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Author's Note: I have learned much from collegial dialogues at JKSIS and elsewhere in the US. However, I alone bear the responsibility for the argument in this paper, my modeling efforts and my empirical analysis. All remaining errors are ours.

Abstract

The debate about the Belt and Road Initiative (BRI) in the west seems to have reached an impasse in the absence of any model-based scientific analysis. In order to assess the impact of BRI using consequentialist logic, it is desirable to have model-based counterfactual results. This paper is a first step in that direction. Aggregate consequences for the Chinese economy in terms of economic growth, output and employment impacts are estimated for two BRI scenarios—a high investment and demand scenario and the current low investment and demand scenario. Some important dynamic econometric issues are discussed in an appendix. Also, a more complex economic systems model with explicit banking and financial sectors for the Chinese economy is presented for further, more sophisticated modeling work. As a first approximation, the current modeling results show that BRI will certainly not harm the Chinese economy; but the low demand scenario does not translate into great gains either. The high demand longer term scenario is much more attractive for the economic policymakers in China. However, even in that instance the economic consequences alone cannot justify the strategic importance given to BRI by the Chinese rulers. One possible conclusion is that the geopolitical motives are the main drivers of BRI with modest prospects of economic gains but real prospects of energy security and overall trade and investment security. But this is a delicate and fraught game in geoeconomics and geopolitics in the 21st century.

Keywords: Belt and Road Initiative, China, East Asia, Social Accounting Matrix, Finance

Introduction and Motivation

The idea of the Belt and Road Initiative (BRI) is quite recent. It was first announced in 2013. However, soon, the Chinese leadership, particularly Xi Jinping articulated a grand vision. As the US Council on Foreign Relations (CFR) states with some degree of incredulity:

> Xi's vision included creating a vast network of railways, energy pipelines, highways, and streamlined border crossings, both westward—through the mountainous former Soviet republics—and southward, to Pakistan, India, and the rest of Southeast Asia. Such a network would expand the international use of Chinese currency, the renminbi, while new infrastructure could "break the bottleneck in Asian connectivity," according to Xi. (The Asian Development Bank estimates that the region faces a yearly infrastructure financing shortfall of nearly $800 billion.) In addition to physical infrastructure, China plans to build fifty special economic zones, modeled after the Shenzhen Special Economic Zone, which China launched in 1980 during its economic reforms under leader Deng Xiaoping. Xi subsequently announced plans for the 21st Century Maritime Silk Road at the 2013 summit of the Association of Southeast Asian Nations (ASEAN) in Indonesia. To accommodate expanding maritime trade traffic, China would invest in port development along the Indian Ocean, from Southeast Asia all the way to East Africa. (Chatzky and McBride, 2019)

Official adoption of BRI by CPC took place during the 19th National Party Congress in 2017. CPC formally adopted the Belt and Road Initiative (BRI) under its Party Constitution as part of a resolution to achieve "shared growth through discussion and collaboration." Consequently, President Xi Jinping endorsed a strategy of PRC's international engagement defined by BRI, interpreted by Japan and most of the west as signaling a sustained commitment to BRI as an International Relations initiative by China. Does this Party Congress mark the point at which Chinese foreign policy rhetoric finally shifted to an operational program that spans at least 68 countries? One cannot be so sure, of course and much analytical work in International Relations, International and Global Political Economy and technical International Economics remains to be done.

Although social science work on BRI is of relatively recent origin, non-economic analyses have dominated the work done so far.[2] The main purpose of this brief note is to offer a preliminary

[2] A representative sample from the recent social science literature on BRI will indicate this:

Aoyama, Rumi. 2016. "One Belt, One Road": China's New Global Strategy," *Journal of Contemporary Asian Studies* 5, no.2:3-22. doi: 10.1080/24761028.2016.11869094

Banerjee, Dipankar. 2016. "China's One Belt One Road Initiative," *ISEAS* 14, https://iseas.edu.sg/images/pdf/ISEAS_Perspective_2016_14.pdf

Callahan, William A. 2016 "China's "Asia Dream": The Belt Road Initiative and The New Regional Order," *Asian Journal of Comparative Politics* 1, no.3: 226-243. https://doi.org/10.1177/2057891116647806

Casarini, Nicola. 2015. "Is Europe to Benefit from China's Belt and Road Initiative?" *Instituto Affari Internazionali* 15, no. 40. https://www.iai.it/sites/default/files/iaiwp1540.pdf

Chaisse**,** Julien, Matsushita, Mitsuo. 2018. "China's 'Belt And Road' Initiative: Mapping the World Trade Normative and Strategic Implications," *Journal of World Trade* 52, (1) : 163–185.

Chatzky, Andrew, McBride, James. 2019. "China's Massive Belt and Road Initiative," *Council On Foreign Relations*. https://www.cfr.org/backgrounder/chinas-massive-belt-and-road-initiative

Chen, Xikang. 2005."Extending the Input-Output Model with Assets," *Economic Systems Research* 17, (2): 211-225. https://doi.org/10.1080/09535310500115074

Cheng, Leonard K. 2016. "Three questions on China's "Belt and Road Initiative," *China Economic Review* 40: 309-313. https://doi.org/10.1016/j.chieco.2016.07.008

Clarke, Michael. 2017. "The Belt and Road Initiative: China's New Grand Strategy?" *Asia Policy* 24: 71-79. Doi:10.1353/asp.2017.0023

Ding, Yibing, and Xiao Li. 2017. "The Past and Future of China's Role in the East Asian Economy: A Trade Perspective." *Canadian Public Policy / Analyse De Politiques* 43, no. S2: S45-56. https://www-jstor-org.du.idm.oclc.org/stable/90003694.

Djankov, Simeon, Miner, Sean. (2016) "China's Belt and Road Initiative: Motives, Scope and Challenges," In *PIIE Briefing*. Peterson Institute for International Economics. https://books.google.com/books?id=YbiqCwAAQBAJ&lpg=PT3&ots=83GIVl_Gbb&dq=belt%20road%20initiative&lr&pg=PT3#v=onepage&q&f=false

Du, Julan, Zhang, Yifei. 2018. "Does One Belt One Road Initiative Promote Chinese Overseas Direct Investment," *China Economic Review* 47: 189-205. https://doi.org/10.1016/j.chieco.2017.05.010

Du, Michael M. 2016. "China's "One Belt, One Road" Initiative: Context, Focus, Institutions, and Implications," *The Chinese Journal of Global Governance* 2 (1). https://doi.org/10.1163/23525207-12340014

Fallon, Theresa. 2015. "The New Silk Road: Xi Jinping's Grand Strategy for Eurasia," *American Foreign Policy Interests* 37, no.3: 140-147. doi: 10.1080/10803920.2015.1056682

Ferdinand, Peter. 2016. "Westward ho—the China dream and 'one belt, one road: Chinese foreign policy under Xi Jinping," *International Affairs* 92 (4): 941–957, https://doi.org/10.1111/1468-2346.12660

Horridge, Mark, Wittwer, Glyn. 2008. "SinoTERM, a multi-regional CGE model of China," *China Economic Review* 19 (4): 628-634. https://doi.org/10.1016/j.chieco.2008.05.002Get

Hu, Biliang, Qingjie Liu, and Jiao Yan. 2017. "Promoting the Belt and Road Initiative by Strengthening '5 1' Cooperation." In *China's New Sources of Economic Growth: Human Capital, Innovation and Technological*

Change, edited by Song Ligang, Garnaut Ross, Fang Cai, and Johnston Lauren, 409-30. Australia: ANU Press. http://www.jstor.org.du.idm.oclc.org/stable/j.ctt1trkk3v.25.

Huang, Yiping. 2016. "Understanding China's Belt & Road Initiative: Motivation, Framework and Assesment," *China Economic Review* 40: 314-321. https://doi.org/10.1016/j.chieco.2016.07.007

Hurley, John, Morris, Scott, Portelance, Gailyn. 2018. "Examining the Debt Implications of the Belt and Road Initiative from a Policy Perspective," *Center for Global Development* 121. https://www.cgdev.org/sites/default/files/examining-debt-implications-belt-and-road-initiative-policy-perspective.pdf

Kong, Lingjie. 2015. "The Belt and Road Initiative and China's Foreign Policy Towards Its Territorial and Boundary Disputes," *China Quarterly of International Strategic Studies* 1, no.2: 325-345. https://doi.org/10.1142/S2377740015500165

Li, Jia. (2008) "The Financial Social Accounting Matrix for China, and its Application to a Multiplier Analysis." *Forum of International Development Studies* 36: 215-239. https://mpra.ub.uni-muenchen.de/id/eprint/8174

Murphy, David. (2016) "One Belt One Road: International Development Finance With Chinese Characteristics." In *Pollution*, edited by Davies Gloria, Goldkorn Jeremy, and Tomba Luigi, 245-52. Australia: ANU Press. http://www.jstor.org.du.idm.oclc.org/stable/j.ctt1rqc934.23.

National Bureau of Statistics. 2012. "Input-Output Tables of China," In *China Data Insight,* China: China Statistics. http://cdi.cnki.net/Titles/SingleNJ?NJCode=N2016030122

Nie, Wenjuan. 2016 "Xi Jinping's Foreign Policy Dilemma: One Belt, One Road or the South China Sea?" *Contemporary Southeast Asia* 38, no. 3: 422-44. http://www.jstor.org.du.idm.oclc.org/stable/24916765.

Nordin, Astrid H. M., Weissmann, Mikael. 2018. "Will Trump make China great again? The belt and road initiative and international order," *International Affairs* 94 (2):231–249. https://doi.org/10.1093/ia/iix242

Organization for Economic Co-operation and Development. 2011. "Input-Out Tables," Last Edited 2011. https://stats.oecd.org/Index.aspx?DataSetCode=IOTS

Ratner, Ely. 2018. "Geostrategic and Military Drivers and Implications of the Belt and Road Initiative," *Council on Foreign Relations*. https://www.cfr.org/report/geostrategic-and-military-drivers-and-implications-belt-and-road-initiative

Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R., De Vries, G. J. 2015. "An Illustrated User Guide to the World Input-Output Databases: the Case of Global Automotive Production," *Review of International Economics* 23: 575-605. http://www.wiod.org/database/wiots16

Vangeli, Anastas. 2002."China's Engagement with the Sixteen Countries of Central, East and Southeast Europe under the Belt and Road Initiative." *China & World Economy* 25, (2017): 101-124. doi:10.1111/cwe.12216

Zhai, Fan, Zhi, Wang. "WTO Accession, Rural Labor Migration and Urban Development in China," *Urban Studies* 29 (12): 2199-2217. https://doi.org/10.1080/0042098022000033827

Zhai, Fan. 2018. "China's Belt and Road Initiative: A Preliminary Quantitative Assessment." *Journal of Asian Economics* 55: 84-92. https://doi.org/10.1016/j.asieco.2017.12.006

analysis of the BRI impacts on PRC with the help of a mathematical model. The implications of BRI for the Chinese economy is examined in terms of output and employment effects in a multi-sectoral context. The preliminary findings presented in this paper can be helpful for making appropriate public policy recommendations ideally to either further progress towards deepening the BRI, or in the worst-case scenario, reverse course on BRI. But it should be kept in mind that the Chinese initiative has a large geopolitical and diplomatic component in addition to considerations of economic security and prosperity.

In the appendix, some modeling issues are discussed, and a more complex systems model is presented. In all likelihood, this more realistic model results will show a more complete set of economic consequences of BRI for PRC including a more complete set of the financial sector impacts in particular. Therefore, to some extent, keeping the qualifications with regards to the present simpler model in mind, the argument of this note should be thought of as a sub-specie of *a fortiori* reasoning. This point will become clear as we proceed. *Inter alia*, it will also offer another public policy tool for promoting efficient and equitable economic growth in the PRC while avoiding or at least mitigating some of the pitfalls of a trade war with the US and Europe, or in the worst case an economic blockade of China by the West, led by the US.

It should be mentioned that in approaching strategically the problems of China's geoeconomics and geopolitics (Zhang et al. 2018, 301-318; Zhang and Xinshen 2013; Zhexin 2016, 55-56; Sattar 2016)[3] and in drawing the consequences for economic growth by considering both efficiency and equity aspects, we are following the lead of economists like Amartya Sen and Joseph Stiglitz.[4] They and their followers emphasize the need to think of the economy as a system that should be evaluated from the perspective of both human well-being fulfilment and economic efficiency.

[3]Dr. Zaidi Sattar, the chairman of the influential Policy Research Institute in Dhaka, Bangladesh has coined the interesting ad inclusive term "Geopolynomics". See Zaidi Sattar,"The new geopolynomics of AIIB," *The Financial Express*, (2016). Dhaka

[4] See Joseph Stiglitz, "How to Restore Equitable and Sustainable Economic Growth in the United States." *American Economic Review* 106, no. 5 (2016): 43-47. In development economics, the debate goes back several decades, e.g., Amartya Sen, *Development as Freedom*. (Oxford: Oxford University Press, 1999). For detailed discussions see Khan (Khan 1997a; Khan 1997b;Khan 2017a; Khan 2017b; Khan 2016;Khan 2002;Khan 1998) and Weiss and Khan (2006).

To the extent many of the BRI-affected sectors in the PRC have public or collective goods characteristics, their distribution is relatively more equitable than private goods in a society with highly unequal income and wealth distribution.[5] Not only have the income, wealth and other types of inequalities in the PRC been high and steadily increasing since the mid-1990s compared particularly with Japan or even Taiwan, these inequalities pose grave threats for social and political cohesion of China in the near future. No abatement is possible unless countervailing public policy measures are taken. Increasing the supply of public and collective goods can be one way—but not the only way and certainly not the magic bullet— of mitigating inequalities in the PRC. To the extent, BRI will affect these sectors positively or negatively both directly and indirectly through the backward and forward linkages in the PRC economy, to that extent BRI will have beneficial or adverse consequences distributionally for years to come. This will indeed be a policy matter of great moment for the Chinese elite.

Therefore, clearly as the political scientists claim correctly, the debate on BRI is also—even primarily—both a domestic politics and an international geopolitical debate in China. The economists can provide through their modeling of possible economic consequences of various types of BRI policies the necessary data that can be used scientifically in this important public policy debate, the outcome of which depends ultimately on political coalition building and political institutional processes within and outside the CPC and Chinese government. It should also be emphasized here that with the narrative or narrativist turn in some areas of social sciences the construction of a persuasive story for identifying the common good and then uncovering and undertaking policies for common good also crucial (Mayer 2014). The process leading up to the BRI decision was clearly a political one although economic "analysis"—sometimes of dubious nature—was advanced occasionally.

[5] See Picketty (2014), Stiglitz (2013) and Schneider and Tavani (2016), See also Khan and Schettino (2018) for documentation of increasing inequalities and polarization, particularly since the 1980s. Khan and Schettino in particular point out the decline of the middle class and the move towards the lower percentiles of income and wealth by many in the US and in PRC using a comparative statistical analysis and several polarization indices over the last four decades. For an important analysis of the local impacts of infrastructural and other damages on the lives of the poor and vulnerable see Aaron Schneider's remarkable recent book on New Orleans, Schneider (2018).

In terms of another Nobel laureate Amartya Sen's capabilities theory, (Sen 1992; Sen 1999; Sen 2009)—especially in the version extended by Khan (Khan 1997a; Khan 1997b; Khan 1998; Khan 2017a; Khan 2017b)[6]— economic consequences of the BRI policy— if negative—will make the PRC much less equitable in social capabilities terms than it would be otherwise. On the other hand, if those consequences turn out to be positive distributionally, these will affect equity in the PRC in a more substantially positive sense socially by increasing human capabilities in the PRC.[7] In the absence of detailed survey based data on well-being indicators, the economy wide employment and income generated by the consequences of BRI can serve as a proxy for an initial approximation of the effects of BRI on well-being in the PRC (Sen 1999; Khan 1997a; Khan 1998; Khan 2017a; Khan 2017b; Khan 2018).

With regards to efficiency, the model used here (see also the frontier production function approach and the equilibrium economic and econometric relations described briefly in appendix 1 of Khan 2019 forthcoming), captures the efficiency aspects rigorously. To the extent, there are monopolies and oligopolies, the degree of inefficiency in both the SOEs and the private sector[8] can be analyzed with the help of firm and industry level cost data. But this is not the focus of this paper.[9] The methodological section which follows makes this clear.

[6] See also Judzik, Khan and Spagnlo (2016) for an analysis of human capabilities enhancing policies in a learning economy. The PRC increasingly fulfils the requirements of a learning economy with a dynamic innovation system. Schneider and Yasar (2016) present impressive---nearly exhaustive and perhaps exhausting! —empirical results on the relation between inequality and mortality. See also Khan (2004) for theoretical results— in an axiomatic framework—on the connections between being at the low end of an income distribution and mortality.

[7] For an analysis of racism in an unequal society and its impact on human capabilities, see Khan (2016)

[8] The problem of regulation has been a vast area of research in both old and new industrial organization fields. Much of it is built around the Averch-Johnson effect in the old and applications of modern game theory in the new industrial organization.

[9] See Kang and Khan (2016) for a particular mathematical microeconomic modeling framework and results for the transportation sub-sectors in Taiwan Implementing this for the UK, a much larger and more complex economy will be time consuming and expensive but can be justified on providing public policy recommendations that could save more money and serve more constituencies in the medium to long run.

Some Methodological Issues

Ideally, one could carry out economy wide modeling of the PRC in a multi-sectoral context so that a disaggregated analysis of macroeconomic demand expansion/contraction from BRI can be done. However, the data limitations with regards to the construction of a Social Accounting Matrix for a recent enough year preclude such detailed modeling. For those who may not be familiar with a SAM, it should be mentioned that a SAM can be likened to a snapshot of the entire set of flows in the economy during a particular time period. SAMs can be constructed at many different levels of disaggregation. For a detailed description and examples including how to use SAMs as a basis for economy wide modeling, the reader is referred to Khan (Khan 1997a; Khan 2007) and Khan and Thorbecke (Khan and Thorbecke 1988; Khan and Thorbecke 1989).

An input-output system at its core describes the flow of inputs as they are used to produce the outputs as well as value added going to various factors of production and the final demand for goods and services. Thus, an input-output system is an important component of a SAM. Since an appropriate SAM is not available for modeling the PRC after 2007, we use the next best alternative of using the most recently available PRC input-output data in this paper.[10]

It should be underlined that even in the absence of a detailed SAM for the PRC, one can nevertheless, with the input-output(I-O) data available, arrive at least at a first approximation for a reasonably recent year. These can then be examined in light of longer run econometric issues such as nonstationarity of many macro time-series (see appendix one for a brief discussion of the most salient time-series and causality issues). Basically, this strategy is followed in this paper. The most recent available I-O table for the PRC for the year 2016 was used to derive multipliers and estimate the output and employment effects of increased aggregate and sectoral demands caused by BRI with an optimistic (i.e. orderly BRI that is high demand generating) and a low (i.e.,

[10] Using the 2010 SAM, the preliminary estimates using the more complex specifications of the model in Appendix 2 indicates that the network of effects will result in larger downside effects on employment, incomes of household, their consumption etc. It seems likely that the well-being of the lower socio-economic households will be affected adversely. see also Antonios Katris, Gioele Figus, Karen Turner, "Disaggregation of the 2010 UK Social Accounting Matrix to report household income quintiles." University of Strathclyde Working Paper No.17-18 (2017).

disorderly BRI that is low demand generating) scenario. It was then used to point out some technical issues in the appendices particularly with regards to complex systems modeling.

To elaborate a bit further, any increase in aggregate and/or sectoral demand will generate a causal process in the interdependent complex economic system, some increase in output and employment primarily in two ways. First, the direct output increase and job gains are generated via a direct demand-based causal process. For a higher production level throughout the economy, more employees are needed. Second, the indirect job gains are associated with the increase in demand for raw materials, commodities and other services used in the production process as well as the final demand by final consumers. The input-output multiplier captures all these different effects in an economy wide model. For the model to capture these effects accurately, there has to be excess capacity, or the generation of extra capacity with economic growth.[11]

The version of the input-output table we have used to estimate the impacts of BRI on the PRC economy contains 47 production activities for which the data was last updated in 2016. Our matrix was retrieved from *Input Output Tables* data set. The input-output model applied to this table is used to estimate the output and employment effects caused by the estimated change in demand resulting from BRI. Growth impacts are estimated by taking investment changes and relations between public and private investments into account (see appendix 1)

[11] The generation of capacity through appropriate extensive and intensive(innovating) investment is discussed in section 3.

Using the Results from Modeling BRI Impacts: Preliminary Aggregate Estimates of Growth, Output and Employment Impacts

It is important to underline the fact that this the best available and most recent multi-sectoral data set for PRC now. Although the present calculations depend partly on the presence of excess capacity, they are also compatible with an expansion of capacity as the Chinese economy reaches the upper limits of capacity utilization. Thus, public and private investments domestically are assumed to be forthcoming. The technical aspects are discussed in appendix 1. The political motivation has already been pointed out in the motivation section.

In order to be conservative in the impact estimates for PRC, the overall multipliers given in appendix 3 have been modified in a direction that will understate the effects of BRI on the PRC economy. This was done this in order to construct an *a fortiori* argument for showing the effects of BRI for the PRC economy would in likelihood be higher in the upward direction than assumed in this paper. One can also do this in a disaggregated manner which the authors intend to do in a future note on this subject.

Here, instead of presenting detailed sector by sector results that are being computed with modifications of the appendix table A3.1 of multipliers so that the BRI effects are biased in the direction of underestimations. The tables in A4 give valuable information regarding the size of important sectors, industries with most exports to Europe and Central Asia (Total $467,132 million), industries with most exports to East Asia and Pacific (Total $857,707 US million), industries with most exports to South Asia (Total $107,360 US million), industries with most exports to Middle East and North Africa(Total $124,580 US million), top export goods from China in 2018, China's top export partners in 2017 and total and sectoral employment figures in the PRC by industry among other things.

With the help of the above information[12]we can conservatively estimate an upward tick in aggregate demand attributable to BRI between 40 and 50 billion dollars in 2018 dollars. The impact

[12] See appendices 3 and 4 for details.

on output would vary between 75 and 90 billion dollars. The employment effect would be about 2 million jobs overall. Clearly, this will be welfare enhancing; but not the big bang that many non-economist western analysts fear. Of course, given the a fortiori nature of my argument, the low demand scenario understates the upwards-tending effects a bit. The point here is simply that under such a scenario, China will gain but there will not be a purely economic incentive for BRI since increased demand for domestic consumption and investments could do just as well.

However, over the next decade the demand generated by BRI will in all likelihood increase thus enabling the Chinese economy to expand. Not only will it expand but given the tendencies towards more higher end technology intensive goods exports, the more advanced sectors will expand relatively quickly leading to an accelerated growth impact of 1 to 1.5 per cent per annum, *ceteris paribus*. Again, even this more attractive scenario can be generated by increased demand for domestic consumption and investments with the latter also stressing the priorities of Made in China 2025. Thus, our results in both scenarios establish the primacy of geopolitics over geoeconomics for China except perhaps in the land-routing of energy through Russia and Central Asia where geopolitical and geoeconomic factors play an equal and complementary role through the BRI.

Conclusions—Domestic Economics, and International Political Economy and Geopolitics of BRI

Our economic analyses show that economic gains for PRC so far are not enormous although future synergies can multiply these manifolds. However, more important than just pure economic costs and benefits may be strategic international political factors. To this extent, we need to consider this preliminary economic impact analysis within a broader strategic framework.

Thus, follow up discussion of Chinese foreign policy and U.S.-China relations in the context of BRI should begin with an understanding of the overall international political context in the 2nd decade of the 21st century. Four sets of observations seem pertinent to me. First, as Allison (2017), Khan and Yang (2018) and several others have underlined, the United States and China are now advancing towards being locked in a geopolitical competition. As Khan and Yang (2018) emphasize, this is for the time being primarily still in Asia. As argued in Khan and Yang (2018) that the somewhat—though not deterministic—path-dependent evolution of this competition will determine the rules, norms, and institutions that govern international relations in the emerging global order-disorder dialectic through the coming decades, deciding crucially matters related to global peace and prosperity.

Our second observation is that the United States might be losing this competition in ways that increase the likelihood of the rapid decay of the U.S.-led order in Asia and perhaps in other parts of the world. However, China by itself will not be able to affect this with or without the BRI.

Third, the overreaction of the U.S. government, media and punditry has failed to approach this competition realistically. Washington—and the west in general—is still mired in prejudices from their collective imperial past and present. The theories with which our analysts in IR and IPE work and the advice they give are based on a fundamental misunderstanding of the grievances of the dominated peoples all over the world many of whom now are looking for an alternative world order with new leadership. It remains beyond the scope of these advisors in the west that China is not Japan and cannot be pushed around as Japan was in the 1980s and 1990s continuing up to the

present. One hopes that the days of western hegemony and neocolonialism will end in this century but how violent this end will depend on the west being able to disenthrall itself from its pet myths of a benign "liberal" world order constructed by the US after WWII.

Here an observation regarding soft power is also in order. Recently, the Chinese have begun to pay attention to this important concept with many practical consequential aspects.[13] So far, the thinkers in the West—particularly in the US—have neglected this dimension of "Nonwestern" and "socialist" soft power. The underlying assumption seems to be that the type of problematic modernity that came to prevail in the Global North is the only modernity possible. This is not only shallow and arrogant but also shortsighted, ignorant and downright dangerous.

Finally, with a sound understanding of the realities and the need to be less hypocritical and more deeply honest about western domination and exploitation of the rest, the way can open for constructive changes in the west and the east including PRC. Despite current trends, the United States can after becoming more deeply democratic and accountable than it has been throughout its entire history, arrest China's momentum and prevent the growth of an illiberal order in Asia. The foundations of American power remain strong, If the US can approach the global issues more responsibly and democratically in a multilateral context global peace and prosperity can be achieved. Meanwhile, with illiberalism developing in the US and other advanced countries, many countries in different parts of the world will probably go their own way and a disorderly international system is likely.

[13] Apparently, three different Chinese phrases have been used for soft power—*ruan shili*, *ruan quanli*, and *ruan liliang*. So far as official usage is concerned, in Hu Jintao's political report delivered to the 17th Party Congress, he used the term *ruan shili*. But Chinese scholars seem undecided about which term is the most appropriate.

References

Aoyama, Rumi. 2016. "One Belt, One Road": China's New Global Strategy," *Journal of Contemporary Asian Studies* 5, no.2 :3-22. doi: 10.1080/24761028.2016.11869094

Banerjee, Dipankar. 2016. "China's One Belt One Road Initiative," *ISEAS* 14. https://iseas.edu.sg/images/pdf/ISEAS_Perspective_2016_14.pdfAschauer, David. "Is Public Expenditure Productive?" *Journal of Monetary Economics* 23, no. 1 (1989): 177-200.

Baker, Scott, R., Nicholas Bloom, and Steven J. Davis. 2016. "Measuring Economic Policy Uncertainty," *The Quarterly Journal of Economics* 131, no. 4: 1593–1636, https://doi.org/10.1093/qje/qjw024

Callahan, William A. 2016. "China's "Asia Dream": The Belt Road Initiative and The New Regional Order," *Asian Journal of Comparative Politics* 1, no.3: 226-243. https://doi.org/10.1177/2057891116647806

Casarini, Nicola. 2015. "Is Europe to Benefit from China's Belt and Road Initiative?" *Instituto Affari Internazionali* 15, no. 40. https://www.iai.it/sites/default/files/iaiwp1540.pdf

Chaisse, Julien, Matsushita, Mitsuo. 2018. "China's 'Belt And Road' Initiative: Mapping the World Trade Normative and Strategic Implications," *Journal of World Trade* 52, no.1: 163–185.

Chatzky, Andrew, and James McBride. 2019 "China's Massive Belt and Road Initiative," *Council On Foreign Relations*. https://www.cfr.org/backgrounder/chinas-massive-belt-and-road-initiative

Chen, Xikang. 2005. "Extending the Input-Output Model with Assets," *Economic Systems Research* 17, no. 2: 211-225 https://doi.org/10.1080/09535310500115074

Cheng, Leonard K. 2016. "Three questions on China's "Belt and Road Initiative," *China Economic Review* 40: 309-313. https://doi.org/10.1016/j.chieco.2016.07.008

Clarke, Michael. 2017. "The Belt and Road Initiative: China's New Grand Strategy?" *Asia Policy* 24: 71-79. Doi:10.1353/asp.2017.0023

Ding, Yibing, and Xiao Li. 2017. "The Past and Future of China's Role in the East Asian Economy: A Trade Perspective." *Canadian Public Policy / Analyse De Politiques* 43, no. S2: S45-56. https://www-jstor-org.du.idm.oclc.org/stable/90003694.

Djankov, Simeon, and Sean Miner. 2016. "China's Belt and Road Initiative: Motives, Scope and Challenges," In *PIIE Briefing*. Peterson Institute for International Economics https://books.google.com/books?id=YbiqCwAAQBAJ&lpg=PT3&ots=83GIVl_Gbb&dq=belt%20road%20initiative&lr&pg=PT3#v=onepage&q&f=false

Du, Julan, and Yifei. 2018. "Does One Belt One Road Initiative Promote Chinese Overseas Direct Investment," *China Economic Review* 47: 189-205. https://doi.org/10.1016/j.chieco.2017.05.010

Du, Michael, M. 2016. "China's "One Belt, One Road" Initiative: Context, Focus, Institutions, and Implications," *The Chinese Journal of Global Governance* 2, no. 1 https://doi.org/10.1163/23525207-12340014

Fallon, Theresa. 2015. "The New Silk Road: Xi Jinping's Grand Strategy for Eurasia," *American Foreign Policy Interests* 37, no.3: 140-147. doi: 10.1080/10803920.2015.1056682

Ferdinand, Peter. 2016. "Westward ho—the China dream and 'one belt, one road: Chinese foreign policy under Xi Jinping," *International Affairs* 92, no. 4: 941–957, https://doi.org/10.1111/1468-2346.12660

Fernald, John. 1999. "Roads to Prosperity? Assessing the Link between Public Capital and Productivity." *American Economic Review* 89, no.3.

Fosu, Samuel. 2013. "Capital Structure, Product Market Competition and Firm Performance: Evidence from South Africa," Discussion Papers in Economics 13/11, Division of Economics, School of Business, University of Leicester.

Horridge, Mark, and Glyn Wittwer. 2008. "SinoTERM, a multi-regional CGE model of China," *China Economic Review* 19, no. 4: 628-634. https://doi.org/10.1016/j.chieco.2008.05.002Get

Hu, Biliang, Qingjie Liu, and Jiao Yan. 2017. "Promoting the Belt and Road Initiative by Strengthening '5 1' Cooperation" In *China's New Sources of Economic Growth: Human Capital, Innovation and Technological Change*, edited by Song Ligang, Garnaut Ross, Fang Cai, and Johnston Lauren, 409-30. Australia: ANU Press. http://www.jstor.org.du.idm.oclc.org/stable/j.ctt1trkk3v.25.

Huang, Yiping. 2016. "Understanding China's Belt & Road Initiative: Motivation, Framework and Assessment," *China Economic Review* 40: 314-321. https://doi.org/10.1016/j.chieco.2016.07.007

Hurley, John, Scott Morris, and Gailyn Portelance. 2018 "Examining the Debt Implications of the Belt and Road Initiative from a Policy Perspective," *Center for Global Development* 121. https://www.cgdev.org/sites/default/files/examining-debt-implications-belt-and-road-initiative-policy-perspective.pdf

Judzik, D., H.A. Khan and L. Spagnlo, 2016. "Social Capabilities–Based Flexicurity for a Learning Economy," *Sage Economic and Labour Relations Review* 27, no. 3: 333-348

Kang, C.C. and H.A. Khan. 2016. "Efficiency Evaluation of Bus Transit Firms with and without Consideration of Environmental Air-pollution Emissions," *Transportation Research (An Elsevier Science Journal*) Part D.

Keynes, John M. 1971-9. *Collected Writings of John Maynard Keynes.* Cambridge. Cambridge University Press.

Khan, Haider, A. 2019 forthcoming. **"**Critical Macroeconomic and Multisectoral Perspectives on US Infrastructure: Challenges and Directions for the 21st Century." In A. Khan and K. Becker eds. *US Infrastructure: Challenges and Directions for the 21st Century*, UK: Routledge.

————2018. "Development Orders and Disorders: Real Competition in Complex Global Capitalist System, China's Ambiguous Case, and the Need for Democratic Socialism in the 21st Century", Paper presented at the New School University, New York City, Jan. 30.

————2017a. "Challenges of Urbanization: Building Healthy Sustainable Smart and Resilient Cities," Paper Presented at the British Academy Workshop on Smart Cities, July 12-15, Bradford University, UK.

————2017b. "A Strategy for Development as Freedom" In Robert Lensink, Stefan Sjogren and Clas Wihlborg eds. *Paths for Sustainable Development*, Gothenberg: University of Gothenberg, Sweden.

————2017c. **"**Macroeconomic Multisectoral Perspectives on US Infrastructure: Challenges and Directions for the 21st Century," Discussion chapter, JKSIS, University of Denver, Denver, USA.

————2016. "On Capitalism and Racism", *E-International Relations*, July 2016.

———— 2007."Social Accounting Matrix: A Very Short Introduction for Modeling", In Econ Papers: https://econpapers.repec.org/paper/tkyfseres/2007cf477.htm (Accessed on Dec. 24, 2018)

———— 2004a. "On Mortality and Poverty: An Axiomatic Approach With A Modified Index", Econ Papers, https://econpapers.repec.org/paper/tkyfseres/2004cf281.htm (Last visited on Dec.26,2018)

———— 2004b. Innovation and Growth in East Asia: The Future of Miracles. New York: Houndsmills and Macmillan/Palgrave

———— 2004c. Global Markets and Financial Crisis in Asia: Towards a Theory for the Twenty First Century. New York: Houndsmills and Macmillan/Palgrave

———— 2003a

———— 2003b

———— 2002. "Innovation and Growth in a Schumpeterian Model" *Oxford Development Studies,* 30, no. 3: 289-306.

———————— 1998. *Technology, Development and Democracy*, Cheltenham: Edward Elgar.

————————1997a. *Technology, Energy and Development*, Cheltenham: Edward Elgar,

———————— 1997b. "Ecology, Inequality and Poverty: The Case of Bangladesh" *Asian Development Review*, 15, no. 2.

————————1985.

————————1983.

———————————— and F. Schettino. 2018. "Income Polarization in the USA: What Happened to the Middle Class in the Last Few Decades?" Article under Review by the *Cambridge Journal of Economics*.

————————————and V. Lippit. 2007.

———————————————— 1993. "The Surplus Approach and the Environment," *Review of Radical Political Economics*, Union for Radical Political Economics 25, no. 3: 122-128, September.

———————————— and E. Thorbecke.1988. *Macroeconomic Effects and Diffusion of Alternative Technologies Within a Social Accounting Matrix Framework: The Case of Indonesia*, U.K: Gower Publishing Co. Aldershot,

———————————————— 1989. "Macroeconomic Effects of Technology Choice: Multiplier and Structural Path Analysis", *Journal of Policy Modeling*, 11, no.1.

Kong, Lingjie. 2015. "The Belt and Road Initiative and China's Foreign Policy Towards Its Territorial and Boundary Disputes," *China Quarterly of International Strategic Studies* 1, no.2: 325-345. https://doi.org/10.1142/S2377740015500165

Li, Jia. 2008. "The Financial Social Accounting Matrix for China, and its Application to a Multiplier Analysis." *Forum of International Development Studies* 36: 215-239. https://mpra.ub.uni-muenchen.de/id/eprint/8174

Mayer, Frederick W. 2014. *Narrative Politics: Stories and Collective Action*, Oxford: Oxford University Press.

Munnell, Alicia. 1992. "Policy Watch: Infrastructure Investment and Economic Growth," *Journal of Economic Perspectives* 6, no. 4: 189-198.

Murphy, David. 2016. "One Belt One Road: International Development Finance With Chinese Characteristics." In *Pollution*, edited by Davies Gloria, Goldkorn Jeremy, and Tomba Luigi, 245-52. Australia: ANU Press. http://www.jstor.org.du.idm.oclc.org/stable/j.ctt1rqc934.23.

National Bureau of Statistics. 2012. "Input-Output Tables of China," In *China Data Insight,* China: China Statistics. http://cdi.cnki.net/Titles/SingleNJ?NJCode=N2016030122

Nie, Wenjuan. 2016. "Xi Jinping's Foreign Policy Dilemma: One Belt, One Road or the South China Sea?" *Contemporary Southeast Asia* 38, no. 3: 422-44. http://www.jstor.org.du.idm.oclc.org/stable/24916765.

Nordin, Astrid H. M., Mikael Weismann. 2018. "Will Trump make China great again? The belt and road initiative and international order," *International Affairs* 94, no. 2: 231–249. https://doi.org/10.1093/ia/iix242

Organization for Economic Co-operation and Development. 2011. "Input-Out Tables," Last Edited 2011. https://stats.oecd.org/Index.aspx?DataSetCode=IOTS

Pour-Ghaz, M. 2013. "Sustainable Infrastructure Materials: Challenges and Opportunities." *International Journal of Applied Ceramic Technology* 10, no. 4: 584-592.

Ratner, Ely. 2018. "Geostrategic and Military Drivers and Implications of the Belt and Road Initiative," *Council on Foreign Relations*. https://www.cfr.org/report/geostrategic-and-military-drivers-and-implications-belt-and-road-initiative

Redd, M, Woodley, R. and J. Page. 2009. "Operations and Maintenance at Atlanta Airport." *Journal of Automated People Movers* (Atlanta: American Society of Civil Engineers): 50-55.

Rivlin, Alice. 1991. "Distinguished Lecture on Economics in Government: Strengthening the Economy by Rethinking the Role of Federal and State Governments" *Journal of Economic Perspectives* 5, no. 2: 3-14.

Sattar, Zaidi. 2016. "The new geopolynomics of AIIB," *The Financial Express*. Dhaka, 21 March

Schneider, A. 2018. *Renew Orleans?* Minneapolis: University of Minnesota Press.

Schneider, M. and D. Tavani. 2016. "A tale of two Ginis in the US, 1921–2012," *International Review of Applied Economics* 30, no. 6: 677–692
————————and Y. Yasar. 2016. "Is inequality deadly and for whom? A Bayesian Model Averaging analysis," *The Social Science Journal*, February.

Sen, Amartya. 2009. *The Idea of Justice.* Cambridge: The Belknap Press of the Harvard University Press.
————————1999. *Development as Freedom*. Oxford: Oxford University Press and New York: Alfred A. Knopf, Inc.
————————1992. *Inequality Reexamined*. Oxford: Oxford University Press.

Statista. 2020. *Main Export Good from China*. https://www.statista.com/statistics/256560/main-export-goods-from-china/

Stiglitz, Joseph. 2016. "How to Restore Equitable and Sustainable Economic Growth in the United States." *American Economic Review* 106, no. 5 (2016) 43-47.
————————2013. *The Price of Inequality*, NY: W.W. Norton

Timmer, M. P., E. Dietzenbacher, B. Los, R. Stehrer, G. J. De Vries. 2015. "An Illustrated User Guide to the World Input-Output Databases: The Case of Global Automotive Production," *Review of International Economics* 23: 575-605.
http://www.wiod.org/database/wiots16

The Economist. 2018. "Belt and Road Initiative Quarterly: Q4 2018" *The Economist*, November 27, 2018.
http://country.eiu.com/article.aspx?articleid=1677389351&Country=China&topic=Politics

World Bank. 2020. *World Integrated Trade Solutions: China.*https://wits.worldbank.org/CountryProfile/en/Country/CHN/Year/LTST/TradeFlow/Export/Partner/all/
————————2016. "China." http://datatopics.worldbank.org/jobs/country/china

Vangeli, Anastas. 2017. "China's Engagement with the Sixteen Countries of Central, East and Southeast Europe under the Belt and Road Initiative." *China & World Economy* 25: 101-124. doi:10.1111/cwe.12216

Zhai, Fan, and Wang Zhi. 2002. "WTO Accession, Rural Labor Migration and Urban Development in China," *Urban Studies* 29, no. 12: 2199-2217.
https://doi.org/10.1080/0042098022000033827

Zhai, Fan. 2018. "China's Belt and Road Initiative: A Preliminary Quantitative Assessment." *Journal of Asian Economics* 55: 84-92. https://doi.org/10.1016/j.asieco.2017.12.006

Zhang, Lingge, Meifeng Luo, Dong Yang, and Kevin Li. 2018. "Impacts of Trade Liberalization on Chinese Economy with Belt and Road Initiative," *Maritime Policy Management* 45, no. 3: 301-318. doi: 10.1080/03088839.2017.1396504

Zhang, Yumei, and Diao Xinshen. 2013. "A 2007 Social Accounting Matrix for China,"

International Food Policy Research Institute (IFPRI) Dataverse, vol.5
https://doi.org/10.7910/DVN/LGZ3VV

Zhexin, Zhang. 2016. "China's International Strategy and Its Implications for Southeast Asia." *Southeast Asian Affairs*: 55-66. https://www-jstor-org.du.idm.oclc.org/stable/26466918.

Data References:

All input-output data come from**:**

National Bureau of Statistics. 2012. "Input-Output Tables of China," In *China Data Insight,* China: China Statistics. http://cdi.cnki.net/Titles/SingleNJ?NJCode=N2016030122

See also:

World Bank. 2020. *World Integrated Trade Solutions: China.*https://wits.worldbank.org/CountryProfile/en/Country/CHN/Year/LTST/TradeFlow/Export/Partner/all/
————2016. "China." http://datatopics.worldbank.org/jobs/country/china

Timmer, M. P., E. Dietzenbacher, B. Los, R. Stehrer, G. J. De Vries. 2015. "An Illustrated User Guide to the World Input-Output Databases: The Case of Global Automotive Production," *Review of International Economics* 23: 575-605. http://www.wiod.org/database/wiots16

Statista. 2020. *Main Export Good from China*. https://www.statista.com/statistics/256560/main-export-goods-from-china/

Li, Jia. 2008. "The Financial Social Accounting Matrix for China, and its Application to a Multiplier Analysis." *Forum of International Development Studies* 36: 215-239. https://mpra.ub.uni-muenchen.de/id/eprint/8174

Appendix 1:

Public and Private Investment Long Run Relationships likely to be affected by BRI—Modeling and Econometric Issues: Public investment in core economic activities including infrastructure in order to enhance both public and private sector productivity.

Is further BRI-related large public investment in PRC feasible?

This appendix briefly discusses two important technical points and one political economy point. First, it clarifies the long run cause and effect relations between demand for PRC products and PRC sectoral outputs and employments. Second, it clarifies the link between the public and private investments in all sectors including infrastructure. It should also be emphasized that the production functions in the text and here are all frontier (i.e. efficient) production functions. An important aspect of the long run cause and effect analysis is that it puts the claim made with regards to the detrimental impact of reduced consumer and investment demands on productivity and long run growth prospects within a rigorous economic and econometric theoretical framework.

We know that research studies in the late 1980s and early 1990s presented results suggesting that reduced. public investment could reduce private sector productivity (Aschauer 1989a; Aschauer 1989b; Munnell 1990a; Munnell 1990b). However, advances in time-series econometrics led to the view is that these studies failed to address the possibility that the results were spurious due to the presence of unit roots in key variables. It was also established that the relevant variables, at least in the case of the U.S., are non-stationary (Tatom 1991; Sturm and Haan 1995). These studies find that when the relevant variables are transformed into first differences to eliminate the unit roots, the results no longer show that the impact of public investment on private investment is positive. In symmetry with this result reduced investments in either sector attributable to BRI will reduce or slow down productivity gains.

Munnell (1992) rightly points out that models estimated in first differences will at most capture short-run adjustments. The more significant link between public capital and private investment productivity is likely to be characterized by a long-run equilibrium relationship. Specifically, a past record of low rates of public capital accumulation should continue to affect current economic performance, even if current rates of public investment have improved. We expect short-term changes in public capital stock to be less relevant than the overall stock of public assets and its trajectory over time.

Morrison and Schwartz, 1996 (U.S., state-level, manufacturing); Nadiri and Mamuneas, 1994 (U.S., national, manufacturing); and Moreno, López-Bazo, and Artís, 2002 (Spain, manufacturing) examined the impact of public investment by estimating neoclassical cost functions. Even though the techniques, and data sources vary, these studies have found significant effects of public capital on reducing production costs.

It is useful to return to the earlier studies of Aschauer and Munnell and examine the question of a long-run relationship between public capital and private economic performance in the presence of non-stationary variables. One approach is to estimate a standard production function in which public capital is included as a factor of production:

(1) $Y = Ak^{\alpha}L^{\lambda}P^{\gamma}$

with K representing private fixed capital, L labor inputs, and P public capital assets. A is a general productivity parameter, representing technical improvements in the production process.

Does public investment influence the productivity of private capital? In order to answer this question, we express the production function in terms of average capital productivity:

(2) $\frac{Y}{K} = AK^{\alpha-1}L^{\lambda}P^{\gamma}$

With constant returns to scale of the model expressed in terms of the output-capital ratio, the exponential coefficients in Equation (2) will sum to zero. Taking the natural logarithm of Equation (2), and assuming that parameter A increases at an exogenously given rate of δ, yields the following model expressed as a long-run relationship:

(3a) $\ln(\frac{Y}{K})^{*} = \ln A^{*} + \beta \ln K^{*} + \lambda \ln L^{*} + \gamma \ln P^{*} + \delta t$

in which β = α-1. With constant returns to scale across all three productive inputs, the relationship becomes:

(3b) $\ln(\frac{Y}{K})^{*} = \ln A^{*} + \lambda(\ln\frac{L}{K})^{*} + \gamma \ln(\frac{P}{K})^{*} + \delta t$

It is possible to estimate the basic relationships shown in Equations (3a) and (3b) using a standard error corrections model based on an autoregressive distributed lag specification, ADL (1,1). For the unrestricted production function of Equation (3a) the model is:

(4) $\Delta \ln(\frac{Y}{K})_t = c + \{(\pi_{\gamma} - 1)\ln(\frac{Y}{K})_{t-1} + (\beta_1 + \beta_2)\ln K_{t-1} + (\lambda_1 + \lambda_2)\ln L_{t-1} + (\gamma_1 + \gamma_2)\ln P_{t-1}\} + \beta_1 \Delta \ln K_t + \lambda_1 \Delta \ln K_t + \gamma_1 \Delta \ln P_1 + \delta t + \varepsilon_t$

Using this model, the earlier work found qualified support for the inference that there are some positive impacts of public investment on private productivity. More recent data did not contradict this inference.

The relevance for BRI is as follows:

Increased public investments in infrastructure and other activities can synergistically complement the simple demand effects of BRI. But there are no reliable studies for the PRC that can give us reliable estimates. As a first approximation, it may be necessary to increase public investment by upwards of 100 billion dollars to increase the growth rate by between 1 and 1.5 percentage points. Is this a likely prospect? If yes, then the impact of BRI on the PRC economy will be quite beneficial even if initial demand increase is low. Given China's political commitment to BRI, however, once such a finding as ours here is brought to the attention of high-level policy makers in CPC and the Chinese government, further BRI-related public investment may occur. But it will have to be a political decision that will take into account the economic issues discussed here as well.

Appendix 2:
BRI in General Equilibrium: A Structural CGE Model for Policy Making within a Complex Socio-economic System

(Post-)Modern Economies as Complex Social- Economic- State Systemic Process under Globalization

Writing in 1926, in a biographical essay on Edgeworth, Keynes underlined some of the problems of complex human systems:

> We are faced at every turn with problems of organic unity, of discreteness, of discontinuity--- the whole is not equal to the sum of the parts, comparisons of quantity fail us, small changes produce large effects, the assumptions of a uniform and homogeneous continuum are not satisfied. (Keynes 1971-9, 269)

If anything, the UK economy as part of the globalized world economy today shows to even a greater degree the kind of complexity captured in Keynes's words above. Fortunately, systems theory and economic theory have both made some progress since those dark days. Although we are far from a genuinely complete theory of complex economic systems, efforts are underway that have already borne some interesting fruit in several limited areas.[14] A review of even partially successful set of country experiences such as are contained in Fosu (2013) can be seen as case studies that reveal many facets of complex developing economies --each with its own sub-systemic characteristics to be sure, but also sharing some common strategic features.

The purpose of this appendix is to incorporate Finance and Banking in (Post-)Modern Economies as Complex Social- Economic- State Systemic Process under Globalization within a complex systems model and draw some appropriate lessons. The main claim is that such an approach can lead to a theoretical view of an enabling developed state that includes many features from the social democratic and democratic socialist models. Needless to say, both the Thatcherite and the New Labor models have been far from such a world. Without making an ideological or political critique of the practices since Thatcher's regime, the model is presented here as an analytical tool that is empirically implementable if appropriate data are made available via a financial cum real sectors SAM with sufficient socio-economic details. We now turn to a brief schematic presentation of this complex systems structural model.

The model is implementable by using an appropriate software (Mathematica, GAMS etc.) through a social accounting matrix (SAM). The key parameters of the model can be calibrated to the SAM for finding the general equilibrium solution. After this step, policy experiments for various types of BRI policies can be carried out giving us quantitative results for different scenarios.
It is important to note that modules 6, 7 and 8 for the banking and finance sectors are where the crucial banking and sub-systems are modeled. This is particularly important for the city of London. What follows is a conceptually clear but empirically compact model that will need further disaggregation to accommodate the concrete realities of actual Islamic finance and banking.

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[14] See for example, Khan (2004b,c; 2003a,b; 1998; 1997a,b; 1983; 1985; Khan and Thorbecke 1988; 1989; Khan and Lippit 1993; 2007) and the references therein.

A Financial- Structural Model of General Equilibrium for Analyzing Varieties of BRIs

The most striking aspect of the model is the possibility of a financial crisis that results directly from the forces unleashed by the moves to liberalize finance quickly—something PRC has avoided wisely so far. With an enabling state facilitating appropriate the risk sharing and corporate governance, such crises can become less frequent or can be avoided altogether, as in the PRC case. Significantly, such crises can occur even in a flexible or `managed float' regime. So, while PRC always had a managed monetary independence, vigilance in the next few years will be essential. BRI in all its forms will not likely increase the probabilities of future financial crises unless the financial markets are liberalized too quickly along with BRI. The persistence of the crisis in Asia during 1997-98 and the 2008 crises worldwide both suggest that `structural' factors rather than fixed exchange rates were the underlying causes of these crises. It is important to recognize that an wisely crafted and implemented PRC banking and Finance strategy within the framework of BRI can produce stable, less crisis-prone and more egalitarian all around capabilities enhancing growth and development for the people of the PRC.

Equations of the Financial GGE Model for PRC :

I. HOUSEHOLD AGRICULTURE (HAG)---there will be many subcategories---this was a major contribution by Richard Stone, an English Nobel laureate in economics

1. $$NW_{HAG}(t) = KAS_{HAG}(t-1) + DSB_{HAG}(t-1) + DPB_{HAG}(t-1) + P_Z(t)Z_{HAG}(t-1) + P^K_{HAG}(t)K_{HAG}(t-1) + S_{HAG}(t)$$

Household net worth at eop (end of period) is = cash + initial deposit at private, state bank + the value of stock held at eop + value of capital, which is the amount of capital at the beginning of period multiplied by price at eop to account for capital gain + saving.

NOTE: Household Position is a net position. The assumption is that the households do not engage in borrowing activity. Household is a recipient of wages/salary, interest from deposit, and firm's profit. It does not borrow for consumption. A household may borrow for investment in a venture, however, once it takes a loan of this kind, then it no longer is classified as household. Depending on the type of business the household will be classified under a certain type of firm.

2. $$QA_{HAG}(t) = NW_{HAG}(t) - P^K_{HAG}(t)K_{HAG}(t)$$

Quantity of financial Assets of household Agriculture is equal to household net worth minus the value of physical capital at eop.

NOTE: Physical capital of household at eop -- $K_{HAG}(t)$ includes investment made during the year. See equations 11, 22, and 33.

3. $q_{HAG} = A_{SB}^{HAG}(i_{sb} / \bar{i}_{sb})^{\sigma_{HAG}-1} + A_{PB}^{HAG}(i_{pb} / \bar{i}_{pb})^{\sigma_{HAG}-1} + A_{Z}^{HAG}(r / \bar{r})^{\sigma_{HAG}-1} + A_{KAS}^{HAG}$

Agriculture households try to maximize the utility of return q_{HAG}, which is formulated using CES type harmonic mean return.

A_i^{HAG} = Distribution parameter

i_{SB}, i_{pb}, and r = interest rate at private, state bank and rate of return on capital (profit) respectively

$\bar{i}_{SB}, \bar{i}_{pb}$, and $\bar{r}$ = normal yield on bank (private and state bank) deposits and company's capital.

σ_{HAG} = elasticity of substitution

The agriculture household asset returns consist of interest from State Bank, Private Bank, the share of the firm's profit, and cash. Government security is not available for households to buy. Therefore, there is no return from government security.

4. $\varnothing_{SB}^{HAG} = A_{SB}^{HAG} \dfrac{(i_{sb} / \bar{i}_{sb})^{\sigma_{HAG}-1}}{q_{hag}}$ → Share of deposit on State owned banks

5. $\varnothing_{PB}^{HAG} = A_{PB}^{HAG} \dfrac{(i_{pb} / \bar{i}_{pb})^{\sigma_{HAG}-1}}{q_{hag}}$ →Share of deposit on private or semi-private banks

6. $\varnothing_{Z}^{HAG} = A_{Z}^{HAG} \dfrac{(r / \bar{r})^{\sigma_{HAG}-1}}{q_{hag}}$ → Share of equity

7. $\varnothing_{KAS}^{HAG} = A_{Z}^{HAG} \dfrac{A_{KAS}^{HAG}}{q_{hag}}$ → Share of Currency

The sum of $\varnothing_{sb}^{HAG}, \varnothing_{pb}^{HAG}, \varnothing_{Z}^{HAG}, \varnothing_{KAS}^{HAG}$ must equal to one

8. $D_{HAG} = \varnothing_{sb}^{HAG}(QA_{HAG}) + \varnothing_{PB}^{HAG}(QA_{HAG})$

Total Agriculture-household Deposit is equal to share of household deposit in State banks multiplied by total financial assets plus the share of household deposit in private/semi-private banks multiplied by total financial assets.

9. $Z_{HAG} = \varnothing_{Z}^{HAG}(QA_{HAG})$

Total Agriculture-household stock/equity is share of stock x total financial assets

10. $KAS_{HAG} = \varnothing_{KAS}^{HAG}(QA_{HAG})$

Total Agriculture-household cash is share of cash x total financial assets

11. $K_{HAG}(t) = K_{HAG}(t-1) + I_{HAG}(t)$

Total Capital owned by Agriculture-household = initial capital + total investment at end of period.

II. HOUSEHOLD NON-AGRICULTURE (HNAG)---Here there will be even more subcategories---this was also a major contribution by Richard Stone, an English Nobel laureate in economics, and his Cambridge growth model.

12. $NW_{HNAG}(t) = KAS_{HNAG}(t-1) + DSB_{HNAG}(t-1) + DPB_{HNAG}(t-1) + P_Z(t)Z_{HNAG}(t-1) + P_{HNAG}^K(t)K_{HNAG}(t-1) + S_{HNAG}(t)$

13. $QA_{HNAG}(t) = NW_{HNAG}(t) - P_{HNAG}^K(t)K_{HNAG}(t)$

14. $q_{HNAG} = A_{SB}^{HNAG}(i_{sb}/\bar{i}_{sb})^{\sigma_{HNAG}-1} + A_{PB}^{HNAG}(i_{pb}/\bar{i}_{pb})^{\sigma_{HNAG}-1} + A_Z^{HNAG}(r/\bar{r})^{\sigma_{HNAG}-1} + A_{KAS}^{HNAG}$

15. $\varnothing_{SB}^{HNAG} = A_{SB}^{NHAG}\dfrac{(i_{sb}/\bar{i}_{sb})^{\sigma_{HNAG}-1}}{q_{hnag}}$ → Share of deposit on State banks

16. $\varnothing_{PB}^{HNAG} = A_{PB}^{NHAG}\dfrac{(i_{pb}/\bar{i}_{pb})^{\sigma_{HNAG}-1}}{q_{hnag}}$ → Share of deposit on private/semi-private banks

17. $\varnothing_Z^{HNAG} = A_Z^{HNAG}\dfrac{(r/\bar{r})^{\sigma_{HNAG}-1}}{q_{hnag}}$ → Share of equity

18. $\varnothing_{KAS}^{HNAG} = A_Z^{HNAG}\dfrac{A_{KAS}^{HNAG}}{q_{hnag}}$ → Share of Currency

The sum of $\varnothing_{sb}^{HNAG}, \varnothing_{pb}^{HNAG}, \varnothing_Z^{HNAG}, \varnothing_{KAS}^{HNAG}$ must equal to one

19. $D_{HNAG} = \varnothing_{sb}^{HNAG}(QA_{HNAG}) + \varnothing_{PB}^{HNAG}(QA_{HNAG})$

20. $Z_{HNAG} = \varnothing_Z^{HNAG}(QA_{HNAG})$

Total Nonagricultural-household stock/equity is share of stock x total financial assets.

21. $KAS_{HNAG} = \varnothing_{KAS}^{HNAG}(QA_{HNAG})$

Total Non-agriculture-household cash is share of cash x total financial assets

22. $K_{HNAG}(t) = K_{HNAG}(t-1) + I_{HNAG}(t)$

Total Capital owned by Non-agriculture-household = initial capital + total investment at end of period.

III. HOUSEHOLD TOTAL (h)

23. $NW_h(t) = NW_{HAG}(t) + NW_{HNAG}(t)$

24. $QA_h(t) = QA_{HAG}(t) + QA_{HNAG}(t)$

25. $qh = q_{HAG} + q_{HNAG}$

26. $\varnothing_{SB}^{h} = Q_{SB}^{HAG} + Q_{SB}^{HNAG}$ → Share of deposit on State banks

27. $\varnothing_{PB}^{h} = Q_{PB}^{HAG} + Q_{PB}^{HNAG}$ → Share of deposit on private/semi-private banks

28. $\varnothing_{Z}^{h} = Q_{Z}^{HAG} + Q_{Z}^{HNAG}$ → Share of equity

29. $\varnothing_{KAS}^{h} = Q_{KAS}^{HAG} + Q_{KAS}^{HNAG}$ → Share of Currency

30. $D_h = D_{HAG} + D_{HNAG}$

31. $Z_h = Z_{HAG} + Z_{HNAG}$

32. $KAS_h = KAS_{HAG} + KAS_{HNAG}$

33. $K_h(t) = K_{HAG}(t) + K_{HNAG}(t)$

IV. FIRMS

34 - 37. $DEF = P_i^k I_i - S_i$ i = FAG, FMIN, FTS, FI

38-41. $Z_i(t) = Z_i(t-1) + \alpha_i + \beta_i\left[(DEF_i(t) / P_i^k(t)\right]$ i = FAG, FMIN, FTS, FI

42s-45. $QL_i(t) = DEF_i(t) - P_z(t)\left[Z_i(t) - Z_i(t-1)\right] + LSB_i(t-1) + LPB(t-1) + LF_i(t-1)$
i = FAG, FMIN, FTS, FI

Another part of the deficit must be financed through borrowing. The required amount of total borrowing at time t $(QL_i(t)$ must be equal to the amount of deficit minus the value of outstanding equity increase at the end of period plus last year's outstanding loan from various types of banks, and foreign loan.

The firm's total loan comes from different sources. From the State Bank, Private Bank, and from foreign loan, with distribution parameter of A_x^i, and interest rate on bank loan of i_l, interest rate of foreign loan of i_f. Using CES specification, the firms try to minimize the cost function based on capitalized borrowing cost of $\bar{i}_{xi} / i_x$.

46.-49. $q_i = A_{sb}^i(\bar{i}_{li} / i_l)^{\sigma_i - 1} + A_{pb}^i(\bar{i}_{li} / i_l)^{\sigma_i - 1} + A_{fl}^i(\bar{i}_{fli} / i_{fl})^{\sigma_i - 1}$
i = FAG, FMIN, FTS, FI

q_i is the average of capitalized interest rates for each type of the firm.

NOTE: It is assumed that interest rate is not the explaining factor for the firm's decision to choose between various banks. Other, "Keynesian" factors are at play here.

The share of loans from various sources for each firm is given by equation 50-61. The sum of the share must equal to 1.

50-53. $\varnothing_{sb}^i = A_{sb}^i \dfrac{(\bar{i}_{Li} / i_l)^{\sigma_i - 1}}{q_i}$ i = FAG, FMIN, FTS, FI

54-57. $\varnothing_{pb}^i = A_{pb}^i \dfrac{(\bar{i}_{li} / i_l)^{\sigma_i - 1}}{q_i}$ i = FAG, FMIN, FTS, FI

58-61. $\varnothing_{lf}^i = A_{lf}^i \dfrac{(\bar{i}_{fli} / i_{fl})^{\sigma_i - 1}}{q_i}$ i = FAG, FMIN, FTS,FI

The demand for loan from each type of bank by each type of firm is given in equation 62 to 73.

62-65. $LSB_i = \varnothing^i_{lsb} QL_i$ i = FAG,FMIN,FTS, FI

Firm's demand for loan from State banks

66-69. $LPB_i = \varnothing^i_{lpb} QL_i$ i = FAG,FMIN,FTS,FI

Firm's demand for loan from private/semi-private banks

70-73. $LF_i = \varnothing^i_{lf} Ql_i$ i = FAG,FMIN,FTS,FI

Firm's demand for loan from abroad

74. $L = \sum_{i=FAG}^{FI} LSB_i + \sum_{i=FAG}^{FI} LPB_i$

Total domestic loan = total loan from all sources.

75-78. $K_i(t) = K_i(t-1) + I_i(t)$ $K_i(t) = K_i(t-1) + I_i(t)$

Total capital stocks held by PRC firms at the end of period equal to capital stock at the beginning plus investment at the end of period.

V. GOVERNMENT (G)

79. $FL_G(t) = FL_G(t-1) + e(\Delta FL^{\$}_G)$

Foreign Loan at time t (eop) = Outstanding Loan from abroad at the beginning plus New Loan from abroad in local currency. The additional loan amount is exogenous, valued at foreign currency (euros/dollars) but converted into local currency by multiplication with exchange rate.

80. $QL_G = LPB_G(t-1) + LSB_G(t-1) + LCB_G(t-1) + P^k_G(t) I_G(t) - S_G(t) - e(\Delta LF^{\$}_G)$

Government Demand for domestic credit = Govt. Investment + initial borrowing from the banking system (SB, PB, and CB), less Government Saving and Loan from abroad.

NOTE: The Government demand for domestic credit is a net position with loan payment included (if any). Any amount of loan repayment from the government to the banking system will appear as reduction in saving by the same amount. Government investment is exogenous.

81. $L_G = \left[\alpha_G^{SB} + \beta_G^{SB}(DEP_{SB})\right] + \left[\alpha_G^{PB} + \beta_G^{PB}(DEP_{PB})\right]$

Bank Credit to Government

82. $LCB_G = QL_{G-} L_G$

Central Bank Loan to Government; it is the government balance sheet residual i.e. the portion of total loan to government that is not fulfilled by commercial banking sector.

83. $K_G(t) = K_G(t-1) + I_G(t)$

VI. COMMERCIAL STATE BANK IN PRC PORTFOLIO (SB)

84. $DSB = DSB_{HAG} + DSB_{HNAG}$

85. $RR_{SB} = u_1^{SB} + u_2^{SB}(DEP^{SB})$

Reserve requirement in the central bank = marginal amount u_i + a fraction of deposits.

86. $QL_{SB} = DSB + ADVCB_{SB} - LSB_G - RR_{SB} + LIK_{SB}$

Domestically available resources or the total loan can be given from domestic resources = deposit + advances from central bank + liquidity credit from central bank - loan to Govt. - reserve requirement.

87. $DCB_{SB} = RR_{SB}\left[1 + \theta(i_{lsb} / \bar{i}_l)^{-\gamma}\right]$

88. $LF_{SB} = \left(L_G^{SB} + DCB_{SB} + \sum_{i=FAG}^{FL} LSB_i\right) - (DSB - REDSCNT - NW)$

VII. COMMERCIAL PRIVATE/SEMI-PRIVATE BANK PORTFOLIO (PB) (Two

89. $DPB = DB_{HAG} + DPB_{HNAG}$

90. $RR_{PB} = u_1^{PB} + u_2^{PB}(DEP^{PB})$

91. $QL_{PB} = DPB + ADVCB_{PB} - LPB_G - RR_{PB} + LIK_{PB}$

Available resources (domestic) = deposit + advances from central bank - loan to Govt. - reserve requirement + liquidity credit from central bank

92. $DCB_{PB} = RR_{PB}\left[1+\theta(i_{lpb}/\bar{i}_l)^{-\gamma}\right]$

93. $LF_{PB} = \left(L_G^{PB} + DCB_{PB} + \sum_{i=FAG}^{FL} LPB_i\right) - (DPB - REDSCNT - NW)$

VIII. COMMERCIAL BANK TOTAL

94. $DEP = DSB + DPB$

Total deposit taken by commercial bank.

95. $RR = RR_{SB} + RR_{PB}$

Total reserve deposit at central bank.

96. $QL + QL_{SB} + QL_{PB}$

Total resources available domestically.

97. $i_L = \bar{i}_L\left[\frac{L(i/i_F)^{\in}(i_R/i_R)^{\phi}}{\alpha QL}\right]^{1/\delta}$

Market clearing interest rate i_L = Loan interest rate; i_F =Foreign Loan interest rate; i_R = Rediscount Interest rate.
$\in, \phi$, and δ = loan supply interest rate elasticities, α = loan supply intercept.

98. $DCB = DCB_{SB} + DCB_{PB}$

Total deposit of commercial bank at central bank, including required reserve.

99. $LF = LF_{SB} + LF_{PB}$

Total residual items. The foreign loan needed by the domestic commercial banking sector to cover excess loan over domestic resources available.

IX. CENTRAL BANK PORTFOLIO

100. $FL = FL_{SB} + FL_{PB} + FL_{FAG} + FL_{MIN} + FL_{IS} + FL_{I} + FL_{G}$

101. $ADVCB = ADV_{CEL} + \varnothing_4\left[(FL_{SB} + FL_{PB}) - FL_{CEL}\right] - \gamma_4(DEPCB - RR)$

Total advances available from central bank = ceiling for advances less other banks' advances, less net deposit at central bank.

102. $KAS_{CB} = KAS_{H}$

103. $NWCB(t) = NWCB(T-1) + DISCR$

DISCR = Accounting discrepancy

104. $CBREV(t) = FL(t) - FL(t-1) - SF(t) + CBRES(t-1)$

Central Bank's reserve = net foreign loan at eop less foreign saving plus reserve at the beginning of the period.

105. $NWRES = CBLG + ADVCB + CBRES - KASCB + DEPCB - NWCB$

X. OTHER FINANCIAL BALANCE

106. $P_Z = \dfrac{ZZ_H}{(Z_{FAG} + Z_{MIN} + Z_{FTS} + Z_I}$

107. $INT = \left(A_{SB}^{H} + A_{PB}^{H} + i_L L_{SB} + i_L L_{PB}\right) + \left(A_{CB}^{SB} + A_{CB}^{PB} + i_L L_{SB} + i_L L_{PB}\right)$

INT equals Interest payment.

XI. PRODUCTION AND PRICE FORMATION

108 - 114. $P_i^k = \xi_4 P_4 + \xi_7 P_7$ ` i = 1,2,3,4,5,6,7

P_i^k = Price indexes for each sector's capital stock; capital goods come from the industrial sector and from import.

115 - 121 $$P_{i0}^{*} = [(\Theta_{1i})^{\sigma_i^{int}}(P_1)^{1-\sigma_i^{int}} + (\Theta_{2i})^{\sigma_i^{int}}(P_2)^{1-\sigma_i^{int}} + (\Theta_{3i})^{\sigma_i^{int}}(P_3)^{1-\sigma_i^{int}} + (\Theta_{5i})^{\sigma_i^{int}}(P_5)^{1-\sigma_i^{int}} + (\Theta_{6i})^{\sigma_i^{int}}(P_6)^{1-\sigma_i^{int}} + (\Theta_{7i})^{\sigma_i^{int}}(P_7)^{1-\sigma_i^{int}}]^{1/(1-\sigma_i^{int})}$$

i = 1,2,3,4,5,6,7; P_{i0}^{*} = cost indexes for sectoral intermediate uses, input output coefficient = a_{ji}^{*} and constant elasticities of substitution among intermediate inputs = σ_i^{int}

122 - 128. $a_{ji}^{*} = \left[\frac{P_i^{*}\Theta_{ji}}{P_j}\right]^{\sigma_i^{int}}$ j = Sector ; i = Market participant HAG - FI

a_{ji}^{*} = Input Output Coefficient.

129 - 135. $$P_i^c = \left[(\Theta_{Li})^{\sigma_i^{FIN}}(W_i)^{1-FIN} + (\Theta_{Ki})^{\sigma_i^{FIN}}(r_i+\delta_i)(P_i^K)^{1-FIN}\right]^{1/(1-\sigma^{1-FIN})} + (\Theta_i^{*})^{\sigma_i^{FIN}}(P_i^{*})^{\sigma_i^{FIN}}$$

CES Cost function = labor cost + fixed capital cost + cost of intermediate goods used
i = sector/commodity 1-7
σ_i^{FIN} = Elasticities of substitution

136 - 142. $L_i = (P_i^c \Theta_{Li} / W_i)^{\sigma_i^{FIN}} X_i$ i = Hag - FI

Level of employment.

143 - 149. $$r_i(t) = \frac{1}{P_i^K(t-1)}\left[P_i^c(t)\Theta_{Ki}\left(\frac{X_i(t)}{K_i(t-1)}\right)^{1/\sigma_i^{INT}}\right] - \delta_i$$

Sectoral rates of profit are determined by output level X and incoming capital stocks $K_i(t-1)$
i = HAG - FI

150. $$r(t) = \frac{r_{HAG}(t)P_{HAG}^K(t)K_{HAG}(t-1) + \cdots r_{FI}(t)P_{FI}^K(t)K_{FI}(t-1)}{P_{HAG}^K(t)K_{HAG}(t-1) + \cdots P_{FI}^K(t)K_{FI}(t-1)}$$

Average rate of profit (used for household portfolio decisions) depends on sectoral rate of profit

151 - 157. $X_{ji} = a_{ji}^{*}\left[\frac{P_i^c\Theta_i^c}{P_i^c}\right]^{\sigma_i^{FIN}} X_i$ j = Commodity 1 - 7

I = Mkt Participant HAG - FI

Intermediate goods flow using a^{*}_{ji} coefficient of input output defined with regard to the intermediate aggregate. (Flow of goods j (sector j) to market participant i; i.e. demand of good j by market participant i).

158 - 164. $Mi = \left[\frac{P_i \Theta_{0i}}{e(1+t_0)P_0} \right]^{\sigma_i^{FIN}} X_i$

i = Sector 5, 6 & 7 (Import Mining and Import other)
Mi = Derived demand for import

165 - 171. $P_i = P_i^c (1 - t_i)$ i = 1-7

After tax prices for each sectors/commodity

XII. INCOME GENERATION AND SAVING

172. $W = w_{HAG} L_{HAG} + \cdots w_{FI} L_{FI} + W_{fh} - W_{hf}$

173 - 179. $\Pi_i(t) = r_i(t) P_i^K(t) K_i(t-1) + \Pi_{fi} - \Pi_{if}$

i = HAG, HNAG, SB, PB, FAG, FMIN, FTS,FI.

Profit income flows.

180 - 185. $OS_i = (1 - \upsilon_i)\Pi_i + SUB$ i = SB, PB, FAG, FMIN, FTS,FI.

Operating surplus of firms i is part of profit after the household share of υ
Government owned firm receives subsidy SUB

186 - 191. $S_i = (1 - d_i - t_i^{dir}) OS_i$ i = SB, PB, FAG, FMIN, FTS,FI

Saving of the firm, equal to operating surpluses less dividend d payment less direct taxes t_i^{dir} .

192. $Y_{HAG} = W_{HAG} + d_{SB}^{HAG} OS_{SB}^{HAG} + \cdots d_{FI}^{HAG} OS_{FI}^{HAG} + v_{SB}^{HAG} \Pi_{SB}^{HAG} + \cdots v_{FI}^{HAG} \Pi_{FI}^{HAG} + TRAN_{gHAG} + TRAN_{fHAG}$

Household AG income = wages +dividend + share of profit +transfer from G and abroad.

193. $Y_{HNAG} = W_{HNAG} + d_{SB}^{HNAG} OS_{SB}^{HNAG} + \cdots d_{FI}^{HNAG} OS_{FI}^{HNAG} + v_{SB}^{HNAG} \Pi_{SB}^{HNAG} + \cdots v_{FI}^{HNAG} \Pi_{FI}^{HNAG} + TRAN_{gHNAG} + TRAN_{fHNAG}$

194. $Y_h = Y_{HAG} + Y_{HNAG}$

Total HH income is the sum of HAG Income and HNAG income

195. $D_{HAG} = D_0^{HAG} + (1+s_{HAG})Y_{HAG} - TRAN_{HAGf} - t_{HAG}^{dir} Y_{HAG} - (A_5^h + i_L L_5) + Y_{HAG} NW_{HAG}$

Consumption demand = initial /basic consumption + consumption - transfer abroad - direct taxes

196. $D_{HNAG} = D_0^{HNAG} + (1+s_{HNAG})Y_{HNAG} - TRAN_{HNAGf} - t_{HNAG}^{dir} Y_{HNAG} - (A_5^h + i_L L_5) + Y_{HNAG} NW_{HNAG}$

197. $D = D_{HAG} + D_{HNAG}$

198. $S_{HAG} = Y_{HAG} - TRAN_{HAGf} - t_{HAG}^{dir} Y_{HAG} - (A_f^{HAG} + i_L L_5) - D_{HAG}$

199. $S_{HNAG} = Y_{HNAG} - TRAN_{HNAGf} - t_{HNAG}^{dir} Y_{HNAG} - (A_f^{HNAG} + i_L L_5) - D_{HNAG}$

200. $S_h = S_{HAG} + S_{HNAG}$

201. $Y_g = \sum_{i=1}^{4} t_i P_i^c X_i + et_0 P_5 M_5 + et_0 P_6 M_6 + et_0 P_7 M_7 + t_h^{dir} Y_h + \sum_{i=SB}^{FI} t_i^{dir} OS_i + \sum_{i=1}^{4} t_i^{\exp} P_i^c E_i$ t

Government income consists of the sum of indirect taxes from all sectors + domestic currency of import indirect taxes + direct taxes from household + the sum of direct taxes of firms + export taxes.

202. $S_g = Y_g - \sum_{i=1}^{7} P_i G_i - TRAN_{gh} - (A_5^g + i_l L_g)$

203. $S_f = \sum_{i=1}^{7} \Pi_{if} + W_{hf} + \sum_{i=5}^{7} eP_i M_i + TRAN_{hf} + TRAN_{gf} - \sum_{i=1}^{4} (1+t_i^{\exp}) P_i^c E_i - W_{fh} - \sum_{i=1}^{4} \Pi_{fi} - TRAN_{fg} - TRAN_{fh}$

Current Account Deficit in foreign currency terms is converted to domestic currency, with export tax rate of $t_i^{\exp}$

XIII. FINAL DEMAND DETERMINATION

204. $\tilde{D} = \sum_{i=1}^{7} \Theta_i^{dem} P_i$ i = 1-7

205 - 211. $C_i = \Theta_i^{dem} + (\alpha_i^{dem} / P_i)(D - \tilde{D})$

i = 1-7

212 - 215. $I_i(t) = \left[I_{0i} + \omega_i \left\{ r_i(t) - i_l(t) \right\} \right] K_i(t-1)$

i = firms ; FAG - FI.

Investment demands of firms depend positively on rate of profit r_i and negatively on loan interest rate i_l. The firm investment parameter is ω_i.

216 - 217 = $I_i(t) = \left[I_{0i} + \omega_i \left\{ r_i(t) \right\} \right] K_i(t-1)$ i = SB and PB

Bank(more generally, financial sectors') demand for investment depends positively on the rate of profit. The decisive factor in this case is the spread between loan - deposit rate. But the spread will correlate with rate of profit thus the spread effect on investment demand has been reflected through the inclusion of r_i.

218. $I_{HAG} = I_{0HAG} + \omega_{HAG}^{i} i_l + \omega_{HAG}^{y} (Y_{HAG} / P_{HAG}^{k})$

219. $I_{HNAG} = I_{0HNAG} + \omega_{HNAG}^{i} i_l + \omega_{HNAG}^{y} (Y_{HNAG} / P_{NHAG}^{k})$

220. $I_h = I_{HAG} + I_{HNAG}$

Household demand for investment is a function of interest rate (with investment parameter ω^i) and real income (investment parameter W^y).

221. $I_g = I_{0g}$

222 - 225. $E_i = E_{0i} \left[\frac{e P_f^E}{(1 + t_i^{Exp}) P_i^c} \right]^{\eta}$

Export depends on the ratio of price of foreign goods and domestic border price, the elasticity is η. i = 1-4

XIV. COMMODITY BALANCES

226 - 232. $Xi = \sum_{j=HAG}^{FI} X_{ij} + C_i + G_i + \xi_i \left(\sum_{j=HAG}^{FI} I_j \right) + p_i \left[\sum_{i=1}^{7} \delta_i K_i(t-1) \right]$

i = Commodity 1-7; j = HAG - FI

p_i = sectoral composition of depreciation

XV. SAVING - INVESTMENT BALANCE

233. $$SI = \sum_{i=HAG}^{FI} S_i + S_f - \sum_{i=HAG}^{FI} P_i^k I_i$$

Saving of all sectors (excluding the G) plus foreign saving less investment of all sectors (foreign saving not included) will be zero if overall macroeconomics balance is to be maintained.

Running the model analytically shows that without sound corporate governance, the system is more fragile and expanding sound corporate governance and risk-sharing reduces the risk of financial crises in a neuro-fuzzy model created by Khan, Chang and Wang (2008).

Appendix 3:
Multiplier Tables

Table A3.1. Multiplier Table

Source: Computed from the original input-output table by creating the 47 by 47 A-matrix and inverting I-A matrix

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
S1	1.211	0.154	0.172	0.019	0.496	0.250	0.076	0.126	0.064	0.020
S2	0.002	1.167	0.003	0.007	0.003	0.005	0.209	0.061	0.026	0.005
S3	0.007	0.003	1.055	0.002	0.048	0.005	0.002	0.003	0.003	0.002
S4	0.043	0.084	0.033	1.198	0.043	0.065	0.078	0.111	0.084	0.638
S5	0.184	0.050	0.306	0.033	1.421	0.114	0.045	0.066	0.063	0.038
S6	0.009	0.016	0.006	0.020	0.015	1.800	0.026	0.044	0.041	0.017
S7	0.003	0.008	0.005	0.031	0.006	0.012	1.669	0.064	0.045	0.020
S8	0.005	0.006	0.007	0.007	0.022	0.018	0.021	1.377	0.457	0.006
S9	0.002	0.005	0.004	0.005	0.007	0.007	0.006	0.009	1.039	0.004
S10	0.048	0.103	0.039	0.078	0.041	0.057	0.069	0.076	0.066	1.149
S11	0.119	0.170	0.037	0.079	0.081	0.190	0.173	0.249	0.220	0.093
S12	0.005	0.004	0.004	0.003	0.004	0.004	0.002	0.006	0.004	0.004
S13	0.020	0.021	0.011	0.022	0.033	0.045	0.034	0.048	0.093	0.021
S14	0.004	0.010	0.005	0.017	0.011	0.009	0.012	0.013	0.013	0.024
S15	0.014	0.034	0.013	0.086	0.018	0.028	0.047	0.044	0.051	0.070
S16	0.005	0.017	0.007	0.036	0.010	0.011	0.046	0.024	0.025	0.025
S17	0.007	0.019	0.008	0.032	0.011	0.017	0.019	0.028	0.027	0.028
S18	0.006	0.015	0.007	0.027	0.011	0.015	0.018	0.022	0.019	0.023
S19	0.015	0.048	0.017	0.072	0.017	0.028	0.042	0.039	0.042	0.055
S20	0.008	0.027	0.011	0.025	0.013	0.017	0.021	0.023	0.020	0.021
S21	0.001	0.006	0.014	0.005	0.003	0.003	0.004	0.006	0.004	0.004
S22	0.001	0.003	0.001	0.003	0.001	0.003	0.004	0.020	0.009	0.002
S23	0.040	0.062	0.029	0.139	0.046	0.077	0.090	0.124	0.085	0.122
S24	0.001	0.002	0.001	0.002	0.002	0.001	0.003	0.003	0.003	0.003
S25	0.003	0.003	0.002	0.003	0.002	0.004	0.002	0.010	0.005	0.003
S26	0.002	0.005	0.002	0.009	0.005	0.006	0.008	0.009	0.009	0.009
S27	0.040	0.059	0.048	0.046	0.098	0.133	0.067	0.074	0.089	0.051
S28	0.008	0.012	0.010	0.009	0.020	0.027	0.014	0.015	0.019	0.010
S29	0.017	0.036	0.020	0.033	0.038	0.039	0.049	0.053	0.049	0.036
S30	0.004	0.008	0.006	0.010	0.008	0.009	0.008	0.010	0.007	0.010
S31	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.003	0.003	0.001
S32	0.007	0.013	0.010	0.010	0.014	0.014	0.015	0.018	0.015	0.011
S33	0.000	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
S34	0.006	0.020	0.008	0.017	0.014	0.015	0.016	0.018	0.022	0.013
S35	0.003	0.009	0.006	0.007	0.005	0.007	0.007	0.007	0.008	0.005
S36	0.000	0.001	0.000	0.002	0.001	0.003	0.001	0.001	0.002	0.002
S37	0.023	0.042	0.028	0.058	0.035	0.041	0.046	0.063	0.055	0.051
S38	0.002	0.006	0.004	0.006	0.004	0.005	0.005	0.005	0.005	0.005
S39	0.005	0.008	0.006	0.008	0.010	0.013	0.009	0.012	0.013	0.008
S40	0.013	0.022	0.017	0.039	0.037	0.040	0.030	0.039	0.041	0.035
S41	0.001	0.002	0.001	0.005	0.003	0.002	0.002	0.004	0.004	0.005
S42	0.008	0.034	0.008	0.014	0.008	0.008	0.016	0.016	0.011	0.009
S43	0.000	0.001	0.000	0.002	0.001	0.001	0.001	0.002	0.001	0.001
S44	0.001	0.002	0.002	0.003	0.001	0.001	0.003	0.002	0.003	0.002
S45	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.002	0.002
S46	0.000	0.002	0.000	0.002	0.000	0.001	0.001	0.002	0.001	0.002
S47	0.006	0.016	0.009	0.018	0.012	0.015	0.016	0.022	0.023	0.016

	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
S1	0.061	0.288	0.054	0.029	0.022	0.029	0.021	0.003	0.025	0.026
S2	0.014	0.005	0.043	0.007	0.005	0.008	0.005	0.001	0.006	0.006
S3	0.005	0.007	0.003	0.003	0.002	0.003	0.002	0.000	0.003	0.002
S4	0.246	0.068	0.144	0.248	0.369	0.194	0.061	0.013	0.120	0.101
S5	0.105	0.136	0.069	0.045	0.039	0.048	0.036	0.005	0.043	0.037
S6	0.040	0.053	0.118	0.041	0.027	0.037	0.021	0.004	0.033	0.063
S7	0.016	0.008	0.021	0.027	0.022	0.041	0.012	0.001	0.025	0.016
S8	0.015	0.026	0.019	0.030	0.010	0.015	0.019	0.002	0.015	0.013
S9	0.007	0.012	0.007	0.006	0.004	0.006	0.007	0.000	0.006	0.008
S10	0.225	0.065	0.131	0.117	0.139	0.093	0.043	0.007	0.065	0.061
S11	1.525	0.141	0.558	0.154	0.085	0.127	0.098	0.013	0.091	0.098
S12	0.006	1.186	0.005	0.004	0.004	0.004	0.003	0.000	0.004	0.002
S13	0.065	0.026	1.260	0.041	0.020	0.039	0.059	0.007	0.054	0.081
S14	0.020	0.022	0.021	1.221	0.040	0.035	0.027	0.004	0.026	0.033
S15	0.062	0.028	0.059	0.095	1.473	0.489	0.091	0.032	0.287	0.229
S16	0.025	0.015	0.034	0.052	0.044	1.172	0.038	0.007	0.081	0.051
S17	0.031	0.022	0.026	0.029	0.030	0.038	1.624	0.010	0.118	0.064
S18	0.026	0.017	0.023	0.028	0.030	0.037	0.094	1.017	0.093	0.047
S19	0.045	0.028	0.040	0.069	0.074	0.097	0.041	0.008	1.245	0.099
S20	0.022	0.022	0.021	0.035	0.027	0.035	0.022	0.002	0.074	1.698
S21	0.004	0.004	0.005	0.006	0.006	0.008	0.005	0.000	0.016	0.007
S22	0.004	0.003	0.004	0.006	0.020	0.013	0.004	0.001	0.007	0.008
S23	0.182	0.074	0.124	0.173	0.174	0.174	0.058	0.009	0.098	0.080
S24	0.003	0.001	0.003	0.003	0.003	0.003	0.001	0.000	0.003	0.001
S25	0.007	0.002	0.003	0.004	0.004	0.003	0.001	0.000	0.003	0.002
S26	0.009	0.006	0.008	0.010	0.009	0.011	0.008	0.001	0.008	0.008
S27	0.082	0.092	0.104	0.071	0.052	0.078	0.097	0.008	0.084	0.124
S28	0.017	0.019	0.021	0.014	0.010	0.016	0.021	0.002	0.017	0.026
S29	0.050	0.043	0.050	0.056	0.044	0.051	0.027	0.003	0.043	0.046
S30	0.011	0.008	0.009	0.011	0.012	0.012	0.007	0.001	0.011	0.013
S31	0.002	0.006	0.003	0.003	0.001	0.003	0.005	0.000	0.004	0.004
S32	0.015	0.014	0.015	0.017	0.013	0.016	0.010	0.001	0.013	0.022
S33	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001
S34	0.018	0.034	0.019	0.021	0.015	0.023	0.017	0.002	0.024	0.019
S35	0.007	0.009	0.007	0.009	0.007	0.009	0.009	0.000	0.010	0.008
S36	0.001	0.001	0.001	0.003	0.002	0.003	0.008	0.000	0.003	0.001
S37	0.062	0.051	0.056	0.063	0.076	0.068	0.056	0.005	0.057	0.051
S38	0.006	0.004	0.006	0.006	0.006	0.006	0.005	0.000	0.005	0.004
S39	0.011	0.012	0.014	0.012	0.009	0.013	0.014	0.001	0.013	0.014
S40	0.043	0.091	0.046	0.042	0.035	0.044	0.044	0.004	0.046	0.055
S41	0.007	0.008	0.006	0.004	0.007	0.005	0.015	0.000	0.009	0.010
S42	0.018	0.012	0.014	0.012	0.012	0.014	0.016	0.001	0.018	0.025
S43	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.000	0.001	0.001
S44	0.002	0.004	0.003	0.003	0.003	0.003	0.005	0.000	0.003	0.007
S45	0.001	0.002	0.001	0.003	0.002	0.003	0.001	0.000	0.003	0.002
S46	0.001	0.001	0.001	0.002	0.001	0.002	0.001	0.000	0.002	0.001
S47	0.019	0.019	0.020	0.022	0.018	0.024	0.016	0.002	0.022	0.027

	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30
S1	0.022	0.062	0.017	0.029	0.044	0.031	0.016	0.016	0.022	0.030
S2	0.006	0.043	0.003	0.005	0.007	0.020	0.002	0.002	0.002	0.002
S3	0.002	0.003	0.002	0.003	0.005	0.003	0.002	0.002	0.003	0.003
S4	0.099	0.082	0.340	0.110	0.083	0.151	0.026	0.026	0.104	0.133
S5	0.037	0.046	0.033	0.058	0.071	0.041	0.027	0.027	0.035	0.055
S6	0.030	0.151	0.014	0.031	0.049	0.033	0.013	0.013	0.018	0.012
S7	0.021	0.227	0.011	0.010	0.030	0.078	0.004	0.004	0.006	0.007
S8	0.010	0.039	0.008	0.008	0.012	0.014	0.016	0.016	0.005	0.006
S9	0.005	0.007	0.004	0.007	0.009	0.006	0.019	0.019	0.004	0.004
S10	0.058	0.056	0.104	0.059	0.075	0.088	0.028	0.028	0.145	0.211
S11	0.090	0.138	0.049	0.116	0.106	0.120	0.023	0.023	0.043	0.047
S12	0.002	0.003	0.004	0.002	0.005	0.004	0.001	0.001	0.003	0.003
S13	0.064	0.060	0.015	0.044	0.027	0.039	0.010	0.010	0.025	0.013
S14	0.021	0.018	0.014	0.014	0.030	0.234	0.004	0.004	0.011	0.008
S15	0.233	0.121	0.051	0.049	0.049	0.246	0.014	0.014	0.044	0.045
S16	0.064	0.037	0.018	0.041	0.026	0.075	0.008	0.008	0.014	0.017
S17	0.120	0.025	0.070	0.038	0.053	0.035	0.023	0.023	0.019	0.026
S18	0.134	0.022	0.084	0.030	0.039	0.065	0.024	0.024	0.016	0.026
S19	0.136	0.033	0.040	0.034	0.035	0.053	0.009	0.009	0.026	0.048
S20	0.036	0.018	0.017	0.021	0.067	0.026	0.024	0.024	0.141	0.016
S21	1.298	0.004	0.003	0.005	0.020	0.006	0.003	0.003	0.018	0.097
S22	0.006	1.015	0.002	0.003	0.004	0.007	0.002	0.002	0.002	0.002
S23	0.077	0.071	1.545	0.321	0.090	0.110	0.033	0.033	0.069	0.041
S24	0.001	0.002	0.004	1.056	0.008	0.003	0.000	0.000	0.001	0.001
S25	0.003	0.002	0.008	0.107	1.048	0.002	0.001	0.001	0.001	0.001
S26	0.009	0.007	0.015	0.022	0.038	1.050	0.009	0.009	0.015	0.005
S27	0.085	0.077	0.048	0.057	0.067	0.070	1.069	0.021	0.046	0.048
S28	0.018	0.016	0.010	0.012	0.014	0.014	0.004	1.053	0.009	0.009
S29	0.035	0.035	0.030	0.030	0.039	0.055	0.026	0.026	1.055	0.024
S30	0.010	0.007	0.009	0.005	0.008	0.009	0.011	0.011	0.006	1.074
S31	0.003	0.002	0.001	0.003	0.007	0.003	0.004	0.004	0.002	0.002
S32	0.011	0.012	0.008	0.008	0.010	0.013	0.018	0.018	0.060	0.093
S33	0.001	0.001	0.001	0.001	0.003	0.001	0.002	0.002	0.001	0.001
S34	0.017	0.015	0.015	0.025	0.051	0.022	0.020	0.020	0.027	0.013
S35	0.007	0.006	0.009	0.013	0.022	0.024	0.009	0.009	0.011	0.043
S36	0.002	0.001	0.003	0.009	0.003	0.002	0.002	0.002	0.001	0.002
S37	0.054	0.040	0.089	0.108	0.076	0.067	0.058	0.058	0.079	0.089
S38	0.005	0.005	0.006	0.006	0.008	0.006	0.009	0.009	0.013	0.009
S39	0.011	0.010	0.010	0.013	0.022	0.011	0.070	0.070	0.011	0.011
S40	0.039	0.039	0.031	0.030	0.036	0.034	0.126	0.126	0.026	0.041
S41	0.009	0.003	0.004	0.003	0.003	0.004	0.003	0.003	0.002	0.003
S42	0.016	0.008	0.011	0.009	0.016	0.047	0.005	0.005	0.006	0.007
S43	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.003	0.001	0.003
S44	0.002	0.002	0.002	0.003	0.007	0.003	0.004	0.004	0.002	0.001
S45	0.001	0.001	0.002	0.005	0.014	0.003	0.003	0.003	0.002	0.001
S46	0.002	0.001	0.002	0.001	0.002	0.002	0.001	0.001	0.002	0.002
S47	0.018	0.013	0.018	0.037	0.084	0.023	0.021	0.021	0.030	0.018

	S31	S32	S33	S34	S35	S36	S37	S38	S39	S40
S1	0.042	0.105	0.019	0.240	0.016	0.020	0.014	0.049	0.007	0.049
S2	0.003	0.003	0.003	0.002	0.001	0.004	0.001	0.002	0.001	0.005
S3	0.005	0.004	0.002	0.071	0.002	0.003	0.002	0.012	0.001	0.006
S4	0.186	0.115	0.046	0.033	0.018	0.030	0.015	0.020	0.010	0.074
S5	0.092	0.072	0.035	0.495	0.028	0.031	0.024	0.100	0.012	0.073
S6	0.026	0.030	0.019	0.029	0.009	0.015	0.014	0.015	0.007	0.046
S7	0.010	0.008	0.012	0.006	0.003	0.008	0.003	0.005	0.003	0.012
S8	0.008	0.009	0.017	0.014	0.006	0.043	0.014	0.018	0.005	0.068
S9	0.006	0.005	0.025	0.006	0.007	0.060	0.016	0.019	0.004	0.044
S10	0.291	0.167	0.049	0.032	0.014	0.027	0.016	0.021	0.008	0.093
S11	0.064	0.073	0.036	0.055	0.016	0.057	0.017	0.025	0.008	0.077
S12	0.005	0.003	0.001	0.002	0.002	0.001	0.001	0.001	0.000	0.003
S13	0.021	0.018	0.018	0.020	0.006	0.018	0.005	0.009	0.003	0.023
S14	0.013	0.013	0.018	0.007	0.005	0.008	0.004	0.004	0.006	0.011
S15	0.065	0.048	0.043	0.014	0.013	0.026	0.009	0.012	0.009	0.048
S16	0.021	0.030	0.015	0.008	0.005	0.013	0.005	0.006	0.005	0.039
S17	0.033	0.024	0.028	0.010	0.069	0.207	0.012	0.015	0.006	0.074
S18	0.030	0.018	0.023	0.010	0.077	0.043	0.008	0.012	0.006	0.061
S19	0.085	0.054	0.027	0.012	0.008	0.015	0.006	0.007	0.004	0.025
S20	0.022	0.026	0.048	0.015	0.007	0.037	0.012	0.015	0.005	0.107
S21	0.146	0.015	0.110	0.003	0.001	0.004	0.002	0.005	0.001	0.005
S22	0.002	0.003	0.003	0.001	0.001	0.003	0.003	0.006	0.002	0.008
S23	0.059	0.053	0.035	0.044	0.034	0.029	0.017	0.021	0.013	0.044
S24	0.002	0.002	0.001	0.003	0.000	0.001	0.000	0.002	0.000	0.001
S25	0.003	0.002	0.001	0.002	0.000	0.001	0.000	0.001	0.000	0.003
S26	0.009	0.015	0.020	0.009	0.010	0.006	0.012	0.009	0.025	0.009
S27	0.070	0.056	0.084	0.110	0.028	0.077	0.023	0.047	0.011	0.089
S28	0.015	0.011	0.017	0.023	0.006	0.016	0.005	0.010	0.003	0.018
S29	0.029	0.080	0.034	0.031	0.008	0.020	0.011	0.017	0.005	0.041
S30	0.007	0.023	0.006	0.007	0.001	0.004	0.001	0.003	0.001	0.009
S31	1.072	0.014	0.016	0.001	0.002	0.007	0.003	0.004	0.002	0.010
S32	0.029	1.036	0.012	0.011	0.003	0.008	0.003	0.006	0.001	0.014
S33	0.001	0.002	1.031	0.002	0.002	0.002	0.006	0.006	0.000	0.002
S34	0.032	0.025	0.021	1.011	0.012	0.021	0.029	0.152	0.009	0.061
S35	0.014	0.015	0.034	0.010	1.116	0.110	0.019	0.063	0.006	0.011
S36	0.005	0.001	0.005	0.001	0.005	1.048	0.006	0.005	0.001	0.004
S37	0.066	0.060	0.030	0.035	0.031	0.063	1.030	0.225	0.062	0.073
S38	0.020	0.036	0.003	0.004	0.004	0.005	0.003	1.108	0.003	0.013
S39	0.018	0.021	0.020	0.021	0.020	0.040	0.050	0.041	1.027	0.022
S40	0.033	0.042	0.048	0.037	0.039	0.075	0.068	0.073	0.034	1.081
S41	0.003	0.002	0.002	0.002	0.001	0.027	0.001	0.002	0.000	0.003
S42	0.006	0.005	0.006	0.005	0.003	0.009	0.003	0.004	0.002	0.006
S43	0.007	0.003	0.002	0.001	0.004	0.002	0.004	0.003	0.000	0.005
S44	0.003	0.003	0.004	0.001	0.003	0.007	0.003	0.006	0.003	0.018
S45	0.003	0.003	0.002	0.002	0.002	0.003	0.008	0.008	0.001	0.003
S46	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.001
S47	0.019	0.063	0.019	0.017	0.014	0.013	0.018	0.037	0.006	0.023

	S41	S42	S43	S44	S45	S46	S47
S1	0.064	0.023	0.093	0.039	0.048	0.125	0.050
S2	0.003	0.003	0.003	0.002	0.002	0.003	0.004
S3	0.026	0.004	0.003	0.006	0.008	0.005	0.006
S4	0.052	0.060	0.070	0.041	0.038	0.058	0.047
S5	0.090	0.043	0.048	0.068	0.092	0.097	0.101
S6	0.035	0.016	0.032	0.071	0.017	0.085	0.045
S7	0.007	0.009	0.007	0.006	0.006	0.008	0.011
S8	0.013	0.012	0.012	0.019	0.025	0.016	0.024
S9	0.008	0.011	0.015	0.017	0.014	0.010	0.020
S10	0.045	0.069	0.078	0.045	0.038	0.057	0.042
S11	0.120	0.089	0.089	0.044	0.061	0.073	0.093
S12	0.006	0.004	0.002	0.003	0.002	0.382	0.003
S13	0.018	0.019	0.028	0.013	0.010	0.019	0.025
S14	0.016	0.012	0.022	0.012	0.011	0.015	0.011
S15	0.039	0.048	0.037	0.023	0.019	0.033	0.036
S16	0.037	0.049	0.022	0.010	0.011	0.014	0.018
S17	0.088	0.146	0.039	0.021	0.036	0.026	0.064
S18	0.071	0.041	0.028	0.016	0.013	0.021	0.032
S19	0.020	0.022	0.019	0.014	0.013	0.059	0.021
S20	0.030	0.035	0.063	0.043	0.010	0.023	0.054
S21	0.005	0.005	0.006	0.008	0.005	0.005	0.035
S22	0.003	0.004	0.004	0.004	0.005	0.003	0.006
S23	0.054	0.039	0.066	0.038	0.040	0.057	0.056
S24	0.003	0.001	0.003	0.002	0.003	0.002	0.003
S25	0.001	0.001	0.004	0.001	0.002	0.002	0.002
S26	0.016	0.010	0.026	0.022	0.016	0.010	0.016
S27	0.066	0.064	0.056	0.055	0.044	0.102	0.078
S28	0.014	0.013	0.012	0.012	0.010	0.021	0.016
S29	0.030	0.026	0.032	0.030	0.022	0.035	0.029
S30	0.005	0.006	0.009	0.004	0.004	0.006	0.006
S31	0.007	0.006	0.004	0.015	0.015	0.004	0.006
S32	0.009	0.011	0.011	0.007	0.006	0.010	0.012
S33	0.002	0.002	0.002	0.013	0.005	0.002	0.003
S34	0.050	0.043	0.020	0.058	0.046	0.026	0.031
S35	0.008	0.011	0.009	0.042	0.033	0.028	0.012
S36	0.002	0.001	0.007	0.002	0.002	0.001	0.003
S37	0.028	0.055	0.086	0.041	0.063	0.047	0.042
S38	0.004	0.008	0.015	0.005	0.002	0.003	0.006
S39	0.014	0.016	0.019	0.021	0.023	0.021	0.054
S40	0.049	0.039	0.040	0.034	0.027	0.048	0.041
S41	1.013	0.004	0.002	0.001	0.009	0.004	0.002
S42	0.050	1.122	0.005	0.004	0.007	0.007	0.005
S43	0.003	0.002	1.009	0.004	0.001	0.001	0.003
S44	0.003	0.003	0.003	1.013	0.005	0.003	0.005
S45	0.009	0.003	0.005	0.019	1.047	0.008	0.003
S46	0.001	0.000	0.001	0.006	0.001	1.012	0.002
S47	0.031	0.025	0.056	0.050	0.040	0.029	1.052

Table A3.2. Sector Identifier Table

Sector No.	Sector Name
S1	Crop and animal production, hunting and related service activities
S2	Forestry and logging
S3	Fishing and aquaculture
S4	Mining and quarrying
S5	Manufacture of food products, beverages and tobacco products
S6	Manufacture of textiles, wearing apparel and leather products
S7	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
S8	Manufacture of paper and paper products
S9	Printing and reproduction of recorded media
S10	Manufacture of coke and refined petroleum products
S11	Manufacture of chemicals and chemical products
S12	Manufacture of basic pharmaceutical products and pharmaceutical preparations
S13	Manufacture of rubber and plastic products
S14	Manufacture of other non-metallic mineral products
S15	Manufacture of basic metals
S16	Manufacture of fabricated metal products, except machinery and equipment
S17	Manufacture of computer, electronic and optical products
S18	Manufacture of electrical equipment
S19	Manufacture of machinery and equipment n.e.c.
S20	Manufacture of motor vehicles, trailers and semi-trailers
S21	Manufacture of other transport equipment
S22	Manufacture of furniture; other manufacturing
S23	Electricity, gas, steam and air conditioning supply
S24	Water collection, treatment and supply
S25	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services
S26	Construction
S27	Wholesale trade, except of motor vehicles and motorcycles
S28	Retail trade, except of motor vehicles and motorcycles
S29	Land transport and transport via pipelines
S30	Water transport
S31	Air transport
S32	Warehousing and support activities for transportation
S33	Postal and courier activities
S34	Accommodation and food service activities
S35	Telecommunications
S36	Computer programming, consultancy and related activities; information service activities
S37	Financial service activities, except insurance and pension funding
S38	Insurance, reinsurance and pension funding, except compulsory social security
S39	Real estate activities
S40	Legal and accounting activities; activities of head offices; management consultancy activities
S41	Scientific research and development
S42	Other professional, scientific and technical activities; veterinary activities
S43	Administrative and support service activities
S44	Public administration and defence; compulsory social security
S45	Education
S46	Human health and social work activities
S47	Other service activities

Appendix 4 :
Sectoral Outputs, PRC Exports particularly to BRI to EU, Asia and Africa and Elsewhere

Table A4.1 Sectoral Outputs as percentages of Total Output

Sector No.	Sector Name	Total Output in 2014 in Core Industries (in million USD)	Industry's Output as a Percentage of Total Output in 2014 (%)
S1	Crop and animal production, hunting and related service activities	1,396,917	4.40
S2	Forestry and logging	108,802	0.34
S3	Fishing and aquaculture	165,148	0.52
S4	Mining and quarrying	1,227,629	3.87
S5	Manufacture of food products, beverages and tobacco products	1,807,706	5.69
S6	Manufacture of textiles, wearing apparel and leather products	1,274,722	4.02
S7	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	400,678	1.26
S8	Manufacture of paper and paper products	227,625	0.72
S9	Printing and reproduction of recorded media	119,291	0.38
S10	Manufacture of coke and refined petroleum products	859,434	2.71
S11	Manufacture of chemicals and chemical products	1,361,317	4.29
S12	Manufacture of basic pharmaceutical products and pharmaceutical preparations	303,940	0.96
S13	Manufacture of rubber and plastic products	531,907	1.68
S14	Manufacture of other non-metallic mineral products	892,413	2.81
S15	Manufacture of basic metals	1,811,694	5.71
S16	Manufacture of fabricated metal products, except machinery and equipment	640,454	2.02
S17	Manufacture of computer, electronic and optical products	1,583,061	4.99
S18	Manufacture of electrical equipment	1,056,006	3.33
S19	Manufacture of machinery and equipment n.e.c.	1,186,406	3.74
S20	Manufacture of motor vehicles, trailers and semi-trailers	1,244,647	3.92
S21	Manufacture of other transport equipment	389,067	1.23
S22	Manufacture of furniture; other manufacturing	179,039	0.56
S23	Electricity, gas, steam and air conditioning supply	1,021,702	3.22
S24	Water collection, treatment and supply	34,892	0.11
S25	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	41,246	0.13
S26	Construction	3,033,938	9.56
S27	Wholesale trade, except of motor vehicles and motorcycles	1,383,666	4.36
S28	Retail trade, except of motor vehicles and motorcycles	286,247	0.90
S29	Land transport and transport via pipelines	592,803	1.87
S30	Water transport	143,078	0.45
S31	Air transport	84,735	0.27
S32	Warehousing and support activities for transportation	169,815	0.53
S33	Postal and courier activities	31,096	0.10
S34	Accommodation and food service activities	532,327	1.68
S35	Telecommunications	331,005	1.04

S36	Computer programming, consultancy and related activities; information service activities	162,287	0.51
S37	Financial service activities, except insurance and pension funding	775,809	2.44
S38	Insurance, reinsurance and pension funding, except compulsory social security	129,070	0.41
S39	Real estate activities	700,059	2.21
S40	Legal and accounting activities; activities of head offices; management consultancy activities	607,514	1.91
S41	Scientific research and development	85,202	0.27
S42	Other professional, scientific and technical activities; veterinary activities	299,441	0.94
S43	Administrative and support service activities	95,495	0.30
S44	Public administration and defence; compulsory social security	763,395	2.40
S45	Education	606,396	1.91
S46	Human health and social work activities	545,819	1.72
S47	Other service activities	520,164	1.64

Number of Production Sectors in the Table

47

Total Output (10.48 trillion) Total Consumption (5.29 trillion)

Table: A4.2: Industries with most exports of goods to Europe, Asia and Africa

Table A4.2.1 Industries with most exports to Europe and Central Asia (Total $467,132 million)

Export Goods	Value (in USD million)
Machine & Electronics	467,132
Textiles & Clothing	191,476
Metals	30,807,315
Chemicals	23,632
Transportation	20,346

Table A4.2.2 Industries with most exports to East Asia and Pacific (Total $857,707 US million)

Export Goods	Value (in USD million)
Machine & Electronics	857,707
Textiles & Clothing	407,518
Metals	81,545
Chemicals	60,866
Transportation	39,673

Table A4.2.3 Industries with most exports to South Asia (Total $107,360 US million)

Export Goods	Value (in USD million)
Machine & Electronics	46,091
Textiles & Clothing	14,364
Chemicals	12,713
Metals	9,412
Plastic or Rubber	4,715

Table A4.2.4 Industries with most exports to Middle East and North Africa (Total $124,580 US million)

Export Goods	Value (in USD million)
Machine & Electronics	39,576
Textiles & Clothing	20,662
Metals	14,584
Transportation	8,466
Plastic or Rubber	7,086

Table A4.2.5 Industries with most exports to Sub-Saharan Africa (Total $ 68, 306 US million)

Export Goods	Value (in USD million)
Machine & Electronics	17,195
Textiles & Clothing	12,866
Metals	7,678
Transportation	6,033
Plastic or Rubber	4,241

Source: World Bank. 2020. *World Integrated Trade Solutions: China.*https://wits.worldbank.org/CountryProfile/en/Country/CHN/Year/LTST/TradeFlow/Export/Partner/all/

Table A4.2.6 Top Export Goods from China in 2018

Export Goods	Value (in billion yuan)
Automatic Data Processing Machines	1,135.5
Clothes, Clothing Accessories	1,041.3
Mobile and Car Telephones	934.3
Textile Yarns, Textile Articles	785.1
Integrated Circuits	559.1
Rolled Steel	398.4

Furniture	354.4
Footwear	309.5
Plastic Products	287
Suitcases, bags and similar containers	178.7
Toys	166.2
LCD panels	152.7
Motor Vehicles (including complete set of spare sets)	97.2
Containers	68.5

Source: Statista. 2020. *Main Export Good from China*. https://www.statista.com/statistics/256560/main-export-goods-from-china/

China's Top Export Partners (2017)

Table A4.2.7 China's Top Export Partners (2017) By Country

Export Partner	Export (in million USD)	Export Partner Share (%)
United States	430,328	19.01
Hong Kong, China	279,210	12.34
Japan	137,258	6.06
Korea, Rep.	102,703	4.54
Vietnam	71,617	3.16
Germany	71,134	3.14
India	68,042	3.01
Netherlands	67,131	2.97
United Kingdom	56,713	2.51
Singapore	45,019	1.99
Russian Federation	42,983	1.89
Malaysia	41,712	1.84
Australia	41,438	1.83
Thailand	38,541	1.70

Table A4.2.8 China's Top Export Partners (2017) By Country

Export Partner	Export (in million USD)	Export Partner Share (%)
East Asia & Pacific	857,707	37.90
Europe & Central Asia	467,132	20.64
North America	461,835	20.40
Latin America & Caribbean	130,039	5.75
Middle East & North Africa	124,580	5.50
South Asia	107,360	4.74
Sub-Saharan Africa	68,306	3.02

Source: World Bank. 2020. *World Integrated Trade Solutions: China.*https://wits.worldbank.org/CountryProfile/en/Country/CHN/Year/LTST/TradeFlow/Export/Partner/all/

China's trade surplus with BRI countries stands at US$31.5bn, accounts for 35.9% of China's global trade surplus (The Economist, 2018)

Total Employment above ages 15: 750.5 million

Table A4.3.1 Employment Figures by Sector (2016)

Sector	Percentage of Total Employment (%)
Agriculture	18.4
Industry	26.8
Services	54.9

Source: World Bank. 2016. "China." http://datatopics.worldbank.org/jobs/country/china