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Introduction to the International Monetary Institute (IMI)

Established on December 20, 2009, IMI is a non-profit academic institution affiliated to China Financial Policy Research Center and the School of Finance of Renmin University.

Following the "general theory of macro-finance", IMI aims to become a world-class think tank, focusing on the studies of international finance, in particular the international monetary system and RMB internationalization. Despite its relatively short history so far, IMI has established itself as a leading research institution and important forum, where industry leaders, policy makers and academic experts from home and abroad share their insights and expertise.

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www.imi.org.cn

STEVE H. HANKE

Professor at John Hopkins University
Member of IMI Advisory Board

Steve H. Hanke is Professor of Applied Economics and Co-Director of the Institute for Applied Economics, Global Health, and the Study of Business Enterprise at The Johns Hopkins University in Baltimore. He is Senior Fellow and Director of the Troubled Currencies Project at the Cato Institute in Washington, D.C.; Special Counselor to the Center for Financial Stability in New York; and contributing editor at Globe Asia Magazine. Prof. Hanke is also member of the Charter Council of the Society of Economic Measurement and the Financial Advisory Council of the United Arab Emirates.

In the past, Prof. Hanke taught economics at the Colorado School of Mines and the University of California, Berkeley. He served as Member of the Governor's Council of Economic Advisers in Maryland in 1976-77; as Senior Economist on President Reagan's Council of Economic Advisers in 1981-82; and as Senior Advisor to the Joint Economic Committee of the U.S. Congress in 1984-88. Prof. Hanke also served as State Counselor to both the Republic of Lithuania in 1994-96 and the Republic of Montenegro in 1999-2003. He was also Advisor to the Presidents of Bulgaria in 1997-2002, Venezuela in 1995-96, and Indonesia in 1998. He played an important role in establishing new currency regimes in Argentina, Estonia, Bulgaria, Bosnia-Herzegovina, Ecuador, Lithuania, and Montenegro. Prof. Hanke has also advised the governments of many other countries, including Albania, Kazakhstan, and Yugoslavia.

Prof. Hanke is Distinguished Associate of the International Atlantic Economic Society; Distinguished Professor at the Universitas Pelita Harapan in Jakarta, Indonesia; and Professor Asociado (the highest honor awarded to international experts of acknowledged competence) at the Universidad del Azuay in Cuenca, Ecuador. He has been awarded honorary doctorate degrees by the Bulgarian Academy of Sciences, the Universidad San Francisco de Quito, the Free University of Tbilisi, and Istanbul Kültür University, in honor of his scholarship on exchange-rate regimes. In 1998, he was named one of the twenty-five most influential people in the world by World Trade Magazine.

This issue is proud to present

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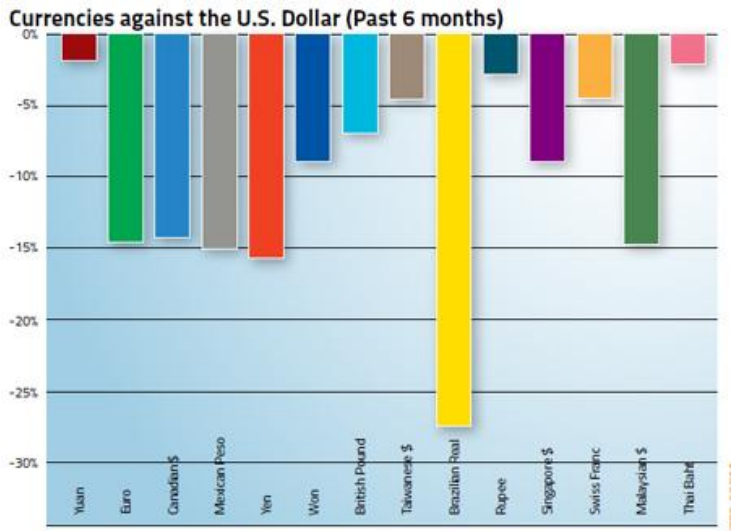
Feature

Currency Wars, Again

By STEVE H. HANKE

The specter of currency wars rises like a phoenix once again. This time around, most of the warriors reside in Washington, D.C. The strong dollar has inflamed the currency warriors (read: mercantilists) led by Democratic Senator Chuck Schumer from New York and Lindsey Graham, Republican Senator from South Carolina. These mercantilists argue that "cheap" foreign currencies give the U.S.'s trading partners an "unfair" advantage, something worth doing battle over.

About the only thing the mercantilists have it right is the fact that the U.S. dollar has been strengthening. As the accompanying chart shows, the currencies of all the U.S.'s top trading partners have lost value against the greenback over the past six months. These losses have ranged from 1.8% for the Chinese yuan to 21.6% for the Brazilian real. Russia, the fifteenth largest trading partner of the U.S., has seen the value of its ruble fall 39.5% over the past six months.

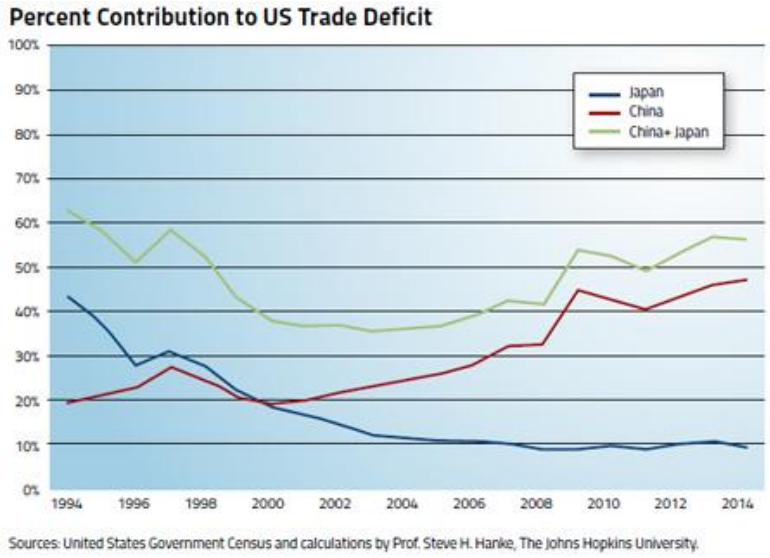


Source: Federal Reserve, Bloomberg L.P. and calculations by Prof. Steve H. Hanke, The Johns Hopkins University.

Note: The currencies presented in this chart represent the U.S.'s top 14 trade partners, ranked in order (from left to right) of their contribution to U.S. trade. Russia–the U.S.'s 15th largest trade partner–has seen its rubble collapse 39.5% against the U.S. dollar within the past 6 months. This currency was not included in this chart, as it would have drastically altered the dimensions of the graph.

So, the currency hawks want to do what they always want to do: go to war. The particular trigger is the Trans-Pacific Partnership (TPP), a trade agreement between Asian countries and the U.S. With this agreement, which the Obama administration is pushing forward, the currency warriors have spotted an opening. They want to insert enforceable rules against so-called currency manipulation into the TPP.

All this saber rattling is a broken mercantilist record, particularly with regard to the U.S.'s biggest Asian trading partners: Japan and China. Indeed, these two countries have accounted for the lion's share of the U.S. trade deficit over the past twenty years (see the accompanying chart).



From early 1970s until 1995, Japan was viewed by the mercantilists as an enemy. They asserted that unfair Japanese trading practices caused the U.S. trade deficit, and that the U.S. bilateral trade deficit with Japan could be reduced if the yen appreciated against the dollar — a "weak dollar policy." Washington even tried to convince Tokyo that an ever-appreciating yen would be good for Japan. Unfortunately, the Japanese complied and the yen strengthened, moving from 360 to the greenback in 1971 to 80 in 1995.

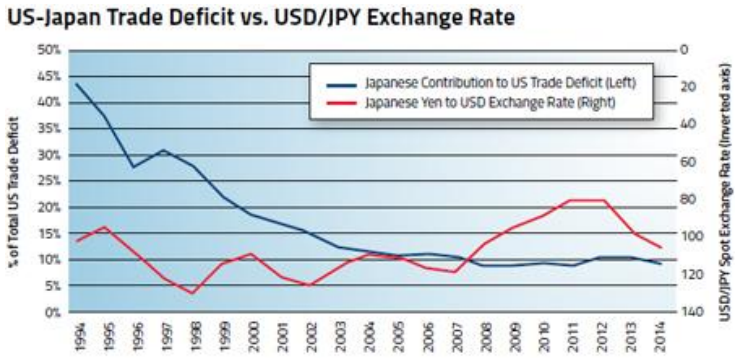
In April 1995, Secretary of the Treasury Robert Rubin belatedly realized that the yen's great appreciation was causing the Japanese economy to sink into a deflationary quagmire. In consequence, the U.S. stopped arm-twisting the Japanese government about the value of the yen and Secretary Rubin began to evoke his now-famous strong-dollar mantra.

"The U.S. trade deficit is the result of the U.S. savings deficiency, not exchange rates."

But, while this policy switch was welcomed, it was too late. Even today, Japan continues to suffer from the mess created by the yen's appreciation.

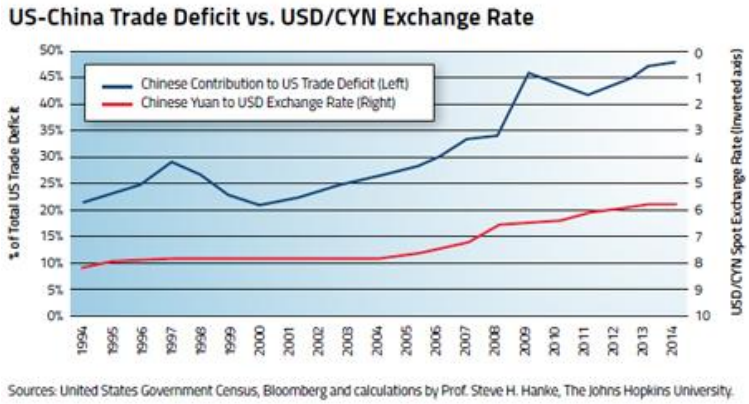
As Japan's economy stagnated, its contribution to the increasing U.S. trade deficit declined, falling from its 1991 peak of almost 60% to 9.3% today. While Japan's contribution declined, China's surged from slightly more than 9% in 1990 to 47.2% today. With these trends, the Chinese yuan replaced the Japanese yen as the mercantilists' whipping boy.

Interestingly, the combined Sino-Japanese contribution to the U.S. trade deficit has actually declined from its 1991 peak of over 70% to 56.7%. This hasn't stopped the mercantilists from claiming that the Chinese yuan is grossly undervalued, and that this creates unfair Chinese competition and a U.S. bilateral trade deficit with China.



Sources: United States Government Census and calculations by Prof. Steve H. Hanke, The Johns Hopkins University.

This raises an obvious question: does a weak yen or yuan vis-à-vis the dollar (in nominal terms) explain the contribution of Japan and China to the U.S. trade deficit? After all, this exchange-rate argument (read: competitive advantage) is what the mercantilists use to wage war. When it comes to Japan, whose contribution to the U.S. trade deficit has been declining for the past twenty years, there is a very weak relationship between the yen's strength and Japan's contribution to the trade deficit (see the accompanying chart). Certainly not something worth going to war over. And as for China, the relationship between the strength of the yuan and China's contribution to the U.S. trade deficit contradicts the mercantilist conjecture (see the accompanying chart). Indeed, the Chinese yuan has appreciated in nominal terms relative to the greenback over the past twenty years, and so has the Chinese contribution to the U.S. trade deficit.



Sources: United States Government Census, Bloomberg and calculations by Prof. Steve H. Hanke, The Johns Hopkins University.

But, evidence fails to sway the mercantilists. They still want tough currency manipulation provisions inserted into the TPP. They don't realize that the term "currency manipulation" is hard to define and, therefore, is not an operational concept that can be used for economic analysis. In consequence, currency manipulation rules would be almost impossible to implement. The U.S. Treasury (UST) has acknowledged this fact in reports to Congress. Indeed, in 2007, the UST attempted to have the International Monetary Fund (IMF) act as a currency cop and go after manipulators. Raghuram Rajan, who is currently governor of India's central bank and was IMF's chief economist in 2007, pronounced the episode an "unmitigated disaster."

It isn't only the mercantilists who don't understand that nominal exchange rates don't have much to do with trade deficits. Some economists — most notably C. Fred Bergsten of the Peterson Institute for International Economics and supply-side guru Arthur B. Laffer — don't seem to understand the economics behind the U.S. trade deficit, which has been with us since 1975. Those economics were fully explained by one of my occasional collaborators, the late Ronald I. McKinnon from Stanford University. Indeed, he elaborated on them in his last book, *The Unloved Dollar Standard: from Bretton Woods to the Rise of China* (2013). In short, the U.S. trade deficit is the result of U.S. savings deficiency, not exchange rates. As a result, the trade deficit can be reduced by some combination of lower government consumption, lower private consumption and lower private domestic investment. You wouldn't know this basic truth by listening to the rhetoric coming out of Washington.

In Brief

Editor's Note:

Up to April 2015, the advisory board members and academic committee members of IMI have been expressing their research opinions on monetary finance and economics through published articles and public speeches. The following is a summary of their research reviews.

Research Review by IMI Advisory Board Members

At the briefing meeting held by the Information Office of the State Council on January 23, **PAN GONGSHENG** introduced the situation of financial sector reform and financial support for the real economy.

In the field of financial sector reform, we have followed the overall strategic arrangements of the 3rd Plenary Session of the 18th Central Committee of CPC, worked actively and steadily to advance financial reform in vital areas and key links, and further enabled the market to play a decisive role in resource allocation to a full extent. As a result, the vitality and dynamism within the financial system was further released. First, the market-based interest rate reform and the exchange rate regime reform were enhanced. Second, the cross-border use of RMB increased notably. Third, the convertibility of RMB under the capital account made new progress. Fourth, the deposit insurance scheme has achieved substantial progress. Fifth, reforms on policy financial institutions proceeded smoothly. Sixth, reform of the foreign exchange administration was deepened. Seventh, the PBoC has improved upon and made innovation in financial services and management in the fields of financial surveys and statistics, payment and settlement, treasury management, banknote issuance, credit reference, anti-money laundering, and financial consumer protection.

PBoC followed the essential requirement of the financial sector supporting the real economy, continued a sound monetary policy, stayed focused and took initiatives as called for, enriched and improved the mix of monetary policy instruments, and conducted fine-tuning and pre-emptive adjustments when appropriate, so as to provide a favorable monetary and financial environment for the

development of the sector. First, the aggregates of money supply were kept at an appropriate volume, which was neither loose nor tight. Second, social financing costs were reduced. Third, the credit structure was further optimized. Fourth, direct financing channels were broadened.

In the medium to long term, efforts will be made to improve the financial market and institutional system to support the sustainable development of the real economy. Efforts will also be made to achieve a sound, balanced and effective macroeconomic management system and monetary policy framework and establish and improve a highly efficient, forward looking, professional and market-friendly regulation regime. The focus will also be put on ways to create a comprehensive, efficient and inclusive financial service system supported by the development in science and technology, reinforce the financial safety net to forestall risks, strengthen global competitiveness of the financial sector, and provide an effective and convenient financial service to support the sound and sustainable growth of the real economy.

In ***"Financial comprehensive operation and supervision division reform"***, **WANG ZHAOXING** pointed out the challenges faced by the supervision division system are as follows. Different supervision departments have different regulations on the same or similar business in cross operation, which leaves great space for arbitrage in supervision. Financial comprehensive management has challenged the supervisors' capability of comprehensively consolidated supervision. The business chain of cross-industrial and cross-market investment and financing brought by comprehensive operation is prone to spread cross-industrial and cross-market financial risks, and make it easier to cause systematic risks. In the current supervision division, there lacks supervision on financial institutions holding companies. It poses higher requirement and more severe challenges to the sharing of supervision information and the coordination of supervision policy.

On completing the financial supervision division system in China, we should establish a supervision framework on financial holding companies to fill the supervision vacuum. Under the supervision division framework, we should establish and complete a firewall system to prevent and control the cross-industrial and cross-market spreading of financial risks. Under the supervision division framework, we should establish and complete a highly efficient supervision coordination mechanism to reduce the space for arbitrage to the maximum extent. Besides implementing supervision division by different industries and institutions, we should also increase cross-institutional, cross-industrial and cross-market functional supervision. We should further strengthen supervision capacity building.

JOSEPH YAM CHI KWONG put forward the sound strategy to safeguard global financial stability. Though the global economy has experienced considerable growth, financial crisis occurred frequently on a local or even global basis, compromising the economic interests of many countries. Apparently, reform has to be implemented in the international monetary system and the global financial system in order to better serve the economy. A common view is that the financial crisis is always led by certain rash macro-economic policies or a weak financial system. To ensure the stability of the global financial system, all countries should join hands to address two main issues.

It is not optimistic to get out of the plight of globalization and national interests through multilateral financial institutions and it is hard for certain institutions to change for getting out of the plight because of some arrangement reasons or political reasons such as the distribution of voting rights and the assignment of high-level management. Recent years of experience show that it's getting harder to manage monetary and financial risks despite the fact that financial globalization brings all the benefits to local fund-raisers and to the investors.

Conflicts exist between the private interest of financial inter-mediation and the public interest of promoting financial efficiency and sustaining financial stability. The financial innovation for the purpose of making profit for financial inter-mediation but under the disguise of promoting financial efficiency will definitely lead to financial crisis. All parties involved in the financial development, decision-makers, regulators, investors, and fund-raisers, will benefit from the knock-on effects of the monetary and financial development, the reform and the order of various projects.

Research Review by IMI Academic Committee Members

CHEN YULU raised the phenomenon of "transformation anxiety" under the "New Normal". With the economic aggregate surpassing 60 trillion yuan, the old growth pattern is no longer sustainable, and yet the new model is still in brewing– crisis and opportunity exist simultaneously, and breaking down the "old" and ushering in the "new" are happening at the same time. The economic growth is shifting to lower gears, the economy is suffering from the pain of restructuring, and prior stimulus policies are in absorbing process. In an environment that the three elements are overlapping, investment is on the decline, external demand is sluggish, and corporate performance is dipping. These problems result in widespread concerns

and pessimism of "China bears". We might as well call this phenomenon "transformation anxiety".

Though China's economy faces more headwinds and challenges from transformation, China is able to maintain stable momentum, upgrade structure, and improve quality of development and people's well being. First, the economic structure has been essentially upgraded. Second, the overall economic risk is manageable. And last, innovative development is emerging systematically.

To cope with the economic "new normal", the central government has proposed that we should "adjust our mindset, acquire the right understanding, resort to appropriate method, and work effectively". We are supposed to transform our understanding about economic growth – more emphasis should be placed upon quality instead of only on quantity. The economic "new normal" does not mean the end of important strategic opportunity for the Chinese economy. What have been changed are only the connotation and conditions of the strategic opportunity. The "new normal" does not mean the economic fundamentals are no longer good, but means the transformation of economic growth pattern and structure. Therefore, we should focus on the main aspect of the problem, seize the development opportunity, overcome "transformation anxiety", and fully comprehend the central government decision, so as to accelerate economic transformation and be more initiative.

At the 2014 China Business Forum organized by London Business School, **BEN SHENGLIN** delivered a speech entitled ***"My dream: the rise of China Inc."***. He talked about the rise of China Inc., the rising Chinese companies on the world stage，it is his version of "The China Dream". He fist put this topic in a historical and global context. When China decided to open up to the rest of the world in 1978, private companies were forbidden. 12 years later, in 1990, China had the opportunity to host the first major regional event: Asian Games in Beijing, which was the first "coming out party" for China. There was no single Chinese company that people outside China could remember. In 2002, the only Chinese brand the world knew was probably Tsingtao Beer. Fast-forwarding to 2014, China is now the world's No. 2 economy in terms of GDP, No. 1 in foreign exchange reserve, the largest nation of international trade, and increasingly a net exporter of capital in terms of outbound investments. Today thanks to internet, globalization, trade and investment, Chinese people know more about the world, and the world knows a lot more about China, Chinese companies and Chinese people.

Many Chinese companies and products are increasingly better known globally, not just the big state-owned enterprises, the big banks, but also the private sector

companies. He particularly emphasized the city of Hangzhou, an under-appreciated Chinese city. Hangzhou is a city with rich history and is the provincial capital of Zhejiang. What make Zhejiang special are the entrepreneurship and the thriving private sector. Approximately 30% of Top 500 Chinese POEs (privately-owned companies) in China are controlled by Zheshang ("Zhejiang entrepreneurs"); over 6 million Zhejiang natives are living outside Zhejiang, including 1.5 million living abroad. They have been able to establish a formidable network of Zhejiang Chambers of Commerce across the globe. In Zhejiang, the number of officially registered companies amounts to 4.2 million, with the self-employed and those diaspora, most of whom are entrepreneurs and small business owners. It is suggested that every one out of 5 Zhejiang natives are business owners, an amazing level of the entrepreneurship.

According to a recent Forbes study, 100 Chinese companies including those in Hong Kong and Taiwan are already on its Top 500 Global Companies list. At the end of the speech, he shared a dream he has today: Chinese companies will not just be bigger, but become stronger and more responsible global corporate citizens. He believes that against a backdrop of political consolidation and economic liberalism, this dream will come true: the Chinese companies will rise!

As **CAO TONG** mentioned in ***"Infrastructure Construction is the Largest Challenge for Internet Financing"***, internet financing provides a platform shared and governed by different players. Labor division and information analysis can be carried out more effectively on the Internet. Although Internet financing does not change the essence of financial market, it promotes the evolution and development of the financial market and related industries and even brings major changes.

The regulation standards of Internet financing need to be redefined. The regulation principles and rules of Internet financing have changed a lot. Subjecting two industries to one regulation standard poses a problem to the current regulatory mechanism that supervises different industries separately. Big data has changed the mode for risk evaluation and the current internal rating method based on financial statistics will be reshaped. We should renew our understanding and definition of the regulation range and mode for Internet financing.

Infrastructure construction is the largest challenge facing Internet financing. One viable option is to use the creativity and activeness of market players and to show them a vision of long-term growth. If we cannot overcome this challenge, Internet financing will not become a brand new financing mode with great social significance. In this sense, Internet financing regulation is not only supervision over

Internet financing practitioners, but also a promotion for the construction of Internet financing ecology.

According to **GUO QINGWANG** on China's fiscal policy, the policy should be more proactive in 2015. Fiscal deficit ratio is an important index in measuring the activeness of fiscal policies. In 2015, we should promote the activeness of fiscal policies not only by elevating structural deficit ratio but also by increasing government expenditure. Now the local governments are mainly responsible for government expenditure and economic growth. Therefore we should increase local expenditure or reduce expenditure pressure for local governments to increase fiscal spending and stabilize economic growth. This year's fiscal policies should focus on two "engines": encouraging innovation and entrepreneurship and increasing public goods and services. Our economy is in the New Normal. In the long run, the major strategic task we are facing is to upgrade our economy and transform to an innovation-driven growth mode. So we should stick to proactive fiscal policies and should not neglect the sustainability of fiscal policies.

First, our government debt, especially local government debt, grows so fast that our fiscal safety is threatened. This means that our fiscal policies cannot be too active. Second, our infrastructure including road construction has achieved giant progress and the marginal yield of large-scale infrastructure construction is fading away. Therefore, active fiscal policies based on large-scale infrastructure construction will become less effective. Although we will keep investing in infrastructure and public facilities, the government will no longer be the only investor and we will promote PPP mode. Otherwise, our fiscal policies will only be "intensive" but not "effective" and our fiscal risks will also be larger.

On the Macro-Finance Salon No. 21 hosted by IMI, **IL HOUNG LEE** delivered a speech entitled ***"Risks and Opportunities in the 'New Normal'"***. He pointed out that economic fundamentals are beginning to stand on their feet in the US. And at the same time, in order to reduce the uncertainties of marginal return on capital, the US is supposed to normalize its monetary policy. On the other side of the Atlantic, the disparity of production rates among European countries is worsening, and the effect of the new round of QE in Europe is yet to be tested. While the growth expectation is prolonged in emerging markets, they are also under pressure from problems such as weakened growth and aging population. The key to further recovering the world economy is to break the deadlock of insufficient labor pool and the mismatch of human resources supplies and product demands in emerging markets. He described the international monetary system as a three-polar system of

"dollar, euro and yuan", which consists of two dimensions – "settlement and store of value". He also believes that the economic cooperation strengthened by free trade zone between China and South Korea will have a "win-win" future.

According to **LIU JUN** on internet finance and elements in traditional Chinese culture, at first sight, these aspects are totally irrelevant. Why internet finance is linked with traditional Chinese culture? Virtue social contact is the acquaintance society on the internet: internet finance can collect and process a large amount of information, expand the scale, and use small model inside the large model. Scene and experiences are similar to "describing the environment" and "creating the environment": an important feature that differentiates internet finance from traditional finance is the development of application scenes and the emphasis on user experience. Connection means fully comprehension: openness, sharing, connection and integration are distinctive features of internet finance. Internet finance has greatly reduced the information asymmetry. Information can be fully communicated, delivered and shared in a convenient way with low cost, which further promotes the multi-dimensional connection, cross-border immersion and integration among institutions, clients, and terminals through internet finance. Harmony is a universal goal: the inclusive nature of internet finance promotes harmony. Welfare is "meta-concept": the foothold of economy is promoting people's welfare, and welfare is an extremely complex and diversified concept.

According to **DAVID MARSH** in the article ***"With QE, euro is again world's favorite borrowing currency"***, the most notable result of today's start of quantitative easing by the European Central Bank seems likely to be a weaker euro as one of the most visible — and potentially disruptive — side effects of the Great Monetary Polarization. A combination of euro weakness, low interest rates and the burgeoning U.S. recovery is propelling the European economy towards faster growth. If this continues, and especially if inflationary pressures start to rise again as the oil price rebounds, calls will rise from Germany and other creditor countries for Mario Draghi, the ECB president, to end the QE stimulus before the planned cut-off in September 2016. The woes of Greece and other debtor nations will break any European euphoria. But the ECB's accommodative stance and higher interest rates elsewhere are likely to make the euro, once again, the world's favorite borrowing currency — a repeat of the euro's initial weakness in the years after it was launched in January 1999. To overcome a growing supply-demand collateral mismatch, the ECB is inaugurating a large-scale securities lending by constituent central banks,

drawing lessons from the U.S. and U.K. practice six years ago when central bank buying government bonds led to a sizable drain in collateral availability.

In ***"Requirements for Shanghai Free Trade Zone (SFTZ) to become the global center for off-shore RMB trading"***, **HERBERT POENISCH** put forward that China with its manufacturing and trade prowess finds itself in the first stage of playing a global financial role. It has been accumulating wealth mainly in the form of foreign exchange reserves. The next stage will be capital exports in the interest of the Chinese government and industry. However, the process of becoming a global currency to match China's economic success has not even completed the first stage.

As a first step, all of China's trade, exports as well as imports should be increasingly invoiced and cleared in RMB through major clearing banks in SFTZ. These should be the major Chinese banks as well as an equal number of major foreign banks. In order to be in a better position to supervise foreign banks, we should require these banks to set up subsidiaries in the SFTZ. All banks will be required to run double accounting, domestic RMB and offshore RMB. Offshore RMB will be traded on non-resident accounts. Secondly, there should be a balance of exports and imports cleared in RMB to avoid a large imbalance, neither liquidity surpluses nor deficits. Both Chinese exporters and importers should be encouraged to use RMB. The clearing should be carried out through the China International Payment System (CIPS) which is to be set up sooner than later. Thirdly, the additional component of financing Chinese FDI in RMB and taking RMB deposits from foreign central banks as foreign exchange reserves should be added. Once the BRICS bank, the New Development Bank (NDB) and a Contingent Reserve Arrangement (CRA) become operational, they will be major players in the offshore RMB market. They will receive contributions from member countries, presumably in offshore RMB which they will lend to borrowers in offshore RMB. Similar arrangements can be made for the China-led Asian Infrastructure Investment Bank (AIIB).

On whether internet finance can replace traditional financial modes, **QU QIANG** pointed out that, in terms of trade cost, internet finance has its advantages over traditional banks. But the most important function of a bank is to ensure liquidity rather than to lower information and transaction cost. We need to focus on the essence of currency to see whether Internet banks can replace traditional commercial banks. That currency is decoupling from its real value is a fundamental change. The central bank and commercial banks must join hands to form a network of social credit based on national credit. Only so can the transaction cost be the lowest.

E-currency and other forms of currency only reflect changes with regard to form rather than essence. We need to make preparation to issue currency. Without preparation, the issuance, expansion and contraction of currency will all be difficult. Internet finance may compete with and impact traditional finance in certain ways, but it will not have a subversive influence. It's not appropriate for us to broadly describe the influences of Internet finance on traditional finance; we'd better analyze and demonstrate them respectively.

ANOOP SINGH made a forecast on the US economy and emerging markets on Macro-Finance Salon No. 20. In his opinion, the US economic recovery came from improved labor market, strong dollar and lower oil price. Emerging economies were confronted with the problem of inefficient investment and production. The emerging economies should also pay more attention to financial system's role in supporting real economy and promoting entrepreneurship.

TU YONGHONG pointed out at the RMB Era Forum that the Shanghai-Hong Kong Stock Connect Initiative is a strong signal China sends to the world. It marks the Chinese capital market is more open. The Initiative not only provides a platform for overseas investors in the capital market, but also explores a path with Chinese characteristics for RMB internationalization.

The Initiative improved the openness of China's capital market. The Initiative sends a strong signal to the world: the openness of China's capital market has entered new stage; it is open to legal persons, institutions, and individuals as well. Ordinary people now can invest in the stock market. This kind of financial institutional reform shows our determination to further open our capital market, and established backflow channels for around 2 billion yuan offshore RMB.

The Initiative is an indispensable drive of RMB internationalization. It provides a new platform for global investors to see a new opportunity, which is, investing with RMB is lucrative; RMB can become a new means of wealth management. Second, with mid and high-speed economic growth, China's stock market has predictable and suitable room for development, and it is to appealing to resist to global capital. Third, large scale capital flow can promote the formation of RMB network effects in the capital market in the short term.

RMB internationalization should follow the following path: trade settlement + outbound investment + bilateral swap. China should expand RMB settlement on the basis of trade.

In ***"Preparation for an upcoming financial crisis"***, **XIANG SONGZUO** raised

four factors that are highly likely to bring the next global financial crisis in 2015 and in the future. The four factors are: the dramatic fall of the prices of oil and four categories of commodities, the debt burden, the polarization on the international monetary market, and the Euro crisis may recur. China is still in a better position. First, there is no possibility and need for substantial RMB depreciation. We should continue to maintain the relative stable exchange rate of RMB, allow wider fluctuation range, and better manage risks. Second, against the backdrop, we should greatly promote the internationalization of RMB. The demand of RMB on the global market now is very strong, while building RMB offshore centers; we should also pay special attention to the international issuance of RMB. Third, we should seize this opportunity to build a commodity trading center in China as soon as possible. We should take quick action to gain the pricing power of commodities. Forth, we should substantially liberalize our financial market, and build a financial center in particular.

According to **ZHANG XIAOPU** in ***"Internet finance will galvanize theoretical innovation of finance"***, recently, the development of internet finance in China is overtaking that in Europe and US. Because of internet finance, our understanding on traditional financial concept, such as information asymmetry, currency function, and payment system, has been deepened. The frontiers of traditional financial theories have also been expanded, and even new theories are emerging.

Internet finance has deepened and enriched the functional perspective of finance. Robert C. Merton, a Nobel laureate in Economics, has been recognized for the functional perspective of finance, whose core view is that financial system possesses six basic functions. The six basic functions are: first, to provide payment and settlement system for commodities, services and assets transactions; second, to segregate stock ownership and raise funds on a large scale; third, to transfer and allocate economic resources over time and space; fourth, to manage uncertainties and control risks; fifth, to provide price information and decentralize decision-making among different sectors; and sixth, to deal with information asymmetry and incentive issues. Reviewing, the evolution of Chinese internet finance, we can see that it has played an role in creating opportunities, improving equality, reducing poverty, and narrowing down income gaps that is irreplaceable by traditional financial system. Recently, an increasing number of scholars have begun to stress the importance of finance's social function. The point is not whether social function is a new function of financial system, but the relationship between it and economic functions.

Internet finance has enriched the practices of financial development theory.

Internet finance has enriched the practices of financial deepening, and the mechanism of how financial development influences economic growth, which is beneficial for the integration between financial innovation and serving the real economy.

Internet finance helps crack the potential paradox of inclusive finance. The development of inclusive finance, in essence, is dependent on financial inclusiveness, and the development of internet finance helps solve the paradox of inclusive finance. Based on China's condition, the development of internet finance has yielded more benefits for tier three and four cities, as well as rural and remote areas, which is an impressive result of the development of inclusive finance.

According to **ZHANG ZHIXIANG** on the prospect of the reform in the international monetary system, under the framework of G20, the International Monetary and Financial Committee of the Board of Governors stated clearly on its 21th meeting communiqué that all member states should agree and approve the 2008 quota and governance reform plan as soon as possible. The key point of the quota and governance reform plan is that it should reflect the increasing importance of emerging economies in the international monetary system, and ensure that smaller economies should keep their influence in the IMF.

According to the charter of IMF, the change of quota is an important agenda, which requires 85% votes and no less than 3/5 member states' approval. On the 29th meeting of the International Monetary and Financial Committee in April 2014, more than 3/5 member states have already declared their support and acceptance of the IMF quota and governance reform plan. But the problem is that the United States, which has 16.75% of the voting right, has not declared support. The 14th General Review of Quotas has been delayed for 4 years which is unprecedented in the history of IMF.

If the 14th General Review of Quotas is unable to proceed because of the obstruction of the United States, its influence on the international monetary system can be compared to the event on 15th August, 1971, when the United States declared the end of convertibility of the US dollar to gold and resulted in the collapse of the Bretton Woods system established after the Second World War. The 2010 quota and governance reform is the call of the times, it aims to strengthen the coordination and cooperation of international community in order to prevent crisis more effectively, and reduce to the maximum extent of the losses brought by crises. The reform of the international monetary system is in line with the requirement of the international community, and the fact that more than 80% member states agree the plan is a

convincing proof.

ZHAO HAIYING pointed out on auditing reform that China's auditing has different tasks from developed countries that have mature and complete laws and regulations in auditing after years of development. China's auditing is in a transformation period with incomplete and sometimes even conflicting regulations which has brought extra challenges to our auditing work and poses a higher demand.

In comprehensively deepening the reform, we should consider how to protect the activeness of enterprises to innovate. On the one hand, we should stick to the rule of law and enforce laws and regulations on the operation of enterprises. On the other hand, we should also encourage enterprises to innovate. Innovation means risk, so we must establish a mechanism to allow enterprises to make mistakes in innovation.

We can make the following three efforts in auditing in the future: first, in auditing, we should find out whether related government organs abide by the law under the existing legal framework; second, we should find whether the existing rules and regulations should be improved and whether the existing system and mechanisms should be reformed in order to make suggestions and advice in terms of systems and mechanisms to our government; third, we should take innovation into consideration when auditing enterprises and establish mechanisms to tolerate financial risks associated with innovation to protect the activeness of enterprises to innovate.

In his speech at the RMB Era Forum, **ZHAO XIJUN** pointed out that, the pro-HK initiative will have an impact on China's capital market, the capital account controls, and the RMB internationalization, which will become more obvious when it is able to affect the market pricing. It aims to promote the development of financial infrastructure, improve market efficiency, so that market can play a better role in resource allocation, provide more opportunities for investors at two sides, as well as professional institutions and service providers, promote the two-way liberalization of capital markets, improving flow of RMB and convertibility, including the openness of capital market, convertibility of capital account and RMB replacement. There are mainly two reasons for Shanghai-Hong Kong stock connect going smoothly and orderly. One is the technical reason, such as the trading system, registration and settlement system, trusteeship and payment system; the other is the well-functioning account system, including capital operation and delivery.

ZHOU DAOXU put forward four priorities in promoting interest rate liberalization. First is to nurture qualified market players. Current market players fail to provide competitive financial supply or market-based financial demands. As to

how to nurture qualified market players, at the supply end, we need to lower the threshold to the financial industry and nurture a diversity of financial organization to provide the real economy competitive supply; at the demand side, we need to accelerate the development of mixed-ownership economy and deepen fiscal and tax reform. Second is to accelerate the set-up of the benchmark interest rate system. An immature benchmark interest rate system is a big constraint. As to how to build the system, first, we need to gradually remove the deposit interest rate ceiling; second, we need to consolidate the fundamental role of Shanghai Interbank Offered Rate (Shibor); third, we need to improve the yield curve of the national bond through a risk-free benchmark interest rate reflecting market supply and demand. Third is to form a monetary system. Monetary system needs to meet the requirements of the interest rate reform. As to how to build the system, one way is to transform the way monetary policies adjust the economy. Second, we need to innovate the way we apply monetary policies. Third, monetary policies need to be more flexible. Fourth, we need to try to achieve one policy objective at a time. Fourth is to develop a risk control plan. We need to guard against the rise of short-term financing costs, prevent risks from the local government financing platforms and real estate industry, and guard against systemic financial risks.

IMI International Monetary Review

Research Report

Challenges to Building the Offshore RMB Market

By International Monetary Institute, Renmin University of China

Editor's Note:

RMB internationalization is one of the most important national strategies. The RMB Internationalization Report has been published annually since 2012, recording the course of RMB internationalization and studying in depth the key theories and policies at each stage.

This article is an excerpt from the "RMB Internationalization Report 2014" which sets the topic on RMB offshore market construction. The research team has looked into the internal logic of the promotion effect offshore markets have on RMB internationalization, and focused on the implications and effects of the establishment and development of RMB offshore markets have on RMB internationalization. Combining the current situation of offshore markets, the research team has discussed about the realistic path for RMB internationalization to follow under the circumstances that capital accounts are not fully open.

There are two main challenges in general. Firstly, how to establish an offshore RMB market successfully? Based on the experience of Hong Kong and London, we must make efforts in products, institution, technical support and legal framework to achieve a faster development and thus promote the internalization of RMB actively. The other challenge is how to face the negative influences arising from the offshore RMB market objectively. According to the international experience, offshore markets might not only bring more risks to the private sector, but also disturb the finance and taxation policies and currency circulation and even do harm to the entity economy. In summary, to establish offshore markets, we should forge ahead with determination and be careful as well.

1. Offshore RMB markets and financial institutes

1.1 Offshore RMB financial products

Ever since the 2008 financial crisis, interest rates overseas decreased and domestic monetary policy was from neutral to tighter. Under such circumstances, the exchange rate of RMB was still rising steadily, which made RMB bonds very popular. At present, 20 percent of offshore RMB bonds was issued by a third party (non-Chinese mainland or Hong Kong enterprises). Its buyers were from different parts of the world for various purposes。For example, the central banks of Australia, Nigeria and Japan are prepared to treat it as foreign exchange reserve. Germany Institutes has crossed boundaries and invested in RMB bonds in prodigious mount. Taiwan also has issued its first "Treasury island Bond". Besides, the offshore RMB bond with a total of ¥1 billion issued by China Construction Bank was so welcome and went out in an instant. All these phenomena show that RMB bonds are becoming more and more internationalized. According to the Twelfth Five Year Plan of Financial Development and Reform，which was released in September 2012, China is in support of Hong Kong to develop into the center of offshore RMB businesses and international asset management and finally consolidate and enhance its position as international financial center. It is predictable that Hong Kong will have a wider offshore RMB market and more convenient financial transactions in the future, which will definitely promote the internalization process of RMB. Relying on the central clearing system of Hong Kong, the whole world will establish sub-centers across east and west continents and in Taiwan-Singapore-London-America. Offshore RMB bonds will experience another explosive growth and potentially surpass Asian Dollar bonds in several years. It will turn into one of the most important financing channels for enterprises.

Besides, SFC of Hong Kong has also approved four RMB bond funds and gold-backed ETF priced and transacted by RMB. In December 2011, China implemented RQFII program in Hong Kong stock market and began to arrange Hong Kong-listed firms to raise funds in mainland stock market. We are trying to release foreign exchange rate controls gradually and sequentially. RQFII stipulates that RMB capital raised by the Hong Kong branches of those mainland fund management companies and securities companies can be invested into mainland securities market. Because of this program, Hong Kong investors can step into mainland market and SFC of Hong Kong has approved 19 RQFII funds amounting to ¥19 billion ever since.

In the aspect of RMB monetary market of Hong Kong, volume was relatively small in early time compared to RMB spot and forward market, whose liquidity situation got gradually improved. In fact, transactions in monetary market

experienced a temporary prosperity because of the news that overseas institutions have been permitted to invest in inter-bank foreign exchange market and soon got back in silence. RMB markets have two apparent levels and banks that can deeply take part into cross-border trading settlement or have healthy accounts are very limited in number. Besides, CNK markets are in lack of liquidity generally and this situation is expected to improve as assets priced by RMB increase in quantity. In transaction aspect, RMB long positions can put their money in the clearing bank (within their inter limitation boundary). The bid price of inter-bank monetary market is calculated on the basis of clearing bank price. It is noted that this price is not the floor of RMB

Table 1 A Comparison of Dim Sum Bonds (DSB) and Synthetic Bonds

	Dim Sum Bonds（DSB）	Synthetic Bonds
Requirements for investors:	Have a RMB account in Hong Kong, stricter requirements for investors.	No need to have RMB funds, no special requirements for investors.
Issuer:	Domestic policy banks and commercial banks[1]。	Mostly domestic real estate companies and overseas-listed enterprises.
Volume:	¥1 to ¥1.5 billion	¥3.5 billion
Maturity:	2 to 3 years	3 to 5 years
Rating:	Yes	No
Liquidity[2]:	Less than ¥0.2 billion	¥0.5 to ¥1 billion
Issuer's RMB backflow:	Yes, but under "one discussion for one case "approval system.	Yes. Issuers can achieve the recycling of RMB by foreign exchange settlement and sales system because they get dollars instead of RMB.
Influence of exchange rate:	No influence because it uses RMB to price and settle.	It focuses on the exchange rate of pricing date (or that on debt instructions) instead of the rate on settlement date. Investors will benefit when RMB appreciates.

[1] Those banks in Taiwan, Hong Kong and Macao are not included. And the Issuing banks should have a 4% core capital at least and make profits for the lasting three years.
[2] The daily market turnover rate

rates with extremely short maturity because banks taking part into RMB trade settlement businesses have limited ability to store RMB. RMB short positions remain their lower price and the longer the maturity, the higher the price. In a nutshell, interest curve of offshore RMB is 50bps lower than that of CNO at least.

Recently, market pays more attention to a "new" currency—non-trade RMB. Actually, we have two RMB markets now. Standard Chartered Bank (Hong Kong) offers trade-related dollar/RMB price and also non-trade dollar/RMB price. Besides, trade-related RMB can replace with CNO because Hong Kong Trade Settlement Banks have automatic access to the Clearing Bank while non-trade RMB can't. Therefore, overseas branches of banks, for example, Standard Chartered Bank United States can buy RMB on commission through SCB HK. But the kind of RMB, in a specific way, whether it is related to trade or not, will decide how SCB HK closes the position and relatively to what extent clients are satisfied about long RMB and short dollars. Nowadays, clients are more satisfied with non-trade RMB and foreign exchange counter sometimes buy non-trade RMB only when lacking of liquidity.

Table 2 RMB Products

RMB Products	Market	Comment
Spot	Yes	
Forward	Yes	RMB Forward, NDFs and RMB forward curve.
FRA/CCS	Yes	
Money market	Yes	There are fewer institutes with RMB, so inter-bank transaction is relatively less.
CDs/structured notes	Yes	
FX options	Yes	Because RMB spot exchange rate is lack of transparency and pricing mechanism, the development of this option is restricted.
Structured products	Partial	
Bonds	Yes	RMB bond market of Hong Kong is under construction.
Mutual funds	Yes	The first offshore RMB Fund was introduced in August 2010.

Source：Global Research Department of SCB and updated by author.

Nowadays, there are RMB/HKD and Dollar/RMB two kind products with a maturity of two years to the longest in RMB forward market. However, their liquidity is still worse than inland forward market and offshore RMB NDF market, so three different forward curves exist now. Thereinto, one-year Dollar/RMB with the amount of $3 to $5 million is welcome in the market and has better liquidity. While trade settlement bank has limitations about its exposure in RMB market, sometimes the market is restricted in scale.

There are several problems in offshore RMB bond market:

(1) The market has less liquidity, but more volatility. On one hand, DSB in Hong Kong can only accommodate only 17.7% of offshore RMB by the end of 2012 and people lack RMB invest channels. Therefore, DSB supply is not enough to satisfy the demand and DSB holders prefer to continue to hold it rather than trade in secondary market. (Offshore RMB in Hong Kong can only be invested in deposit and DSB and the later one are more profitable.) In fact, DSB's fluidity is far more weaker than Eurobonds and dollar bonds, even less than other Asian bonds. On the other hand, DSB's popularity relies on people's expectation of RMB appreciation. Once this trend cannot consist or exchange rate begins to violate both-ways, investors would sell bonds in large number, resulting in big undulation in market.

(2) The market lacks efficient credit rating system and relative credit rating institution. It is bad for investors and the market.

(3) RMB re-flow mechanism is not perfect now. Synthetic bonds like DSB may be used to re-flow hot money to the mainland, which will influence macroeconomic stability and obstruct macro-control over it.

(4) The lack of long-time financing tools means long-time investment projects have to rely on bank loans instead of issuing bonds. This obstacle has long caused the mismatch of long-time projects and short-time bank loans. In order to solve this problem and adapt to the demand of urbanization in the future, China should pay more attention to develop bond market. It is estimated that investment demand in infrastructure is about ¥20 to ¥30 trillion in the next ten years and the Twelfth Five year Plan requests that the percentage of direct financing increase to 15%. Therefore, the scales of municipal bonds and corporate bonds are likely to double during the next five years. However, there are still big challenges to develop offshore bond markets and improve the efficiency of such markets. For example, how to consolidate fragmented onshore and offshore bond markets? How to supervise the issuing process and establish a perfect market system? Besides, it is important to involve more international financial institutions to deepen and broaden mainland

bond markets. And the development of bond markets will in turn stimulate banks to pay more attention to financing demands of small and medium-sized enterprises as well as consumers.

1.2 Offshore RMB financial institutions

Offshore banks are also called offshore units, which are banks or other financial organizations located in each offshore financial center. They can only do business with other offshore banks or foreign institutions other than in domestic market. The appearance of offshore banks leads to the emergence of offshore market. In traditional international market, transactions are between resident and non-resident. In financial market, institutions like banks offer loans to foreign organizations or underwrite negotiable securities and investors purchase non-resident negotiable securities in secondary market. Offshore financial market offer intermediary services to non-resident investors and borrowers. Institutions generally accept foreign currency deposit from non-resident and provide foreign currency loans to non-resident. Usually this kind of business has nothing to do with residents and national economic activities, so it is called transitional or offshore business.

Offshore bank business in China has experienced a tortuous process. People's Bank of China and the State Administration of Foreign Exchange approved China Merchants Bank (CMB) to take the lead in offshore bank business in Shenzhen in June 1989. Afterwards，they approved Shenzhen Development Bank (SDB)，Guangdong Development Bank (GDB) and its Shenzhen branch, Industrial and Commercial Bank of China (ICBC)，Agricultural Bank of China (ABC) and its Shenzhen branches to run offshore bank businesses. However, affected by the Asian Financial Crisis in 1997, People's Bank of China stopped offshore services of these five banks at the beginning of 1999. Offshore businesses of Chinese-funded banks entered its clean-up and rectification stage. In June 2002, People's Bank of China approved CMB and SDB to rerun their offshore businesses and Bank of Communications and Pudong Development Bank to develop their offshore businesses. At present, offshore services of banks listed above are well developed. It is roughly estimated that the asset of offshore bank business was over $2 billion by the end of June 2006. Their gross offshore savings are about $2 billion; gross international settlements are nearly $20 billion; gross profits realized are over $20 million.

Generally, Chinese-funded bank businesses can be categorized into several groups: foreign exchange proceeds deposit, foreign exchange loan, foreign exchange inter-bank lending, international settlements, issuance of negotiable big amount certificate of deposit, foreign exchange guarantee, advisory service and other

businesses approved by State Administration of Foreign Exchange. Investors can open HKD savings account, foreign currency savings account, HKD current account, USD checking account, HK financial account, foreign currency financial account, online account and import and export L/C. In November 2003, People's Bank of China offered clearing arrangement for banks that have personal RMB business in Hong Kong. In February 2004, banks in Hong Kong began to run personal RMB businesses, and by the end of that year, Hong Kong RMB current deposit and fixed term deposit have reached ¥12.127 billion. In 2005, RMB deposit in Hong Kong increased significantly because the trade activities settled by RMB have been increasing and the upper bound of RMB flowing from Hong Kong to inland banks has updated to ¥8 thousand and HK residents have been able to sign a check within this boundary per account per day to consume in Guangdong Province. By November 2012, institutions running RMB business, which are permitted by Hong Kong economic and financial administration, have reached 138 with nearly 3 million RMB current and savings accounts and 750 thousand RMB fixed term deposit accounts. Compared with RMB deposit business, RMB loan business began later, which was officially opened to public in 2011. However, RMB outstanding loans has shown a strong growth momentum, having increased from ¥2 billion in 2010 to ¥30.8 billion in 2011. Furthermore, by the end of November 2012, there has been a total of ¥2.6 trillion exchanged to HKD and other currencies by institutions who were permitted to do RMB businesses in Hong Kong. In the meanwhile, HKD and other currencies which amounted to the equivalent of ¥2.6 trillion have been exchanged to RMB. In the aspect of remittance, there have been 28,434 remittances from Hong Kong to the Mainland with a amount of ¥160.35 billion.

The characteristics of offshore bank business in China:

(1) All kinds of businesses develop with a rapid speed but a still small scale. Since the overall recovery of offshore bank industry in 2002, the Chinese-funded commercial banks in China have experienced a steady increase of their offshore businesses. It is roughly estimated that its total assets, its total outstanding deposit and its total international settlement reached $1.6 billion, $1.2 billion and $6 billion respectively in 2004. These three numbers reached $1.7 billion, $1.55 billion and $15 billion in 2005. All these three indicators increased with a rapid speed, particularly the international settlement business. However, the offshore bank businesses in China are still small in scale. By the end of June 2006, the total offshore business asset of the four Chinese-funded bank was $2 billion and this number even includes foreign banks offshore business asset in China. In fact, the total number of offshore business asset and debt is no more than $20 billion, which

is far less than that of international offshore financial centers, like London, Hong Kong and Singapore. It has not been developed into a perfect and mature offshore financial market yet.

(2) There are only a few service varieties and a narrow business scope. In general, offshore businesses of Chinese-funded banks in China stay in the traditional businesses, like deposit, loan and international settlement, focusing on international settlement and riskless trade financing. Their services concentrate on Chinese domestic institutions and foreign enterprises in regions such as Hong Kong, Macao and Taiwan only. Clients from Europe, America and Japan are rare.

(3) Single Capital resource and irrational asset-liability structure. Limited by service targets and products, offshore business volumes of Chinese domestic commercial banks are clearly small and short of capital with a single capital resource. In the meanwhile, their asset-liability structures are irrational. This short-save and long-loan structure will cause liquidity problems.

(4) Profits increase at a faster speed. But the profitability is normal and external competitiveness is weak. The amount of profit realized by Chinese domestic commercial banks through offshore businesses was $5 million, $11 million and $22 million respectively by the end of June 2004, 2005 and 2006. The year-on-year growth rate was over 100%, which was a greater number. However, because of the small volume of liability business, scale and scope of asset business were limited. Besides, considering the volume of liability and term structure, banks have to hold a lot of positions to maintain their liquidity. Therefore, offshore business has a lower return rate and a lower profit rate. Actually, profit rate of Chinese domestic bank offshore business was only 1% in June 2006.

What's more important, we will face more challenges to establish RMB offshore center in sovereign states.

Firstly, like London, there are not a few entity economic agencies supporting the establishment of RMB offshore center and this problem is limited within several people at the policy level. London is the biggest exchange rate transaction center in the world and its RMB storage is really small and has limited actual profit. However, the plan to build offshore RMB European center is mainly pushed by the British Cabinet and Treasury and constantly stressed by British mainstream media and politicians. It is mainly because Britain will be the first nation to benefit once RMB become convertible on capital account. But it is still bristled with difficulties to operate the plan.

Secondly, offshore domestic commercial bank in London should pay more attention to solve the peer regulation problem. Post-financial crisis in 2008, the

British authorities adopt prudential supervision and deny the supervision of China Banking Regulatory Commission (CBRC) over Chinese domestic banks in London. They require that overseas offshore Chinese commercial bank should be a legal entity wholly-owned by onshore domestic bank (This requirement is applicable not only to China). That is to say, offshore subsidiary company and parent company should have independent accounts. We prefer another form to build offshore banks. In specific, supposee that the British authorities and CBRC have peer regulation system and common criteria and share common supervision results, then Chinese banks can freely build branches in London instead of wholly-owned subsidiaries. And because branches share a common account with the parent company, it can satisfy only one capital adequacy rate requirement and run a larger scale and scope of businesses than subsidiaries. However, because of the financial crisis, especially the bankruptcy of Lehman Brothers, the British authorities realized that they couldn't forbid capital re-flow from London to New York parent companies and this would do harm to normal British depositors once the financial crisis happened. Therefore, after the crisis, British authorities adapt the prudential supervision and reset the standard and require that offshore subsidiaries should accept the overall supervision of British authorities to protect British normal depositors. But the requirement has disadvantages, as it will limit the business scale of multinational banks in London. Chinese domestic banks have constrained business scale in London nowadays. In the second half of 2013, British Treasury Secretaries said they might scrap the limit of this aspect and permit Chinese banks to build branches conditionally to push London to become one offshore RMB overseas center. But it is still an oral plan rather than a policy.

Finally, state-owned commercial banks have their own problems. In one aspect, state-owned Chinese enterprises adopt quasi-public servants system and their salary system is based on administrative level and technical title. These characteristics are applicable to the Chinese system but have lots of problems in developed countries. Taking the example of a subsidiary company in London, it can only recruit those Chinese employees with low level of education and financial qualities. The top financial graduates will not apply for these companies mainly because of their personnel policy and salary system. These systems lack incentives and have no competitiveness over other foreign capital offshore banks. In the other aspect, Chinese banks have limited profitability. They are used to the inland big interest gap between deposits and loans and make monopoly profits. They are actually far away from financial reservoirs and have become monopolist in the mainland of China. However, having a better development in developed countries needs a high level of

competitiveness and creativity. For those subsidiaries of state-owned banks that don't have any intermediary business innovation or market business innovation, they don't have other profit resource and their growth will face a constraint.

1.3 Interaction between onshore and offshore financial market

Traditional international market is also called onshore market, which is in charge of a country's international debit and credit of its currency and is regulated by the country's policies and regulations. Main traits are as follows: the market is regulated by the country's laws and rules; the debit and credit costs are high; transactions are between residents and non-residents; institutions usually run the country's credit business, which is actually a kind of capital export. Comparatively, new international market is called offshore market or foreign market, which is a place for non-resident to borrow or lend currency overseas. Main traits: its services target to non-resident and transactions are between foreign borrowers and lenders; people trade with worldwide convertible currencies instead of domestic currency; and capital financing business has nothing to do with domestic policies and rules. We can observe that private capital plays a more important role in international stage; financial market globalization becomes faster and faster; developing countries have a larger proportion of investment; large-scale merger and acquisition continuously increases; and multinational bank has realized business integration and web-based goals. And international market will become more and more important.

The international market can stimulate the international trade and investment, adjust the balance of international payments and push the development of production and capital internationalization. Meanwhile it will also depart the financial part from entity economy and extend financial risks because of the financial integration and huge capital flow between countries.

Based on the actual situation and market characteristics, China should take steps to establish offshore financial market gradually. Nowadays, the non-convertibility of RMB is inconsistent with the free flow of offshore center capital. So in order to build offshore market, we should adopt an outside-inside separation mode to segregate onshore and offshore business. When Chinese financial market totally open its capital accounts and exchange market is free enough, the offshore center operation mode can be adjusted and inland residents can trade with offshore accounts.

In the short term, we should still hold the separation mode. Reasons are as follows: (1) RMB is not freely convertible for the exchange regulation, financial institutions operate in a monopolized way and interest rate liberalization is still underway. Against this backdrop it is important for the government to intervene and provide

macro-control on the market and to maintain the independence of its monetary policy to stabilize and develop Chinese financial market. And the separation mode is more suitable for Chinese experience. (2) The separation mode will isolate two markets and protect onshore market from offshore market's violation and shocks and maintain the stability and safety of onshore market. And the offshore market can act as a demonstration, helping to stimulate the transfer of Chinese financial market and to take fully use of worldwide surplus liquidity. (3) At the beginning of this development stage, separation between two markets can significantly avoid backward effects to enlarge the gap between regional economies.

In the long run, China should transfer its mode to partial infiltration kind to attract foreign investment and develop its economy. The separation model will set up walls against financial risks and prevent outside economy variability from harming domestic economy. But it will also prevent the communication between domestic side and foreign side and thus foreign capital cannot influence Chinese economy in a good way. It is meaningless to develop offshore market in this aspect. So when Chinese economy has developed to a suitable level, financial supervision system has been substantially improved and offshore market has been well operated with rich experience, it is important to transfer the development mode and build a usual flow channel between onshore and offshore accounts. In specific, only offshore capital infiltration to inland market is permitted in early days and inland capital infiltration to offshore market is forbidden. And the infiltrations can only choose loans in initial stage. Financing tools like bonds and securities will gradually be permitted. This is called conditional two-side infiltration. We should consider every aspect from policy designs to operations and manage this business in a effective, timely and appropriate way. We should also set a lower infiltration proportion no matter the volume to prevent large scale capital from entering onshore market.

1.4 Settlement and clearing system of offshore RMB market

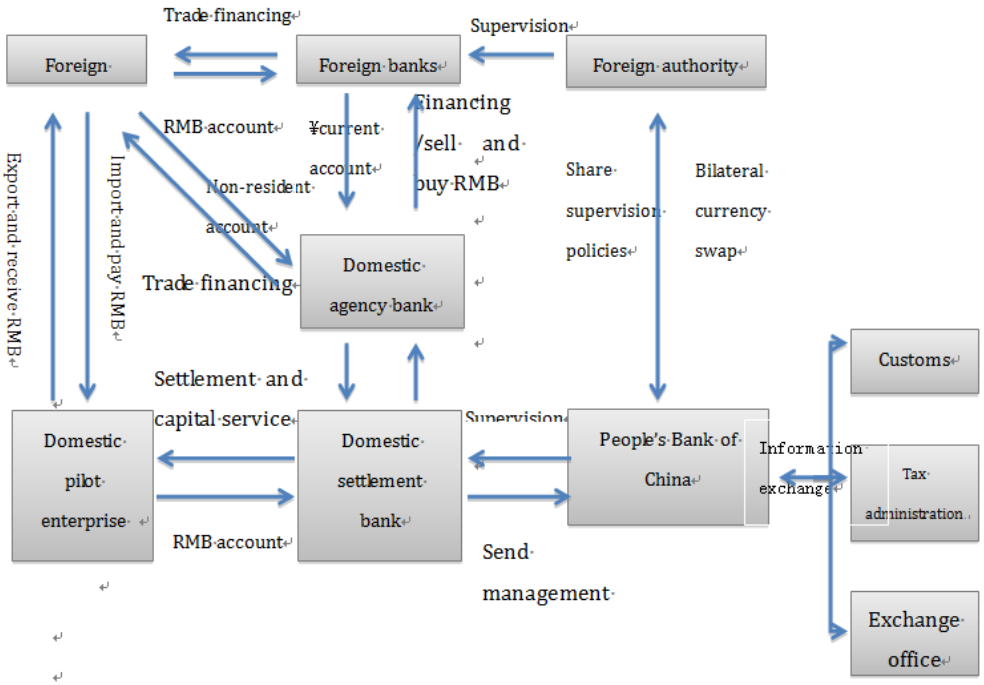
At present, RMB offshore businesses are paid and settled through agency banks. Inland commercial banks open RMB inter-bank current accounts for foreign financial institutions, set fundamental funds and provide fundamental funds services, and sell and buy RMB within the legal boundary at the request of foreign organizations. Commercial banks acting as the RMB payment and settlement system, provide RMB liquidity to offshore market and realize the reflow the RMB. In specific, there are four categories:

(1) Agency banks are the interface of foreign banks to RMB high value payment system (HVPS). Inland agency banks (on behalf of foreign banks involved in trades and their clients) do RMB cross-boundary settlement business with inland settlement

banks (on behalf of inland clients involved in trades) through RMB HVPS.

(2) Agency banks provide liquidity for RMB trade settlement to a certain extent. Because of the non-convertibility of capital account, companies who take part in international trade settlement may not get sufficient RMB in the exchange market. To solve this problem, People's Bank of China allow agency banks to buy and sell RMB within a certain boundary to enrich the fluidity.

(3) Agency banks are members of inland inter-bank market and can borrow or lend RMB in inter-bank market, which is a guarantee of extra fluidity to offshore markets.



Besides the internationalization of RMB and the development of offshore RMB market, other supporting measures should be taken to transfer the settlement risk because of the inherent defect of agency bank model. Specifically, branches of non-central commercial banks acting as agency banks have troubles in maintaining financial stability:

(1) The safety of payment information relies only on foreign agency banks.

(2) Branches of non-central commercial banks have no ability to ensure the sudden block trading (and even have position limitations in some countries). Once the agency bank is caught in a bad situation for some reasons, the risk will at once be transferred to payment and settlement part and becomes settlement risk.

(3) Offshore payment and settlement platform should be systemically important institution, while foreign commercial bank agency system is not. So there are big weaknesses at the supervision level.

Therefore, offshore RMB market requires a efficient offshore settlement system. Take the example of CHIPS, most of the cross-boundary settlements have lower efficiency requirements and they are not asked to accomplish within seconds. So if CHIPS costs less, it will attract most of the clients even when it takes more time. And the future RMB offshore market can refer to CHIPS system to build its own settlement system. (See Table 3)

Table 3 CHIPS and offshore RMB settlement system

	CHIPS	Offshore RMB settlement system (plan)
Settlement	Netting settlement	Netting settlement
Shareholders and organization form	CHIPS is a system operated by commercial institution CHPC, whose shareholders consist of the Clearing House Association LLC (organization member), 18 A-class members (international banks) and 4 AA-class members(international banks).	It plans to be operated in the model of business. Its shareholders consist of inland big banks and several international banks with a number limitation of 10. It will also absorb 50-100 domestic banks and international banks as members.
Operation model	CHIPS requests that all participated banks have deposit branches in the USA and enough financing channels to satisfy the capital demand at the beginning and ending of each day. Transactions within member banks are accomplished by the inner system and those inter banks are realized through CHIPS. Any non-member bank can commit a member bank to deal with its cross-border payments.	Cross-border RMB payment system can be used directly here. Other financial institutions can commit IPSR member bank to deal with its own cross-border RMB payments. Actually, all agency banks participated in the domestic system should be absorbed as IPSR members.

Characteristics and the mechanism arrangements	Netting settlement costs less than overall real-time settlement. CHIPS require every account has an initial $3.5 billion deposit every day and a settlement volume of $2 trillion every day. In other words, one dollar initial deposit can support 500 dollars settlement amount. Its leverage ratio is the highest of worldwide settlement systems. Even based on the total net liquidity requirements for participants, the leverage ratio are over 20, while that of Fedwire is only 5-6. Fedwire system provide overdraft service and banks have to pay interests. However, CHIPS adopt netting settlement method and has a lower requirement over fluidity. With the help of its efficient algorithm, most of payment order can be conducted without providing overdraft service and paying interests.	We should pay more attention to the automatic transfer of Chinese orders and English orders and eliminate the language obstacles. The system should also be operated as long as possible, trying to ensure most of 24 hours or at least 18 hours and provide RMB payment and settlement services to main financial centers (like London, New York). It can link to international main exchange settlement system (including CLS) through Synchronous delivery across currencies. Refer to CHIPS, we can bring in the algorithm system to increase liquidity and reduce RMB cross-payment costs. Besides, CHIPS have interests to provide related technical consulting services.

2. Domestic monetary policy and financial regulation will be under greater pressure

2.1 Development of offshore market may interfere with domestic monetary policy

Since the 1990s, the development of offshore financial markets has gradually added some discordant factors to the stability of world economy. Among them was the interference in domestic monetary policy. Currently, challenges to monetary policy when building the offshore market include the following three aspects:

First, when the cost in the offshore market is less than the cost of the currency in

the onshore market due to the absence of reserve requirements in the former, the result is the formation of domestic monetary tightening pressure. In the process of the development of offshore financial market in Singapore, the domestic deposits were subject to the reserve requirement which was 26% in the early 1980s.The requirement included 6 % cash balance and 20% double cash flow ratio. Its domestic depository institutions used offshore institutions to evade the deposit reserve requirements, thus reducing costs in order to provide customers with more attractive interest rates. Of course, doing so would lead to the expansion of domestic deposit base and the reduction of money supply, thereby forcing domestic interest rates to rise. Later, the Singapore regulatory authorities strengthened supervision, and only then the situation was curbed. What is more, when the host government uses monetary easing to stimulate economic growth, a large sum of money will flow to offshore financial markets in pursuit of higher returns. At this time, the government will have to take a series of measures, including raising interest rates to curb capital outflows. As a result, the expansionary policy would be difficult to implement.

Second, offshore financial markets may bring imported inflation. Because the offshore market inter-mediation activities make one country's idle money become another country’s money supply, this adds a new means of credit expansion which makes the country's inflationary pressures increase. When commercial banks raise money from the offshore markets to provide domestic enterprises with a large number of foreign currency loans and the enterprises exchange the foreign currencies for domestic currencies, the domestic money supply will be under expansionary pressure. Meanwhile, when the government of an offshore market tightens the money supply to curb inflation, domestic banks and businesses can borrow from offshore financial markets at lower interest rates, thereby weakening or even completely offsetting the monetary policy effect of their government. As for the situation in Thailand, large amount of foreign debt borrowed through the offshore market known as the Bangkok International Banking Facilities and foreign capital inflows at the times of good market expectations are generally exchanged into Baht to use. As a result, the domestic capital position becomes loose, and with the rapid expansion of domestic credit, there is an increasing expansionary pressure on the domestic money supply, which impacts on the operation of their own monetary policy.

In addition, the development of offshore financial markets makes the determination mechanism of interest rates and currency exchange rates more complicated for the currency issuers. The situation that offshore interest rates and domestic interest rates coexist while offshore and domestic exchange rates coexist

will severely challenge the government's domestic economic and financial policy formulation and effective implementation.

Specific to challenges of the development of RMB offshore market to domestic monetary policy, there are mainly two key issues.

(1) Fighting for the pricing power of exchange rates and interest rates during the construction of the offshore market

Developing offshore financial markets under the background that interest rates and exchange rates in China have not yet been fully market-oriented will inevitably lead to offshore financial markets' impact on the economy. Especially when the offshore market develops to a certain size, it will have some effects on the domestic market, and may bring some risks to the country.

First, we can consider the issue from the perspective of the impact on the pricing power of exchange rate. In general, offshore markets are quite sensitive to exchange rate movements of overseas markets because of factors like their higher degree of financial liberalization. A slight change in the international market will make a highly liberalized and less bureaucratically interfered offshore market quickly react to the change, with appreciation or depreciation trend occurring prior to the onshore market. Thus, RMB exchange rates of the offshore market play the leading role in the price discovery in the onshore market spot rate. However, at the early stage of the development of the offshore market, domestic market size is much larger than the offshore RMB exchange market, so the influence of RMB exchange rate of the offshore market is quite limited and the pricing power of exchange rate is still within the grasp of domestic market. But in the long term, as the offshore market expands, it grows in influence and finally takes over the pricing power of exchange rate from the domestic market.

Second, we can consider the issue from the perspective of the impact on the pricing power of interest rate. At present, interest rates of China's mainland market have not been fully market-oriented and are still under control. Because the offshore market does not have reserve requirements, its deposit insurance fees and taxes are lower. This, among other things, will lead to the situation where RMB interest rates in offshore market are much different from those in domestic market. However, due to the presence of the control of the capital account, low interest rates of the offshore market cannot lead to large-scale capital flows, so the domestic interest rates will not be directly and significantly impacted. But in the long run, the control of the capital account will be gradually loosened. With massive arbitrage prompting a large amount of RMB capital to pour into the mainland market, the domestic money supply will increase. In order to suppress excessive growth of the money supply, the

People's Bank of China generally adopts tight monetary policy such as raising the deposit reserve requirements and deposit and lending interest rates. Through this transmission mechanism, the offshore market can influence interest rates of the domestic market greatly.

(2) Promoting the transition of monetary policy from aggregate pattern to price-based pattern

Since reserve requirements of offshore markets are lower, the money multiplier is larger, therefore the scale of funds is larger. Vast capital inflows will result in monetary authorities having difficulties in monitoring domestic monetary aggregates, therefore continuing to use quantitative tools will reduce the effectiveness of monetary policy. With the constant improvement of the offshore market, the marketization of interest rates will continue to deepen and the effectiveness of the use of price instruments will also increase. In this context, the shift of the monetary policy from aggregate pattern to price-based pattern will help with the effective price transmission between inside and outside and help to promote cross-border capital flow freely. It can also avoid capital movements on a large scale, ensure the realization of the monetary policy target, and maintain the independence of monetary policy.

The development of offshore financial markets may also undermine the effectiveness of domestic monetary policy. For example, if the central bank tightens the money supply when confronted with domestic inflation, this measure may lead to higher interest rates. If domestic interest rates are higher than those of RMB offshore markets, this gap may lead to a net capital inflow, which may offset the effect of the central bank's monetary policy. When the domestic economy experiences persistent surplus, RMB will be under the pressure of appreciation. To maintain stable exchange rates, the central bank will have to sell a certain amount of local currency. However, if the exchange rates of offshore financial markets are higher than domestic ones, arbitrage activities may make a part of RMB capital within the country outflow to the offshore financial market, which may partially offset the central bank’s efforts for stable exchange rates.

In short, arbitrage opportunities will inevitably arise between offshore financial markets and the domestic market before the marketization of interest rates in China is completed. The inflow and outflow of speculative capital may have a certain impact on domestic financial markets. In the meantime, the transmission mechanism from offshore financial markets to onshore market and the influence of offshore financial markets on domestic expectation are both uncertain. These factors will definitely increase the difficulty of practicing domestic monetary policy and the

uncertainty of the effects of the policy.

2.2 Development of offshore market demands an higher level of financial regulation

One of the reasons why offshore financial markets appear is to avoid domestic regulations, so the development of offshore financial markets will inevitably demand higher level of financial regulations.

First, in offshore financial markets, capital can flow freely, which will result in higher cost of hot money control and increasing difficulties to monitor cross-border capital flows. If we cannot set a reasonable firewall, the speed and depth of the spread of an international financial crisis will exceed market expectations and be out of control. Therefore, we must determine the "degree" of financial openness prudently to avoid potential risks caused by excessive financial openness.

Second, the full convertibility of RMB, marketization of exchange rates and interest rates and other reforms will be realized before the offshore financial centers are established. Once these reforms are carried out, China's current regulatory policy of capital account, exchange rate policy, interest rate policy and bank industry regulatory measures will be faced with great challenges. This requires China to establish a new set of macro-prudential financial regulation mode. At present, China is, in general, at the initial stage of the construction of macro-prudential supervision system, so it is undoubtedly a major challenge to the regulatory authorities to develop a new prudential regulatory system suitable for domestic offshore markets. We have to improve as soon as possible the current situation that various departments only carry out their duties but cannot coordinate effectively , otherwise we cannot adapt to the huge impact from the full open-up of international offshore markets. Hence a systemic financial crisis.

Finally, of the three channels of existing cross-border trade in RMB payment, no one is entirely through our own channels for RMB cross-border payment system, which brings great security risks to the cross-border flow of RMB funds. Each of capital changes is vulnerable to real-time monitoring of some countries with ulterior motives, which severely restricts China's economic and financial cooperation with the countries in the Middle East, Africa and other politically sensitive areas. The daily trading volume of RMB has reached 120 billion dollars, which means RMB becomes the world's ninth largest foreign exchange market trading currency. It is quite imminent to build an independent cross-border payment system for RMB.

Market risk prevention and regulatory issues are the parts most concerned about in the financial sector, so is the case with the RMB offshore market. Whether the offshore business can develop well or not is largely dependent on the level of

regulation and regulatory capabilities. In order to ensure the smooth conduct of offshore business, it is necessary to take into account both regulatory effectiveness and possible hindering effect of excessive regulation to offshore banking business in the implementation of regulation. Therefore it is important to determine the "degree" of regulation. We must learn lessons from predecessors and carefully analyze the risk prevention and regulatory mechanism for the building of the offshore RMB market so that the smooth and healthy development of the RMB offshore market can be assured.

(1) Regulation of currency issuing country

In general, foreign reserve assets selected by foreign central banks, whether they are in the form of bonds or deposits, are realized by a large amount of capital provided by the government and the banking system of the currency issuing country. The huge flows gradually change into loanable funds through circulation of the banking system and expenditure mechanism of the government, thus creating revenue. With the constant standardization and strengthening of market access management and streamlining of the approval process of RMB business, any bank conducting offshore business should get approval from the Chinese and the foreign relevant authorities where the offshore financial institutions stand. In the approval process, the different types of licenses should also be issued based on the applicant's own situation, at the same time; the scope of business of the applicant should also be clearly classified so it can be managed more effectively.

(2) Home countries' regulation of offshore financial institutions

Offshore financial institutions act as "bridges" throughout the market. For example, some commercial banks and investment banks could not only guide the direction of funds to providers, but also provide valuable information to those who need funds. The importance of this reconciliation cannot be underestimated. Therefore, in order to ensure the effectiveness of this reconciliation, the home country must take responsibility to ensure that any offshore banking institution is absolutely under adequate supervisions. According to the relevant regulations once issued by the Basel Committee and accepted by international community, there are three aspects that we need to pay attention to. First, we should implement the regulatory way that the home country regulators are directly in charge of banks and that businesses of banks throughout the world are subject to this regulation. Second, the establishment of cross-border branches of banks should be approved by the home country supervisory authorities. Regulators should have the ability to prohibit or hinder the establishment of legal persons under consolidated supervision, or regulators should have the ability to stop the banks from establishing branches in

suspected countries. Finally, the home country supervisory authorities should have inside and outside information of cross-border banking institutions to monitor various business indicators.

(3) Legislation of a regulatory system for RMB offshore financial centers

First, we need to improve the financial legislation for RMB offshore markets. In this process, the legislation should not be too restrictive while helping to lower the transaction costs. Second, we need to establish industry regulatory standards. We should not only adjust liquidity ratio appropriately, but also introduce tax deduction and exemption policies related to offshore financial markets. Third, enhancing market access regulation is essential. We should start from the standardization of the approval process and ask offshore banks to make a clear classification management of the holdings of different licenses and make the head office bearing the business risk as the final insolvent person. Finally, we need to introduce other necessary regulatory regimes. In addition to requiring financial institutions involved in offshore business to hold a rigorous and comprehensive internal control system, we demand their keeping in touch with the State Administration of Foreign Exchange in any situation. In addition, we should separate inside and outside of offshore financial markets so that the independence of the offshore financial markets account is maintained for monitoring.

IMI International Monetary Review

Special Column on RMB and SDR

Editor's Note:

The International Monetary Fund's Special Drawing Right will be under review in 2015. The issue of whether RMB should be part of the SDR, the composite reserve currency used in official financing, draws broad attention from both academia and industry. This column aims to share opinions on this issue. The first article records a speech by Yaseen Anwar at the ICBC Conference in Beijing on 2nd March. The second article is written by Jukka Pihlman, published on The Business Times on 19th January.

**We are grateful to Yaseen Anwar and Jukka Pihlman for their contributions. We thank the Official Monetary and Financial Institutions Forum (OMFIF) for collaboration and support.*

Internationalization of the RMB

By YASEEN ANWAR[*]

Distinguished guests, ladies and gentlemen:

It is indeed an honor for me to be here and I am proud to be associated with the premier institution in the world. My brief talk today will reflect a viewpoint as a former Governor of the Central Bank of Pakistan.

The key message I wish to leave you with today is that there are compelling reasons why the RMB should and is likely to be included this year in the IMF Special Drawing Rights (SDR) basket of reference currencies that currently includes Euro, Yen, Sterling, and the U.S. Dollar. We should also ensure a stable International Monetary System going forward with RMB as an alternative Reserve Currency.

It is not in our agenda today to ascertain the causes of the recent Global Financial Crisis, but we must remember the underlying lesson, that our actions and the lack of them can both entail equal consequences, and in this case, the price of lack of

[*] Yaseen Anwar, Senior Advisor of ICBC, former Governor-State Bank of Pakistan.

collective action led to a near crippling of the Global Economy and the Financial System. The majority amongst us agree that the Global Financial Crisis and the ensuing Euro Debt Crisis have exposed infrastructural weaknesses in the incumbent International Monetary System and that the time has come to effect requisite reforms. After all, Public Trust is at stake.

The International Monetary System refers to the set of rules, policies and institutions that govern international payments for settling trades and capital flows between businesses and nations. It provides the necessary liquidity to regulate and facilitate the international trade of goods, services as well as official capital account transactions. A key component of any International Monetary System is the Reserve Management System which ensures that adequate funds are available to continue essential payments in a capital flow crisis. The Reserve Management System relies upon the selection of reserve currency to act as a unit of account, store of value and medium of exchange. The Reserve Currency decision is therefore of significant importance for the functioning of the International Monetary System and the choice of reserve currency is a reflection of the collective preference of the international community. This is an important decision to make, one that is hugely consequential for Global Financial Stability.

Our existing International Monetary System is based on a multiple currency Reserve Management System with the predominance of one single national currency – the U.S. Dollar. As per IMF data, the dollar comprises 63% of all foreign official reserves while the Euro 24%. It is noteworthy that 25 years ago, 65% of reserves were held by developed countries and 35% by emerging markets. Now the position is reversed with 67% of world reserves held by emerging markets, reflecting the economic role of Asia in general and China in particular.

In light of the recent crises and the emergence of a multi-polar world economy, the current International Monetary System is likely to evolve from its existing form to a more Multi-polar, Multi-currency System in which the U.S. Dollar would continue to play a notable role, albeit alongside other currencies which are likely to include the Euro and the RMB.

The existing International Monetary System goes back 100 years when the U.S. Dollar overtook the Sterling as a reserve currency as the United States had become the hub of industrialization and international trade for the western world. The Dollar being also backed by Gold made the selection easier. The United States was able to retain the coveted international Reserve Currency status for the greater part of the last one hundred years by providing the users of its currency with open access to deep, broad-based, and liquid capital markets with low transaction costs and

unfettered confidence of the global community.

However in recent years, the Global Financial Crisis has shaken the confidence of the international financial community. This erosion of confidence has resulted in Central Banks re-visiting their strategies. Strategies that call for allocating their reserves in liquid, less volatile and more diversified currencies that possess depth and breadth in the global markets. That is precisely what is advocated under the Black-Litterman model that calls for investments to be allocated into different asset classes and geographically diversified. The RMB represents that solution to mitigate the inherent risks faced by all Central Banks in recent years.

As economic and financial reforms continue in China, the RMB has already begun to play a much more prominent role on the world stage. The first channel is through trade settlement and secondly, RMB denominated products have increased overseas exponentially and policy makers are opening up China's large domestic financial markets to foreign investors.

Let me highlight how the RMB has begun to go global as evidenced by the following milestones:

1. According to SWIFT, an organization which monitors currency flows, the RMB in 2014 overtook the EURO to become the second most actively used currency to settle Trade Finance payments after the U.S. Dollar.
2. As of January 2015, the RMB has become the 5th largest payment settlement currency, marginally after the Yen. I believe it will become the 4th in the coming months, after the U.S. dollar, Euro, and Sterling.
3. More than 10,000 financial institutions are doing business in RMB, up from 900 in 2011.
4. The offshore RMB Bond market has doubled in size each year since 2008.
5. Since ICBC Singapore was designated in 2013 as the RMB Clearing bank, 37 Trillion RMB volume was settled in 2014 in Singapore alone.
6. From just 3% in 2010, the RMB is now used to settle approximately 20% of China’s total trade.
7. Twenty-Nine (29) Currency Swap Agreements (CSA) valued at RMB 3.3 Trillion (U.S. $534 Billion) have been signed by PBOC with other countries to support trade in RMB.
8. Fifty (50) Central Banks and Sovereign Wealth Funds have signed Agency Agreements with PBOC to invest in Chinese onshore Bond market, evidencing confidence and trust in RMB on a global basis.

9. The U.K. Government, in October 2014, issued a RMB 2 Billion bond to add to the Bank of England Reserves, the first ever issued by a western country, a tacit endorsement of the RMB as a convertible reserve currency.

The above clearly demonstrates the success of the second largest economy in the world in making huge strides towards a formal recognition of the RMB as a freely convertible currency by the IMF. Anecdotal evidences also suggest almost 1% - 5% of the reserves of central banks have investments in RMB and I can confirm that the State Bank of Pakistan invested in excess of 5% of its reserves in RMB in 2013.

One definition of a freely usable currency to qualify as a reserve currency includes:

a) At least 1% of a member country's official reserves holdings are invested in that currency and,
b) At least 3 of the member countries reporting a currency that meets the first threshold.

Once again, the above clearly demonstrates and fulfils the eligibility of the RMB in the IMF basket of qualifying currencies.

Earlier I had mentioned that Public Trust is at stake and the Global Financial Crisis has shaken the confidence of the financial markets. It behooves the Central Banks and policy makers to take collective action to restore the International Monetary System's confidence by including the RMB in its rightful place as a Reserve currency. This effort would help resolve the global imbalances and lower capital flows and FX fluctuations that we have seen recently.

In conclusion, the current system with all its flaws has been relevant for a very long time and still has roots. The time has come for a coordinated shift towards a balanced Multi-Currency Reserve Management System. The System provides alternatives to Central Bank Reserve Managers for diversifying foreign exchange currency holdings and is consistent with a multi-polar world.

The Internationalization of the RMB and its greater role in the International Monetary and Reserve Management System have been a growing theme and given the growing size of the Chinese economy as well as its status as the world's largest exporter. It seems only natural that the RMB takes its place as an international reserve currency.

Thank you!

IMI International Monetary Review

IMF Decision could Propel Renminbi past Sterling and Yen

By JUKKA PIHLMAN[*]

The Chinese currency's path to internationalization has been stellar so far but something may happen this year that could propel the renminbi (RMB) into the currency stratosphere.

The International Monetary Fund's (IMF) Special Drawing Rights (SDR) – the IMF's 'virtual currency' based on a basket of other currencies reviewed every five years – rarely warrant much excitement. But if the RMB gets included in 2015, alongside the dollar, euro, pound and yen, it could boost the Chinese currency's fortunes overnight.

Due to the sheer magnitude of Chinese exports – China is the world's largest exporter of goods and services and export is the key determinant of the currencies' weights in the SDR basket – RMB would go straight past the yen and the pound to become the third-highest-weighted currency in the SDR. It is hard to overestimate the importance of this move to the global adoption of RMB.

Automatically, all central banks would become holders of RMB exposure through their SDR assets and the official recognition of the RMB's reserve currency status would spur RMB investment by central banks all over the world.

The IMF loans to its member countries are denominated in SDR, so countries in IMF programmes would be partially exposed to RMB fluctuations and the interest rates paid on these loans would also become slightly higher than currently as Chinese interest rates are higher than those of the current SDR currencies.

Perhaps the biggest direct and immediate impact would be on some international institutions such as the African Development Bank and Bank of International Settlements, whose balance sheets are denominated in SDR. Inclusion of RMB to SDR would lead to a significant hedging demand for the RMB as SDR hedging in the markets needs to be done in the constituent currencies.

Last time the IMF reviewed the composition of the SDR in 2010, it concluded the RMB did not meet the key criteria of being a freely usable currency. But a lot has changed ever since, making this year's decision much more finely poised.

Most of the indicators used in determining the 'free usability' of a currency, such as foreign exchange trading volume and payments in that currency, have

[*] Jukka Pihlman, Managing Director and Head of Central Banks and Sovereign Wealth Funds at Standard Chartered Bank. He previously worked for the IMF and the central banks of New Zealand and Finland.

experienced significant growth, with RMB now ranked fifth as a global payment currency according to Society for Worldwide Inter-bank Financial Telecommunications (SWIFT). According to Standard Chartered Renminbi Globalization Index, the RMB is now over 20 times more internationalized than it was at the start of 2011.

These are all factors that the IMF will have to take into account. Looking at the official reserves of central banks – another important criterion for admission into the SDR club – the IMF may also want to note that, while the amount remains relatively low, at least 60 of these central banks have already begun to invest in RMB as part of their reserves.

Most central banks in Asia and South America have been investing in RMB for years, but the news about a number of European central banks including the Bank of England, Banque de France and Swiss National Bank investing in RMB and recent reports that even the European Central Bank is considering adding the RMB to its reserves represents highly significant developments and shows how rapidly attitudes to the RMB are changing.

However, the IMF faces a classic 'chicken and egg' situation: until it confers official reserve currency status on to the RMB, there will be no official data showing the proportion of global central bank reserves invested in the currency. The only way of gauging the overall amount of RMB investment under current conditions would be to gain information directly from the People's Bank of China and through informal surveys of market participants.

Nevertheless, the fast-paced adoption of the RMB by central banks and the inclusion of RMB in their reserves – underpinned by the Chinese authorities' continued and conscious efforts in making the RMB more accessible – could help swing the IMF decision in the RMB's favour.

The final decision is in part discretionary and politics will invariably play a part. But supporters of the RMB's inclusion may draw comfort from the fact that changes to the SDR composition are relatively 'easy' to vote through.

Most big IMF decisions require an 85 per cent majority, effectively giving the US, with its almost 17 per cent share of the vote, the power of veto. However, according to Article XV of the IMF's Articles of Agreements, the IMF Executive Board can make the SDR decision with only 70 per cent of the vote, provided there is no change to the methodology.

More importantly, the Europeans have indicated by their actions that they are unlikely to stand in the RMB's way, as long as the technical argument stacks up. France, Germany, Italy and the U.K. have joined the China led Asian Infrastructure

Investment Bank (AIIB) as founding members and many other European countries are likely to follow. Most significant and explicit support thus far came from Germany as they officially announced that "the German side supports China's goal to add the RMB to the SDR currency basket based on existing criteria" at the conclusion of the First China-Germany High-Level Financial Dialogue on 17th March 2015.

For many central banks, especially smaller ones and those on IMF programmes, the SDR decision will have huge significance. Many of these countries have already been experiencing increased trade with China, making it increasingly sensible for them to hold RMB reserves.

But the fact that RMB investment cannot currently be reported as part of a central bank's official reserves means that many are holding back from this logical step. At the very least, even if the IMF chooses not to include RMB in its drawing rights, it will need to address this urgent reporting issue. Otherwise, by the time the next SDR review comes around in 2020, there will be no official reserve statistics on which to base the decision – despite the fact that by then the RMB is likely to have become the world's fourth most used trading currency, accounting for close to 35 per cent of China's trade.

The RMB is very far from challenging the Dollar's dominance as an official reserve currency. More than three fifths of central bank reserves are still held in the US currency.

But with China now accounting for over 11 per cent of all world trade, and the RMB growing fast in stature, the big decision on whether to officially admit the Chinese currency to the club is not one that the IMF will be able to postpone forever.

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Working Paper

The Normalized CES Production Function: Theory and Empirics*

By RAINER KLUMP*, PETER MCADAM** and ALPO WILLMAN***

The elasticity of substitution between capital and labor and, in turn, the direction of technical change is critical parameters in many fields of economics. Until recently, though, the application of production functions with specifically non-unitary substitution elasticities (i.e., non-Cobb–Douglas) was hampered by empirical and theoretical uncertainties. As recently revealed, "normalization" of production-technology systems holds out the promise of resolving many of those uncertainties. We survey and assess the intrinsic links between production (as conceptualized in a production function), factor substitution (as made most explicit in Constant Elasticity of Substitution functions) and normalization (defined by the fixing of baseline values for relevant variables). First, we recall how the normalized Constant Elasticity of Substitution function came into existence and what normalization implies for its formal properties. Then we deal with the key role of normalization in recent advances in the theory of business cycles and of economic growth. Next, we discuss the benefits normalization brings for empirical estimation and empirical growth research. Finally, we identify promising areas of future research.

Keywords: Constant Elasticity of Substitution Production Function; Estimation; Factor-Augmenting Technical Change; Growth Theory; Identification; Normalization.

1. Introduction

Substituting scarce factors of production by relatively more abundant ones is a

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* Member of IMI Academic Committee; President of University of Luxembourg

** European Central Bank & University of Surrey

*** European Central Bank

key element of economic efficiency and a driving force of economic growth. A measure of that force is the elasticity of substitution between capital and labor which is the central parameter in production functions, and in particular Constant Elasticity of Substitution (CES) ones. CES production functions allow the elasticity of substitution to be any positive number; in contrast, the more well-known Cobb–Douglas variant imposes that elasticity to be unity.

Until recently, the application of production functions with non-unitary substitution elasticities was hampered by empirical and theoretical uncertainties. As has recently been revealed, 'normalization' of production functions and production-technology systems holds out the promise of resolving many of those uncertainties and allowing considerations such as the role of the substitution elasticity and biased technical change to play a deeper role in growth and business-cycle analysis.

Normalization essentially implies representing production relations in consistent indexed number form. Without normalization, it can be shown that the production function parameters have no economic interpretation since they are dependent on the normalization point and the elasticity of substitution itself. This feature significantly undermines estimation and comparative-static exercises, among other things.

Notwithstanding, this leaves open the issue of how we set and interpret normalization points. All CES production functions, unless explicitly normalized, are at least implicitly normalized in the point where input values equal one. However, that implicit normalization is empirically counter-factual and, from a theory standpoint, unattractive. Accordingly, normalization points tend to be pinned down by some prevailing economic theory or empirical counterpart – typically some steady-state or initial condition, or in some neighborhood of particular interest to the researcher. Beyond that, normalization (explicit normalization) also implies internal consistency between other aspects of the data or model. As we shall see, if this internal consistency condition is violated – as typically has been the case in theoretic analysis based on the non-normalized (or 'trivially' normalized) CES function – then analysis concerning the effects of alternative elasticity of substitution values on economic development is flawed.

Let us first, though, place the importance of the topic in perspective. Due to the central role of the substitution elasticity in many areas of dynamic macroeconomics, the concept of CES production functions has recently experienced a major revival. The link between economic growth and the size of the substitution elasticity has long been known. As already demonstrated by Solow (1956) in the neoclassical growth model, assuming an aggregate CES production function with an elasticity

above unity is the easiest way to generate perpetual growth. Since scarce labor can be completely substituted by capital, the marginal product of capital remains bounded away from zero in the long run. Nonetheless, as we argue below, the case for an above-unity elasticity appears empirically weak and theoretically anomalous.[1]

It has been shown that integration into world markets is also a feasible way for a country to increase the effective substitution between factors of production and thus pave the way for sustained growth (Ventura 1997; Klump 2001; Saam 2008). On the other hand, it can be shown in several variants of the standard neoclassical (exogenous) growth model that introducing an aggregate CES production function with an elasticity of substitution below unity can generate multiple growth equilibria, development traps and indeterminacy (Azariadis 1996; Klump 2002; Kaas and von Thadden 2003; Guo and Lansing 2009).

Public finance and labor economics are other fields where the elasticity of substitution has been rediscovered as a crucial parameter for understanding the impact of policy changes. This relates to the importance of factor substitution possibilities for the demand for each input factor. As pointed out by Chirinko (2002), the lower the elasticity of substitution, the smaller the response of business investment to variations in interest rates caused by monetary or fiscal policy.[2] In addition, the welfare effects of tax policy changes, specifically, appear highly sensitive to the values of the substitution elasticity. Rowthorn (1999) also stresses its importance in macroeconomic analysis of the labor market and, in particular, how incentives for investment exercise a significant effect on unemployment when the elasticity of substitution departs from unity.

Indeed, there is now mounting empirical evidence that aggregate production is better characterized by a non-unitary (and in particular below unitary) elasticity of substitution (see e.g., Chirinko *et al.* 1999; Klump *et al.* 2007; Leon-Ledesma *et al.* 2010a). Chirinko (2008)'s recent survey suggests that most evidence favors elasticities ranges of 0.4–0.6 for the United States. Moreover, Jones (2003, 2005)[3] argued that capital shares exhibit such protracted swings and trends in many countries as to be inconsistent with Cobb–Douglas or CES with Harrod-neutral technical progress (see also Blanchard 1997; McAdam and Willman 2013). Such

[1] The critical threshold level for the substitution elasticity (to generate such perpetual growth) can be shown to be increasing in the growth of labor force and decreasing in the saving rate (see La Grandville 1989b).

[2] This may be one reason why estimated investment equations struggle to identify interest-rate channels.

[3] Jones' work essentially builds on Houthakker (1955)'s idea that production combinations reflect the (Pareto) distribution of innovation activities, Jones proposes a 'nested' production function. Given such parametric innovation activities, this will exhibit a (far) less than unitary substitution elasticity over business-cycle frequencies but asymptote to Cobb–Douglas.

variability would also suggest the presence of biases in technical change.

The coexistence of capital and labor-augmenting technical change has different implications for the possibility of balanced or unbalanced growth. A balanced growth path (BGP) – the dominant assumption in the theoretical growth literature – suggests that variables such as output, consumption, etc. tend to a common growth rate, whilst key underlying ratios (e.g., factor income shares, capital–output ratio) are constant (Kaldor 1961). Neoclassical growth theory suggests that, for an economy to possess a steady state with positive growth and constant factor income shares, the elasticity of substitution must be unitary (i.e., Cobb–Douglas) or technical change must be Harrod-neutral.

As Acemoglu (2009) (ch. 15) comments, however, there is little reason to assume technical change is necessarily labor-augmenting.[4] In models of 'biased' technical change (e.g., Kennedy 1964; Samuelson 1965; Acemoglu 2003; Sato 2006), scarcity, reflected by relative factor prices, generates incentives to invest in factor-saving innovations. In other words, firms reduce the need for scarce factors and increase the use of abundant ones. Acemoglu (2003) further suggested that while technical progress is necessarily labor-augmenting along the BGP, it may become capital-biased in transition. Interestingly, given a below-unitary substitution elasticity this pattern promotes the stability of income shares while allowing them to fluctuate in the medium run.

However, when analytically investigating the significance of non-unitary factor substitution and non-neutral technical change in dynamic macroeconomic models, one faces the issue of 'normalization', even though the issue is still not widely known. The (re)discovery of the CES production function in normalized form in fact paved the way for the new and fruitful, theoretical and empirical research on the aggregate elasticity of substitution which has been witnessed over recent years.

In La Grandville (1989b) and Klump and de La Grandville (2000) the concept of normalization was introduced in order to prove that the aggregate elasticity of substitution between labor and capital can be regarded as an important and meaningful determinant of growth in the neoclassical growth model. In the meantime this approach has been successfully applied in a series of theoretical papers (Klump 2001; Papageorgiou and Saam 2008; Klump and Irmen 2009; Xue and Yip 2013; Guo and Lansing 2009; Wong and Yip 2010) to a wide variety of topics.

A particular striking example of how neglecting normalization can significantly

[4] Moreover, the point that a BGP cannot coexist with capital augmentation is becoming increasingly questioned in the literature (see Growiec 2008; La Grandville 2012; Leon-Ledesma and Satchi 2010).

bias results and how explicit normalization can help to overcome those biases is presented in Klump and Saam (2008). The effect of a higher elasticity of substitution on the speed of convergence in a standard Ramsey type growth model is shown to double if an implicitly normalized CES function is replaced by a reasonably normalized one.

Further, as Klump *et al.* (2007, 2008) demonstrated, normalization also has been a significant development for empirical research on the parameters of aggregate CES production functions,[5] in particular when coupled with the system estimation approach. Empirical research has long been hampered by the difficulties in identifying at the same time an aggregate elasticity of substitution as well as growth rates of factor-augmenting technical change from the data. Following Diamond *et al.* (1978), the received wisdom suggests that their joint identification was infeasible. Accordingly, for more than a quarter of a century following Berndt (1976), common opinion held that the US economy was broadly characterized by aggregate Cobb–Douglas technology, leading, in turn, to its default incorporation in economic models (and, accordingly, the neglect of possible biases in technical progress in empirical work).[6]

Translating normalization into empirical production-technology estimations allows the presetting of the value of the distribution parameter (or, if estimated, facilitates the setting of reasonable initial conditions); it provides a clear correspondence between theoretical and empirical production function parameters and allows us *ex post* validation of estimated parameters. In a series of papers, Leon-Ledesma *et al.* (2010a, 2010b) showed the empirical advantages in estimating and identifying production technology systems when normalized. Further, McAdam and Willman (2011b) showed that normalized factor-augmenting CES estimation, in the context of estimating 'New Keynesian' Phillips curves, helped better identify the volatility in the driving variable (real marginal costs) that most previous researchers had not detected.

Here, we analyze the intrinsic links between production (as conceptualized in a production function), factor substitution (as made most explicit in CES production functions) and normalization. The paper is organized as follows. In Section 2 we recall how the CES function came into existence and what this implies for its formal properties. Sections 3 and 4 will deal with the role of normalization in recent

[5] It should be noted that the advantages of re-scaling input data to ease the computational burden of highly nonlinear regressions has been the subject of some study (e.g., ten Cate 1992). And some of this work was in fact framed in terms of production-function analysis (De Jong 1967; De Jong and Kumar (1972)). See also Cantore and Levine (2011).

[6] It should be borne in mind, however, that Berndt's result concerned only the US manufacturing sector.

advances in the theory of business cycles and economic growth. Section 5 will discuss the merits normalization brings for empirical growth research. The last section concludes and identifies promising area of future research.

2. The Normalized CES Production Function and Variants

It is common knowledge that the first rigid derivation of the CES production function appeared in the famous Arrow *et al.* (1961) paper (hereafter *ACMS*).[7] However, there were important forerunners, in particular the explicit mentioning of a CES-type production technology (with an elasticity of substitution equal to 2) in the Solow (1956) paper (done, Solow wrote, to add a 'bit of variety') on the neoclassical growth model. There was also the hint to a possible CES function in its Swan (1956) counterpart (on the Swan story see Dimond and Spencer 2008).[8] Shortly before, though, Dickinson (1954) (p. 169, fn 1) had already made use of a CES production technology in order to model 'a more general kind of national-income function, in which the factor shares are variable' compared to the Cobb–Douglas form. It has even been conjectured that the famous and mysterious tombstone formula of von Thunen dealing with 'just wages' can be given a meaningful economic interpretation if it is regarded as derived from an implicit CES production function with an elasticity of substitution equal to 2 (see Jensen 2011).

In this section we want to demonstrate that the formal construction of a CES production function is intrinsically linked to normalization, and how it is linked. The function may be defined as follows:

$$Y_t = F(K_t, N_t) = C\left[\pi K_t^{\frac{\sigma-1}{\sigma}} + (1-\pi) N_t^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \quad (1)$$

where distribution parameter $\pi \in (0, 1)$ reflects capital intensity in production; C is an efficiency parameter, and σ is the elasticity of substitution between capital, K, and labor, N. Like all standard CES functions, equation (1) nests a Cobb–Douglas function when $\sigma = 1$; a Leontief function with fixed factor proportions when $\sigma = 0$ and a linear production function with perfect factor substitution when $\sigma \to \infty$.

The construction of such an aggregate production technology with a CES property starts from the formal definition of the elasticity of substitution which had been introduced independently by Hicks (1932) and Robinson (1933) (on the differences between the two approaches to the concept, see Hicks 1970). It is there defined (in

[7] It is still not widely known that the famous ACMS paper was in fact the merging of two separate submissions to the *Review of Economics and Statistics* following a paper from Arrow and Solow, and another from Chenery and Minhas.

[8] In the inaugural ANU Trevor Swan Distinguished Lecture, Peter L. Swan (Swan 2006) writes, 'While Trevor was at MIT he pointed out that a production function Solow was utilizing had the constant elasticity of substitution, CES, property. In this way, the CES function was officially born. Solow and his coauthors publicly thanked Trevor for this insight (see Arrow et al, 1961)'.

the case of two factors of production, capital and labor) as the elasticity of *K/N* with respect to the marginal rate of substitution between *K* and *N* (the percentage change in factor proportions due to a change in the marginal rate of technical substitution) along an isoquant:[9]

$$\sigma \in [0, \infty) = \frac{d\,(K/N)\,/\,(K/N)}{d\,(F_N/F_K)\,/\,(F_N/F_K)} = \frac{d\log(K/N)}{d\log(F_N/F_K)} \tag{2}$$

As Hicks notes this concept of elasticity can be equally expressed in terms of the second derivative of the production function, but only under the assumption of constant returns to scale (due to Euler's theorem).

Since under this assumption the marginal factor productivities would also equal factor prices and the marginal rate of substitution would be identical with the wage/capital rental ratio, the elasticity of substitution can also be expressed as the elasticity of income per person *y* with respect to the marginal product of labor in efficiency terms (or the real wage rate, *w*), that is, Allen's theorem (Allen 1938). Given that income per person is a linear homogeneous function $y = f(k)$ of the capital intensity $k = K/N$, the elasticity of substitution can *also* be defined as:

$$\sigma = \frac{dy}{dw} \cdot \frac{w}{y} = -\frac{f'(k)\,[f(k) - kf'(k)]}{kf''(k)\,f(k)} \tag{3}$$

Although it is rarely stated explicitly, the elasticity of substitution is implicitly always defined as a point elasticity. This means that it is related to one particular baseline point on one particular isoquant (see Figures 1 and 2). From there a whole system of non-intersecting isoquants is defined which all together create the CES production function. Even if it is true that a given and constant elasticity of substitution would not change along a given isoquant or within a given system of isoquants, it is also evident that changes in the elasticity of substitution would of course alter the system of isoquants.

Following such a change in the elasticity of substitution, the old and the new isoquant are not intersecting at the baseline point but are tangents, if the production function is normalized (by the values of the baseline points). And they should not intersect because given the definition of the elasticity of substitution (i.e., the percentage change in factor proportions due to a change in the marginal rate of technical substitution) at this particular point (as in all other points which are characterized by the same factor proportion) the old and the new CES function should still be characterized by the same factor proportion and the same marginal

[9] Alternatively, the substitution elasticity is sometimes expressed in terms of the parameter of factor substitution, $\rho \in [-1, \infty)$, where $\rho = \frac{1-\sigma}{\sigma}$.

rate of technical substitution.

Just as there are two possible definitions of σ following (3) – from $\frac{dy}{dw} \cdot \frac{w}{y}$ and then from $-\frac{f'(k)[f(k)-kf'(k)]}{kf''(k)f(k)}$ – thus there are two ways of uncovering the normalized production function. These, we cover in the following two sub-sections.

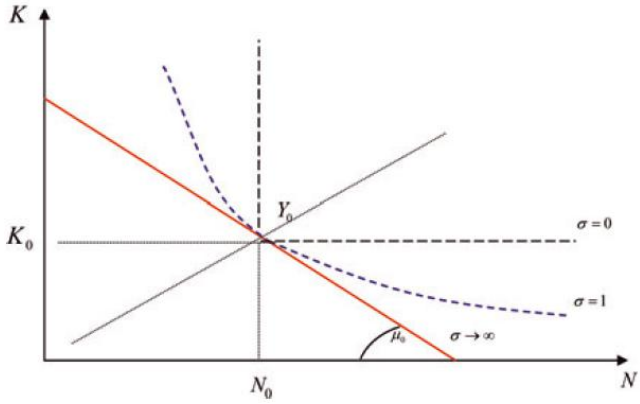

Figure 1. Isoquants of Normalized CES Production Functions.

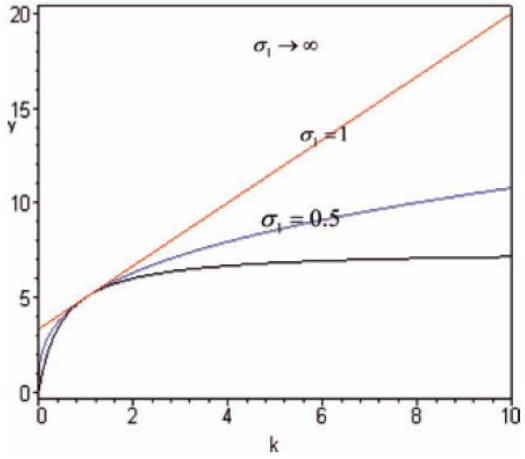

Figure 2. Normalized per-capita CES Production Functions.

2.1 Derivation via the Power Function

Let us start from the definition $\sigma = \frac{d \log(y)}{d \log(w)} = \frac{dy}{dw}\frac{w}{y}$, integration of which gives the power function,

$$y = cw^{\sigma} \tag{4}$$

where *c* is some integration constant.[10] Under the assumption of constant returns to scale (or perfectly competitive factor and product markets), and applying the profit-maximizing condition that the real wage equals the marginal product of labor, and with the application of Allen's theorem, we can transform this equation into the form $y = c(y - k\frac{dy}{dk})^{\sigma}$.

Accordingly, after integration and simplification, this leads us to a production function with the constant elasticity of substitution function (see La Grandville 2009, p. 83ff for further details):

$$y = \left[\beta k^{\frac{\sigma-1}{\sigma}} + \alpha\right]^{\frac{\sigma}{\sigma-1}} \tag{5}$$

and,

$$Y = \left[\beta K^{\frac{\sigma-1}{\sigma}} + \alpha L^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \tag{6}$$

in the extensive form.

It should be noted that (5) and (6) contain the two constants of integration β and $\alpha = c^{-\frac{1}{\sigma}}$, where the latter directly depends on σ. Identification of these two constants makes use of baseline values for the power function (4) and for the functional form (5) at the given baseline point in the system of isoquants. In a dynamic setting this baseline point must (as we will see later) also be regarded as holding at a particular point in time, $t = t0$:

$$y_0 = c w_0^{\sigma} \tag{7}$$

$$y_0 = \left[\beta k_0^{\frac{\sigma-1}{\sigma}} + \alpha\right]^{\frac{\sigma}{\sigma-1}} \tag{8}$$

Together with (5) this leads to the normalized CES production function,

$$y = y_0 \left[\pi_0 \left(\frac{k}{k_0}\right)^{\frac{\sigma-1}{\sigma}} + (1 - \pi_0)\right]^{\frac{\sigma}{\sigma-1}} \tag{9}$$

and

[10] ACMS started from the empirical observation that the relationship between per-capita income and the wage rate might best be described with the help of the power function. Note, $\sigma = 1$ implies a linear relationship between *y* and w which would, in turn, imply that labor's share of income was constant. However, instead of a linear $y - w$ scatter plot, ACMS found a concave relationship in the US data. The authors then tested a logarithmic and power relationship and concluded in favor of $\sigma < 1$. Integration of power function (4) then leads to a production function with constant elasticity of substitution, consistent with definitions (2) and (3).

$$Y = Y_0 \left[\pi_0 \left(\frac{K}{K_0} \right)^{\frac{\sigma-1}{\sigma}} + (1-\pi_0) \left(\frac{N}{N_0} \right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{10}$$

in the extensive form. Parameter $\pi_0 = \frac{y_0 - w_0}{y_0} = \frac{r_0 K_0}{Y_0}$ denotes the capital share in total income at the point of normalization.[11] As a test of consistent normalization, we see from (10) that for $t = t0$ we retrieve $Y = Y0$.

2.2 Derivation via the Homogeneous Production Function

It was shown by Paroush (1964), Yasui (1965) and McElroy (1967) that the rather narrow assumption of Allen's theorem is not essential for the derivation of the CES production function which can start directly from the original Hicks definition (2). This definition can be transformed into a second-order differential equation whose solution also implies two constants of integration.

Following Klump and Preissler (2000) we start with the definition of the elasticity of substitution in the case of linear homogeneous production function $Y_t = F(K_t, N_t) = N_t f(k_t)$ where $k_t = K_t/N_t$ is the capital–labor ratio in efficiency units. Likewise $y_t = Y_t/N_t$ represents per-capita production.

The definition of the substitution elasticity, $\sigma = -\frac{f'(k)[f(k) - k f'(k)]}{k f'(k) f(k)}$, can then be viewed as a second order differential equation in k having the following general CES production function as its solution (intensive and extensive forms),

$$y_t = a \left[k_t^{\frac{\sigma-1}{\sigma}} + b \right]^{\frac{\sigma}{\sigma-1}} \tag{11}$$

$$Y_t = a \left[K_t^{\frac{\sigma-1}{\sigma}} + b N_t^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{12}$$

where parameters a and b are two arbitrary constants of integration with the following correspondence with the parameters in equation (1): $C = a(1+b)^{\frac{\sigma}{\sigma-1}}$ and $\pi = 1/(1+b)$.

A meaningful identification of these two constants is given by the fact that the substitution elasticity is a point elasticity relying on three baseline values: a given capital intensity $k_0 = K_0/N_0$, a given marginal rate of substitution $[FK/FN]_0 = w_0/r_0$ and a given level of per-capita production $y_0 = Y_0/N_0$. Accordingly, (1) becomes

[11] Under perfect competition, this distribution parameter is equal to the capital income share but, under *imperfect* competition with non-zero aggregate mark-up, it equals the share of capital income in total factor income.

$$Y_t = Y_0 \left[\pi_0 \left(\frac{K_t}{K_0} \right)^{\frac{\sigma-1}{\sigma}} + (1-\pi_0) \left(\frac{N_t}{N_0} \right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \quad (13)$$

where $\pi_0 = r_0K_0/(r_0K_0 + w_0N_0)$ is the capital income share evaluated at the point of normalization. Rutherford (2003) calls (13) [or (10)] the 'calibrated form'.

2.3 A Graphical Representation

Normalization as understood by La Grandville (1989b), Klump and de La Grandville (2000) and Klump and Preissler (2000) is again nothing else but identifying these two arbitrary constants in an economically meaningful way. Normalizing means the fixing (in the $K - N$ plane as in Figure 1) of a baseline point (which can be thought of as a point in time at $t = t_0$), characterized by specific values of N, K, Y and the marginal rate of technical substitution μ_0 – in which isoquants of CES functions with different elasticities of substitution but with all other parameters equal – are tangents.

Normalization is helpful to clarify the conceptual relationship between the elasticity of substitution and the curvature of the isoquants of a CES production function (see La Grandville 1989a for a discussion of various misunderstandings on this point). Klump and Irmen (2009) point out that in the point of normalization (and only there), there exists an inverse relationship between the elasticity of substitution and the curvature of isoquant of the normalized CES production function. This relationship also has an interpretation in terms of the degree of complementarity of both input factors. At the normalization point, a higher elasticity of substitution implies a lower degree of complementarity between the input factors. The link between complementarity between input factors and the elasticity of substitution is also discussed in Acemoglu (2002a) and in Nakamura and Nakamura (2008).

Equivalently (in the $k - y$ plane as in Figure 2) the baseline point can be characterized by specific values of k, y and the marginal productivity of capital (or the real wage rate). If base values for these three variables are selected, this means of course that also a baseline value for the elasticity of production with respect to capital input is fixed which (under perfect competition) is equal to the capital share in total income.

2.4 Normalization as a Means to Uncover Valid CES Representations

Normalization thus creates specific 'families' of CES functions whose members all share the same baseline point but are distinguished by the elasticity of substitution (and *only* the elasticity of substitution).

As shown in Klump and Preissler (2000), normalization also helps to distinguish those variants of CES production functions which are functionally identical with the

general form (1) from those which are inconsistent with (5) in one way or another.

Consider, first, the 'standard form' of the CES production function, as it was introduced by ACMS, restated below:

$$Y = C\left[\pi K^{\frac{\sigma-1}{\sigma}} + (1-\pi)N^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \tag{14}$$

This variant is clearly identical with (10), albeit (and this is a crucial aspect) with the 'efficiency parameter' C and the 'distribution parameter' π being defined in the following way (solving for completeness in terms of both σ and the substitution parameter $\rho = \frac{1-\sigma}{\sigma}$):

$$C(\sigma,\cdot) = Y_0\left[\frac{r_0K_0^{1+\rho} + w_0N_0^{1+\rho}}{r_0K_0 + w_0N_0}\right]^{-\frac{1}{\rho}} = Y_0\left[\frac{r_0K_0^{1/\sigma} + w_0N_0^{1/\sigma}}{r_0K_0 + w_0N_0}\right]^{\frac{\sigma}{\sigma-1}} \tag{15}$$

$$\pi(\sigma,\cdot) = \frac{r_0K_0^{1+\rho}}{r_0K_0^{1+\rho} + w_0N_0^{1+\rho}} = \frac{r_0K_0^{1/\sigma}}{r_0K_0^{1/\sigma} + w_0N_0^{1/\sigma}} \tag{16}$$

Expressions (15) and (16) reveal that, in the implicitly normalized case, both 'parameters' (apart from being dependent on the scale of the normalized variables) change with variations in the elasticity of substitution, unless the particular case of K_0 and N_0 are exactly equal arises, implying $k_0 = 1$.

This makes the implicitly normalized form in general inappropriate for comparative-static exercises in the substitution elasticity. It is the interaction between the normalized efficiency and distribution terms and the elasticity of substitution which guarantees that within one family of CES functions the members are only distinguished by the elasticity of substitution. Given the accounting identity (and abstracting from the absence of an aggregate mark-up),

$$Y_0 = r_0K_0 + w_0N_0 \tag{17}$$

it also follows from this analysis that treating C and π in (14) as deep parameters is equivalent to assuming $k_0 = 1$. In the case $\sigma = 0$, we have a perfectly symmetrical Leontief function.

As explained in Klump and Saam (2008) the Leontief case can serve as a benchmark for the choice of the normalization values for $k0$ in calibrated growth models. The baseline capital intensity corresponds to the capital intensity that would be efficient if the economy's elasticity of substitution were zero. For $k < k_0$ the economy's relative bottleneck resides in this case in its capacity to make productive use of additional labor, as capital is the relatively scarce factor. For $k > k_0$ the same is true for capital and labor is relatively scarce. Since the latter case is most

characteristic for growth model of capitalist economies, calibrations of these model can be based on the assumption $k > k_0$.

In the following sub-sections, we will illustrate how normalization can reveal whether certain production functions used in the literature are legitimate.

2.4.1 David and van de Klundert (1965) Version

Consider the CES variant proposed by David and van de Klundert (1965):

$$Y = \left[(BK)^{\frac{\sigma-1}{\sigma}} + (AN)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{18}$$

This variant is identical with (10) as long as the two 'efficiency levels' are defined in the following way:

$$B = \frac{Y_0}{K_0} \pi_0^{\frac{\sigma}{\sigma-1}} \tag{19}$$

$$A = \frac{Y_0}{N_0} (1 - \pi_0)^{\frac{\sigma}{\sigma-1}} \tag{20}$$

Again, it is obvious that the efficiency levels change directly with the elasticity of substitution.

2.4.2 Ventura (1997) Version

Consider now a CES variant used by Ventura (1997):

$$Y = \left[K^{\frac{\sigma-1}{\sigma}} + (AN)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{21}$$

At first glance (21) could be regarded as a special case of (14) with B being equal to one. With a view on the normalized efficiency level it becomes clear, however, that $B = 1$ is not possible for given baseline values and a changing elasticity of substitution. Given that Ventura (1997) makes use of (21) in order to study the impact of changes in the elasticity of substitution on the speed of convergence, in the light of this inconsistency his results should be regarded with caution. Indeed, as shown in Klump (2001), Ventura's results are unnecessarily restrictive; working with a correctly normalized CES technology leads to much more general results.

2.4.3 Barro and Sala-i-Martin (2004) Version

Next consider the CES production function proposed by Barro and Sala-i-Martin (2004):

$$Y = C \left[\pi (BK)^{\frac{\sigma-1}{\sigma}} + (1 - \pi) ((1 - B) N)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{22}$$

Normalization is helpful in this case in order to show that (22) can be transformed without any problems into (10) and/or (14) so that the terms B and $1 - B$ simply disappear. If for any reason these two terms are considered necessary elements of a standard CES production function, they cannot be chosen independently from the

normalized values for C and π, but they remain independent from changes in σ.

2.5 The Normalized CES Function with Technical Progress

So far, we have treated efficiency levels as constant over time. If we now consider factor-augmenting technical progress one has to keep in mind the intrinsic links between rising factor efficiency and the distribution of income. This brings us to one further justification for normalizing CES production function which is closely related to the concept of neutral technical progress and which was first articulated by Kamien and Schwartz (1968).

Normalization implies that there may be considered a reference (or representative) value for the capital income share (and thus for income distribution) at some given point. Technical progress that does not change income distribution over time is called Harrod-neutral (or labor-augmenting) technical progress. There are other types of neutral technical change, however, that would not have this effect.[12] So the whole concept of whether technical progress is neutral with respect to the income distribution relies on the idea that one has to check whether or not a given income distribution at one point in time remains constant. This given income distribution, which is used to evaluate possible distribution effect of technical progress, is exactly the income distribution in the baseline point of normalization at a fixed point in time, $t = t_0$.

2.5.1 Constant growth rates of normalized factor efficiency levels

A CES production function with factor-augmenting technical progress can be written as

$$Y = \left[\left(E_t^K K \right)^{\frac{\sigma-1}{\sigma}} + \left(E_t^N N \right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{23}$$

where E_t^K and E_t^N represent the levels of efficiency of both input factors.[13]

Thus, whereas the ACMS specification seems to imply that technological change is always Hicks-neutral, the above specification allows for different growth rates of factor efficiency. To circumvent problems related to Diamond-McFadden's Impossibility theorem (Diamond *et al.* 1978; Diamond and McFadden 1965), we assume a certain functional form for the growth rates of both efficiency levels and

[12] See the seminal contribution of Sato and Beckmann (1970) for such a classification.

[13] In the case where there is such technical progress, the question of whether σ is greater than or below unity takes on added importance. Recall, when $\sigma < 1$, factors are 'gross complements' in production and 'gross substitutes' otherwise. Thus, it can be shown that with gross substitutes, substitutability between factors allows both the augmentation and bias of technological change to favor the same factor. For gross complements, however, a capital-augmenting technological change, for instance, increases demand for labor (the complementary input) more than it does capital, and vice versa. By contrast, when $\sigma = 1$ an increase in technology does not produce a bias towards either factor (factor shares will always be constant since any change in factor proportions will be offset by a change in factor prices).

define

$$E_t^i = E_0^i e^{\gamma_i (t-t_0)} \tag{24}$$

where γ_i denotes growth in technical progress associated with factor i and t represents time. The combination $\gamma_K = \gamma_N > 0$ denotes Hicks-neutral technical progress; $\gamma_K > 0, \gamma_N = 0$ yields Solow-neutrality; $\gamma_K = 0, \gamma_N > 0$ represents Harrod-neutrality; and $\gamma_K > 0 \neq \gamma_N > 0$ indicates general factor-augmenting technical progress.[14]

E_0^i are the fixed points of the two efficiency levels, taken at the common baseline time, $t = t_0$. Again, normalization of the CES function implies that members of the same CES family should all share the same fixed point but differ in their elasticity of substitution values (Figures 1 and 2 showed this graphically). In order to ensure that this property also holds in the presence of growing factor efficiencies, it follows that

$$E_0^N = \frac{Y_0}{N_0}\left(\frac{1}{1-\pi_0}\right)^{\frac{\sigma}{1-\sigma}}; E_0^K = \frac{Y_0}{K_0}\left(\frac{1}{\pi_0}\right)^{\frac{\sigma}{1-\sigma}} \tag{25}$$

Note that at $t = t_0$, $e^{\gamma_i (t-t_0)} = 1$. This ensures that at the common fixed point the factor shares are not biased by the growth of factor efficiencies but are just equal to the distribution parameters π_0 and $1 - \pi_0$.

Inserting equation (24) and the normalized values (25) into (23) leads to a normalized CES function that can be rewritten in the following form that again resembles the ACMS variant:

$$Y = \left[\pi_0 \left(\frac{Y_0}{K_0} \cdot e^{\gamma_K (t-t_0)} \cdot K_t\right)^{\frac{\sigma-1}{\sigma}} + (1-\pi_0)\left(\frac{Y_0}{N_0} \cdot e^{\gamma_N (t-t_0)} \cdot N_t\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \tag{26}$$

or equivalently,

$$Y = Y_0\left[\pi_0 K_0^{\frac{\sigma}{\sigma-1}} \left(K_t \cdot e^{\gamma_K (t-t_0)}\right)^{\frac{\sigma-1}{\sigma}} + (1-\pi_0) N_0^{\frac{\sigma}{\sigma-1}} \left(N_t \cdot e^{\gamma_N (t-t_0)}\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \tag{27}$$

In this specification of the normalized CES function, with factor-augmenting technical progress, the growth of efficiency levels for capital and labor is now measured by growth in the expressions $K_0 e^{\gamma K (t-t_0)}$ and $N_0 e^{\gamma N (t-t_0)}$, respectively, and t_0 is the baseline year. Again, we see from (27) that for $t = t_0$ we retrieve $Y = Y_0$.

Special cases of (27) are the specifications used by Rowthorn (1999), Acemoglu (2002a) or Bentolila and Saint-Paul (2003), where $N_0 = K_0 = Y_0 = 1$ is implicitly

[14] Neutrality concepts associate innovations to related movements in marginal products and factor ratios. An innovation is Harrod-neutral if relative input shares remain unchanged for a given capital-output ratio. This is also called labor-augmenting since technical progress raises production equivalent to an increase in the labor supply. More generally, for $F(X_i, X_j, \ldots, A)$, technical progress is X_i–augmenting if $F_A A = F_{X_i} X_i$.

assumed, or by Antras (2004) who sets $N_0 = K_0 = 1$. Blanchard (1997), Caballero and Hammour (1998) and Berthold *et al.* (2002) work with a version of (27) where in addition to $N_0 = K_0 = 1$, $\gamma_K = 0$ is also assumed so that technological change is purely labor-augmenting.

It is also worth noting that for constant efficiency levels $\gamma_N = \gamma_K = 0$ our normalized function (27) is formally identical with the CES function that Jones (2003) (p. 12) has proposed for the characterization of the 'short term'. In his terminology, the normalization values k_0, y_0 and π_0 are 'appropriate' values of the fundamental production technology that determines long-run dynamics. This long-run production function is then considered to be Cobb–Douglas with constant factor shares equal to π_0 and $1 - \pi 0$ and with a constant exogenous growth rate. Actual behavior of output and factor inputs is thus modeled as permanent fluctuations around 'appropriate' long-term values. For a similar approach in which Cobb–Douglas parameter values are used to normalize a CES production function, see Guo and Lansing (2009).

2.5.2 Growth Rates in Normalized Technical Progress Functions: Time-Varying Frameworks

Following recent theoretical discussion about possible biases in technical progress (e.g., Acemoglu 2002a), it is not clear that growth rates of technical progress components should always be constant. An innovation of Klump *et al.* (2007) was to allow deterministic but time-varying technological progress terms where curvature or decay terms could be uncovered from the data in economically meaningful ways. For this they used a Box and Cox (1964) transformation in a normalized context:

$$g_i(\gamma_i, \lambda_i, t, t_0) = \frac{\gamma_i}{\lambda_i} t_0 \left(\left[\frac{t}{t_0} \right]^{\lambda_i} - 1 \right), i = K, N \tag{28}$$

The curvature parameter λ_i determines the shape of the technical progress function. For $\lambda_i = 1$, technical progress functions, g_i , are the (textbook) linear specification; if $0 < \lambda_i < 1$ they are exponential; if $\lambda_i = 0$ they are log-linear and $\lambda_i < 0$ if they are hyperbolic functions in time. Note, the re-scaling of γ_i and t by the fixed point value $t0$ in (28) allows us to interpret γ_N and γ_K directly as the rates of labor- and capital-augmenting technical change at the fixed-point period.

Asymptotically, function (28) would behave as follows:

$$g_i(\gamma_i, \lambda_i, t, t_0) = \begin{cases} \lim_{t\to\infty} g_i = \infty & \text{for } \lambda_i \geq 0 \\ \lim_{t\to\infty} g_i = -\frac{\gamma_i}{\lambda_i} t_0 & \text{for } \lambda_i < 0 \end{cases}$$

$$\frac{\partial g_i}{\partial t} = \gamma_i \left(\frac{t}{t_0}\right)^{\lambda_i - 1} \Rightarrow \begin{cases} \frac{\partial g_i}{\partial t} = \gamma_i & \text{for } \lambda_i = 1 \\ \lim_{t\to\infty} \frac{\partial g_i}{\partial t} = 0 & \text{for } \lambda_i < 1 \end{cases}$$

This framework allows the data to decide on the presence and dynamics of factor-augmenting technical change rather than it being imposed *a priori* by the researcher. If, for example, the data supported an asymptotic steady state, this would arise from the estimated dynamics of these curvature functions [i.e., labor-augmenting technical progress becomes dominant (linear), that of capital absent or decaying].

In addition, as McAdam and Willman (2013) pointed out, the framework also allows one to nest various strands of economic convergence paths towards the steady state. For instance, the combination,

$$\gamma_N > 0, \lambda_N = 1; \gamma_K = 0, \lambda_K = 0 \tag{29}$$

coupled with the assumption, $\sigma >> 1$ corresponds to that drawn upon by Caballero and Hammour (1998) and Blanchard (1997), in explaining the decline in the labor income share in continental Europe.

Another combination speculatively termed 'Acemoglu-Augmented' Technical Progress by McAdam and Willman (2013) can be nested as

$$\gamma_N, \gamma_K > 0; \lambda_N = 1, \lambda_K < 1 \tag{30}$$

where $\sigma < 1$ is more natural.

Consider two cases within (30). A 'weak' variant, $\lambda_K < 0$, implies that the contribution of capital augmentation to TFP is bounded with its growth component returning rapidly to zero; a 'strong' case, where $0 < \lambda_K < 1$, capital imparts a highly persistent contribution with (asymptotic convergence to) a zero growth rate. Both cases are asymptotically consistent with a BGP, where output growth converges to that of labor-augmenting technical progress, γ_N , plus the rate of growth of the labor force. Accordingly, the interplay between $|\gamma_N - \gamma_K|$ and λ_K, λ_N can be considered sufficient statistics of BGP divergence. Normalization, moreover, makes this kind of classification quite natural since we are looking at biases in technical progress relative to some representative point.

2.6 An Aside: The Substitution Elasticity and Factor Income Shares

Normalization allows us to have a valid idea of the reference points for factor income shares and the bias of non-neutral technical change – in both cases, biases

relative to a benchmark or reference point. Regarding the former, we know (e.g., McAdam and Willman 2013) that factor shares vary over time. Indeed such variation – as La Grandville (2009) notes – has been a major motivation for moving to more flexible functional forms for production. We now explain the link between them.

Non-neutral technical change will matter in so far it influences developments in output, relative prices, factor intensities, income shares and cost pressures. Movements in these variables affect the inter-temporal decisions of consumers and firms. Some indications of the key role played by factor substitution can be gauged from the following. Assuming competitive markets and profit maximization, relative factor income shares are:

$$\Theta_t = \frac{r_t}{w_t}\frac{K_t}{N_t} = \frac{\pi_0}{1-\pi_0}\left(\frac{\Gamma_t^K K_t/K_0}{\Gamma_t^N N_t/N_0}\right)^{\frac{\sigma-1}{\sigma}} \tag{31}$$

where $\Gamma_t^K = e^{\gamma K(t-t_0)}$ etc.

It is straightforward to show that the effect of technical bias and capital deepening on factor income shares is related to whether factors are gross complements or gross substitutes:

$$\operatorname{sgn}\left\{\frac{\partial\Theta}{\partial(K/N)}\right\}, \operatorname{sgn}\left\{\frac{\partial\Theta}{\partial\left(\Gamma_t^K/\Gamma_t^N\right)}\right\} = \operatorname{sgn}\{\sigma-1\} \tag{32}$$

Hence, an increase in factor J -augmenting ($J = K, N$) technical change 'favors' factor J (i.e., implying $\frac{\partial F_I/\partial\Gamma^J}{\partial F_I/\partial\Gamma^I} = 1$, $J \neq I$, and raising J 's income share for given factor proportions) if factors are gross substitutes ($\sigma > 1$). The effects reverse if factors are gross complements.

Thus, it is only in the gross-substitutes case that a factor J-augmenting change in technology is J-biased. Naturally, the relations between the substitution elasticity, technical bias and factor shares evaporate under Cobb–Douglas: factor income shares are constant and relative factor prices are purely determined by capital deepening.

Equation (31) illustrates the impact of technology shocks on factor payments depends on the substitution elasticity and the factor bias of the shock. This influences the dynamic response of interest and wages (and hence hours) to technology shocks. Note, though, statement (32) defines factor *demand* reactions to technology changes. They therefore abstract from labor-supply reactions (although we will return to this in Section 5).

3. The Elasticity of Substitution as an Engine of Growth

Although one of the first references to a CES structure of aggregate production appears in the Solow (1956) paper, it had been for a long time impossible to answer the question of what effect the size of the substitution elasticity has on the steady-state values in the standard neoclassical growth model. Common sense would certainly suggest that easier factor substitution – via helping to overcome diminishing returns – should lead to a higher level of development. But a formal proof of this conjecture seemed for a long time out of reach. In fact, when Harbrecht (1975) tried to answer this question with the help of a (implicitly normalized) David and van de Klundert (1965) CES variant, he found the contrary result! His analysis was, of course, biased by the dependency of the distribution and efficiency parameters on the elasticity of substitution, when the CES function is not correctly normalized.

Already some years earlier, as mentioned in Section 2.4, Kamien and Schwartz (1968) had presented a proof of the central relationship between the substitution elasticity and output but only for the special case in which the baseline values for K and N were equal. Their proof is based on the General Mean property of the CES function, which had already been recognized by ACMS.

A General Mean of order p is defined as

$$M(p) = \left[\sum_{ti=1}^{n} f_i x_i^p \right]^{\frac{1}{p}} \tag{33}$$

where $x_i , \ldots , x_n$ are positive numbers (of the same dimension) and where the weights $f_i , \ldots , f_n$ sum to unity. Special cases of the General Mean are the arithmetic, the geometric and the harmonic means where the order p would be 1, 0 and −1, respectively. If p tends to $-\infty$, the mean becomes the minimum of the numbers $(x_i , \ldots , x_n)$.

One of the most important theorems about a General Mean is that it is an increasing function of its order (Hardy *et al.* 1934, p. 26f; Beckenbach and Bellman 1961, pp. 16–18; see also the proof in La Grandville 2009, pp. 111–113). More exactly, it says that the mean of order p of the positive values xi with weights f_i is a strictly increasing function in p unless all the x_i are equal. With the two factors K and N (and implicit normalization $K0 = N0$) this leads to the following statement:

Enlargement of the elasticity of substitution results in an increase in output from every combination of factors except that for which the capital labor ratio is equal to one. (Kamien and Schwartz 1968, p. 12)

Of course, this result can be generalized provided that all numbers have the same

dimension which is precisely achieved by normalizing numbers of different dimensions.

La Grandville (1989b) developed a graphical representation of normalized CES structures. He demonstrated that the general relationship between the elasticity of substitution and the level of development is usually positive. Moreover, when there are two factors of production, numerical results suggest that the function has a *single* inflection point (La Grandville and Solow, 2006): in other words, between its limiting values, $\lim p \in (-\infty,\infty) M(p)$, the function $M(p)$ is first convex then concave. For typical production-function weights (i.e., $f_1 = 0.4$; $f_2 = 1 - f_1$) that inflection point occurs around $p \approx 0$ (i.e., the Cobb–Douglas neighborhood).

This means that within some relevant interval around that even small perturbations of the substitution elasticity (however such a change may be implemented) might have extremely large implications for an economy. In short, raising your elasticity of substitution can raise your growth rate and its effect may be potentially even larger than that traditionally studied in the case of (equivalent percentage) improvements in the savings rate and/or technical progress (such reasoning is reflected in the third quote that started our paper).

The formal proof for the conjecture was then presented by Klump and de La Grandville (2000), based on a very general normalized CES production function. An alternative proof is presented in Klump and Irmen (2009) who also deal with normalized CES functions in a Diamond-type version of the neoclassical growth model. It distinguishes efficiency and distribution effects of changes in the elasticity of substitution which can work in different directions if not all individuals have the same savings pattern so that redistribution matters. The interaction of both effects creates an acceleration effect for capital accumulation which can have a positive or a negative effect on the steady state. It can be shown, however, that even in this setting a higher elasticity of substitution leads to a higher steady-state level as long as the efficiency effect dominates the distribution effect, which is the most likely case.

Klump and Preissler (2000) extend the analysis of the standard neoclassical growth model with a normalized CES production function by calculating the effect of the size of the elasticity of substitution on the speed of convergence towards the steady state. Earlier studies of this problem, for example, Ramanathan (1975), which were not considering normalization had not derived convincing results. With an explicitly normalized CES production function, it is possible to show that an increase in the elasticity of substitution reduces the speed of convergence if the steady-state value of capital intensity is higher than its baseline value (which seems

the most likely case).

Klump (2001) presents the analysis of a Ramsey type (intertemporal optimizing) growth model with a normalized CES production function. He is able to prove that as long as the steady-state value of the capital intensity is higher than its baseline value the comparative-static effect of a change in the elasticity of substitution on the steady state is strictly positive. The result were only recently reproduced by Xue and Yip (2013) using a different approach. For the effect of the elasticity of substitution on the speed of adjustment the same results as in the Solow model can be derived in the Ramsey model (see Klump and Saam 2008). This result holds irrespective of the value of the elasticity of substitution, whereas Ventura (1997) making use of an implicitly normalized CES production function could only generate meaningful results for $\sigma < 1$.

Summing up, an increase in σ increases the steady-state level of production and capital intensity while lengthening the convergence time to the new steady state. From the standpoint of short run growth, this leaves open the question of whether growth in the short run will increase or decrease relative to an initially lower σ comparative value.

Temple (2008) has criticized the use of normalized CES functions for calculating convergence effects of a higher factor substitution because of an unclear economic meaning of the chosen baseline value for the capital intensity. However, as has been clarified by Klump and Saam (2008) the essence of normalization does not consist in the arbitrary choice of baseline values but in forcing the researcher to give an explicit statement about the relationship between baseline and steady-state (*ss*) values. As growth models are generally motivated by the idea that labor is relatively scarce in the steady state it seems reasonable to normalize such that $kss > k0$. In addition, in a growing economy, it is always feasible to assume capital intensity would be below the steady state, whereas values above the steady state raise the question of how the economy has found itself in such a starting position with surplus capital stock.

The setting may be different in the business-cycle literature, where fluctuations around the (typically zero growth) steady state are studied. In this case it makes sense to use steady-state values as normalization parameters (Guo and Lansing 2009; Cantore *et al.* 2010, hereafter CLMW (2010)).

Finally, Irmen (2011) is able to show in an endogenous growth framework with a normalized CES production function that the steady-state growth rate of output per worker increases with the elasticity of substitution. The efficiency effect induced by a higher degree of factor substitution makes innovation investments more profitable

that raise permanently the productivity of labor. All analysis using normalized CES production functions confirm that the elasticity of substitution is among the most powerful determinants of growth. La Grandville (2009), 2012) suggests that changes in the elasticity of substitution have a much higher effect on social welfare than changes in the rate of technical progress – see chapter 13, pp. 316-319, where the author compares the ratio of sensitivities of a given value function, V (e.g., savings or consumption flows over time), to a change in the elasticity of substitution and to a change in the rate of (Harrod-neutral) technical progress: $e_{V,\sigma}/e_{V,\gamma_N}$.

4. Estimated Normalized Production Function

Previous sections of our paper introduced the concept of normalization and largely its importance in theoretical analysis. Here we discuss how the idea of normalization should be applied in *empirical* analysis and, more importantly, whether it makes the estimation of the parameters of the CES production function easier and more robust? We show that its merits are strong especially if system approach (containing cross-equation restrictions) is used. In this context the scepticism on the proper identification of the elasticity of substitution and technical progress from each other aroused by the famous Diamond–McFadden impossibility theory largely loses its practical importance. In fact, we argue that a general factor-augmenting specification results in markedly less biased estimates of the elasticity of substitution parameter than imposing *a priori* neutrality constraints. In the context of single equation approach, though, normalization is of lesser use.

An added problem,[15] however, is that often the predictions of different elasticity and technical change combinations can have similar implications for variables of interest, such as factor income shares and factor ratios. Notwithstanding, whether factor income movements are driven by high or low substitution elasticities and with different combinations of technical change is profoundly important in terms of their different implications for, for example, growth accounting, inequality, calibration in business-cycle models, public policy issues etc.

By way of illustration, Tables 1 and 2 present an overview of empirical results obtained for the elasticity of substitution. We concentrate on the results from time-series or panel studies on aggregate data. In the case of the United States, which has been widely studied, it is possible to find values of the elasticity of substitution above unity (with Harrod-neutral technical progress), at unity (with Hicksneutral progress) and below unity (with Hicks-neutral progress and with technical progress augmenting both factors). The situation for other countries is no

[15] See the discussion in Leon-Ledesma *et al.* (2010b) and possible observational equivalence in examining income share developments and inferring the associated bias in technical progress.

better; for Germany, values of above, below and at unity have been estimated. Using information about the degree of factor substitution from other sources does not resolve this puzzle, either. It has been recognized, for example, by Lucas (1969) that older time-series studies for the United States have generally provided lower estimates than cross-section studies that were supportive of the Cobb–Douglas function. More recent cross-section analysis based on micro data that were used to estimate the relationship between business capital formation and user costs (e.g., Chirinko *et al.* 1999) estimates very low elasticities of substitution ranging from 0.25 to 0.40. A drawback of these kinds of studies, however, is their inability to quantify any growth rate(s) of technical progress.

That there should be diversity in production function estimates – even for countries whose data properties are relatively stable and well-understood – is not surprising. It doubtlessly reflects the familiar trapdoor of empirical pitfalls: data quality; *a priori* modeling choices (such as whether to test for certain types of factor neutrality or impose them); the performance of various estimators (e.g., single equation, systems) and algorithms; as well as more prosaic data problems (e.g., outliers, uncertain auto-correlation, structural breaks, quality improvements, measurement errors etc.).

At a simple level, normalization removes the problem that arises from the fact that labor and capital are measured in different units – although as we have seen its importance goes well beyond that. Under Cobb–Douglas, normalization plays no role since, due to its multiplicative form, differences in units are absorbed by the scaling constant. The CES function, by contrast, is highly non-linear, and so, unless correctly normalized, excluding technical progress, out of its three key parameters – the efficiency parameter, the distribution parameter, the substitution elasticity – only the latter is ‘deep’. The other two parameters turn out to be affected by the size of the substitution elasticity and factor income shares.

Table 1. Empirical Studies of Aggregate Elasticity of Substitution and Technological Change in the US.

Study	Sample[a]	Assumption on Technological Change	Estimated Elasticity of Substitution: σ	Estimated Annual Rate Of Efficiency Change		
				Neutral: $\gamma_N = \gamma_K$	Laboraugmenting: γ_N	Capital-Augmenting: γ_K
Arrow *et al.* (1961)	1909-1949	Hicks-Neutral	0.57	1.8	–	–
Kendrick and Sato (1963)	1919-1960	Hicks-Neutral	0.58	2.1	–	–
Brown and De Cani (1963)	1890-1918	Factor Augmenting	0.35		Labor saving ($\gamma_N - \gamma_K = 0.48$)	
	1919-1937		0.08		Labor saving ($\gamma_N - \gamma_K = 0.62$)	
	1938-1958		0.11		Labor saving ($\gamma_N - \gamma_K = 0.36$)	
	1890-1958		0.44		?	
David and van de Klundert (1965)	1899-1960	Factor Augmenting	0.32	–	2.2	1.5
Bodkin and Klein (1967)	1909-1949	Hicks-neutral	0.50-0.70	1.4-1.5		
Wilkinson (1968)	1899-1953	Factor Augmenting	0.50		Labor saving ($\gamma_N - \gamma_K = 0.51$)	
Sato (1970)	1909-1960	Factor Augmenting	0.50 – 0.70	–	2.0	1.0
Panik (1976)	1929-1966	Factor Augmenting	0.76		Labor saving ($\gamma_N - \gamma_K = 0.27$)	
Berndt (1976)	1929-1968	Hicks-neutral	0.96-1.25	?	–	–
Kalt (1978)	1929-1967	Factor Augmenting	0.76	–	2.2	0.01
Antràs (2003)	1948-1998	Hicks-neutral	0.94-1.02	1.14	–	–
		Factor-augmenting	0.80		Labor saving ($\gamma_N - \gamma_K = 3.15$)	
Klump *et al.* (2007b)[b]	1953-2002	Factor-augmenting	0.7	–	–	–
León-Ledesma *et al.* (2010)	1960- 2004	Factor-augmenting	0.60-0.70	–	1.60	0.70

Notes:
[a] All studies are estimated on annual frequency data except León-Ledesma *et al.* (2010b) which is quarterly. Although, to aid comparability, we annualized their estimates for technical change in the table.
[b] We do not report technical change estimates for Klump *et al.* (2007b) since they estimate with structural breaks in their technical progress terms. For reasons of space, the reader is referred to León-Ledesma *et al.* (2010a) for the original references.

Table 2. Empirical Studies of Aggregate Elasticity of Substitution in Selected Other Countries.

Study	Countries	Sample (Frequency)	Assumption For Technological Change	Estimated Elasticity Of Substitution: σ
Lewis and Kirby (1988)	Australia	1967-1987 (Weekly)	Hicks-Neutral	0.78
Easterly and Fischer (1995)	Soviet Union	1950-1987 (Annual)	Hicks-Neutral	0.37
Andersen *et al.* (1999)	Panel of 17 OECD countries	1966-1996 (Annual)	Hicks-Neutral	1.12
Bolt and van Els (2000)	Austria	1971-1996 (Quarterly)	Hicks-Neutral	0.24
	Belgium			0.78
	Germany			0.53
	Denmark			0.61
	Spain			1
	Finland			0.34
	France			0.73
	Italy			0.52
	Netherlands			0.27
	Sweden			0.68
	UK			0.6
	US			0.82
	Japan			0.3
Duffy and apageorgiou (2000)	Panel of 82 developed and developing countries	1960-1987 Annual)	Hicks-Neutral	1.4
Ripatti and Vilmunen (2001)	Finland	1975-1999 (Quarterly)	Factor-Augmenting	0.6
Willman (2002)	Euro area	1970-1997 (Quarterly)	Solow-Neutral	0.95-1.05
McAdam and Willman (2004)	Germany	1983-1999 (Quarterly)	Hicks-Neutral	0.7, 1, 1.2
Berthold *et al.* (2002)	US, Germany, France	1970-1995 (Semi-Annual)	Harrod-Neutral	1.15, 1.45, 2.01
Bertolila and Saint-Paul (2003)	13 industries in 12 OECD countries	1972-1993	Harrod-Neutral	1.06
McAdam and Willman (2004a)	Germany	1983-1999 (Quarterly)	Hicks-Neutral	0.7, 1, 1.2
Klump *et al.* (2007b)	Euro Area	1970-2003 (quarterly)	Factor-Augmenting	0.7
Luoma and Luoto (2010)	Finland	1902-2004 (annual)	Factor-Augmenting	0.5

Notes: For reasons of space, the reader is referred to Klump *et al.* (2007b) for most of these original references.

If one compares the explicitly normalized with the implicitly normalized function, as before, that is,

$$Y_t = C\left[\pi\left(\Gamma_t^K K_t\right)^{\frac{\sigma-1}{\sigma}} + (1-\pi)\left(\Gamma_t^N N_t\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

$$Y_t = Y_0\left[\pi_0\left(\frac{\Gamma_t^K K_t}{\Gamma_0^K K_0}\right)^{\frac{\sigma-1}{\sigma}} + (1-\pi_0)\left(\frac{\Gamma_t^N N_t}{\Gamma_0^N N_0}\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

we may be unsure as to where the estimation benefits of normalization derive. After all, both equations contain the same number of parameters. In fact, the latter equation seemingly *adds* complexity by incorporating normalized reference points into the estimation (the empirical choice of the normalization point is a particular aspect discussed in Section 4.2).

The answer as to why normalization should improve matters empirically reflects the following. The distribution and efficiency parameters (respectively, Y_0; π_0 and C; π) can now either be imposed prior to estimation or at least have a deep interpretation in terms of the data (i.e., the representative capital income share). Effectively normalization allows us to reduce the number of freely estimated parameters by two.

This follows straightforwardly from our earlier analysis. In the implicitly normalized formulation the parameters C and π above have no clear theoretic or empirical meaning. Instead, they are composite parameters conditional on, besides the selected fixed points, the elasticity of substitution (re-stating equations (15) and (16)):

$$C(\sigma, \cdot) = Y_0\left[\frac{r_0 K_0^{1/\sigma} + w_0 N_0^{1/\sigma}}{r_0 K_0 + w_0 N_0}\right]^{\frac{\sigma}{\sigma-1}}$$

$$\pi(\sigma, \cdot) = \frac{r_0 K_0^{1/\sigma}}{r_0 K_0^{1/\sigma} + w_0 N_0^{1/\sigma}}$$

The additional merit in using the normalized instead of the implicitly normalized form is that all parameters have a clear empirical correspondence. In particular, the distribution parameter is identified as the capital income share of total factor income at the fixed point. Hence, a suitable choice for the fixed point may alleviate the estimation of the deep parameters and, to repeat, makes the estimated production function suitable, for example, for subsequent comparative-static analysis.[16]

[16] We used the word 'deep' when we discuss the C and π parameters. By deep, we meant that it is not dependent on any parameter other than itself. In the implicitly normalized case, the parameters of the production function (the efficiency and distribution parameter) are functions of σ (except for the counterfactual case of $K = N = 1$), and are therefore not deep.

Table 3 presents some consistent sets of (deterministic) initial values for generating data and the implied ranges of the true values of C and π for $\sigma \in [0.2, 1.3]$. In the first row we assume $K_0 = N_0 = 1$. This allows us to solve $Y0$from the first row – with initial values of $\Gamma_0^K = \Gamma_0^N$=1.

In fact this represents a special case because indexing by the point of normalization equaling one is neutral implying that the true value of $C = 1$ and $\pi = \pi_0 = r_0 = 0.3\ \forall\sigma$(this, in turn, implies solving the normalized real wage rate as $\frac{(1-\pi_0)Y_0}{N_0}$). In this special case it does not matter if the same initial values of parameters are used, whether the system is estimated in normalized or implicitly normalized form.

In all other cases, however, this is not so. To illustrate, in these other cases we have adjusted the initial conditions for output to make them consistent with an initial (and arguably more reasonable) value for r (the real user cost of capital) equal to 5%. The sample average normalization insulates the normalized system from the effects of changes in initial values in generating the data but the true values of composite parameters C and π vary widely: $C \in [0.23, 0.79]$, $\pi \in [0.23, 0.99]$. Thus, we confirm that the actual income distribution of the data is completely unrelated to the true value of π.

This illustrates the difficulty that a practitioner faces when trying to estimate implicitly normalized forms since the actual data scarcely give any guidelines for appropriate choices for the initial parameter values of C and π.

Table 3. Consistent Normalization Values.

						C		π	
N_0	π_0	r_0	K_0	$Y_0^* = Y_0 = \frac{r_0}{\pi_0}K_0$	$w_0 = \frac{(1-\pi_0)Y_0}{N_0}$	when $\sigma = 1.3$	when $\sigma = 0.2$	when $\sigma = 1.3$	when $\sigma = 0.2$
1	0.3	0.3	1	1	0.7	1		0.4	
1	0.3	0.05	5	0.833	0.583	0.546	0.225	0.228	0.996
1	0.3	0.05	8	1.333	0.933	0.788	0.225	0.210	0.999

Notes: C and π in the final two columns are calculated according to equations (15) and (16) for $\sigma \in [0.2,1.3]$. Outside of the "special case" note the following partial derivatives showing how ceteris paribus changes in initial values
change these last two parameters, C and π :
$C_\sigma, C_{Y_0}, C_{K_0}, C_{w_0} > 0, C_{N_0} < 0$
$\pi_\sigma, \pi_{N_0} < 0, \pi_{K_0}, \pi_{w_0} > 0$

As Leon-Ledesma *et al.* (2010a) have documented, that results in serious estimation problems. They estimated normalized and implicitly normalized forms where in the latter case the initial parameter values for C and π are selected randomly from their

given range such as in Table 3. When $\hat{C}$ and $\hat{\pi}$ substantially depart from their true, theoretical values, there are significant and quantitatively important biases in the estimated substitution elasticity and technical change.

4.1 Estimation Forms

The recognition of normalization says nothing specifically about the way production and production technology should be estimated and how normalization impacts those estimation choices. Typical estimation forms found in the literature include: the non-linear CES production function; the linear first-order conditions of profit maximization; linear approximation of the CES function and 'system' estimation incorporating the production function and the first-order conditions.[17]

To proceed let us express the CES function, equation (27), in log form:

$$\log\left(\frac{Y}{Y_0}\right) = \frac{\sigma}{\sigma-1}\log\left[\pi_0\left(e^{\gamma_K(t-t_0)}\frac{K_t}{K_0}\right)^{\frac{\sigma-1}{\sigma}} + (1-\pi_0)\left(e^{\gamma_N(t-t_0)}\frac{N_t}{N_0}\right)^{\frac{\sigma-1}{\sigma}}\right] \tag{34}$$

From this we can derive the marginal profit-maximization conditions,[18]

$$\log(r) = \underbrace{\log\left(\pi_0\frac{Y_0}{K_0}\right) + \frac{1}{\sigma}\log\left(\frac{K_0}{Y_0}\right)}_{\alpha_r} + \frac{1}{\sigma}\log\left(\frac{Y}{K}\right) + \frac{\sigma-1}{\sigma}(\gamma_K(t-t_0)) \tag{35}$$

$$\log(w) = \underbrace{\log\left((1-\pi_0)\frac{Y_0}{N_0}\right) + \frac{1}{\sigma}\log\left(\frac{N_0}{Y_0}\right)}_{\alpha_w} + \frac{1}{\sigma}\log\left(\frac{Y}{N}\right) + \frac{\sigma-1}{\sigma}(\gamma_N(t-t_0)) \tag{36}$$

Where, as before, γ_N and γ_K are the respective growth rates of labor and capital augmenting technical progress. Equations (35) and (36) represent the first-order conditions with respect to capital and labor, respectively.

Estimation of production and technology parameters based on the first-order conditions and other single-equation approaches is hampered by the fact that they only admit estimates of technical progress terms contained by their presumed FOC choice (in that sense any *bias* in technical progress is, by definition, not separately identifiable). This apparent drawback is presumably (in the minds of the researcher at least) compensated by their tractable form and linearity. Accordingly, these forms are common (more common, for instance, than direct non-linear CES estimation):

[17] We confine ourselves to constant-returns production functions. This is largely done to be consistent with much of the aggregate evidence (e.g., Basu and Fernald 1997).

[18] Given that the real user cost and real interest rate can be sometimes negative in historical samples (particularly in the 1970s), the user cost conditions is usually expressed in levels rather than logarithms. Note, the last two conditions in some estimation cases are merged in many papers:

$$\log\left(\frac{K_t}{N_t}\right) = \alpha_i + \sigma\log\left(\frac{w_t}{r_t}\right) + (\gamma_N - \gamma_K)(1-\sigma)t$$

$$\log\left(\frac{K_t}{N_t}\right) = \alpha_j - \frac{\sigma}{1-\sigma}\log\frac{r_t K_t}{w_t N_t} + (\gamma_N - \gamma_K)t$$

For example, equation (35) has been widely used in the investment literature (e.g., Caballero 1994) and (36) was the form used by ACMS amongst many others.

A notable feature of the above three equations is that if estimated in *single*-equation mode, the normalization points (denoted by the curly lower brackets) are absorbed by the respective constants, α_r and α_w. Thus, from an estimation stand point, it is only when the non-linear CES function is estimated directly or where the system approach is used, does formal normalization play an explicit empirical role.

Another possible vehicle of estimation is the Kmenta (1967) approximation (which became an important, if apparently unacknowledged, pre-cursor to the translog form). This is a Taylor-series expansion of the log CES production function around $\sigma = 1$.[19]

$$y_t = \pi_0 k_t + \lambda k_t^2 + \underbrace{\pi_0\left[1+\frac{2\lambda}{\pi_0}k_t\right]\gamma_K\tilde{t} + (1-\pi_0)\left[1-\frac{2\lambda}{1-\pi_0}k_t\right]\gamma_N\tilde{t} + \lambda\left[\gamma_K-\gamma_N\right]^2\cdot\tilde{t}^2}_{tfp} \qquad (37)$$

where $t = t - t_0$, $y_t = \log[(Y_t/Y_0)/(N_t/N_0)]$, $k_t = \log[(K_t/K_0)/(N_t/N_0)]$, $tfp = \mathrm{Log}(TFP)$ and $\lambda=\frac{(\sigma-1)\pi_0(1-\pi_0)}{2\sigma}$. Equation (37) shows that the output–labor ratio can be decomposed into capital deepening and technical progress, weighted by factor shares and the substitution elasticity (where $sgn(\lambda) = sgn(\sigma - 1)$ and $\lim_{\lambda\in[0,\infty)}\lambda \in [-\infty, 1/2\pi_0(1-\pi_0)]$). In addition, (37) shows that, when $\sigma \neq 1$and $\gamma_K \neq \gamma_N > 0$, additional (quadratic[20]) curvature is introduced into the estimated production function.

With the predetermined normalization point, the advantage of (37) over the Kmenta approximation of the implicitly normalized CES is – as usual – that, since all variables appear in indexed form, the estimates are invariant to a change in units of measurement. Another advantage is that in the neighborhood of the normalization point (i.e., $K_t = K_0$, $N_t = N_0$, $\pi = \pi_0$) and without σ deviating 'too much' from unity, as the approximation also assumes, the terms including the normalized capital intensity and multiplying linear trend have only second-order importance and, without any significant loss of precision, can be dropped, yielding,

[19] Linearization around a unitary substitution is algebraically the most convenient form, as can be easily verified.
[20] This is quadratic or higher depending on the order of the approximation.

$$y = \pi_0 k_t + \lambda k_t^2 + \underbrace{\underbrace{[\pi_0 \gamma_K + (1-\pi_0)\gamma_N]}_{\theta}\tilde{t} + \underbrace{\lambda[\gamma_K - \gamma_N]^2}_{\epsilon}\tilde{t}^2}_{tfp} \quad (38)$$

Estimation of equation (38) yields four parameters, $\pi_0, \hat{\lambda}, \hat{\theta}, \hat{\epsilon}$, for four primitives, $\pi_0, \sigma, \gamma_K, \gamma_N$. Using $\pi 0$ allows us to identify σ from composite parameter λ, that is, $\sigma = (1 - \frac{2\hat{\lambda}}{\pi_0(1-\pi_0)})^{-1}$. However, without *a priori* information on which one of two technical progress components dominates and, in addition, that the signs of estimates λ and are (or are constrained to be) the same, one cannot identify γ_K and γ_N . This leads to the following weak identification result: for $\gamma_N > \gamma_K$ we obtain $\gamma_N = \hat{\theta} + \pi_0\sqrt{\frac{\hat{\epsilon}}{\hat{\lambda}}}$ and $\gamma_N = \hat{\theta} - (1-\pi_0)\sqrt{\frac{\hat{\epsilon}}{\hat{\lambda}}}$ and for $\gamma_N < \gamma_K$ we obtain, $\gamma_N = \hat{\theta} - \pi_0\sqrt{\frac{\hat{\epsilon}}{\hat{\lambda}}}$ and $\gamma_N = \hat{\theta} + (1-\pi_0)\sqrt{\frac{\hat{\epsilon}}{\hat{\lambda}}}$.

Given this, even under the helpful environment of normalization, we can say that although the Kmenta approximation can be used to estimate σ, it cannot effectively identify the direction of the biased technical change.[21] However, the approximation is a useful vehicle to, *ex post*, calculate TFP.

4.2 The Point of Normalization – Literally!

To be empirically operational, *the point of normalization* must be defined (i.e., what these Y_0, K_0 are in practice). If the estimation data were deterministic, this would be unproblematic: every sample point would be equally suitable for the point of normalization. For instance, in theoretic settings, the normalization point is often calibrated around the non-stochastic steady state (e.g., Klump and Saam 2008; CLMW 2010).

However, since actual data are inevitably stochastic (and the intensity with which factors are utilized is also unobserved), this convenience does not carry over because the production function does not hold exactly in any sample point. Therefore, to diminish the size of cyclical and stochastic components in the point of normalization, an appealing procedure is to calibrate the normalization point in terms of sample averages for the underlying variables – typically geometric averages for growing variables (such as factors of production) and arithmetic ones for approximately

[21] The Kmenta approximation, both empirically and in terms of general identification, has enjoyed limited success (see Kumar and Gapinski 1974; Thursby 1980; Leon-Ledesma *et al.* 2010a).

stationary variables (e.g., factor income shares, the real interest rate and user cost).

The non-linearity of the CES function, however, in turn, implies that the sample average of production need not exactly coincide with the level of production implied by the production function with sample averages of the right hand variables *even with a deterministic DGP*. To circumvent this problem, Klump *et al.* (2007) introduced an additional parameter ξ whose expected value is around unity (which we might call the normalization constant[22]). Hence, we can define $Y_0 = \xi\bar{Y}$, $K_0 = \bar{K}$, $N_0 = \bar{N}$,$\pi_0 = \bar{\pi}$ and $t_0 = \bar{t}$ where the bar refers to the respective sample average (geometric or, as in the last two, arithmetic).

An advantage of the explicitly normalized system over the implicitly normalized system, in turn, is that the distribution parameter $\bar{\pi}$ has a clear data-based interpretation. Therefore, it can either be fixed prior to estimation or, at least, the sample average can be used as a very precise initial value of the distribution parameter. Likewise, a natural choice for the initial value of normalization constant, ξ , is one. Estimated values of these two parameters should not deviate much from their initial values without casting serious doubts on the reasonableness of estimation results. In the implicitly normalized case, by contrast, no clear guidelines exist in choosing the initial values of distribution parameter π and efficiency parameter C. This is especially the case if the function that the estimation method optimizes contains several local optima, as demonstrated to be a concrete problem in analyzing both real data (Klump *et al.* 2007) and Monte Carlo generated data (Leon-Ledesma *et al.* 2010b). Hence, in the context of non-linear estimation this may imply a well-defined advantage of the explicitly normalized over the implicitly normalized system.

5. Normalization in Growth and Business-Cycle Models

Production functions are a key part of business-cycle and growth macro-models. Over the last few decades, the two main competing models in the macro profession have been the RBC (real business cycle) model and the NK (New Keynesian) model. Both imply relatively tight, theory-led dynamics and are typically furnished with a rich number of stochastic shocks which displace the agent from his optimal plans. The standard RBC model is a variant of the representative agent neoclassical model, where business cycles are due to non-monetary sources (primarily, changes in technology). The NK one supplements that with various real and nominal rigidities

[22] Only in the log-linear case of Cobb–Douglas would one expect ξ to exactly equal unity. Hence, in choosing the sample average as the point of normalization we lose precision because of the CES's nonlinearity. If, alternatively, we choose the sample mid-point as the normalization point, we should also lose because of stochastic (and in actual data, cyclical) components that would also imply non-unitary ξ.

to better capture the data.

However, what both models tend to share in practice is a focus on Cobb–Douglas aggregate production. This is especially puzzling given that such models tend to be motivated as *business-cycle* frameworks. Yet over business-cycle frequencies one might precisely expect relatively little (and presumably below unitary) factor substitutability as well as the presence of *non-neutral* technical change to capture factor income share developments. By introducing and assessing non-unitary production forms, the potential for a better understanding of technology and policy transmission and for a richer decomposition of historical time-series is likely to be considerable.

The introduction of normalized technologies in simple business-cycle models is relatively straightforward and can be illustrated using the canonical RBC model. The model is relatively well known and can therefore be introduced compactly. The standard model with CES production technology in the supply side would be given by:

$$\Lambda_t = \beta \mathbb{E}_t \{\Lambda_{t+1}[1 + r_{t+1} - \delta]\} \tag{39}$$

$$w_t = \upsilon \frac{N_t^S}{\Lambda_t} \tag{40}$$

$$Y_t = Y_0 \left[\pi_0 \left(\frac{K_t}{K_0} e^{\gamma_t^K} \right)^{\frac{\sigma-1}{\sigma}} + (1 - \pi_0) \left(\frac{N_t}{N_0} e^{\gamma_t^N} \right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{41}$$

$$w_t = (1 - \pi_0) \left(\frac{Y_0}{N_0} e^{\gamma_t^N} \right)^{\frac{\sigma-1}{\sigma}} \left(\frac{Y_t}{N_t} \right)^{\frac{1}{\sigma}} \tag{42}$$

$$r_t = \pi_0 \left(\frac{Y_0}{K_0} e^{z_t^K} \right)^{\frac{\sigma-1}{\sigma}} \left(\frac{Y_t}{K_t} \right)^{\frac{1}{\sigma}} \tag{43}$$

$$C_t + K_t - (1 - \delta) K_{t-1} \leq Y_t \tag{44}$$

$$\gamma_t^j = \rho_j \gamma_{t-1}^j + \eta_t^j \tag{45}$$

where Λ_t, w_t and r_t are, respectively, the marginal utility of consumption (Ct),wages and the interest rate (all expressed in real terms). Parameters β, δ and υ represent, respectively, the discount factor, the capital depreciation rate and a scaling constant. Processes γ_t^j are technology shocks – as equation (45) shows usually modeled as a stationary AR(1) process – for $j = K, N$ (i.e., capital-augmenting and labor-augmenting shocks, respectively). Equations (39) and (40) represent the

household's optimal consumption and labor supply choices given, for example, the separable utility function,

$$U(C,N)=\frac{C_t^{1-\sigma_c}}{1-\sigma_c}-\upsilon\frac{N_t^{1+\varsigma}}{1+\varsigma} \tag{46}$$

where σ_c is the coefficient of relative risk aversion and $\varsigma$is the inverse of the Frisch elasticity. This particular utility function implies $\Lambda_t = C_t^{-\sigma_c}$. If the researcher wanted to simulate this model conditional on different values of the substitution elasticity, s/he would do the following:

(i) Imposed key normalization parameters: $r_0 = \frac{1}{\beta} - 1 + \delta$, and, for some given N_0, K_0, π_0, solve out $Y_0=\frac{r_0}{\pi_0}K_0$ and $w_0 = (1 - \pi_0)\frac{Y_0}{N_0}$ following Table 3 (for temporary shocks, these normalization points will be chosen to be the same as the presumed steady state);

(ii) Reset the leisure scaling parameter υ to equate the real wage expressions in (40) and (42), implying $\upsilon = \frac{(1-\alpha_0)r_0^{\sigma_c}}{(r_0-\delta\alpha_0)^{\sigma_c}}$.

In this simple way, conventional dynamic exercises can be performed on the model (e.g., examining the effect of technology shocks) which are robust to changes in the substitution elasticity.

In this vein, CLMW (2010) looked at the relationship between technology shocks and hours worked – a key controversy between NK and RBC explanation of the business cycle – by expressing both models in consistent normalized form. They showed that, depending on the value of the substitution elasticity and the source of the shock (capital- or labor-augmenting), both models could generate positive or negative hours responses (thus, largely overturning conventional wisdom on the mechanisms in the models).

6. Conclusions and Future Directions

The elasticity of substitution between capital and labor represents a key parameter in many fields of economics: for example, business-cycle and growth outcomes, income distribution, stabilization policy, labor market dynamics etc. The empirical evidence – for the United States and other developed economies – is clear in rejecting the unitary-elasticity Cobb–Douglas specification in favor of (generally below unity) CES aggregate production functions.[23] When investigating the

[23] Duffy and Papageorgiou (2000) suggest developing countries may be better empirically represented by an above-unity aggregate substitution elasticity.

ramifications of a non-unitary substitution elasticity, one necessarily faces the issue of normalization.

The importance of explicitly normalizing CES functions was discovered in the seminal paper by La Grandville (1989b), then further explored by Klump and de La Grandville (2000), Klump and Preissler (2000), La Grandville and Solow (2009), and first empirically implemented and investigated by Klump *et al.* (2007). Normalization starts from the observation that a family of CES functions whose members are distinguished only by different elasticities of substitution needs a common benchmark point. Since the elasticity of substitution is defined as a point elasticity, one needs to fix benchmark values for the level of production, the inputs of capital and labor and for the marginal rate of substitution, or equivalently for per-capita production, capital intensity and factor income shares.

Overall, we can say the following points.

(a) Normalization is necessary for identifying in an economically meaningful way the constants of integration which appear in the solution to the differential equation from which the CES function is derived (and thus makes it suitable for comparative-static analysis).

(b) Normalization helps to distinguish among the various functional forms, which have been developed in the CES literature and thus to choose which CES production functions are legitimate.

(c) Normalization is necessary for securing the basic property of CES production in the context of growth theory, namely the strictly positive relationship between the substitution elasticity and the output level given the CES function's representation as a 'General Mean'.

(d) In situations where the researchers wish to gauge the sensitivity of results (steady-state or dynamic) to variations in the substitution elasticity, normalization is imperative.

(e) Normalization alleviates the estimation of the deep parameters of the aggregate production function, in particular the elasticity of substitution and the growth rates of factor-augmenting technical progress.

(f) Normalization is convenient when biases in the direction of technical progress are to be empirically determined, since it fixes a benchmark value for factor income shares. This is important when it comes to an empirical evaluation of changes in income distribution arising from technical progress. If technical progress is biased in the sense that factor income shares change over time the nature of this bias can be best classified with regard to a given baseline value.

That said, in our view there are at least five promising and related areas for future

research on normalization:

(1) Following Jones (2005) one can regard a macroeconomic production function as a reduced form which should be derived from micro-foundations. This conjecture has been taken up by Growiec (2008) who shows that a CES production function can be linked to Weibull distributions of unit factor productivities, whereas a Cobb–Douglas function responds to Pareto distributions. It is still an open question, however, how the normalization values of the CES function can be linked in a meaningful way to the parameters of the underlying unit factor productivity distributions.[24]

(2) A better understanding of the micro-foundations of the normalized CES function would also help to better understand reasons for possible international differences and intertemporal changes in the elasticity of substitution. Both seem to be linked to some deeper economic, social and cultural parameters as well as to the level of development measured by capital per units of labor or income per capita (Klump and de La Grandville 2000; Duffy and Papageorgiou 2000; Masanjala and Papageorgiou 2004; Mallick 2010, Wong and Yip 2010).

(3) La Grandville (2009, 2012) has suggested that an increase in the elasticity of substitution has a much stronger effect on aggregate wealth than an increase in the rate of technical progress. This suggestion can be viewed in two ways. First, in terms of comparative statics. For example, if two countries are otherwise the same but have different (though constant) substitution elasticities, one can trace the effects of that difference on their growth prospects. Second, even though the substitution elasticity empirically is (or appears to be) quite stable, such structural changes (e.g., larger internal or external markets) are possible, that make factor substitution easier and may launch some kind of 'sigma-augmenting' technical progress at work whose exact mechanisms are not yet understood. Kamien and Schwartz (1968) had already pointed out that changes in the elasticity of substitution have similar effects on relative factor prices and on the distribution of income as the augmentation in factor efficiency. This is obvious from expression (31) given above. As in other areas of induced technical change, these changes in relative factor prices and income distribution might trigger biases in the direction of technical change which are worth being analyzed in more detail.[25]

[24] Prompted by this remark in a first draft of our survey, Jakub Growiec explored the link in Growiec (2011).

[25] Since Hicks (1932), the value of the substitution elasticity has often been seen as reflecting economic flexibility and thus deep institutional factors such as labor bargaining power, the taxation burden, degree of economic openness, the characteristics of national education system, etc. Accordingly, some view changes in the substitution elasticity as drivers of endogenous growth and as such potentially even more important than traditionally studied growth factors such as savings and technical progress (La Grandville 2009; Yuhn 1991).

(4) In business-cycle and growth models, the Cobb–Douglas aggregate production function is the default choice. However, the convenience/centrality of Cobb–Douglas production functions in macro is likely to be obscuring important issues. We would therefore expect that normalization –which leads to a clarified and deeper understanding of CES properties – will end up being more widely used in such models. In so doing, its use should help shed light on the propagation and decomposition of business-cycle shocks and policy transmissions.

(5) Production functions are often single-level variants, given that, in macroeconomics certainly, only two factors of production are considered. However, potentially that obscures the interactions between and within different factor categories. For example, there are high- and low-skill types of labor and different strata of capital such as equipment, software, and buildings and infrastructure. In this respect, an important departure from the aggregative framework was made in the seminal contributions of Kazuo Sato and Zvi Griliches. Sato (1967) generalized the CES production function by nesting the CES at two levels and augmenting the list of possible inputs.

A popular focus for work on the two-level CES function is on explanations of the increase in the skill premium observed in western economies during the last three decades. Does the premium reflect capital–skill complementarity (as in Griliches 1969 and Krussel *et al.* 2000)? Or can the premium can be attributed to technical change that was biased in favor of skilled workers (e.g., Katz and Murphy 1992, Acemoglu 2002b; Autor *et al.* 2008)?[26] Both approaches rely on particular nestings and estimated values for the elasticities of substitution between different categories of production factors and would be highly amenable to the simplification that normalization offers [see Leon-Ledesma *et al.* (2012) for some early work in that direction]. Knowledge of this might also deepen our understanding of skill

This is termed the 'de La Grandville Hypothesis' following Yuhn (1991) (i.e., the conjecture that the high growth rate of east Asian countries was due not to a higher rate of technical progress, but to a higher elasticity of substitution). Also, earlier, Solow (1956) and Pitchford (1960) showed in the neoclassical growth model that a CES function with an elasticity of substitution greater than one can generate sustained growth (even without technical progress). See also Masanjala and Papageorgiou (2004) for a theoretical model where the aggregate elasticity of substitution is endogenized and depends on the level of economic development.

[26] The capital–skill hypothesis gained particular currency given the sharp decline in the constant-quality relative price of equipment, for example, Gordon (1990), particularly for information and communication technologies. This decline naturally led to an uptake in usage of such capital. Given complementarity between capital and skilled labor, the faster usage of such capital increased the relative demand for skilled labor and – despite the apparent increase in the supply of such labor – the skill or wage premium relative to unskilled labor increased in a dramatic and persistent manner. On the other hand, authors such as Katz and Murphy (1992), Acemoglu (2002b) and Autor *et al.* (2008) claimed that the skill premium can be attributed to technical change that was biased in favor of skilled workers. Given that skilled and unskilled workers are gross substitutes, an increase in skilled labor efficiency led to an increase in the relative wages (and factor shares) of skilled workers.

differences between and within developing countries.

To conclude our survey, we re-stress that production functions are ubiquitous in theoretical and empirical models, and ubiquitously Cobb–Douglas! This appears to us not only an unjustifiable simplification but also an impediment to understanding various economic phenomena. The paper by CLMW (2010) is hopefully a useful contribution in fashioning otherwise standard Real Business Cycle and New Keynesian models around a normalized CES supply side and showing the impact in terms of overturning the prediction that these separate models made for the technology–hours correlation. But this is merely one example. We would hope therefore that normalized CES functions would be an integral part of the make-up of macroeconomic models, in the same way as nominal and real rigidities have become.

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IMI International Monetary Review

Risk-Adjusted Performance of Mutual Funds: Evidence from China*

By GANG JIANHUA* and QIAN ZONGXIN**

In this paper, we evaluate the performance of individual mutual fund listed in China between 2006 and 2014. We build an indicator more consistent with investors' rationality to track funds' performance. More specifically, we firstly estimate the time-varying abnormal returns of each China's mutual fund by introducing an additional factor of active peer benchmark. An index of riskiness is then estimated and used to calculate the augmented performance measure (APM). The APM therefore addresses investors' preference towards managerial premium of a certain fund and their aversion to the tail risk. Empirical evidence shows that the APM incorporates information beyond the first and second moments of the distribution of fund returns, therefore it encompasses better fund-choosing decisions as compared with Sharpe ratio and the economic performance measure.

1 Introduction

Performance of mutual funds can be evaluated by comparing their historical abnormal return series, which are defined as excess fund returns excluding the compensations for various risk factors. Conditional on their systematic risk exposure, indicators as such are well-documented and designed to measure funds' ability to generate profits over safe assets. Therefore, investors may be attracted by funds with "superior" performance than other ones. Literature on the factor-model family to estimate the abnormal returns is rich, both theoretically and empirically. In his seminal study, Jensen (1968) uses a single factor model to estimate the abnormal return series. Jensen's single factor model is then quickly extended to include more factors in order to capture more explanatory variables to accurately explain the excess return. Fama and French (1993) introduces a three-factor model and Carhart (1997) adds a measurement of momentum as a fourth factor to pin-point the effect of persistence. Recent contribution (Ferson and Schadt, 1996; Christopherson et al.,

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* Research Fellow of IMI, School of Finance, Renmin University of China.
**Research Fellow of IMI, School of Finance, Renmin University of China. Corresponding author, tel: 00861082500617; email: qianzx@ruc.edu.cn.

1998; Avramov and Wermers, 2006; Mamaysky et al., 2008) allows time variations in the estimated abnormal returns. Hunter et al. (2014) proposes an active peer benchmark (APB)-augmented factor model, which accounts for commonalities in mutual fund strategies. Empirical evidence shows that this augmentation substantially reduce the correlation of residuals between categorized individual funds, which makes the alpha keen to reflect out-performance of management skill within fund categories.

Compared with the standard Sharpe ratio, the advantage of the abnormal return-based indicator acknowledges that mutual funds are not only affected by management skills of the funds but also affected by changes in the systematic risk. Funds' excess returns used to calculate standard Sharpe ratios do not exclude systematic risk compensations, and therefore, may bias the evaluation results. The idea of Sharpe ratio to formulate a risk-adjusted return while implying normality is reasonably consistent with individual rationality. The reason is simple: rational and risk-averse investors would tend to appreciate one unit of excess profit only if it would not incur too much excess volatility. Investors therefore will be indifferent towards different investments with identical return-risk ratio. The Sharpe ratio is then a typical implementation of the tradeoff between fund's returns and the corresponding volatility. It uses the standard deviation of excess returns of a given fund's as an indicator of risk.

However, the standard deviation being a proxy of riskiness has been widely criticized, because one of the prerequisites for it to be reasonable is the assumption of normality. As is well known, non-Gaussian properties such as non-zero skewness or excess kurtosis are the norms of the financial market yet completely discarded by lower moments. Therefore, investment decision based only on the lower moments would be misleading and expose investors to tail risk. Realizing this, Homm and Pigorsch (2012) formulates an economic performance measure (EPM) which includes the information contained in higher moments as well as in lower ones. Specifically, the denominator of the Sharpe ratio is replaced by the Aumann and Serrano (2008) economic index (the AS index) of riskiness. Despite its analytical elegance, the Homm and Pigorsch (2012) EPM, as a single indicator of the refined risk-adjusted excess return by construction, fails to tell investors which fund may be chosen because of its superior management skills. Rather, a higher EPM can objectively tell a better balance of all four moments in the return series of a given fund, and vice versa. In other words, the EPM calculation is based on the excess fund returns as its nominator and the AS index as its denominator. Hence, although the EPM addresses the importance of higher moments of the fund's returns across

time, it does not discriminate management premium from systematic risk compensations.

In this paper, we combine the APB-augmented four factor model of Hunter et al. (2014) with the Homm and Pigorsch (2012) EPM. The essential idea is to distill the superior management premium from the abnormal returns of funds whilst addressing the non-normality of the raw return distribution. More specifically, our model can be demonstrated as a two-step procedure: First, we estimate the abnormal fund returns using the APB-augmented four factor model; Second, we estimate the AS index of riskiness and then calculate the Homm and Pigorsch (2012) EPM using the estimated abnormal returns from the first step. In this way, we manage to separate the management skill premium of funds from systematic risk compensations and, in the meantime, normalize the premium by the corresponding risk in terms of weighted average of all four moments. The resulting per risk return is more likely to capture the contributions of active fund managers.

We apply our model to evaluate the performance of all funds that are publicly listed in China from 2006 to 2014. Existing literature on China's financial markets has focused on stock market reforms and their impacts (Firth et al., 2010; Li et al., 2011; Liao et al., 2011, 2014; Liu et al., 2014); asset pricing (Yao and Luo, 2009; Xiong and Yu, 2011); and spillover effects across sectors or markets in/between domestic China or/and outside China (see Chen et al., 2010; Moon and Yu, 2010; Qian and Luo, 2014).[1] However, very few studies focus on the performance of China-listed funds. One most relevant paper by Xu (2005) studies the investment funds' daily performance from 2000 to 2004 using a single-factor model. the contribution of our paper is then four-fold: Firstly, we focus on most China-listed funds' abnormal returns rather than the excess returns in order to pin-point the best ones because of their superior management skills; secondly, compared with the single-factor model, the four-factor model controls potential bias caused by omitted variables; thirdly, active peer benchmarks are then introduced in the baseline four-factor model, which reduces residual commonalities arising from similar trading strategies among fund managers. Therefore, management skill premium would accurately emerge as the APB-adjusted alpha; finally, we implement the EPM measurement which takes into account skew and fat-tail behavior in the fund's abnormal return series which is even more consistent with individual rationality.

The paper proceeds as follows: Section 2 introduces the background information on the development of China's mutual funds industry; Section 3 introduces our methodology; Section 4 describes the data-set; Section 5 presents and discusses the

[1] See Xu (2005) for a survey of relevant literature.

empirical results; Section 6 concludes the paper.

2 The development of the mutual fund industry in China

China had the very first investment fund in 1991. Throughout the whole 1990's, China's investment fund industry was featured by the closed-end, trust-like investment funds and the lack of necessary regulation. In these early days, the number of China's closed-end funds (the "old funds") was small and the assets under management were insignificant. In late 1997, the State Council of China issued the Interim Measures for the Administration of Securities Investment Funds, which came into effect in 1998. Newly-established funds (the "new funds") that were of investment purpose must yield to regulations of this interim policy, and that all regulations with regard to investment funds must be carried out by the China Securities Regulatory Commission (the CSRC). But again, only the closed-end funds were allowed by then and operations of these funds are subject to many conservative regulatory constraints[2]. Not until 2001 was the first open-end fund introduced and publicly traded, which is also known as the first mutual fund in China. After 2002, China's mutual fund industry started to boom[3], especially after the launch of the Securities Investment Funds Law in June, 2004, and mutual funds quickly dominated China's fund market. Recent statistics from the CSRC show that there are 1,897 funds valued at 731.5 billion US dollars that are publicly listed by the end of 2014, among which 1,763 are mutual funds valued at 709.5 billion US dollars, accounting for 97 per cent of the aggregate market value of all public funds.[4]

3 Methodology

3.1 A two-stage augmented performance measure

The augmented performance measure (APM) that we derive generalizes the Hunter et al. (2014) APB-augmented four-factor model in two distinct dimensions: First, our model sets all parameters to be time-varying in order to satisfy optimal dynamic strategies. Second, the APM is capable to track low- and high-order risk. Specifically, our model not only eliminates common component (due to common strategies among fund managers) from the residuals regarding cross correlation but also evaluates risk element within abnormal returns (proxied by the APB-adjusted alphas). The APM model then has two stages as follows,

[2] See Xu (2005) for details.

[3] In 2002, China's first fund specialized in the bond market was established and China's first money market fund was introduced in 2003.

[4] Before 2006, institutional investors occupied over 50 per cent of mutual fund holdings, while individuals held more than 80 percent by the end of 2010.

Stage 1: We generalize the Carhart (1997) four-factor model into a setting which allows parameters to be time-varying. This four-factor model is then used as the baseline model. We then follow the paper by Hunter et al. (2014) to include an APB factor in the baseline model. In this stage, we focus on the time-varying Jensen's alphas in the augmented-APB model.

Stage 2: We then introduce a risk gauge, the augmented performance mea-sure (APM), to further adjust Jensen's alphas derived from stage 1. We implement the calculation procedure of the economic performance measure (EPM) by Homm and Pigorsch (2012), but replace the excess return series by the time-varying alphas. In contrast to the Sharpe ratio, the APM divides the "mean excess alphas" by its AS index instead of dividing by its standard deviation.

In the following three subsections, we break down the two-stage procedure and statistical features of the APM.

3.2 The APB-augmented factor model

Methodology to evaluate fund's performance varies from a simple Sharpe ratio comparison to a family of mutiple factor models, among which Carhart (1997) revises the Fama and French (1993) model by introducing a fourth factor to track momentum. Recent literature generalizes the settings of alpha and beta to be time-varying either with exogenous economic variables or Kalman filters. Another thread of literature addresses the problem of similar strategies used by fund managers, so that it is difficult to tell the star mangers from the crowd due to correlated residuals. Recent empirical evidence reiterates common practices of liquidity preference and momentum may cloud the real causes of funds' superior performance. Our method follows Hunter et al. (2014) to include an active peer benchmark (APB) in the conventional four-factor model. Ac-cording to Hunter et al. (2014), the APB then corrects the commonality bias by decomposing Jensen's alpha into some systematic component and the skill premium. Therefore, an econometric meaning of the APB is to stand as an additional independent variable to control common, unpriced idiosyncratic risks taken by mutual funds, while the practical idea to include an APB resides in the endogenous selection of a certain fund within its category, in addition to the exogenously determined factors in the standard regressions estimating the fund loadings and Jensen's alpha.

In this study, we firstly generalize the static Carhart (1997) four-factor model into a setting which allows parameters to be time-varying. This TVP four-factor model is then used as our baseline model. The model is as follows,

$$\begin{aligned} r_{i,t} &= \alpha_{i,t} + \beta_{i,t,rmrf} r_{rmrf,t} + \beta_{i,t,smb} r_{smb,t} + \beta_{i,t,hml} r_{hml,t} \\ &\quad + \beta_{i,t,umd} r_{umd,t} + e_{i,t} \end{aligned} \tag{1}$$

where, ri,t is the fund i0s monthly NAV return minus the three-month treasury bill rate, and rrmrf,t, rsmb,t, rhml,t, and rumd,t are the excess return on the market value-weighted portfolio[5], returns of size, book-to-market, and momentum[6]. Independent variables in terms of returns in model (1) are based on monthly time series. It is important to note that all coefficients in equation (1), αi,t, βi,t,rmrf , βi,t,smb, βi,t,hml, and βi,t,umd, are time-varying parameters (TVP) in certain predetermined rolling windows. This TVP setting is desirable and meaningful because dynamic strategies would certainly prefer funds with competitive abnormal returns (positive Jensen's alpha or αi,t in model (1) and statistically significant) and the stability of it.

We then follow the paper by Hunter et al. (2014) to include an APB factor in our baseline model,

$$r_{i,t} = \alpha_{i,t} + \beta_{i,t,rmrf} r_{rmrf,t} + \beta_{i,t,smb} r_{smb,t} + \beta_{i,t,hml} r_{hml,t} + \beta_{i,t,umd} r_{umd,t} + \lambda_{i,t} \varepsilon_{APB_i,t} + e_{i,t}. \quad (2)$$

And again, TVPs are assumed in the augmented model (2). According to Hunter et al. (2014), model (2) suggests if a fund manager's superior performance is truly unique and uncorrelated with his active peer group's average, then the alpha is identical as in the four-factor model (1). Otherwise the i,t should yield to adjustment by the term i,tAPBi,t. In many cases, the existence of i,tAPBi,t would even render Jensen's alpha insignificant, because fund managers may follow similar profitable strategies. Therefore, model (2) eliminates commonalities in idiosyncratic risk-taking by funds in the same active peer benchmark group. As a result, it improves the estimation efficiency of the standard four-factor model.

However, the APB-adjusted alpha is a measure of absolute abnormal return. Investors' income fluctuation risk associated with time variations in this setting is neglected. It could be the case that fund managers take on excess risk in order to offer competitive abnormal return. Hence, focusing on the value of APB-adjusted alpha may still incomplete even though it is reliable to reflect skill premium. Rational investors require reasonable risk levels in terms of low and high orders. A risk-adjusted performance indicator is then necessary to account for the additional

[5] China (excluding Hong Kong) has two stock exchanges: the Shanghai and Shengzhen stock markets and no stock in China can be cross-listed simultaneously in both markets. Because of the capital control, China also has two categories of stocks targeting different types of investors: the A-share for Chinese citizens and B-share for non-citizens to trade (insignificant in terms of trading volume). Here, the market value-weighted portfolio we use consists of listed stocks both in Shanghai and Shenzhen exchanges but only includes the A-shares.

[6] Data for momentum of China's stocks comes from the Resset Database, http://www.resset.cn/en/.

risk associated with potential aggressiveness of fund managers.

3.3 APM as a measurement of riskiness

There are several ways to interpret the word “risk” in finance. Rothschild and Stiglitz (1970, 1971) considers increases in risks to be defined in terms of dynamic innovations in the probability density functions. Objective riskiness as such is absolute and risk-neutral. However, agents in the financial market exhibit various subjective preferences towards risk-return relationship. Therefore, Diamond and Stiglitz (1974) generalizes the concept of riskiness by revealing an element of asymmetry that jitters an agent who is risk averse significantly more than if he is otherwise less risk averse. Diamond and Stiglitz (1974) defines the riskiness of a gamble based on two distinct considerations: (i) riskiness of the gamble in absolute terms; and (ii) how risk averse an agent truly is. Hence, a single index capable of addressing both considerations is valuable. Aumann and Serrano (2008) quantifies the riskiness (the AS index) based on the risk aversion. The index is positively homogeneous, continuous, and sub-additive and respects first- and second-order stochastic dominance. The riskiness suggests duality to risk aversion to which a risk-averter is averse. So on the whole, the index reflects the following natural notion of less risky: given that an investment is accepted by some agent, less risk-averse individuals accept riskier investments (Aumann and Serrano, 2008; Homm and Pigorsch, 2012).

The APM is a single index based on the dynamics of Jensen's alpha and the AS index of the alphas, such that it correctly represents skill premium as per risk. While Homm and Pigorsch (2012) directly use the excess fund returns to build the EPM of funds, our approach uses the abnormal fund returns based on the APB-augmented four-factor model which excludes the systematic risk compensations from the excess returns. The APM has the following form,

$$APM(\alpha^*_{i,t}) = \frac{E\left(\alpha^*_{i,t}\right)}{AS(\alpha^*_{i,t})} \tag{3}$$

where AS(:) stands for the AS index (see Aumann and Serrano (2008)). Thus, in contrast to the Sharpe ratio, the APM divides the \mean excess alphas" by its AS index. According to Homm and Pigorsch (2012), the APM can be constructed with various settings: normal distribution assumption (equivalent to the Sharpe ratio), inverse normal distribution (NIG), and the nonparametric procedures. In order to make our results practically applicable (minimizing sample selection bias) and also distinct from the Sharpe ratio, we focus on the NIG calculation. Therefore, the representation of the AS index and of the APM in terms of the moments is given by:

$$\widetilde{AS}^{(NIG)}(\mu,\sigma^2,\chi,\kappa) = \frac{\left(3\kappa\mu - 4\mu\chi^2 - 6\chi\sigma + \frac{9\sigma^2}{\mu}\right)}{18} \quad (4)$$

$$\widetilde{APM}^{(NIG)}(\mu,\sigma^2,\chi,\kappa) = \frac{18\mu}{\left(3\kappa\mu - 4\mu\chi^2 - 6\chi\sigma + \frac{9\sigma^2}{\mu}\right)}$$

where μ, σ^2, χ, and κ stands for the first four moments. They all obey conditions that are assumed in Aumann and Serrano (2008).

3.4 Properties of the augmented performance measure

Most properties of the APM can be easily inferred from the properties of the AS index. First of all, because both the numerator and the denominator of the APM as in (3) are homogeneous, so the APM is scale invariant. And because the APM adopts the strictly monotone index by Aumann and Serrano (2008) as its denominator, therefore the APM can be proved to be also strictly first- and second-order monotonic. It is similar to the proof of EPM by Homm and Pigorsch (2012). Provided that the AS index is monotonic with respect to the first- and second-order, and, without generality, assume that first- and second-order dominates, then we have the AS index to be first-(second-) order monotonic AS() < AS().[7] We also know that the mean is monotonic with respect to stochastic dominance, therefore E()E(). It then immediately follows that the APM()APM(), which can be interpreted as the APM itself has the first- (second-) order monotonicity with respect to stochastic dominance. We then follow the generalized continuity properties proved by Homm and Pigorsch (2012) to see if the APM can do well in terms of continuity. The APM clearly satisfies the following assumptions:

Assumption 1. The economic index of riskiness $AS(\alpha_t)$ exists for all $n \geq 0$.

Assumption 2. There exists a real number $b > \frac{1}{AS(\alpha_t)}$, such that $\sup_n M_n(-b) < \infty$:

Homm and Pigorsch (2012) proves that given the above assumptions, the generalized continuity holds as follows[8],

Proposition 1. (Generalized Continuity). If Assumption 1 and 2 hold, then $\alpha_t \xrightarrow{d} \alpha_0$ implies $AS(\alpha_t) \rightarrow AS(\alpha_0)$.

Therefore, if we further assume that the time series of Jensen's alphas, $\{\alpha_t\}_{t\geq 1}$, to be uniformly integrable, then we have the following results with regards to generalized continuity for our APM,

[7] See Aumann and Serrano (2008) for the proof of AS index to be of monotonicity with respect to stochastic dominance.

[8] See Homm and Pigorsch (2012) for very detailed proof.

Corollary 1. (Generalized Continuity for APM). If Assumption 1, 2 hold, then $\alpha_t \xrightarrow{d} \alpha_0$ implies $APM(\alpha_t) \rightarrow APM(\alpha_0)$.

Just as the EPM, the APM approximates the APM of normally distributed returns as the sampling frequency decreases. While the Sharpe ratio is appropriate for low frequency returns, the APM is appropriate for both low and high frequency returns, with no disadvantages compared with the Sharpe ratio in the former case.

There is one more argument about why the APM differs from the Sharpe ratio and the EPM. As criticized by many works, the mean-variance decision framework (the Sharpe ratio) typically ignore either higher moments which matters in the asymmetry of return distribution (at least in finite sample and low frequency data) or much higher probability of extreme events in practice. Therefore, the similarity of APM and EPM resides in the fact that both index consider skewness and kurtosis in addition to location and scale. However, APM and EPM are also very different in terms of reflecting managers' skill premium. The EPM does include this premium implicitly, but as an unobservable component within the excess return, the EPM also includes systematic compensation which shed difficulties to separate the premium. Therefore, investment decisions based on the EPM may exhibit superior features compared with the mean-variance measures but are still incomplete. The reason is simple: investors would typically prefer better managed fund with reasonable risk profile. Hence, the APM that we calculate in this section satisfies both objectives by considering the APB-augmented Jensen's alpha as per risk[9] in general term.

4 Data

According to Mamaysky et al. (2008), we use monthly data rather than the daily data for fund performance to eliminate micro structural problems[10]. The sample starts from 2006 until September of 2014. Our data-set includes official data of China's three-month treasury bill rate, which is only available from China Central Depository and Clearing Co., Ltd. (CCDC) ever since 2006[11]. Time series of dividend-adjusted NAV (net asset values) returns of China's mutual funds is from the Wind[12] database, which classifies China's mutual funds into nine categories (or groups) in terms of their strategic characteristics: the large-cap value (LV), large-cap balance (LB), large-cap growth (LG), mid-cap value (MV), mid-cap balance (MB),

[9] The risk here refers to as the economic index of riskiness (the AS index, Aumann and Serrano (2008)).

[10] More detailed discussion about this can be found in Mamaysky et al. (2008).

[11] There are several unofficial sources that have quite different quotes of the China's T-bill rates, but this paper prefers the official series that reflects the whole market in aggregate terms.

[12] http://www.wind.com.cn/En/Default.aspx

mid-cap growth (MG), small-cap value (SV), small-cap balance (SB), and small-cap growth (SG). The classification of these types is similar to the one in Hunter et al. (2014) for the US funds. Because the APB-augmented model requires cross-sectional data-sets to be large enough to have statistical meanings, therefore, each category in our sample contains at least 30 funds. In addition, only the active funds that have been listed for at least 36 months are chosen. According to our criteria as stated, only the cluster that includes LV, LB, LG, and MG forms a satisfactory data-set. Hence, yielding to some data limitations as above, our analysis focuses on the funds that fall into these four categories. There are 41 funds in the LV, 152 funds in the LB; 224 funds in the LG, and 87 funds in the MG group.

5 Empirical Results

5.1 Group distribution of estimated abnormal returns

Empirical Results are demonstrated through Table 1 to Table 7. Table 1 summarizes distributional properties of the estimated average abnormal returns of individual funds within each fund group. It suggests that, on average, funds in the LV group produce higher abnormal returns than the funds in other groups. Differences in abnormal returns across individual funds are also smaller in the LV group. The group of MG funds has the largest variation of 3.32 percent compared with the other three groups. Normality tests (the last column in Table 1) of the returns are all rejected and highly significant in all groups, which suggests the decision-making based on the mean-variance approach will be misleading at least for finite samples. Test results in Table 1 also imply the non-normality is partially caused by dramatic skewness (positive or negative). Therefore, the violation of normality due to higher-order moments leads to the necessity of ranking individual funds according to a much general risk-return trade-off.

5.2 Fund ranking

Table 2 to 5 summarize the rankings of individual funds (the top 20) within each group according to their augmented performance measures (the APM) that we have built in section 3. To facilitate comparisons of the results, we assign exclusive ticker to each fund for identification. Our ticker system has a general format of "the group ticker" plus "individual fund ID".[13] Table 2 to 5 report rankings based on three different criteria: the APM, Sharpe ratio, and average abnormal return (the APB-augmented alpha or the APB-). In general, risk-averse investors may not want

[13] Due to the length limit, we are unable to provide all fund names as well as their tickers anywhere in this paper. An appendix which lists the Wind codes, names of individual funds and their corresponding tickers can be obtained upon request from the author.

to pick a certain fund only according to its dominating APB-, because after adjusting its accompanying risk (low-and high-order moments) this particular fund does not seem attractive in the aspect of superior management. For example, the one with the highest APB-in the large-cap value (LV) group (see Table 2, fund ID: 37) only ranks the thirteenth after risk-adjustment based on Sharpe ratio and APM. Likewise, the top fund under APB in the large-cap balance (LB) group (see Table 3, fund ID: 181) ranks the twenty-eighth under Sharpe ratio, but the third under the APM. Therefore, results show that the skill premium itself is volatile, and some funds may trump their peers only accidentally but in no sense sustainably. It is also true that some funds exhibit heavy volatility in low order but rarely in higher order. Similarly, the large-cap growth (LG) group as in Table 4 puts the best APB-fund (ID: 204) into a place outside top-ten under the Sharpe ratio, but its performance is still preferable, though not the best, if we put weights on superior higher order moments of its return distribution. The ranking of the top-one fund by APB-in the mid-cap growth funds (see Table 5, ID: 25) plummets after risk adjustments.

Table 6 reports the correlations between rankings by different performance indicators. As is clear from this table, the three performance indicators generate systematically different fund rankings. Results in Table 6 suggest that a rational and risk averse investor most likely would choose a set of completely different funds than an investor who is risk neutral. Table 6 therefore implies high-order moments of the abnormal return distribution, such as skewness and kurtosis, are non-negligible in calculating investment risk to investors who are risk averse. Fund selection under the Sharpe ratio may expose investors to excessive risk as suggested by exotic skewness and excess kurtosis, which generate welfare loss.

5.3 Performance comparison across groups

Table 7 summarizes the distributional properties of the APMs in different groups. On average, funds belonging to the LV category perform much better than other groups in terms of the APM (3.65 in LV versus 0.61 in LB, 0.47 in LG and 1.00 in MG). The LV fund group also has the highest median performance of 3.28 (medians of 0.16, 0.29 and 1.07 in the LB, LG and MG, respectively). However, dispersion of the performances in the LV group is also substantial. Results as such suggest that categorizing mutual funds solely based on their strategic characteristics (value, balance or growth) does not apply in China. Table 7 also gives the normality tests (the fifth column), which are all highly significant and therefore reject the null of Gaussian distribution. The pairwise Wilcoxon signed-rank tests are also provided in the last column of Table 7, which intend to test the null hypothesis of zero difference between the observed signed-rank medians and the zero signed-rank median. And

results returned show the group medians are significantly different from zero. Hence, the median funds in all four groups generate positive utility gains for risk-averse fund investors.

6 Conclusion

We study the economic performance of mutual funds in China over the sample period from 2006 to 2014 using monthly data. In order to separate fund managers' skill premium from systematic risk compensations, we implement the active peer benchmark (APB) augmented four factor model. The APB-augmented model is then used as the baseline model. Our approach is a two-stage procedure which is designed to firstly (stage one) estimate the APB-augmented abnormal returns of individual funds. A new feature is then introduced (stage two): we consider the general distributional properties in terms of high-order moments that the abnormal returns may exhibit and calculate the augmented performance measure (the APM). The APM is a measure that takes into account the risk (revealed by low- and high-order moments) associated with time variations in abnormal returns of individual funds. The APM therefore differs from the Sharpe ratio and the EPM. It satisfies risk averse investors' needs of preferring some fund which delivers better returns due to superior managerial skills and has reasonable risk profile at the same time. In essence, the APM can achieve both objectives by considering the APB-augmented Jensen's alpha as per risk in a general term. Using a sample from China's mutual fund market, we are able to show that fund selections based on the rankings of average abnormal returns may not be sufficient for risk-averse investors. In principal, choosing a fund that has some modest return but less risk may improve investors' welfare. Empirical evidence in this paper further confirms that skewness and kurtosis contain valuable information for the true riskiness of funds and therefore should not be neglected. Hence, investment decisions based on mean-variance measures are sometimes misleading. Finally, although mutual funds' performance in China is diverse, funds with median performance of each group are still producing positive values for their investors, which shows the benefit that institutional investors can bring.

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Table 1 Summary statistics of individual funds' average abnormal returns

Group	Group Mean	Group Median	Group S.D.	Group Min	Group Max	Normality
Largecap Value	0.43%	0.49%	0.42%	-1.08%	1.07%	0.00
Largecap Balance	0.14%	0.20%	0.91%	-5.59%	2.30%	0.00
Largecap Growth	0.18%	0.17%	0.86%	-3.43%	3.86%	0.00
Midcap Growth	0.09%	-0.21%	3.32%	-17.77%	20.86%	0.00

Notes: Abnormal returns are non-annualized monthly returns. The normality reports *p* values of the Jarque-Bera test.

Table 2 Rankings in the Largecap Value (LV) group

Ranking	Criteria		
	APM	Sharpe	APB − α
1	7	36	37
2	53	43	39
3	36	25	29
4	38	42	36
5	52	9	32
6	54	8	53
7	16	53	35
8	15	39	49
9	9	35	26
10	19	51	22
11	40	29	51
12	49	32	15
13	37	37	25
14	23	47	19
15	42	22	52
16	32	26	3
17	39	21	8
18	3	49	18
19	27	34	43
20	34	3	47
21	29	7	12
22	35	19	48
23	20	16	38
24	43	18	16
25	8	38	54
26	21	54	40
27	51	48	21
28	47	15	23
29	48	52	27
30	18	23	7

Notes: Numbers that are under the three criteria (APM, Sharpe and APB − α) stand for the fund IDs within the LV category (group). The rankings are done independently based on the APM, Sharpe and APB − α, respectively. Table 2 to 5 only lists the top-30 funds as suggested in the column with the title "Ranking" (the first column).

Table 3 Rankings in the Largecap Balance (LB) group

Ranking	Criteria		
	APM	Sharpe	APB − α
1	167	36	181
2	41	157	98
3	181	208	162
4	178	211	152
5	29	183	67
6	229	188	207
7	163	84	85
8	82	65	228
9	23	40	105
10	183	78	46
11	65	27	33
12	49	37	210
13	36	160	231
14	117	24	227
15	188	231	41
16	43	158	29
17	233	216	117
18	84	118	189
19	40	70	212
20	152	49	167
21	46	167	65
22	97	23	166
23	102	217	154
24	208	46	125
25	157	29	163
26	78	119	120
27	211	97	224
28	118	181	180
29	216	152	178
30	27	221	36

Notes: Numbers that are under the three criteria (APM, Sharpe and APB − α) stand for the fund IDs within the LB category (group). The rankings are done independently based on the APM, Sharpe and APB − α, respectively.

Table 4 Rankings in the Largecap Growth (LG) group

Ranking	Criterion		
	APM	Sharpe	APB − α
1	52	57	204
2	40	202	210
3	154	231	31
4	148	182	242
5	204	240	37
6	179	50	142
7	57	29	263
8	50	1	195
9	45	40	282
10	151	179	120
11	82	150	57
12	240	48	249
13	182	178	150
14	1	128	145
15	263	47	274
16	265	165	52
17	48	167	95
18	29	161	1
19	47	239	134
20	150	130	175
21	130	172	130
22	65	58	183
23	128	95	240
24	274	66	62
25	185	72	185
26	239	96	110
27	235	204	254
28	202	263	66
29	178	52	212
30	231	156	179

Notes: Numbers that are under the three criteria (APM, Sharpe and APB − α) stand for the fund IDs within the LG category (group). The rankings are done independently based on the APM, Sharpe and APB − α, respectively.

Table 5 Rankings in the Midcap Growth (MG) group

Ranking	Criterion		
	APM	Sharpe	APB − α
1	65	61	25
2	78	19	63
3	68	116	125
4	122	98	52
5	66	41	75
6	69	93	113
7	57	113	100
8	110	63	98
9	46	85	90
10	30	115	124
11	109	22	115
12	88	52	61
13	32	75	93
14	106	36	116
15	61	125	41
16	82	86	19
17	71	25	22
18	113	95	36
19	79	45	95
20	94	37	49
21	81	49	45
22	59	100	24
23	51	96	37
24	116	90	111
25	105	111	96
26	108	42	34
27	56	24	85
28	72	124	58
29	50	34	17
30	28	58	42

Notes: Numbers that are under the three criteria (APM, Sharpe and APB − α) stand for the fund IDs within the MG category (group). The rankings are done independently based on the APM, Sharpe and APB − α, respectively.

Table 6 Correlations between rankings by different performance indicators

Fund Group	APM, Sharpe	Sharpe, APB − α	APB − α, APM
Largecap Value	-0.19	0.21	0.09
	(0.23)	(0.18)	(0.58)
Largecap Balance	0.06	0.06	0.04
	(0.45)	(0.47)	(0.63)
Largecap Growth	0.00	-0.07	0.01
	(0.95)	(0.30)	(0.88)
Midcap Growth	-0.04	0.08	-0.19
	(0.72)	(0.46)	(0.09)

Notes: *p* values are in the parenthesis.

Table 7 APM distributions of different groups

Fund Group	Mean	Median	S.D.	Normality	Signed-rank
Largecap Value	3.65	3.28	3.01	0.00	0.00
Largecap Balance	0.61	0.16	2.95	0.00	0.00
Largecap Growth	0.47	0.29	2.26	0.00	0.00
Midcap Growth	1.00	1.07	1.03	0.00	0.00

Notes: *p* values are reported for the normality test (fifth column) and the Wilcoxon signed-rank test (sixth column) of median for statistical significance. The pairwise Wilcoxon signed-rank test has a null hypothesis of zero expected median by comparing the signed-rank of the observed series with a synthesized series with zero median. A significant signed-rank test means the observed median differs from zero significantly.

IMI News

2015 IMI Annual Academic Committee and Plenary Meeting

On January 31, IMI Annual Academic Committee and Plenary Meeting was held in Culture Square. Many distinguished IMI academic committee members attended the meeting, including: Chen Yulu, Chairman of the Committee, President of Renmin University; Ben Shenglin, Professor of Zhejiang University; Cao Tong, President of WeBank; Hu Xuehao, Deputy Director General, Ministry of Finance; Ji Zhihong, Director General, Financial Market Department, PBoC; Liu Jun, Executive Director and Vice President, China Everbright Group; Wei Benhua, Former Deputy Administrator-in-Bureau, the State Administration of Foreign Exchange; Xuan Changneng, Director General, Financial Stability Bureau, PBoC; Alfred Schipke, Senior Resident Representative, IMF China; Zhang Jie, Associate Dean, School of Finance, Renmin University; Zhang Zhixiang, Former Director General, International Department of PBoC; Zhao Haiying, Vice President, Central Huijin Investment Ltd, etc.

Director Zhang Jie presented IMI Report 2014 and outlined 2015 plans. He also made an overview on IMI's Ten Highlights during the last year as follows.

1. 2014 International Monetary Forum and Press Conference of RMB Internationalization Report which enormously increased the international influence of the Report.

2. EuroRMB Seminars in London and Frankfurt. It is the first time that a Chinese think tank started European road show on RMB internationalization issues.

3. Updated academic exchange platforms including Round-table on Money and Finance and Macro-Finance Salon.

4. Issuance of the English quarterly International Monetary Review which completed the structure of "4 periodicals and 1 book series".

5. Breakthrough of team building with the appointment of Pan Gongsheng and Wang Zhaoxing as Advisory Board members and Rainer Klump, etc., as Academic Committee members.

6. Launch of "Series of IMF History" Project. It is the first time for the most authoritative and circumstantial book series about IMF to be translated into English.

7. Enhancement of international exchange. IMI has established long-term

strategic partnerships with more than 20 organizations and academic institutions from Europe, America and Asia.

8. Initiation of the Talent Development Project which is a sustainable training program organized in a professional and all-round way.

9. Strengthening of the "3+1" media communication platform by utilizing the complementary advantage of traditional and new media.

10. Practice of the standard work process under the "One Chart" Project leading to the leap of standardization and systematization constructions.

Round-table on Money and Finance

Round-table on Money and Finance·Winter 2014
2015, China's Financial New Force

On January 10, Round-table on Money and Finance • Winter 2014, which themed on "2015, China's Financial New Force", was held in Shenzhen. More than 150 distinguished guests from Beijing, Shenzhen, Hong Kong and Taiwan attended the conference, including Pan Gongsheng, deputy-governor of PBoC; Ma Weihua, former president of China Merchants Bank; Cao Tong, co-director of IMI, president of WeBank; Xiang Songzuo, chief economist of Agricultural Bank of China; Liu Jun, vice president of China Everbright Group; Zhang Jianjun, president of PBoC Shenzhen; Wang Yongli from Bank of China; etc. Ben Shenglin, executive director of IMI, chaired the conference.

Governor Pan Gongsheng elaborated on the relationship between "economic new normal and financial business model" in his opening speech. Mr. Ma Weihua emphasized that the financial industry should actively adapt to the new normal, cultivate financial demands and search for development momentum. Mr. Cao tong gave a speech on "the Social significance and development path of Internet finance". Mr. Liu Jun stressed in his comments that the nature of finance is credit. Finance can accelerate the flow of capital, and internet finance can make it even faster. Mr. Xiang Songzuo pointed out in his comments that the safety of domestic and international internet payment and the management of new payment instruments are major problems to be solved in internet clearance system.

Macro-Finance Salon

Macro-Finance Salon (No. 19): Theoretical Thinking on RMB Internationalization

On January 25, Macro-Finance Salon (No. 19) was held in Renmin University. Dr. Wang Yu, deputy director of PBoC Research Bureau, was invited to deliver a speech entitled "Theoretical Thinking on RMB internationalization". Dr. Wang shared her theoretical thinking on RMB internationalization in five aspects: background and history of RMB internationalization, establishment of relevant policy framework, development of cross-border RMB business, development of off-shore RMB market and the future of RMB internationalization.

Macro-Finance Salon (No. 20): Global Outlook--the US Economy and Emerging Markets

On March 17, Macro-Finance Salon (No. 20) was held in Culture Square. Mr. Anoop Singh, managing director and head of regulatory affairs, Asia Pacific for JP Morgan, was invited to deliver a speech on the outlook of the US economy and emerging markets. He talked about the outlook of global economy from the perspectives of the US economy, the Fed's policy changes, low growth rate in emerging economies, and the key to China's growth. In his opinion, the US economic recovery came from improved labor market, strong dollar and lower oil price. Emerging economies were faced with the problem of inefficient investment and production. The emerging economies should also pay more attention to financial system's role in supporting real economy and promoting entrepreneurship.

Macro-Finance Salon (No. 21): Risks and Opportunities in the "New Normal"--Need Market Solution

On March 20, Macro-Finance Salon (No. 21) was held in Culture Square, Renmin University of China. Mr. Il Houng Lee, member of IMI Academic Committee and President of Korea Institute for International Economic Policy (KIEP), was invited to deliver a speech entitled "Risks and Opportunities in the 'New Normal'". He pointed out that economic fundamentals are beginning to stand on their feet in the US. And at the same time, in order to reduce the uncertainties of marginal return on

capital, the US is supposed to normalize its monetary policy. On the other side of the Atlantic, the disparity of production rates among European countries is worsening, and the effect of the new round of QE in Europe is yet to be tested. While the growth expectation is prolonged in emerging markets, these countries are also under pressure from problems such as weakened growth and aging population.

Macro-Finance Salon (No. 22) and the 2014 Internal Research Report Release Conference (No. 1)

On March 28, the Macro-Finance Salon (No. 22) and the 2014 Internal Research Report Release Conference (No. 1) was held in Renmin University. Prof. He Qing, research fellow of IMI and deputy director of Money and Banking Department, School of Finance, delivered a theme speech.

The conference disclosed the research results over the topic of Global Monetary Layout and Off-shore Market Development. Prof. He demonstrated the background, model planning and analysis of the thesis. He pointed out that trade, capital flows, economic volume, financial development level and even language would all impact the regional distribution of international currency. He also held that RMB internationalization is an irresistible trend, and we must increase RMB's share in major global financial centers.

External Review Meeting of RMB Internationalization Report 2015

On March 22, the External Review Meeting of RMB Internationalization Report 2015 was held in Renmin University. The external review panel addressed the meeting on their review of the third draft of the Report. The meeting was attended by Chen Yulu, chief editor of the Report and president of Renmin University of China; Wei Benhua, former deputy-in-bureau of the State Administration of Foreign Exchange; Lin Dajian, deputy director of the Department of Foreign Affairs of NDRC; Qu Fengjie, director of the Institute of International Economic Research at NDRC; Guo Jianwei and Wang Zuogang, directors of the Monetary Policy Department II of PBoC; Zong Liang, deputy director of the Institute of International Finance of PBoC, and Tu Yonghong, deputy director and council member of IMI. Zhao Xijun, associate dean of the School of Finance, chaired the meeting.

Professor Tu Yonghong first introduced the internal logic and the framework of

this Report. They have set up the theme of this Report as “One Belt and One Road” Initiative, which accords with the national strategies. It is the first time that people from various areas have been invited to compile this Report. During the reviewing session, experts have shared their insights on this Report. Wei Benhua said that this Report is greatly relevant to the national strategic planning. Lin Dajian thought that RMB internationalization will play an important role in the development of “Belt and Road”. Other experts including Guo Jianwei and Sun Lujun have also shared their observations on this Report. In the end, President Chen Yulu concluded that the logical convergence of “Belt and Road” with RMB internationalization will help our future systematic research to be more targeted. China needs to reach balance between the two strategies. The development in our financial system will help to direct global capital to the building of the “Belt and Road”.

Call for Papers

International Monetary Review

International Monetary Review is an internal academic magazine sponsored by International Monetary Institute. Following the principle of including both Chinese and western merits with precise and practical academic spirit, International Monetary Review focuses on the cutting-edge theoretical researches in internationalization of RMB, reform of international monetary system, regional monetary and financial cooperation, China's international financial strategies, and other macro-financial theories and policies.
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Tel: 86-10-62516755
Email: imi@ruc.edu.cn