposing harsh restrictions on SMIC in December <ul style="list-style-type: none"> - The restrictions bars SMIC from using U.S. technology and equipment to produce 10 nm or smaller (expanded to 14nm or smaller in July 2022) chips due to activities between SMIC and entities of concern in the Chinese military industrial complex.
2022	<ul style="list-style-type: none"> ◆ Regulations on investment in China related to subsidies under the U.S. "CHIPS Plus Act" (enforced on August 9) <ul style="list-style-type: none"> - The National Security Guardrails limits recipients of the U.S. funding from investing in the expansion of semiconductor manufacturing in foreign countries of concern such as China and Russia for 10 years. ◆ Stricter export control of semiconductors to China (announced by the U.S. BIS on October 7) <ul style="list-style-type: none"> - Banning exports of advanced semiconductors used in supercomputers and AI - Banning exports of U.S.-made semiconductor manufacturing equipment and materials for advanced semiconductors (non-Chinese manufacturers have given a one-year grace period that would allow for their China-based chip plants to continue to import the equipment from the U.S.). - Banning U.S. engineers from supporting the development or production of semiconductor in China.

Source: JRI, based on various media sources

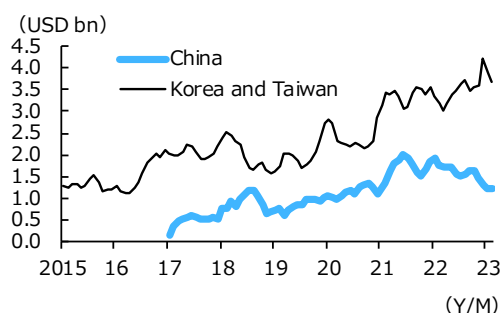
The CHIPS and Science Act substantially restricts the expansion of output by foreign semiconductor companies in China. The Act will provide significant grants to companies investing in U.S. semiconductor manufacturing over the next five years. Grant applications will be accepted from the end of February 2023, with not only U.S. companies but also Asian firms such as TSMC and Samsung mentioned as potential grant recipients. However, the recipients will be subject to restrictions on investing to increase production in China for ten years by the Act's guardrail provisions. They will be barred from expanding output by more than 5% for high-tech chips and 10% for general-purpose chips. According to IC Insights, a U.S. research firm, China's semiconductor self-sufficiency rate is 16.7% (as of 2021), of which only 6.6% is contributed by domestic companies, while foreign companies, including the potential grant recipients, account for the remaining 10.1%.

Semiconductor-related export controls to China that were tightened in October 2022 make it difficult to secure equipment to expand semiconductor output in China. This tightening resulted in the prohibition of exports of U.S.-made equipment for manufacturing advanced semiconductors, as well as high-performance semiconductors used in supercomputers and AI. While the restricted items are advanced products (logic semiconductors of 16 nm/14 nm or below, DRAM memory of 18nm half-pitch or less, and NAND flash memory with 128 layers or more), certain components used in advanced semiconductors have also become subject to the restrictions. The impact may extend to a wide range of production processes.

China's appeal as the world's factory may decline substantially as these export controls make it challenging to manufacture high-tech products using advanced chips. Although the restrictions currently apply to manufacturing equipment by U.S. companies, some other countries are following suit, including Japan, which will tighten its restrictions in July 2023, and the Netherlands, which plans to announce new restrictions by the summer of 2023. Of China's semiconductor equipment imports in 2022, imports from Japan accounted for 31%, those from the U.S. for 16%, and the Netherlands for 14%. If all three countries tighten their restrictions, the impact on China will be significant.

South Korea and Taiwan, which house Asia's major chip manufacturers, continue to increase their imports of semiconductor manufacturing equipment to enhance production capacity in preparation for future demand increases, even though the chip market is currently undergoing inventory adjustment. Meanwhile, in China, imports of semiconductor manufacturing equipment are already decreasing due to the tightening of U.S. restrictions. Given the expected tightening of restrictions, China's import of chip manufacturing equipment may decrease further, making it even more challenging to increase the output of advanced semiconductors in China. Since China's domestic manufacturing equipment makers

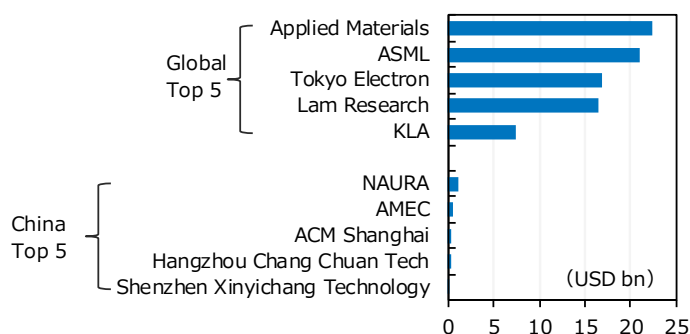
<Imports of Semiconductor Manufacturing Equipment from China, Korea and Taiwan>



Source: JRI, based on China Customs and CEIC

Note: 3-month backward moving average.

<Sales of Semiconductor Manufacturing Equipment Makers (2021)>



Source: JRI, based on CINNO Research, VLSI Research

remain small by global standards, it will be difficult to substitute imported equipment with Chinese equipment. China's semiconductor industry, especially for advanced semiconductors, is expected to suffer a huge blow, with production remaining weak for some time as it will be difficult to avoid the negative impact of tightened U.S. restrictions.

■ **China forced to revise its semiconductor industry reinforcement plans**

In May 2015, the Chinese government announced its plan to raise China's semiconductor self-sufficiency rate to 75% as part of "Made in China 2025," its industrial policy aimed at upgrading the manufacturing sector. However, the vast semiconductor fund that was established to serve this purpose has faced a series of business failures by the portfolio companies, as well as the arrest of some of its executives on corruption charges. With the added issue of a lack of technology and personnel needed in the semiconductor industry, the goal will be almost impossible to achieve under current conditions. The situation surrounding semiconductor production is expected to deteriorate further due to the restrictions by the U.S., forcing the Chinese government to drastically revise its policy for becoming a semiconductor powerhouse.

(Minoru Nogimori)