DISCUSSION PAPER SERIES

DP13721

STRUCTURAL CHANGE IN THE CHINESE ECONOMY AND CHANGING TRADE RELATIONS WITH THE WORLD

Robert Koopman, Eddy Bekkers and Carolina Lemos Rego

INTERNATIONAL TRADE AND REGIONAL ECONOMICS

ISSN 0265-8003

STRUCTURAL CHANGE IN THE CHINESE ECONOMY AND CHANGING TRADE RELATIONS WITH THE WORLD

Robert Koopman, Eddy Bekkers and Carolina Lemos Rego

Discussion Paper DP13721
Published 07 May 2019
Submitted 06 May 2019

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

STRUCTURAL CHANGE IN THE CHINESE ECONOMY AND CHANGING TRADE RELATIONS WITH THE WORLD

Abstract

This paper examines the impact of structural change in China, in particular a reduction in the savings rate, an increase in the share of skilled workers, and an increase in productivity in technologically advanced manufacturing sectors targeted by Made in China 2025. Baseline projections until 2040 are generated with the WTO Global Trade Model, a dynamic computable general equilibrium model. With the modelled structural changes the Chinese economy is projected to reorient its focus increasingly onto the domestic economy, raising the share of private household and government consumption in GDP, turning China's trade surplus into a trade deficit, reducing China's share in global exports, raising the share of services in both production and exports, shifting the destination markets of Chinese exports from developed to developing countries, and changing its pattern of comparative advantage away from sectors like light and heavy manufacturing to electronic and machinery equipment. The large bilateral trade surplus vis-a-vis the United States is projected to fall to almost zero.

JEL Classification: F14, F43, I25

Keywords: Dynamic CGE-Modelling, structural change, China

Robert Koopman - robert.koopman@wto.org
World Trade Organization and CEPR

Eddy Bekkers - eddy.bekkers@wto.org
World Trade Organization

Carolina Lemos Rego - carolina.lemos@graduateinstitute.ch
World Trade Organization

Structural change in the Chinese economy and changing trade relations with the world

Eddy Bekkers

Robert Koopman

Carolina Lemos Rego

World Trade Organization

ABSTRACT: This paper examines the impact of structural change in China, in particular a reduction in the savings rate, an increase in the share of skilled workers, and an increase in productivity in technologically advanced manufacturing sectors targeted by Made in China 2025. Baseline projections until 2040 are generated with the WTO Global Trade Model, a dynamic computable general equilibrium model. With the modelled structural changes the Chinese economy is projected to reorient its focus increasingly onto the domestic economy, raising the share of private household and government consumption in GDP, turning China's trade surplus into a trade deficit, reducing China's share in global exports, raising the share of services in both production and exports, shifting the destination markets of Chinese exports from developed to developing countries, and changing its pattern of comparative advantage away from sectors like light and heavy manufacturing to electronic and machinery equipment. The large bilateral trade surplus vis-a-vis the United States is projected to fall to almost zero.

Keywords: Dynamic CGE-Modelling, Structural Change, China

JEL codes: F14, F43, I25

Disclaimer: The opinions expressed in this article should be attributed to its authors. They are not meant to represent the positions or opinions of the WTO and its Members and are without prejudice to Members' rights and obligations under the WTO.

printdate: March 20, 2019

1 Introduction

The Chinese economy has gone through enormous changes in the last 30 years, displaying spectecular GDP growth (Figure 1) reaching the status of a middle-income country (Figure 2) and shifting many resources from agriculture into manufacturing and services. As a result, China is now the largest exporter in the world with most of its exports in manufacturing (Figure 3). Three remarkable features characterize the Chinese economy. First, it has displayed a very high savings rate in comparison to other main economies (Figure 4). Second, the share of manufacturing in both production and exports is very high (Figures 3 and 5). And third, China has displayed a considerable current account surplus (Figure 6). In particular, the bilateral trade surplus with the United States has drawn attention in this regard.

Some of these features are expected to change in the next twenty years. In particular the following changes are expected to occur: the savings rate is expected to fall with the demographic changes towards an ageing society and reforms in the public sector towards a more broad-based provision of services in health care, education, pensions and social insurance; the share of services is expected to rise as these become more expensive with development and preferences change; a large increase in the number of skilled workers is more people graduate (World Bank (2012)); finally, the Chinese government has identified a couple of sectors whose development should be promoted, in particular high-end manufacturing sectors.

In this paper we explore how the Chinese economy will develop and what the impact will be of three types of structural change: (i) a falling savings rate; (ii) a rising number of skilled workers; and (iii) faster productivity growth in prioritized high-end manufacturing sectors. We examine the impact of these trends on the Chinese economy, the role of the Chinese economy in the world, and the interaction between the Chinese and the American economy. We employ the WTO Global Trade Model (GTM), a dynamic computable general equilibrium model, to generate projections on the impact of these trends. Macro-projections on GDP per capita, population, and labor force growth from the OECD and the UN are employed to generate baseline projections on the development of the global economy until 2040. These macro-projections are supplemented by savings rate projections from Cepii (Foure et al. (2013)), differential productivity growth based on WTO-estimates, and adjusting income elasticities of consumption. To model the falling savings rate and the rising share of skilled workers we use the projections until 2030 in the World Bank report on China (World Bank (2012)). The additional productivity

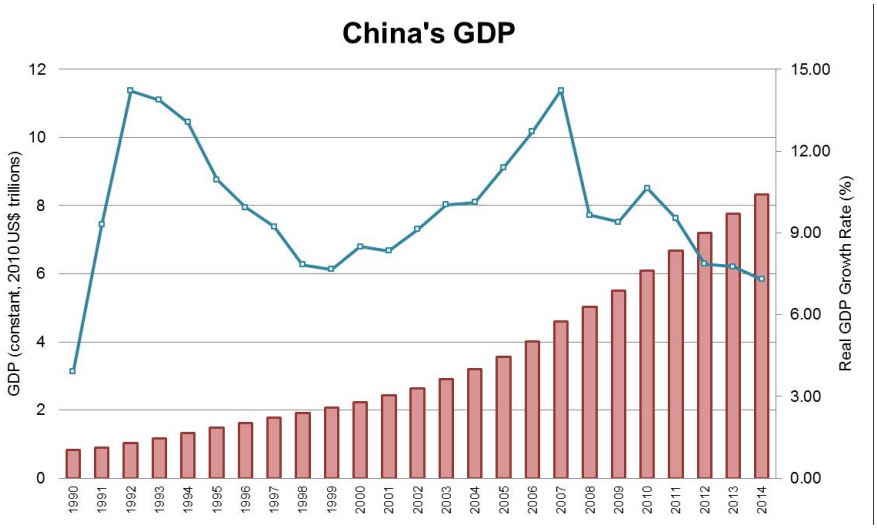

Figure 1: Growth in Chinese real GDP and value of GDP in trillions of dollars from 1990 to 2014

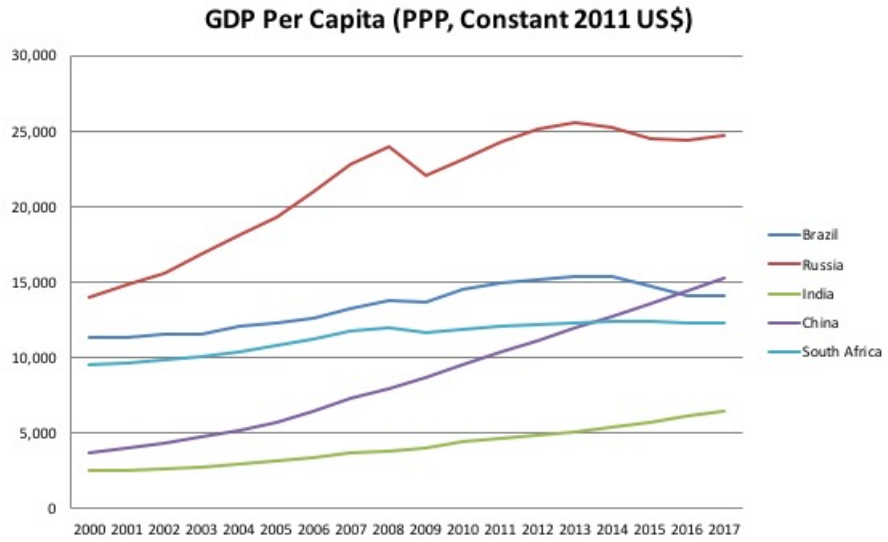

Figure 2: Development of GDP per capita of the BRICS countries

growth in the high-end manufacturing sectors is based on Made in China 2025, an industrial policy project of the Chinese State Council announced in 2015.

Other researchers have also examined the impact of structural change and rebalancing of the Chinese economy. Most relevant for our work are the studies on the effect of Chinese rebalancing on other countries. First, Koopman et al. (2014) have examined as well the impact of a rebalancing of the Chinese economy on the global economy, concentrating on the impact on the United States. However, they have modelled different policy experiments besides the reduction in the savings rate, in particular a slowdown of economic growth, shifting preferences towards services, and an increase in labour productivity. In our work the slowdown of economic

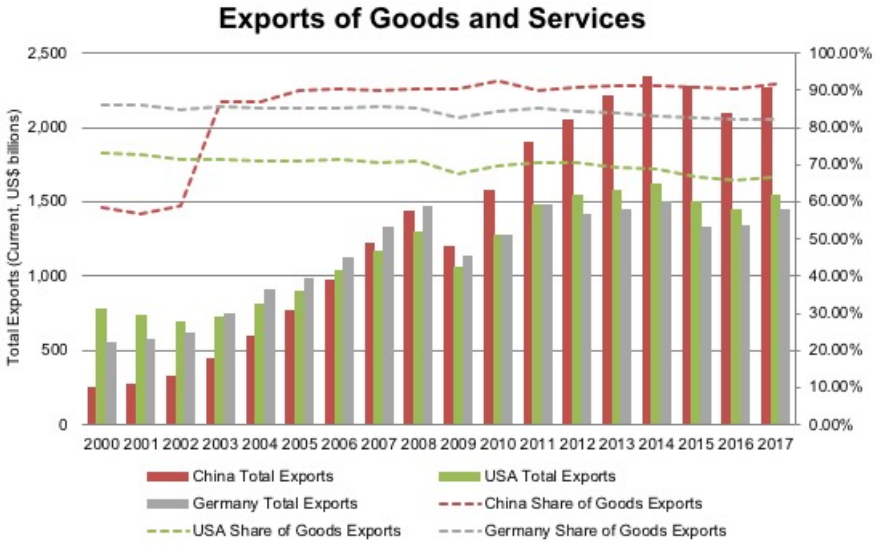

Figure 3: Goods and services exports of China, the USA, and Germany

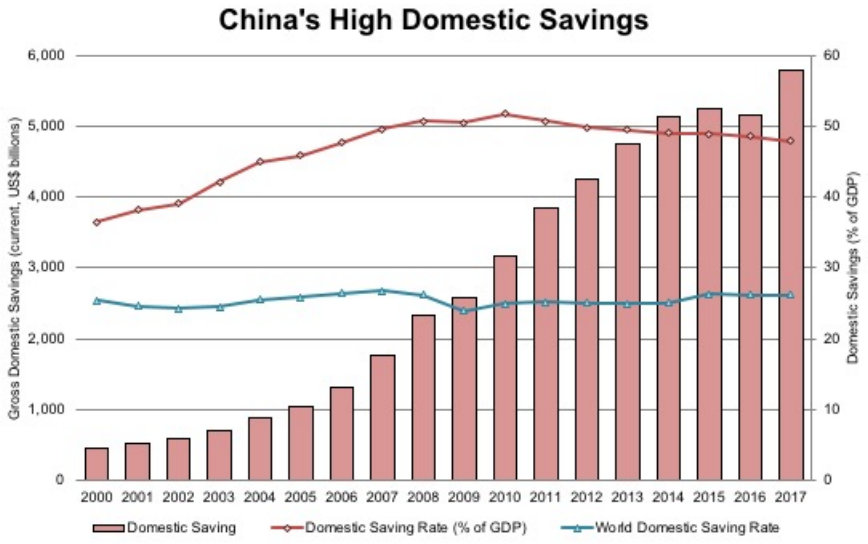

Figure 4: Development of the gross savings rate (China and global average) and the value of gross savings in China

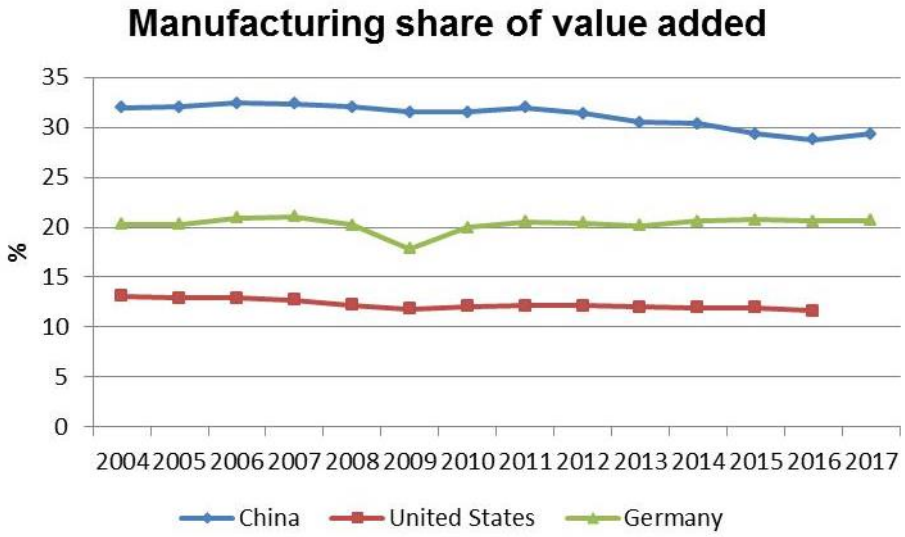

Figure 5: Share of manufacturing sector value added in total value added

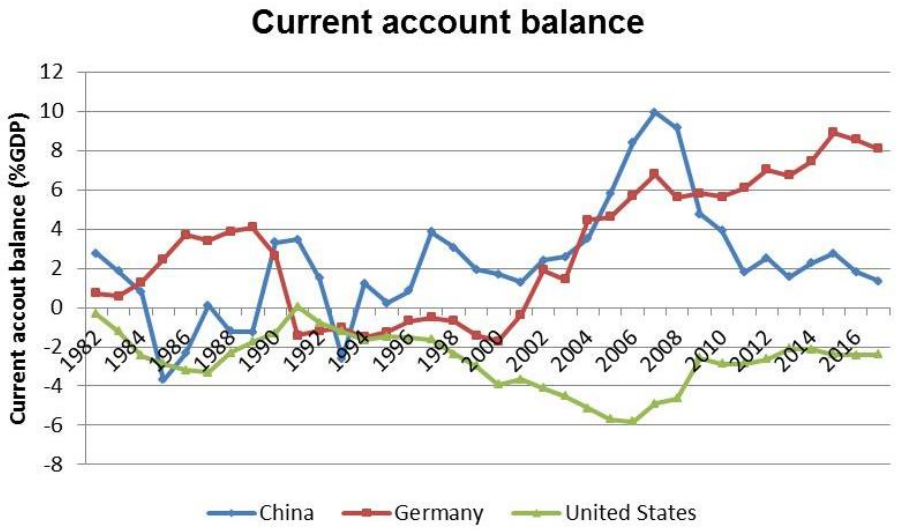

Figure 6: Development of current account as a percentage of GDP

growth is already part of the baseline scenario and the share of services in GDP is already rising in the baseline because of structural change. Instead we focused on other trends such as productivity growth targeted to specific sectors aimed at Made in China 2025 and a rising share of skilled workers.

Second, Zhai and Morgan (2016) have studied the impact of a slowdown in economic growth in China on other Asian economies, finding that a reduction in economic growth of 1.6 percentage points in China would lead to a reduction in economic growth in developing Asia of 0.26 percentage points with considerable variation across different regions. The growth reduction is modelled through a reduction in real investment growth by 3 percentage points. The model

in Zhai and Morgan (2016) features endogenous adjustment in capital and labour utilitization. Their study is different from ours, since we mainly focus on rebalancing and not so much on a slowdown in economic growth.

Third, Lakatos et al. (2016) have explored the impact of structural change in China on growth and poverty in Africa, concentrating on the one hand on two types of rebalancing also modelled by Koopman et al. (2014) (a lower savings rate and a higher share of services in consumption) and on the other hand on the slowdown of economic growth, by comparing the baseline growth trajectory with a hypothetical constant growth trajectory with growth staying at its initial high level. The authors find that a slowndown of economic growth exerts a negative impact on Africa. However, rebalancing in China more than compensates for the negative income effects of slower growth, because of higher import demand and favourable terms of trade effects. Other studies on structural change in China have explored for example how the value chain structure of Chinese exports has changed over time, uncovering a rising share of domestic content in Chinese exports (Kee and Tang (2016), Lemaine and Unal (2017)) and how a shift in demand from manufacturing to services has affected China's net exports of embodied CO2-emissions (Qi (2014)).

This paper is organized as follows. The next section introduces the Global Trade Model, used to conduct the simulations. Section 3 outlines the design of the baseline projections and the policy experiments. Section 4 presents and discusses the results of the simulations. Section 5 concludes.

2 Global Trade Model

The GTM has been developed by a team of GTAP in cooperation with the Economic Research and Statistics Division at the WTO. The model is a recursive dynamic CGE model featuring multiple sectors, multiple production factors, intermediate linkages, multiple types of demand (private demand, government demand, investment demand, and intermediate demand by firms), non-homothetic preferences for private households, a host of taxes, and a global transport sector. Each region features a representative agent collecting factor income and tax revenues and spending this under utility maximization on private consumption, government consumption, and savings. Firms display profit maximizing behavior, choosing the optimal mix of factor inputs and intermediate inputs. Savings are allocated to investment in different regions.

The GTM is based upon the GTAP model so retains many of its features including CDE preferences and an Armington trade structure. But the model also contains a range of additional features. First, the model is recursive dynamic, thus featuring endogenous capital accumulation. The capital stock at the beginning of period t is equal to the capital stock at the end of period $t-1$ plus investment minus depreciation. Second, the model features isoelastic factor supply of land and natural resources. Third, it allows for changes in spending shares (for example changes in import shares or the share of labor income in total factor income) employing the twist-parameter approach developed by Dixon and Rimmer (2002). Fourth, price and quantity indices in the model are defined using the "ideal" index approach. The ideal (or Fisher) price index is a geometric mean of the Laspeyres and and Paasche price indices. Fifth and finally, the model is flexible in its trade structure, allowing for a perfect competition setting with Armington preferences, but also for a setting with monopolistic competition, either with homogeneous firms (Ethier-Krugman) or with heterogeneous firms (Melitz). Further details on the GTM can be found in Aguiar et al. (2018).

3 Design of simulations

3.1 Baseline projections

We begin our analysis by constructing a baseline projection of the world economy until 2040. An aggregation with 12 regions, 15 sectors and 5 factors of production is used, as displayed in Table 1. The sectoral aggregation includes sectors such as motor vehicles, transport equipment, machinery and electronic equipment, of particular interest for examining the ongoing and proposed structural changes taking place in the Chinese economy, such as those promoted by the Made in China 2025 initiative. A more detailed aggregation in terms of regions and sectors is not necessary for our purposes. Baseline data from the latest release of GTAP 10 (GTAP10p2) are projected from 2014 out to 2040. We discipline the trajectory of the world economy using projections on GDP per capita growth, population and labor force growth, as well changes in the share of skilled workers. The growth of population, labor force and number skilled workers are imposed on the projections, while GDP per capita growth is targeted by means of endogenizing labor productivity growth, allowing for endogenous capital accumulation based on recursive dynamics.

GDP per capita growth is obtained from OECD Shared Socioeconomic Pathways projections

Table 1: Overview of Regions, Sectors and Production Factors

Regions	Sectors	Production Factors
Oceania	Agriculture	Land
China	Natural Resources	Unskilled Labor
Japan	Processed Food	Skilled Labor
East Asia	Light Manufacturing	Capital
Southeast Asia	Petroleum, Coal Products	Natural Resources
South Asia	Chemical, Rubber and Plastic Products	
Canada & Mexico	Heavy Manufacturing	
USA	Motor Vehicles and Parts	
Latin America	Transport Equipment	
European Union (28)	Electronic Equipment	
Middle East, North- and Sub-Saharan Africa	Machinery and Equipment	
Rest of World	Other Manufactures	
	Transport	
	Business Services	
	Non-tradable Services	

employing the middle-of-the-road scenario, SSP2 (Dellink et al. (2017)). Population and labor force growth projections derive from UN population projections employing the medium variant for 2015 (UN (2015)). Finally, changes to the number of skilled and unskilled workers come from projections on education levels by IIASA (KC and Lutz (2017)). In particular, the change in the share of tertiary educated workers is used as a proxy for the change in the share of skilled workers.

The model baseline incorporates three additional types of structural change. First, to account for structural change in a narrow sense (that is, a rising share of services output in total output and falling agricultural and manufacturing shares), we include differential productivity growth across sectors based on historical data. In particular, EUKLEMS and OECD-STAN sectoral total factor productivity (TFP) growth data are employed to estimate the historical deviation of sectoral TFP growth from average TFP growth. These differential productivity growth rates are imposed on the baseline projections. On average, productivity growth tends to be stronger in agriculture and manufacturing compared to services. As a result the relative price of services rises leading to a rising share of this sector, given the limited scope for substitution between the three broad sectors.[1].

Second, domestic savings rates are targeted following projections from CEPII's MaGE model (Foure et al. (2013)). Savings rates vary with GDP per capita growth and demographic factors in

[1]We have also explored the hypothesis that differential productivity growth in manufacturing is larger in strongly growing countries, but did not find empirical support for it (Bekkers et al. (2018)).

a life-cycle framework in their model. Since savings rates remain virtually constant in the basic model in which savings are a Cobb-Douglas share of national expenditures, projecting savings rates based on empirical regularities leads to a more realistic path for savings rates. This is especially important in the case of countries such as China, which have very large savings rates.

Third, we allow for changing income elasticities as countries grow richer. In particular, we have regressed the main parameter of the utility function of private consumption determining the income elasticity, Incpar, on GDP per capita growth. This leads to falling income elasticities of food items and rising income elasticities of services over time.

Besides the different types of structural change, we have included isoelastic supply functions with supply elasticities equal to 1 to allow for changes in the aggregate amount of land and natural resources employed. The other parameters of the model are set at standard values, following the values in the GTAP 10 database.[2]

These baseline projections contain four dynamic changes relevant for the trajectory of the Chinese economy. First, the OECD projections on GDP per capita growth contain a considerable slowdown in the projected GDP per capita growth. In Koopman et al. (2014) and Lakatos et al. (2016) slower productivity growth is part of the policy experiment. We include slower GDP per capita growth in the baseline, since it is part of the middle-of-the-road scenario of the OECD projections. To examine the impact of slower GDP per capita growth, we compare the 2015 situation (at the beginning of the simulations) with the 2040 situation. It does not seem realistic to generate a counterfactual scenario where GDP per capita growth in China would stay at the high level of the last 10 years for another 15 or 25 years. Second, the share of high-skilled workers rises in the baseline, based on the IIASA projections. Third, the gross savings rate in China falls considerably from 2015 to 2040 in the baseline projections, from about 50% to under 40%. Fourth, differential productivity growth across sectors leads to a considerable rise in the share of services. Both the third and the fourth feature lead to a falling share of manufacturing in output. Koopman et al. (2014) model the reduction in the manufacturing share through the demand side with shifting preferences. In our simulations differential productivity growth and falling savings rates already lead to a considerable reduction in the manufacturing share in production, so we do not include shifting preferences. In line with the report by the World Bank on structural changes in the Chinese economy, we model stronger trends in our policy experiments for the second and third change, falling savings rates and rising shares of skilled

[2]Details can be verified from replication files, available upon request.

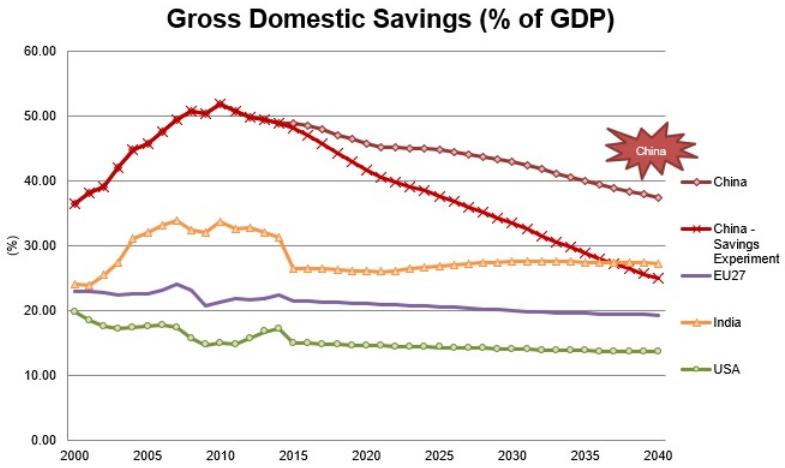

Figure 7: Projected gross savings rates in the baseline in selected countries

workers.

3.2 Policy experiments

We introduce three policy experiments to examine the possible effects of the undergoing structural changes in China on trade, production and welfare:

1. Based on the report by the World Bank the gross savings rate in China is targeted to decreases to 33.5% by 2030. Figure 7 shows that the gross savings rate falls to about 42% in 2030 in the baseline. To target a gross savings rate we impose a constant percentage reduction in the savings rate from the start of the simulations (2014) and assume that this constant percentage reduction in the savings rate continues until 2040. With this approach the percentage point reduction in the savings rate will become smaller over time, leading to a savings rate of about 25% in 2040, which is in the range of the projected savings rates of other main countries displayed in Figure 7 and the historical global average displayed in Figure 4.

   Technically, the Chinese savings rate is targeted to reach 33.5% by 2030 by means of an annual percentage change reduction in the ratio of gross savings to GDP. The value of the shock is obtained by calculating the percentage difference between the baseline value of the savings rate in 2030 and its targeted value of 33.5% for the same year. The shock is then annualized and applied from 2015 up to 2040, leading to a savings rate of about 25% in 2040.

2. Based on the report by the World Bank, the share of skilled workers in the Chinese

economy is projected to reach "advanced countries" levels by 2040. This means that the share would increase to about 40% in 2040. This target aligns with the logic in Made in China 2025 in which China expressed the wish to reach "advanced countries" levels of technology in targeted manufacturing sectors. To sustain this development, the share of skilled workers should also rise to "advanced country" levels.

Technically, the share of skilled workers in China is targeted to reach the levels of "advanced countries" by means of annual additional percentage changes in the supply of different skilled and unskilled workers, so as to keep the total size of the labor force constant. First, a special aggregation is used in which countries are separated between "advanced countries" and "rest of the world" following the World Bank's country classification by income level[3]. The baseline shares of skilled and unskilled labor in China in 2040 are then compared with those of advanced countries and the percentage difference between them is calculated as an annual growth rate between 2014 and 2040, so as to close the gap between the share of skilled labor in China and in advanced countries.

3. In May 2015 the Chinese State Council presented Made in China 2025 aimed at promoting high-end manufacturing sectors. More specifically ten priority sectors are defined: next-generation information technology; high-end numerical control machinery and robotics; aerospace and aviation equipment; maritime equipment; rail equipment; new-energy vehicles; electrical equipment; new materials; biomedicine and high-performance medical devices; and agricultural equipment. For these sectors the Chinese government aimed at achieving larger domestic and international market shares by means of investment in technological innovation and increased productivity growth, particularly focusing on higher rates of self-sufficiency, thus reaching higher domestic market shares (US Chamber of Commerce (2017)). We mapped the ten prioritized sectors into four GTAP-sectors: electronic equipment; motor vehicles and parts; other transport equipment; and machinery and equipment. We endogenized productivity growth in these sectors targeting increases in self-sufficiency rates, based on the targets for increases in self-sufficiency reported in US Chamber of Commerce (2017) for the ten prioritized sectors.

   Technically, we calculated the extent to which China is aiming to close the gap to self-sufficiency in five years (from 2020 to 2025) as reported by US Chamber of Commerce

[3] Advanced countries are those which fall in the high-income group – that is, with a GNI per capita of $12,476 or more.

(2017). More specifically, we calculate the projected percentage reduction in import dependency rates in China in five years according to US Chamber of Commerce (2017), annualized it, and imposed it on the reduction in import dependency in our model for the four mentioned sectors.[4]

4 Results

The results of the experiments are presented in a cumulative format, following the order in which the experiments are introduced in the previous section, also presenting the results of the baseline simulations. Hence, experiment 1 refers to the savings rate reduction, experiment 2 to the savings rate reduction and the increase in the share of skilled workers combined, and experiment 3 to all three shocks combined, thus including as well additional productivity growth in sectors targeted by Made in China. The presentation of the results is split up into three parts, distinguishing between the impact on (i) China, (ii) the interaction between China and other countries, and (iii) the interaction between China and the United States.

4.1 Chinese economy

Figure 8 displays the share of household consumption in China in the baseline and in the policy scenarios. The share of household consumption is projected to rise from 0.38 in 2015 to 0.44 in 2040 in the baseline, whereas in the policy scenarios it is projected to rise to 0.52. This brings the household consumption share closer to the global average of 0.58. We remember from the previous section introducing the experiments that the share of gross savings is projected to fall from 0.49 in 2015 to respectively 0.38 and 0.25 in the baseline and experiments. Hence, both in the baseline and the experiments the household consumption share does not rise as much as the savings rate falls. This can be explained by the fact that the share of government expenditures also rises. This implies that a falling savings rate does not lead one-for-one to rising household consumption. In particular the simulations show that the share of government expenditures rises from 0.13 in 2015 to 0.18 in the baseline and to 0.22 in the policy scenarios, indicating that the government expenditures share rises much more in relative terms (compared to its initial level) than household expenditures.

[4]Since the starting rates of self-sufficiency (concorded) reported in US Chamber of Commerce (2017) tend to be much lower than in our baseline data we mapped the extent to which China closed the gap to complete self-sufficiency (and so reduced the import dependency rate).

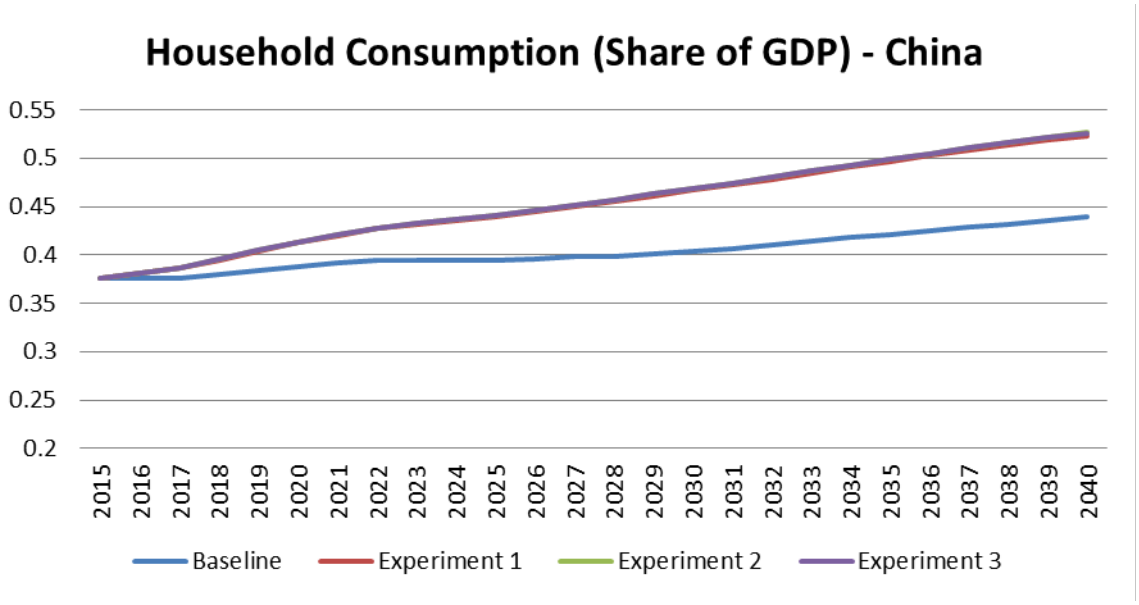

Figure 8: The share of household consumption in GDP

We can see this point more formally as follows. In the model private households and the government are consolidated, so income is equal to consumption plus savings plus government expenditures, $Y = C + S + G$. Hat differentiating then gives the following expression for the relative change in the share of consumption to income with sh_{ec} the share of expenditure category ec:

$$\widehat{\frac{C}{Y}} = -\frac{sh_s}{sh_c}\widehat{\frac{S}{Y}} - \frac{sh_g}{sh_c}\widehat{\frac{G}{Y}} \tag{1}$$

We can explain the relatively stronger increase in the share of income spent on government expenditures as follows. Preferences for private goods are non-homothetic. With expenditures switching in the direction of goods with high income elasticities as China grows richer, the marginal utility of income on private household consumption falls. As a result the share of income spent on private household consumption would fall, if we would abstract from the falling savings rate imposed exogenously.[5] With the falling savings rate the share of government consumption rises much more than the share of private household consumption.

Another mechanism that could explain the stronger rise in the share of government expenditures is that the slower productivity growth of services leads to a rise in the relative price of government consumption which mainly consist of services (Baumol effect). With limited scope for substitution between private household and government expenditures this would raise the share of government expenditures. However, this phenomenon is not present in the model,

[5]See for further discussion of this mechanism in the model McDougall (2003) or Bekkers et al. (2018).

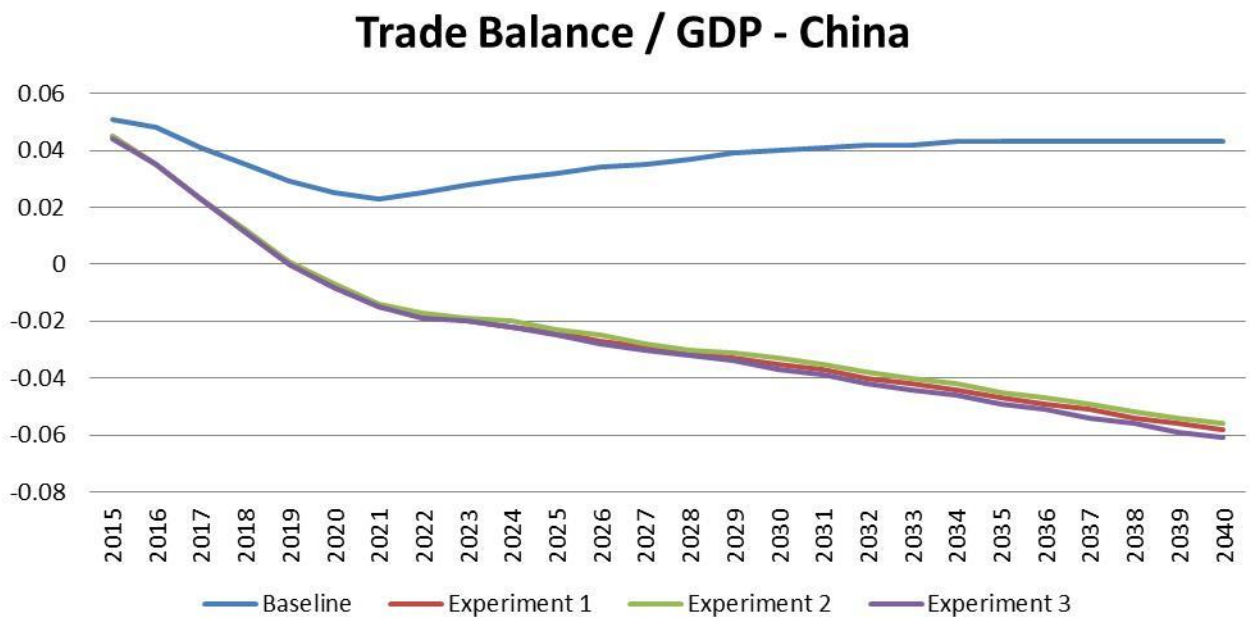

Figure 9: The trade balance as a share of GDP

because of the Cobb-Douglas preferences between the three expenditure categories savings, household consumption, and government consumption.

Figure 9 displays the development of the trade balance (as a fraction of GDP) in the baseline and for the three experiments. The figure shows that the trade surplus falls somewhat in the baseline over time. Most remarkable, however, is that the trade surplus turns into a trade deficit under the falling savings rate experiment. To explain this finding, we have to recall the macroeconomic identity that the trade balance (exports minus imports) is equal to savings minus investment:[6]

$$S - I = X - M \tag{2}$$

The allocation of global investment across regions is in our model determined by the rate of return to capital in the different regions. Since a falling savings rate does not have a big impact on the attractiveness to invest in China and thus on investment in China, the identity in (2) shows that the trade balance of China necessarily has to deteroriate with a drastic reduction in the savings rate. Obviously, the chosen closure rule to allocate global investment plays a large role in this finding. If we would have imposed a fixed trade balance or a Feldstein-Horioka type closure with domestic investment largely following domestic savings as in Foure et al. (2013), the trade balance would have been much more stable.

[6]To derive this equation we can combine $Y = C + I + G + X - M$ with $Y = C + S + G$.

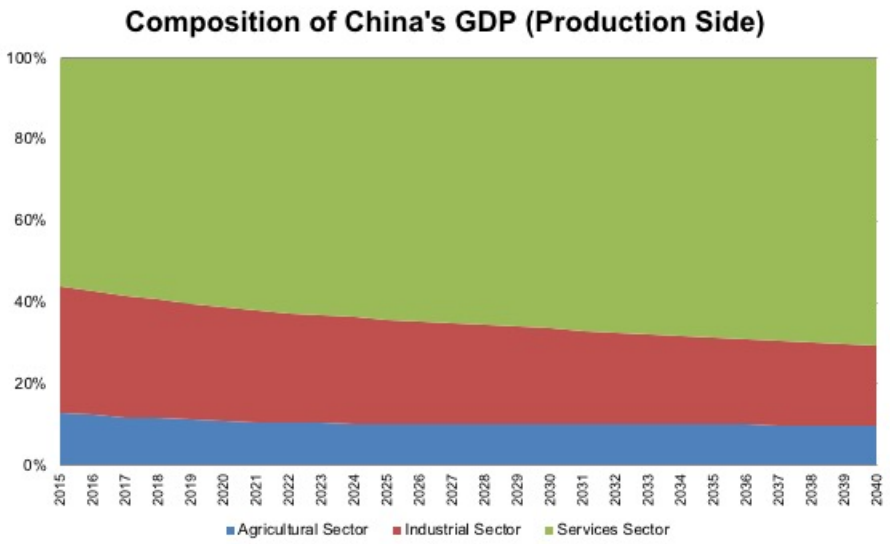

Figure 10: The contribution of agriculture, manufacturing and services to GDP

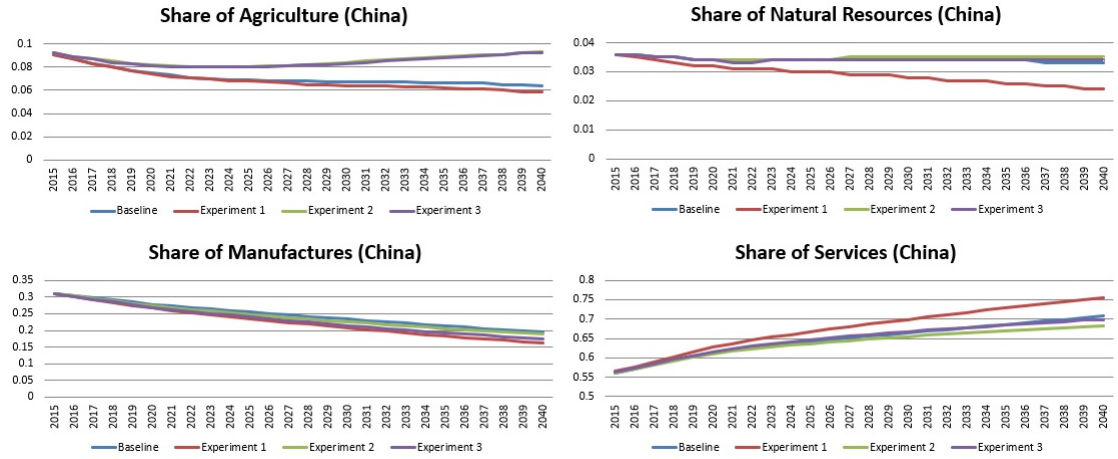

Figure 11: The development of the share of agriculture, natural resources, manufactures, and services in GDP

Figure 10 displays the contribution of the three broad sectors agriculture, manufacturing, and services to the value of production in the baseline projections.[7] Structural change in the sectoral composition of production is clearly visible. The share of manufacturing falls from 0.31 to 0.2, whereas the share of services is projected to rise from 0.56 to 0.71. The share of agriculture is projected to fall from 0.09 to 0.06. The reason for these changes is twofold. First, larger productivity growth in manufacturing and services leads to falling relative prices and thus a falling value share of these sectors, given the limited scope for substitution between broad sectors. Second, the income elasticity is largest for the services sectors. Hence, as China grows richer a larger share of income will be spent on services.

[7]The fourth broad sector, natural resources, is omitted in this figure.

Figure 11 displays the development of the share of the four broad sectors in the value of production in the baseline and the three cumulative experiments. The first experiment, a falling savings rate leads to a falling share of manufacturing and natural resources and a strongly rising share of services. Two mechanisms are responsible for this finding. First, the falling savings rate goes together with less investment and more government and household consumption and investment is less services intensive. Second, the falling savings rate converts the trade surplus into a trade deficit. As a result a larger share of Chinese production is sold domestically and domestic sales are more concentrated on services than export sales.

Adding the second experiment, a strongly rising share in the number of skilled workers, reduces the services share again, even below the services share in the baseline, whereas the agricultural share rises again. Services are relatively high-skill intensive, whereas agriculture is relatively low-skill intensive. As a result agricultural goods become relatively more expensive and with limited scope for substitution, this raises the value share of this sector in the total value of production. Finally, the third shock, higher productivity growth in high-end manufacturing sectors does not have a big impact on the shares of broad sectors in total production.

4.2 China in the global economy

In this subsection simulation results on the position of China in the global economy will be presented. We start with the development of the role of China in the global economy as measured by the share of Chinese exports in global exports. Figure 12 shows that in the baseline China's share in global exports would increase from about 0.16 to 0.19 between 2015 and 2040. However, with a drastic reduction in the savings rate the Chinese export share would fall to about 0.11. The increase in China's share in global exports in the baseline is due to the fact that China's GDP growth is above the global average. The falling export share in the rebalancing scenario is driven by the fact that in this case China would reorient its focus away from exporting towards production for the domestic market. Figure 12 makes clear that falling savings rates would have a strong impact on the role of China in global trade.

Figure 12 displays the share of the different export destinations in Chinese exports in 2015 and in 2040 under the baseline and the three experiments. The figure makes clear that the market shares of Southeast Asia and SSA-MENA (Sub-Saharan Africa and Middle East and Northern Africa) are projected to rise, whereas the market share of Japan, the USA and the EU are projected to fall. In general these trends are reinforced in the different experiments,

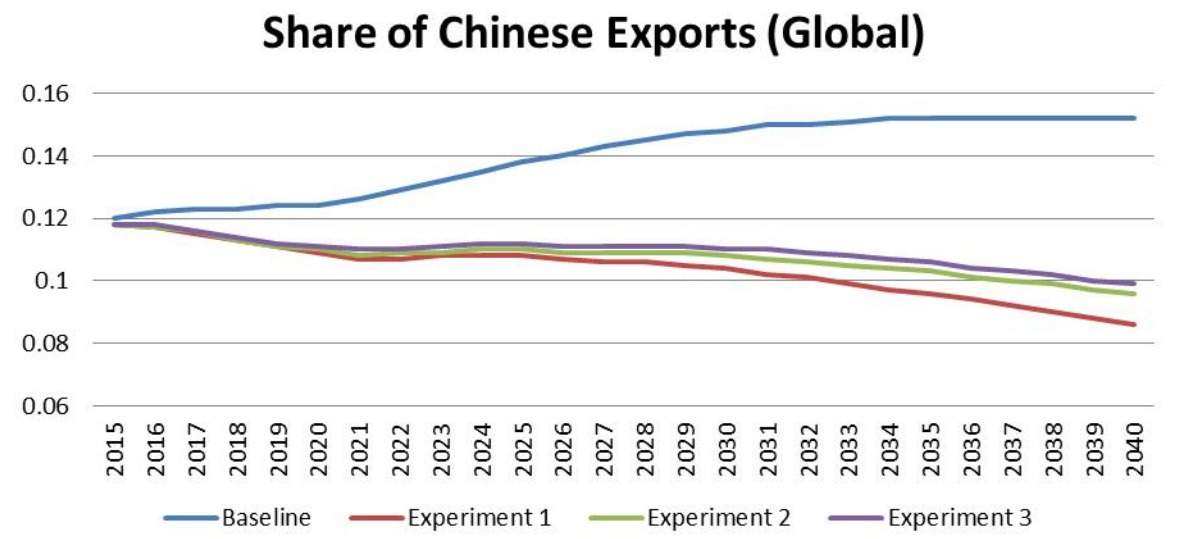

Figure 12: The share of Chinese exports in global exports (including intra-regional trade)

although the impact is limited.

Figure 14 shows the development of the share of manufacturing exports in total exports in the baseline and for the experiments. The share of manufacturing exports starts from a very high level of about 0.93 and is also projected to stay at a high level of around 0.92 in the baseline. However, the fall in the savings rate and the rise in the number of skilled workers is projected to reduce the share of manufacturing exports and raise the share of services exports (not displayed), whereas the Made in China 2025 policies targeted at selected manufacturing sectors will raise the manufacturing share again. A rising number of skilled workers leads to a lower share of manufacturing exports and higher share of services exports for standard factor abundance reasons: high-skilled workers are used relatively intensively in services so with an increase in the number of high-skilled workers specialization will shift in the direction of services. To explain that a falling savings rate leads to a lower share of manufacturing exports, we employ the results of Figure 16, discussed below, showing that a falling savings rate raises China's real exchange rate. Phrased differently, China becomes less competitive as a result and this has a stronger impact on manufacturing exports than on services exports, since trade elasticities are larger for manufacturing goods.

Figure 15 displays the revealed comparative advantage (RCA) of China, defined as the share of exports in a sector relative to the global share of exports in the same sector. The figure makes clear that China has currently a comparative advantage in manufacturing and in particular in light and heavy manufacturing, electronic equipment, machinery, and other goods. In the

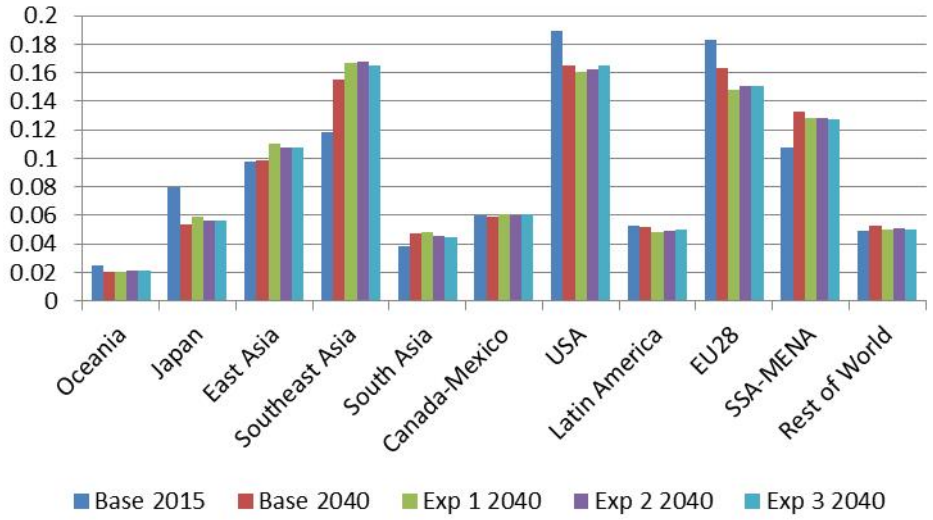

Figure 13: The share of exports to different destinations in Chinese exports

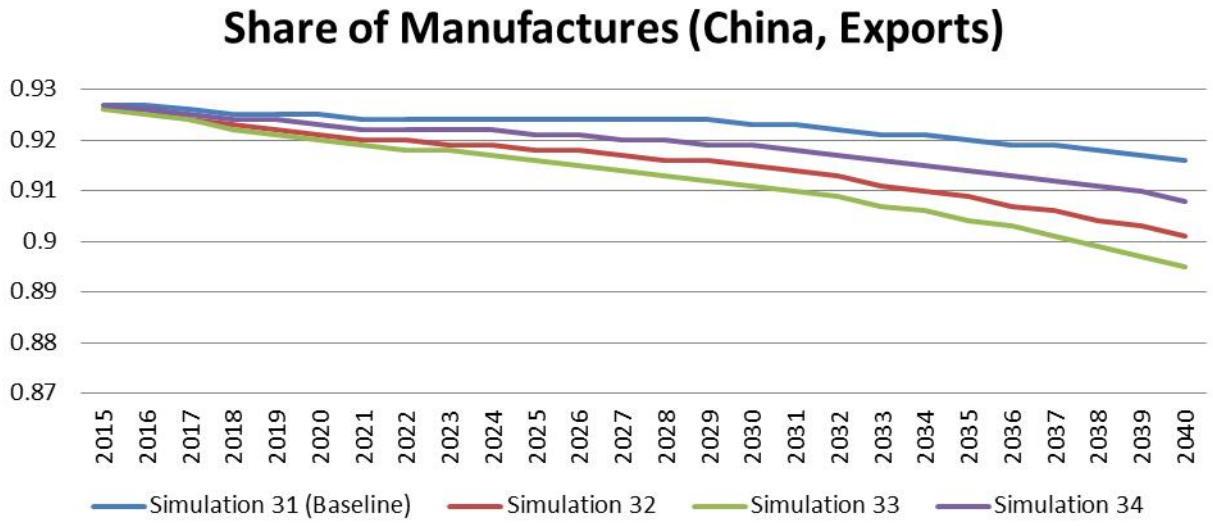

Figure 14: The share of manufacturing exports in total exports in China

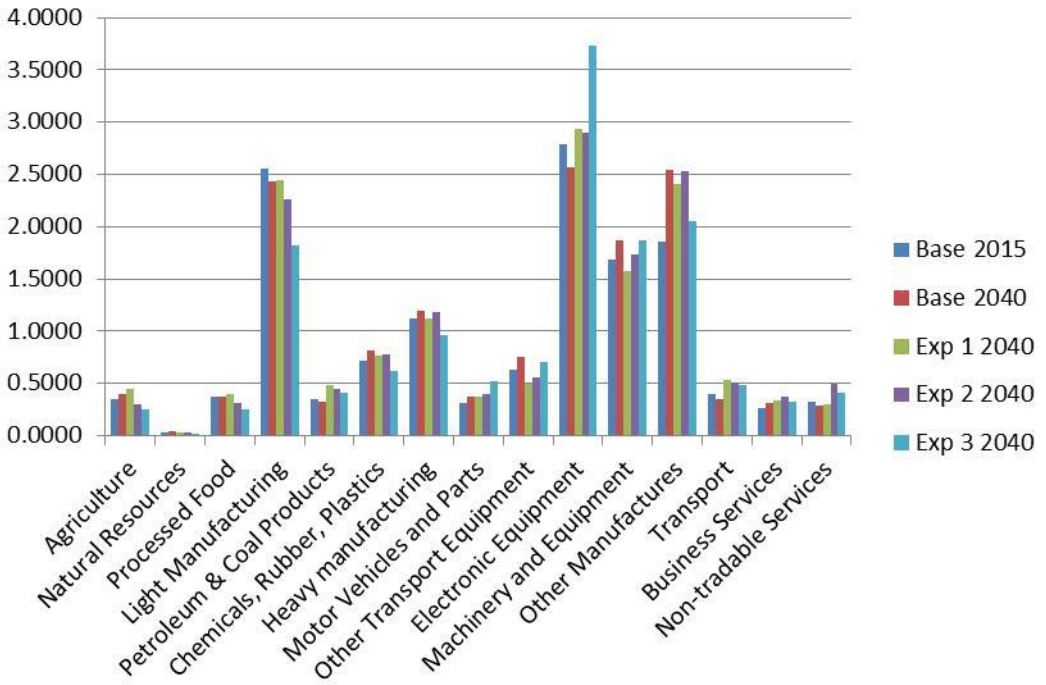

Figure 15: Revealed comparative advantage of Chinese exports by sector

baseline and the savings rate and skilled workers share experiments this pattern of comparative is not projected to change much. However, the Made in China 2025 experiment would significantly raise China's comparative advantage in the sectors targeted by this program and in particular electronic equipment, whereas comparative advantage in the traditional manufacturing sectors such as light manufacturing and other goods (textiles for example) is projected to fall. However, the substantial additional productivity growth in the four targeted sectors as a result of Made in China 2025 does not lead to a change from revealed comparative disadvantage to revealed comparative advantage in for example motor vehicles and parts.

Finally, Figure 16 shows the development of the real exchange rate defined as the (fob-)price of exports relative to the (cif-)price of imports. The figure makes clear that the real exchange rate falls in the baseline, whereas it is rising in the savings scenario. The reason is that in the latter scenario the Chinese economy would get into a trade deficit, which goes along with falling price competititiveness. More specifically, the reduction of the savings rate leads to net capital inflows into China (given limited changes in investment), thus raising investment demand for factor inputs, thus driving up the price of exports. Figure 16 makes clear that adding both a rising share of skilled workers (Experiment 2) and additional productivity growth in targeted manufacturing sectors (Experiment 3) would exert downward pressure on the real exchange rate, as it would make Chinese exports cheaper again.

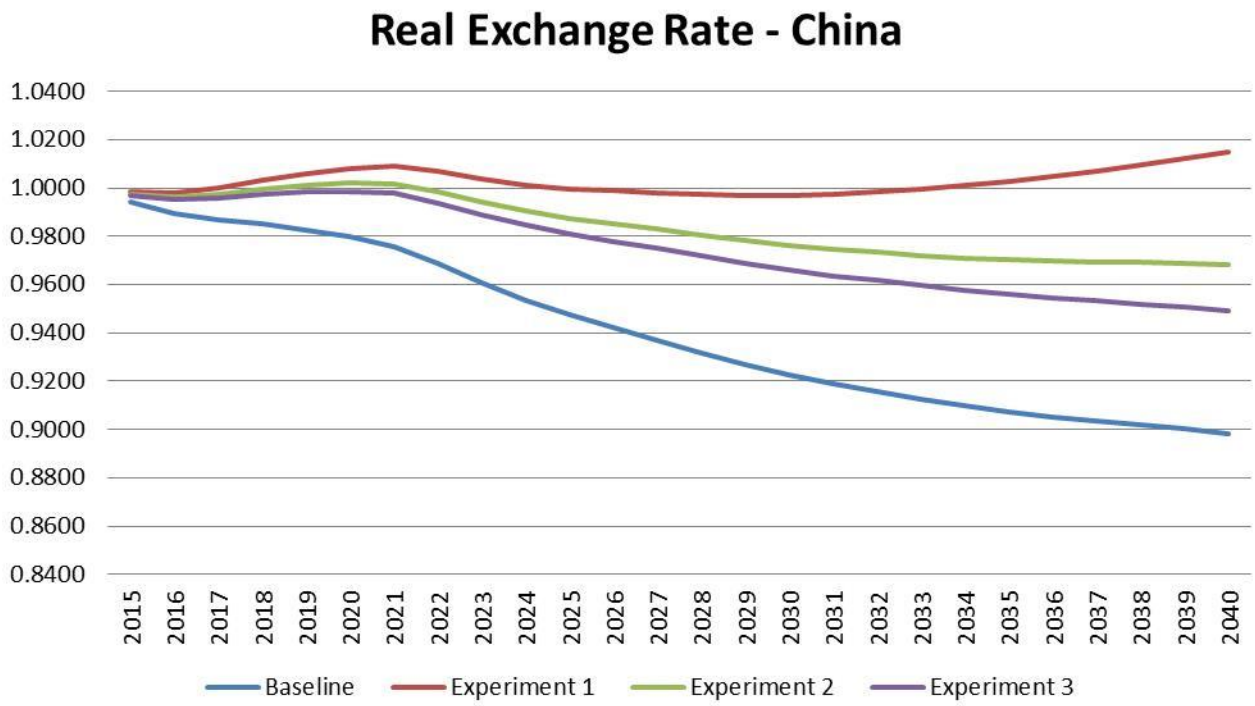

Figure 16: Real exchange rate (price of exports relative to price of imports) of China

4.3 Impact on trade relation between China and the United States

In this subsection we focus on the (trade) relations between China and the United States. Figure 17 displays the development of the aggregate trade balance of the United States. The figure makes clear that the aggregate trade balance is projected to deteriorate slightly in the baseline from about -5% of GDP to about -6% of GDP, whereas it will improve for the three experiments to -4% of GDP, especially as a result of the falling savings rate in China and the implied deterioration of the trade balance in China. The implication is that globally less savings are available to invest in different countries and so less investments will be flowing to the United States.

Figure 18 focuses on the development of the bilateral trade balance between the United States and China in thousands of dollars. In the baseline the bilateral trade surplus of China vis-a-vis the United States would rise from about 300 billion in 2015 to 450 billion in 2030. With falling saving rates, however, the bilateral trade surplus would get close to zero, falling to about 50 billion. With the increase in the number of skilled workers this tendency would be less-pronounced and the bilateral surplus of China would fall to about 100 billion. The reason for the falling bilateral trade surplus is that China would become less competitive, as reflected in the higher level of China's real exchange rate under the savings rate experiment,

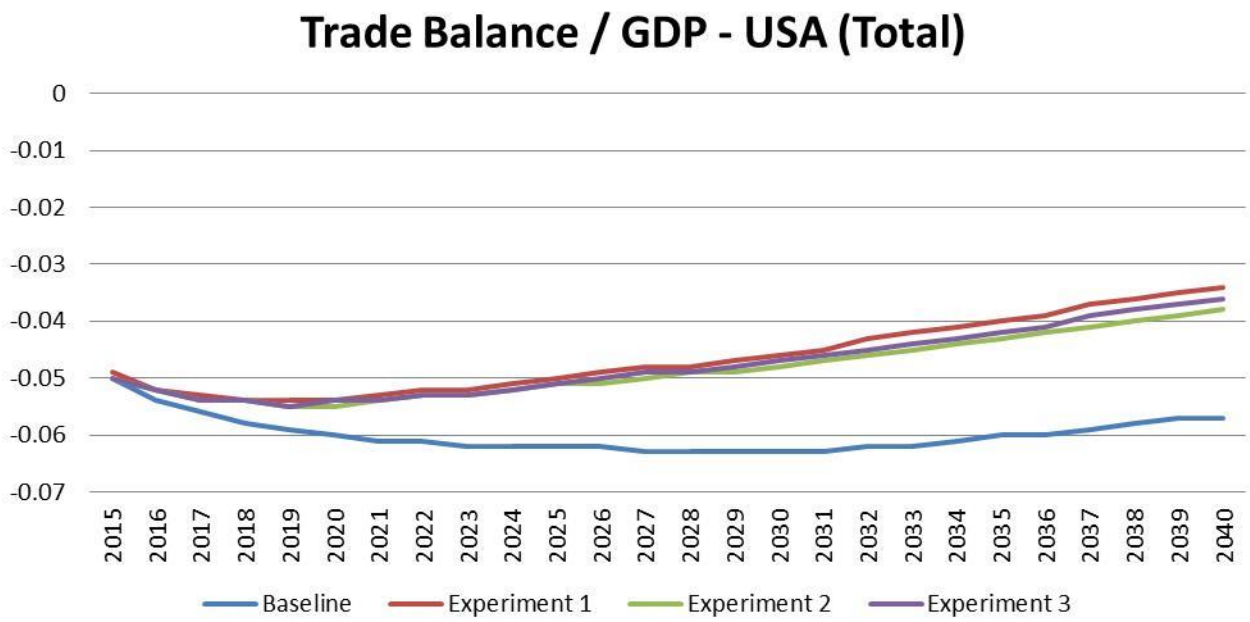

Figure 17: The trade balance as a share of GDP in the United States

whereas the United States would become more competitive, as reflected in the lower level of the real exchange rate of the United States. Furthermore, China would be reoriented towards its domestic economy, leading both to less exports and imports. Since a relatively large share of Chinese exports goes to the United States, whereas a smaller share of its imports come from the United States, this reorientation will contribute to the reduction in the bilateral trade surplus of China vis-a-vis the United States.

Figure 19 displays the development of the bilateral trade surplus of China vis-a-vis the United States for four selected sectors, two sectors in which the United States has a surplus and two sectors in which China has a surplus. The figure shows the same trends as the figure on the aggregate trade deficit. In the baseline the trade surplus of China will rise further, whereas the adjustment of the savings rate will reduce the bilateral surplus of China. As expected the Made in China 2025 experiment improves the trade balance in the targeted sectors (motor vehicles and electrical equipment), whereas it will reduce the trade balance in non-targeted sectors like agriculture and heavy machinery.

5 Concluding remarks

In this paper we have studied the impact of structural change in China, expected to rebalance the Chinese economy. Starting from baseline projections of the global economy generated

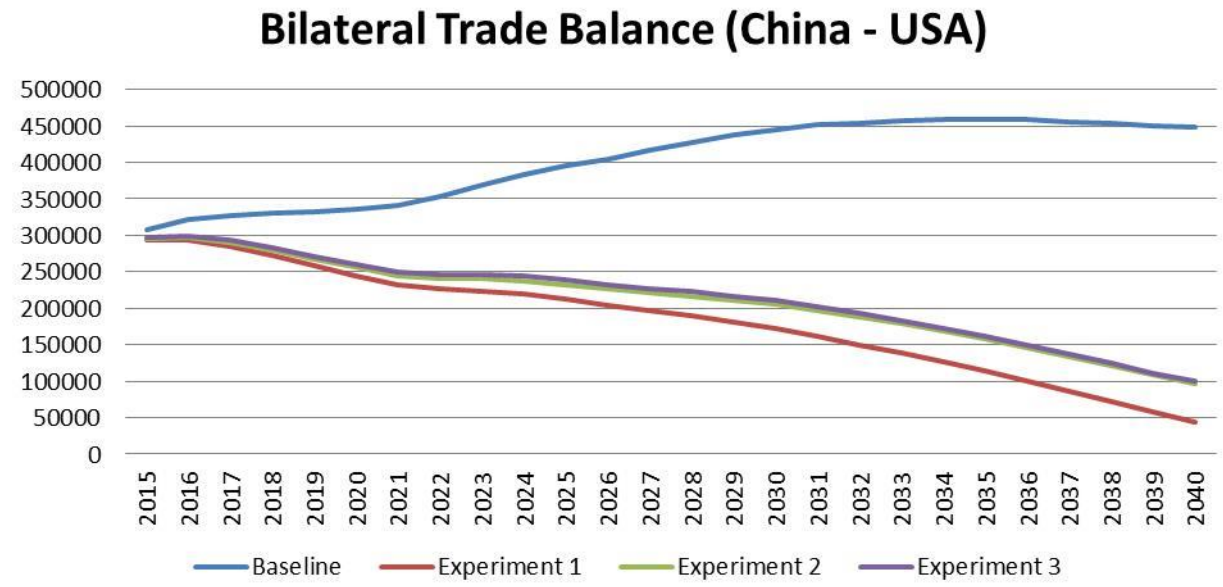

Figure 18: The bilateral trade surplus of China vis-a-vis the United States in thousands of dollars

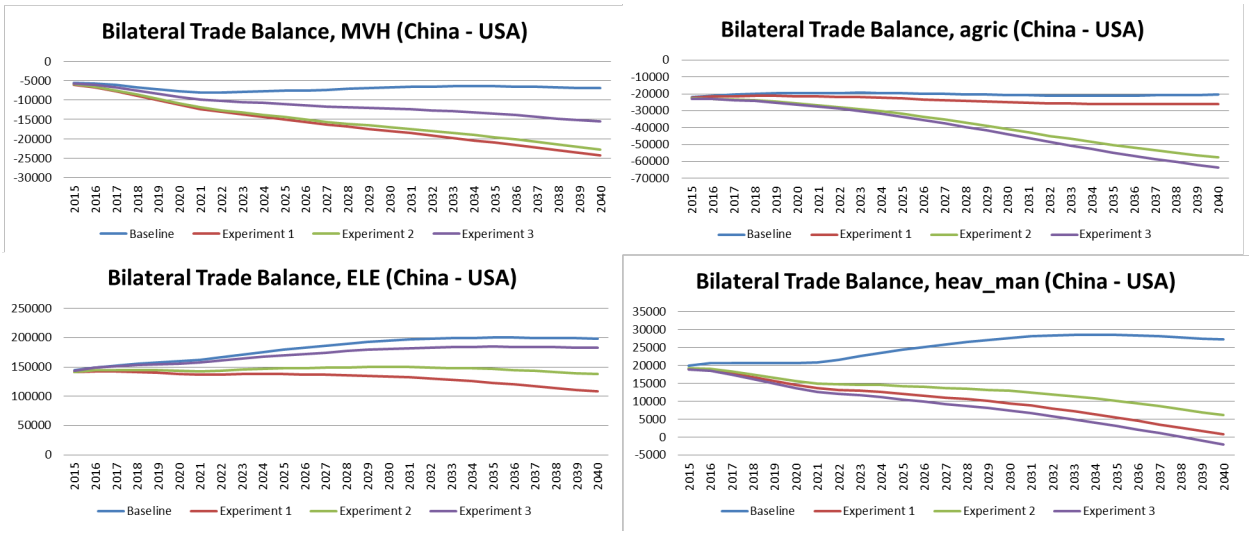

Figure 19: The bilateral trade surplus of China vis-a-vis the United States in four selected sectors

with the WTO Global Trade Model, we have introduced three experiments into the model, a falling savings rate, a rising share of skilled workers, and higher productivity growth in targeted high-end manufacturing sectors. In the baseline China's share in global exports will increase considerably, and both its aggregate trade surplus and trade surplus vis-a-vis the United States will rise. With the structural change experiments, however, these trends will be reversed. The aggregate trade surplus will turn into an aggregate trade deficit, whereas the trade surplus vis-a-vis the United States will fall close to zero. Furthermore, the share of Chinese exports in global exports will fall, as the Chinese economy will be oriented more on domestic sales.

The rebalancing of the Chinese economy has five other main implications. First, the fall in the savings rate will raise the share of private household and government spending considerably with the latter rising more than the former. Second, the share of services in the economy will increase considerably, at the expense of a smaller share of manufacturing and agriculture. Third, China gains comparative advantage in the sectors targeted by Made in China 2025, although the share of the total manufacturing sector in Chinese exports will fall. Fourth, a larger share of Chinese exports will go to Southeast Asia, Sub-Saharan Africa and the Middle East and North Africa, whereas the share exported to Japan, the EU, and the USA is projected to fall. Fifth, the trade deficit of the United States is projected to fall as a result of rebalancing in China and the bilateral trade balance between China and the United States is projected to get close to zero.

Future work could extend the paper in the following directions. First, the macroeconomic closure rule determining the allocation of global investment across regions could be generalized, combining rate-of-return sensitive investment with a Feldstein-Horioka mechanism. Second, changes in value-added export patterns instead of gross export patterns could be explored. Third, instead of following the projections from the World Bank on the reduction in the Chinese savings rate, the determinants of the Chinese savings rate could be studied more into depth, exploring for example the trajectory of the savings rate in other East Asian countries that developed economically before China, such as Korea and Japan.

References

Bekkers, Eddy, Robert Koopman, Robert Teh, and Giulia Sabbadini (2018). Long run trends in international trade. The impact of new technologies. Mimeo WTO.

Aguiar, Angel, Eddy Bekkers, Erwin Corong, Joseph Francois, Robert Teh and Dominique van der Mensbrugghe (2018). WTO Global Trade Model. Description of the Model. Mimeo WTO.

Dellink, Rob, Jean Chateau, Elisa Lanzi, Bertrand Magne (2017). Long-term economic growth projections in the Shared Socioeconomic Pathways. Global Environmental Change 42: 200–214.

Dixon, P.B., and M.T. Rimmer (2002). Dynamic general equilibrium modelling for forecasting and policy: a practical guide and documentation of MONASH, 1st ed., vol. 256. Amsterdam: Elsevier.

Foure, Jean, Agnes Benassy-Quere, and Lionel Fontagne (2013). Modelling the world economy at the 2050 horizon. Economics of Transition 21(4): 617-654.

KC, Samir and Wolfgang Lutz (2017). The human core of the shared socioeconomic pathways: Population scenarios by age, sex and level of education for all countries to 2100. Global Environmental Change 42: 181–192.

Kee, H. L. and H. Tang (2016). Domestic value added in exports: Theory and firm evidence from China. American Economic Review 106(6): 1402–36.

Koopman, Robert, Alexander Hammer, Lin Jones, and Marinos Tsigas (2014). Potential Implications of China's Rebalancing on China, the United States, and the Bilateral Economic Relationship. GTAP Conference Paper.

Lakatos, Csilla, Maryla Maliszewska, Israel Osorio-Rodarte, and Delfin Go (2016). China's Slowdown and Rebalancing Potential Growth and Poverty Impacts on Sub-Saharan Africa. World Bank Policy Research Working Paper 7666.

Lemoine, Francoise and Deniz Unal (2017). China's Foreign Trade: A "New Normal." China & World Economy 25(2): 1–21.

McDougall, Robert (2003). A New Regional Household Demand System for GTAP. GTAP Technical Paper No. 20.

Qi, Tianyu, Niven Winchester, Valerie J. Karplus, and Xiliang Zhang(2014). Will Economic Restructuring in China Reduce Trade-Embodied CO2 Emissions? Energy Economics 42: 204-212.

UN Department of Economic and Social Affairs Population Division (2015). World Population Prospects. The 2015 Revision.

United States Chamber of Commerce (2017). Made in China 2025: Global Ambitions Built on Local Projections.

World Bank (2012). China 2030. Building a Modern, Harmonious, and Creative High-Income Society.

Zhai, Fan and Peter Morgan(2016). Impact of the People's Republic of China's Growth Slowdown on Emerging Asia: A General Equilibrium Analysis. Asian Development Bank Institute.