Bajo-Rubio, Oscar; Gómez-Plana, Antonio G.

Working Paper

Spending in social services in China: A multi-country analysis

GLO Discussion Paper, No. 447

Provided in Cooperation with:
Global Labor Organization (GLO)

Suggested Citation: Bajo-Rubio, Oscar; Gómez-Plana, Antonio G. (2020) : Spending in social services in China: A multi-country analysis, GLO Discussion Paper, No. 447, Global Labor Organization (GLO), Essen

This Version is available at:
https://hdl.handle.net/10419/210985

Spending in social services in China: A multi-country analysis*

Oscar Bajo-Rubio
(Universidad de Castilla-La Mancha)

Antonio G. Gómez-Plana
(Universidad Pública de Navarra and INARBE)

Abstract

In this paper, we simulate the effects of an increase in the levels of public spending in health care and social assistance in the Chinese economy, and examine its global effects, i.e., the effects on the main macroeconomic variables of seven regions of the world economy, namely, China, Japan, United States, European Union, Latin America, Asia-Pacific and Rest of the World. Three different rules to finance the increase in public expenditure are considered. The empirical methodology makes use of a computable general equilibrium model, through an extension of the Global Trade Analysis Project model. The policy measure simulated led to either expansionary or contractionary effects on China's activity levels, depending on whether the government deficit is left to increase, or if taxes are raised instead in order to offset it. While no sector seemed to be particularly hurt by this measure, trade flows were negatively affected, but this did not seem to have a strong influence on the rest of the world.

Keywords: Computable general equilibrium, Spending in social services, Global economy, China

JEL classification: D58, H53, H62

* The authors acknowledge financial support from the Spanish Ministry of Economy, Industry and Competitiveness, through the projects ECO2016-78422-R (O. Bajo-Rubio) and ECO2017-86054-C3-2-R (A. G. Gómez-Plana), as well as from the University of Castilla-La Mancha through the project 2019-GRIN-26952, co-financed by the European Union via the European Regional Development Fund (O. Bajo-Rubio).

1. Introduction

In a globalised world like the one we live in, characterised by a high degree of economic integration, knowing the scope of economic interrelationships across countries acquires a growing importance; and, among such interrelationships, those related to fiscal policy become especially relevant. There are a number of recent empirical studies available that examine to which extent the fiscal policy measures implemented in a particular country affect other neighbouring countries. Most of these studies, which make use of the VAR methodology, analyse the case of the euro area such as, e.g., Beetsma et al. (2006), Hebous and Zimmermann (2013), Dabla-Norris et al. (2017), or Alloza et al. (2018); although some of them deal with the OECD countries, like Auerbach and Gorodnichenko (2013) or Goujard (2017). In general, the results of these studies show that fiscal policy measures have economically and statistically significant effects on the output levels of other countries.

On the other hand, one of the most relevant events in the world economy over the last decades, has been the spectacular development of the Chinese economy. From being a secondary actor in international affairs, China has become a superpower in both economic and political grounds. China was until recently the world's fastest-growing major economy, with growth rates averaging 10% over 30 years. At present, China is the world's second largest economy in terms of nominal GDP, and Chinese GDP accounts for 15% of world GDP. Her presence in international trade is also remarkable, accounting for more than 10% of total world trade, and being the world's largest exporter and the second-largest importer of goods. However, the share of services in GDP is still very far from that of the advanced economies (Latorre et al., 2018). Accordingly, the analysis of the effects of changes in the Chinese economic policy on the whole world economy makes up nowadays one of the most relevant questions for international economic policy.

These impressive developments have resulted in an extraordinary improvement in the living standards of the Chinese population, even though the levels of per capita income are still far from those of the most advanced countries. In such a context, the Chinese government has expressed its concern about getting further advancements in the living standard of its population, at the same time that a growing demand for better living conditions is arising on the side of Chinese citizens. As a result, increasing efforts will be devoted in the next few years in order to improve living conditions, in particular with the view of ending rural poverty (Wills, 2018). A general discussion on the central principles that govern Chinese economic policies is presented in Cheng and Ding (2017).

The aim of this paper will be quantifying the effects of one of the main policies that can result in an improvement in the living conditions of the population, such as the public provision of health and social services, which might lead in turn to the development of a welfare state on the lines of most developed countries. Notice also that the increased ageing of the population associated with the likely rise in life expectancy in the next few years, would be an additional factor leading to the need of a higher spending in health and social services. The main difference with regard to the studies mentioned at the beginning of this introduction, is threefold. Firstly, the empirical methodology will make use of a computable general equilibrium (CGE) model, which allows obtaining the consequences of changes in a particular variable on the whole economy under analysis, as well as the specific effects across the different productive sectors. The standard CGE models represent Arrow-Debreu general equilibria; see Shoven and Whalley (1992), Dixon and Jorgenson (2013) or Burfisher (2016) for a detailed discussion of these models

and some of their extensions. Secondly, the model will be set on a multi-country basis, so that we will be able to analyse the effects of the proposed policy measure, not only on the Chinese economy, but also on several regions of the world economy. The latter feature is of particular relevance given the size of the Chinese economy and its likely influence on other economies, in particular those of Eastern Asia. Thirdly, since a higher spending in health and social services should result in a higher government deficit, we include some additional simulations where taxes rise in order to offset this increase in government deficit, namely, through an increase in the direct taxes on labour, and an increase in indirect taxes. Notice that simulating a rise in labour taxes would make sense given the current Chinese tax structure that shows a lower level of those taxes with respect to most countries (Klemm et al., 2018).

A comprehensive assessment of the main developments of the Chinese health system in recent years is presented in Liang and Langenbrunner (2013). While the Chinese government has made enormous efforts towards universal health coverage of the population, some problems still remain, both in terms of the quality and accessibility to health services. In particular, differences between rural and urban areas, and between western and eastern regions of the country, are still remarkable.

We show in Table 1 some indicators of the extent of health expenditure, namely, the total health expenditure as a percentage of GDP, and the health expenditure made by the general government, the latter as a percentage both of GDP and of the total general government expenditure, for China and several selected countries, six developed (Canada, Japan, the United States and three European countries –France, Germany and Spain) and six emerging (two from Asia –India and Indonesia, two from Latin America –Brazil and Mexico, plus Russia and Turkey); the data refer to 2016. As can be seen, China performs clearly below the developed countries in all three indicators, i.e., lower health expenditure and lower public involvement. Regarding the emerging countries of the table, the Chinese figures are comparable to those of Mexico, Russia and Turkey; whereas Brazil shows figures for total health expenditure similar to those of the developed countries coupled with a very small contribution of the public sector. Finally, both the levels of total health expenditure and public involvement in China are notably above than in India and Indonesia.

[Table 1 here]

Accordingly, we will simulate in this paper the effects of an increase in the levels of public spending in health care and social assistance in the Chinese economy, and examine its global effects, i.e., the effects on the main macroeconomic variables of seven regions of the world economy, namely, China, Japan, United States, European Union, Latin America, Asia-Pacific and Rest of the World. The empirical methodology will be based on a CGE model, as mentioned before, through an extension of the Global Trade Analysis Project (GTAP) model. In Section 2, we provide a brief description of the model. The data and calibration process are discussed in Section 3, and the results from the simulations are shown in Section 4. Section 5 concludes.

2. The model

The model used in this paper is a modification of Bajo-Rubio and Gómez-Plana (2018), which is in turn an extension of Lanz and Rutherford (2016). It is based on GTAP9inGAMS (where GAMS stands for General Algebraic Modeling System, i.e., a high-level modeling system for mathematical programming and optimization), and is a static, multi-region CGE model. The centrepiece of GTAP is the GTAP Data Base, a global data base representing the world economy, which contains complete bilateral trade information, transport and protection linkages. The last release is the GTAP 9 Data Base (Narayanan et al., 2015), which includes 140 regions and 57 sectors, and takes 2004, 2007 and 2011 as reference years. This paper presents a version describing seven open economies (regions), disaggregated in twelve productive sectors, one private representative consumer and a public sector for each region, and three primary factors (i.e., labour, capital and natural resources). The listing of the world regions and sectors appears in Table 2, and their correspondence with the GTAP 9 Data Base can be seen in Appendix I.

[Table 2 here]

Specifically, we extend the original model as follows:

(1) The original version of GTAP9inGAMS has one representative agent for each country or region. The model developed here splits the representative agent into public and private agents, extending the equations, and using National Accounts and other data sources to assign the corresponding micro and macro variables.

(2) Public expenditure and public savings are modelled as independent and endogenous variables according to the different scenarios; unlike the original GTAP9inGAMS, which assumes exogenous public expenditure and national savings, where public and private savings are aggregated.

(3) There is unemployment at regional level. It must be noted that due to the high unemployment rate in some regions, instead of using the common assumption of full employment in labour markets, the model includes unemployment in a way derived from the wage curve models.

(4) The trade balance is endogenous at regional level, unlike GTAP9inGAMS where it is assumed to be exogenous.

Next, we will present a brief description of the model; see Bajo-Rubio and Gómez-Plana (2018) for details. The full set of equations is presented in Appendix II.

The equilibrium of the model involves the simultaneous solution of three sets of equations, namely, zero-profit conditions for firms; market clearing in goods, natural resources and capital markets; and constraints on income balance (total revenue must equal total expenditure), labour market (that includes unemployment), and macroeconomic closure of the model.

Production technology is described by a nested CES-Leontief structure of intermediate inputs and factors. Firms maximise profits subject to the technology constraints, and the demands for factors and intermediate inputs are obtained from Shephard's lemma on cost

functions. Firms exhibit constant returns to scale and follow a competitive pricing rule, with free entry and exit of firms; except for two sectors (i.e., Agricultural products and Mining products) that use natural resources as specific factor, so exhibiting decreasing returns to scale.

Each country or region has two consumers: a representative private household behaving as a rational consumer, and a public consumer (see below). The representative private household maximises a nested Cobb-Douglas utility function subject to the budget constraint, which includes rents from factor endowments and exogenous savings.

Since the GTAP Data Base and GTAP9inGAMS includes a single representative agent, we have split it into a private representative household (see above) and the public sector. For this purpose, we have made use of the National Accounts, the GTAP 9 Data Base (Narayanan et al., 2015), as well as other sources such as United Nations (2014), European Commission (2015) and International Monetary Fund (2015), in order to add to the multi-country model the level of public savings, as well as the public gross capital formation at national/regional level.

The role of the public sector in the model is twofold, i.e., it is an owner of resources and a purchaser of certain goods. On the one hand, as an owner of resources, its income includes net tax revenues, where net taxes consist of taxes on primary factors, taxes on intermediate inputs, taxes on goods, tariffs, subsidies on output, and subsidies on exports. On the other hand, the public sector is a purchaser of a Leontief bundle of goods and services, the most relevant in quantitative terms being those included in the sector Government services (i.e., public administration, defence, education, health and social services).

Regarding the foreign sector, the model represents the world as divided into seven regions, with trade balance at global level but allowing for trade imbalances at national or regional level. Sectoral exports and imports are endogenous, as well as aggregate trade balances. Consumers (both private and public) perceive domestic and imported goods as differentiated according to their origin (i.e., domestic or foreign), following Armington's (1969) assumption, which allows for the possibility of intra-industry trade.

The representative private household owns fixed endowments of natural resources, capital and labour, which are internationally immobile. Rents of natural resources and capital adjust to clear domestic markets. There is a fixed endowment of labour and, since unemployment is assumed to be endogenous, employment (i.e., the labour endowment minus unemployment) is elastic up to the fixed amount of labour. The unemployment rate is determined through a wage equation (Blanchflower and Oswald, 1994) such as:

$$\frac{W}{P} = \left(\frac{u}{u0}\right)^{\beta}$$

where W is the nominal wage, P is the consumer price index, u is the unemployment rate, $u0$ is the unemployment rate in the benchmark (see below), and $\beta < 0$. Notice that, as long as $\beta \to 0$, the wage equation approaches a downward-rigid real wage.

Total investment is split into sectoral gross capital formation using a fixed-coefficients Leontief structure (as in Dervis et al., 1981). Finally, the macroeconomic closure model involves

an equation stating that investment and savings (private, public, and foreign) are equal.

The model is solved as explained in Rutherford (1999), with the general equilibrium model defined as a mixed complementarity problem (see Mathiesen, 1985). The software used in the empirical application is GAMS/MPSGE.

3. Calibration and data

The model has been calibrated using the GTAP 9 Data Base (Narayanan et al., 2015) with data for 2011. Most of the data for the public sector have been taken from GTAP (i.e., regional public savings have been estimated as the difference between tax revenue and public expenditure). The calibration method is based on a benchmark equilibrium corresponding to the National Accounts and a set of exogenous parameters. The benchmark values for the elasticities appearing in the different equations of the model, shown in Table 3, are taken from the GTAP 9 Data Base (Narayanan et al., 2015). In turn, the parameter β (i.e., the elasticity of the real wage with respect to the unemployment rate) has been fixed as -0.1, a standard value from the wage curve literature (see, e.g., Blanchflower and Oswald, 1995).

[Table 3 here]

On the other hand, in the case of China the sector Government services has been split into two subsectors, using data from World Health Organization (2019) and the World Input-Output Database (Timmer et al., 2015). Specifically, according to the data for China from Timmer et al. (2015), 20.38% of the output included in Government services corresponds to health and social work services. Since the latter involves both public and private expenditure, we have taken additional information from World Health Organization (2019) showing that the share of public expenditure represents 53.72% of total. Accordingly, we combined this information with GTAP data, so the sector Government services for China has been divided into (i) Public health and social work services, and (ii) Rest of government services, which account for 10.95% of the whole sector and the remaining 89.05%, respectively. All figures refer to our benchmark year, i.e., 2011.

The data utilised for some regional variables are presented in Table 4. Regional unemployment rates have been estimated using the labour force and the total unemployment for each country or region, with the data coming from World Bank (2015). In turn, the shares of public gross capital formation on total gross capital formation have been estimated with data from European Commission (2015) and United Nations (2014), together with the exchange rates taken from International Monetary Fund (2015) (at 30 December 2011). The figures for the European Union, United States and Japan have been taken from European Commission (2015), and those for the rest of the regions from United Nations (2014). Latin America has been proxied using data from Brazil (2009) and Mexico, the Republic of Korea is the proxy for Asia-Pacific, and Rest of the World has been estimated as the average of the other six regions.

[Table 4 here]

4. Simulation results

We present in this section the results of three simulations, where the level of the Chinese real government expenditure in health and social services is fixed up to a 20% of the Chinese public expenditure (i.e., a level comparable to that of the most advanced countries: see the last column in Table 1), starting from a value of 10.95% at the benchmark. The simulations are performed under the restriction that the rest of the real government expenditure is constant, being the whole public expenditure endogenous; hence, this policy measure amounts to a fiscal expansion. In the first scenario, the increase in health spending leads to a higher government deficit, which is simulated as endogenous. Besides, we include two other additional scenarios where taxes rise in order to offset the increase in government deficit. So, the second and third scenarios are characterised by an increase in the direct tax rates on labour, and an increase in indirect tax rates, respectively.

The results of the simulations on the main macroeconomic variables are shown in Table 5 as percentage changes from benchmark, except for the unemployment rate and the ratio government deficit/GDP, where changes are expressed as percentage points. The numeraire used is the US consumer price index. In particular, we present the results of the simulations on the levels of GDP and employment, the unemployment rate, real wage rate, compensation of employees, gross operating surplus, the ratio of government deficit to GDP, exports, and imports, on the economies of China and the other six regions of the world economy. Notice that GDP is measured at factor cost, so that it equals the sum of the compensation of employees and gross operating surplus.

[Table 5 here]

When the government deficit is left as endogenous, the increase in the share of health services in total public expenditure has a small expansionary effect on Chinese GDP. The GDP growth of 0.35% is due to the increase in employment of 0.19% and a positive effect on wages, with a rise of 0.61%; the unemployment rate falls by 0.18 percentage points. The joint effect of the increase in employment and wages rises the compensation of employees by 0.79%, which, coupled with a minor fall in the gross operating surplus, results in a favourable redistributive effect for workers. The ratio of government deficit to GDP increases by 1.27 points. The effect on international trade flows is also relevant. As will be discussed later, productive factors leave some Chinese sectors to be employed in the provision of new health services. Since the tradable sectors are among those losing factor employment, their output decreases and so their exports by 0.54%. At the same time, as tradable sectors are intensive users of imported intermediate inputs, total imports are also going to decrease by 0.85%.

In the next two simulations we allow for taxes to rise in order to offset the increase in government deficit. When direct tax rates on labour are raised, the former expansionary effect on Chinese GDP turns to contractionary: GDP falls by 2% and employment by 1.3%, and the unemployment rate rises by 1.24 percentage points. Such relatively high contractionary effects could be explained by the fact that direct taxes in China are extremely low (see Klemm et al., 2018), so that a rise in those taxes in order to offset the higher government deficit should mean

a very high increase. On the other hand, wages fall by 2.38% and the compensation of employees by 3.64%, whereas the gross operating surplus rises by 0.62%, so that income distribution worsens for workers. Finally, the ratio of government deficit to GDP hardly changes, and the decreases in exports and imports are higher than in the previous scenario, of 0.91 and 1.77%, respectively.

When the increase in the share of health services is accompanied by a rise in indirect taxes, the overall effect on the Chinese economy is slightly contractionary, with a decrease in GDP and employment of 0.10 and 0.48%, respectively, and an increase in the unemployment rate of 0.46 percentage points. The rest of the effects are similar to those of the first scenario, namely, increases in wages and compensation of employees, a decrease in the gross operating surplus, resulting in a favourable redistributive effect for workers, and an almost unchanged ratio of government deficit to GDP; the fall in exports and imports, in turn, is higher and similar to that of the second scenario, of 1 and 1.5%, respectively.

Regarding the effects on the other world regions, trade flows are the transmission mechanism of the effects of the simulated policy on the rest of the world. As shown in Table 5, both exports and imports always decrease for the rest of the world regions (with some exceptions in the second scenario in the case of imports), especially for exports; the fall in exports is stronger for Japan, Latin America and Asia-Pacific. The rest of effects are generally small, leading to (always slight) expansions in Japan, United States and European Union (except for the case of Japan in the third scenario), and contractions in Latin America, Asia-Pacific and Rest of the World. Such a result, on the other hand, would be in line with the available evidence. In a recent paper, Latorre et al. (2018) analysed the effects of an increase in foreign direct investment in the services sectors of the Chinese economy. While the overall impact was found to be positive for China, the estimated effects on the other world regions were very small, which is justified by the authors in terms of the lower export orientation of the services sectors as compared to manufactures.

The analysis of a set of sectoral variables provides some additional information that helps to explain the previous macroeconomic results. These sectoral variables are employment, output level, prices and trade flows, i.e., exports and imports. The results for our twelve sectors for the case of China, are shown in Table 6.

[Table 6 here]

Both employment and output increase in Government services (between 5 and 6%), and decrease in the rest of sectors (except for Agricultural products in the second scenario). The sectors experiencing higher losses of employment and output are Construction and Electronic equipment in the first scenario; Trade, Other services and Textiles in the second scenario; and Food products and Trade in the third scenario.

Sectoral prices show an asymmetric behaviour, even though changes are generally small in the first and third scenario; on the contrary, in the second scenario the extreme cases are

Agricultural products and Trade, with a decrease of 6.45% and an increase of 3.80%, respectively.

Finally, as shown in Table 5, aggregate trade flows always fall. There is a generalised fall in exports in all cases, with the only exceptions of Agricultural products and, to a lesser extent, Food products, in the second and third scenarios, which are related to the reduction in prices experienced in these two sectors. However, in the case of imports, their sectoral behaviour is more asymmetric, with the highest increase taking place in Government services in all three scenarios, as well as in Trade in the second scenario; the higher decreases, in turn, occurred in Agricultural products and Food products in the second and third scenarios.

Next, we present a sensitivity analysis of the previous results. In particular, for all scenarios, four elasticities have been doubled and halved, namely, the substitution elasticity between labour and capital (σ_i^{VA}), the Armington substitution elasticity between domestic and imported goods (σ_i^{d}), the substitution elasticity among imported varieties (σ_i^{m}), and the elasticity of the real wage with respect to the unemployment rate (β). Tables 7 and 8 show the results on several macroeconomic variables (i.e., GDP, employment, the ratio of government deficit to GDP, exports, and imports) for the case of China, and on GDP for the rest of world regions, respectively; the full sensitivity analysis for all variables is available from the authors upon request.

[Table 7 here]
[Table 8 here]

The results for China are robust both in size and sign in most cases. Only in the indirect taxes scenario, a change in the sign of GDP appears for two elasticities, due to the closeness of the benchmark value to zero. Regarding the rest of world regions, the results for GDP are also very robust in size. Again, in some cases and due the closeness of the benchmark values to zero, there is a change in the sign of the effect, but its size is kept close to zero. We can conclude that the results do not change significantly when some crucial parameters of the model are changed.

5. Conclusions

Over the last decades, China has become one of the leading actors in the world economy, experiencing very high and steady growth rates for more than 30 years. As a result, China is currently the world's second largest economy in terms of nominal GDP, with a most remarkable presence in international trade, accounting for more than 10% of total world trade. However, and despite the great improvement in the living standards of the population, the levels of per capita income are still far from those of the most advanced countries. Given the increasing concern about getting further advancements in the living standard of the Chinese population, both on the side of the government and citizens, coupled with the progressive ageing of the population associated with the likely rise in life expectancy in the next few years, a policy devoted to increase spending in health and social services should be more and more in the politicians' agenda. Such a policy, on the other hand, would be a central element in the development of a welfare state on the lines of most developed countries.

In this paper, we have analysed the effects of an increase in the levels of public spending in health care and social assistance in the Chinese economy, using the CGE methodology through an extension of the GTAP model. Specifically, we have extended the GTAP model on the following grounds: (i) the representative agent's separation between public and private agents; (ii) the complete modelling of the public sector with endogenous public savings and expenditure; (iii) unemployment through a wage curve approach; and (iv) trade balance endogenous at regional level. The model was set in a multi-country basis, which allowed us assessing the effects of this policy measure, not only on the Chinese economy, but also on seven regions of the world economy, namely, China, Japan, United States, European Union, Latin America, Asia-Pacific and Rest of the World. In the simulations, the level of the Chinese real government expenditure in health and social services was fixed up to a 20% of the Chinese public expenditure, a level comparable to that of the most advanced countries; since the rest of the real government expenditure was kept as constant, such a policy measure amounted to a fiscal expansion. In addition, since a higher spending in health and social services should result in a higher government deficit, three different rules to finance the increase in public expenditure were considered, with the latter taken as endogenous, and accompanied by an increase in the direct tax rates on labour or in indirect tax rates, respectively.

When the government deficit was left as endogenous (scenario 1), we found small expansionary effects on the Chinese economy in terms of GDP and employment, together with an increase of 1.27 points in the ratio of government deficit to GDP. When taxes were raised in order to offset this increase in government deficit, the effects on GDP and employment turned to be contractionary, especially in the case of an increase in the direct tax rates on labour (scenario 2); the contractionary effects were very small, however, in the case of an increase in indirect tax rates (scenario 3). The combined effects on employment and wages led to a favourable redistributive effect for workers in scenarios 1 and 3; unlike scenario 2, where income distribution worsened for workers. The reason of the differential effects in scenario 2 could be that, since direct taxes in China are extremely low, a rise in those taxes in order to offset the higher government deficit should mean a very high increase. Finally, since productive factors left some Chinese sectors to be employed in the provision of new health services, both exports and imports decreased, especially the latter, in all three scenarios; the fall in trade flows was higher in percentage terms (roughly, double) in scenarios 2 and 3 than in scenario 1. Regarding the effects on the other world regions, exports and imports decreased in most cases, especially in the case of exports; the rest of effects were generally small, leading to (always slight) expansions in Japan, United States and European Union (except for Japan in scenario 3), and contractions in Latin America, Asia-Pacific and Rest of the World.

Turning to the sectoral results, both employment and output increased in Government services and decreased in the rest of sectors; while sectoral prices showed an asymmetric behaviour, being changes generally small in scenarios 1 and 3, but not so much in scenario 2. In turn, there was a generalised fall in exports, with imports performing more asymmetrically, even though they fell in most sectors. In short, sectoral effects were mainly driven by the increase in factor and input demand in Government services that shifted resources away from the remaining sectors of the Chinese economy. The international spillover effects depended on the

change in prices, since lower Chinese prices involved a gain in international competitiveness and larger exports; and on the change in the demand for intermediate inputs, now increased for Government services and reduced for the remaining sectors.

Summarising, according to the results of this paper, the macroeconomic effects on the Chinese economy of an increase in the levels of public spending in health care and social assistance would depend on whether the government deficit is left to increase, or if taxes are raised instead in order to offset it. While no sector seemed to be particularly hurt by this measure, trade flows were negatively affected, but this did not seem to have a strong influence on the rest of the world.

References

Alloza, M., Burriel, P. and Pérez, J. J. (2018): "Fiscal policies in the euro area: Revisiting the size of spillovers", Working Paper 1820, Banco de España.

Armington, P. S. (1969): "A theory of demand for products distinguished by place of production", *International Monetary Fund Staff Papers* 16, 159-178.

Auerbach, A. J. and Gorodnichenko, Y. (2013): "Output spillovers from fiscal policy", *American Economic Review: Papers and Proceedings* 103, 141-146.

Bajo-Rubio, O. and Gómez-Plana, A. G. (2018): "A multi-country analysis of austerity policies in the European Union", Working Paper 18-03, Spanish Association of International Economics and Finance.

Beetsma, R., Giuliodori, M. and Klaassen, F. (2006): "Trade spill-overs of fiscal policy in the European Union: A panel analysis", *Economic Policy* 21, 639-687.

Blanchflower, D. G. and Oswald, A. J. (1994): *The Wage Curve*, The MIT Press, Cambridge, MA.

Blanchflower, D. G. and Oswald, A. J. (1995): "An introduction to the wage curve", *Journal of Economic Perspectives* 9, 153-167.

Burfisher, M. E. (2016): *Introduction to General Equilibrium Models* (2nd edition), Cambridge University Press, Cambridge.

Cheng, E. and Ding, X. (2017): "A theory of China's 'miracle': Eight principles of contemporary Chinese political economy", *Monthly Review* 68, No. 8, 46-57.

Dabla-Norris, E., Dallari, P. and Poghosyan, T. (2017): "Fiscal spillovers in the euro area: Letting the data speak", Working Paper 17/241, International Monetary Fund.

Dervis, K., de Melo, J. and Robinson, S. (1981): "A general equilibrium analysis of foreign exchange shortages in a developing economy", *Economic Journal* 91, 891-906.

Dixon, P. B. and Jorgenson, D. W. (2013). *Handbook of Computable General Equilibrium*, Elsevier, Amsterdam.

European Commission (2015): *AMECO Database*.

Goujard, A. (2017): "Cross-country spillovers from fiscal consolidations", *Fiscal Studies* 38, 219-267.

Hebous, S. and Zimmermann, T. (2013): "Estimating the effects of coordinated fiscal actions in the euro area", *European Economic Review* 58, 110-121.

International Monetary Fund (2015): *International Financial Statistics*.

Klemm, A., Coelho, I., Duncan, A. and Liu, L. (2018): "People's Republic of China: Tax policy and employment creation", Country Report 18/92, International Monetary Fund.

Lanz, B. and Rutherford, T. F. (2016): "GTAPinGAMS: Multiregional and small open economy models", *Journal of Global Economic Analysis* 1, No. 2, 1-77.

Latorre, M. C., Yonezawa, H. and Zhou, J. (2018): "A general equilibrium analysis of FDI growth in Chinese services sectors", *China Economic Review* 47, 172-188.

Liang, L. and Langenbrunner, J. C. (2013): "The long march to universal coverage: Lessons from China", UNICO Studies Series 9, The World Bank.

Mathiesen, L. (1985): "Computation of economic equilibria by a sequence of linear complementarity problems", *Mathematical Programming Study* 23, 144-162.

Narayanan, G. B., Aguiar, A. and McDougall, R. (eds.) (2015): *Global Trade, Assistance, and Production: The GTAP 9 Data Base*, Center for Global Trade Analysis, Purdue University, West Lafayette, IN.

Rutherford, T. F. (1999): "Applied general equilibrium modeling with MPSGE as a GAMS subsystem: An overview of the modeling framework and syntax", *Computational Economics* 14, 1-46.

Shoven, J. B. and Whalley, J. (1992): *Applying General Equilibrium*, Cambridge University Press, Cambridge.

Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R. and de Vries, G. J. (2015): "An illustrated user guide to the World Input-Output Database: The case of global automotive production", *Review of International Economics* 23, 575-605.

United Nations (2014): *National Accounts Statistics: Main Aggregates and Detailed Tables, 2013*.

Wills, K. (2018): "Seeking balance: China strives to adapt social protection to the needs of a market economy", *Finance & Development*, December, 20-23.

World Bank (2015): *World Development Indicators 2011*.

World Health Organization (2019): *Global Health Observatory (GHO) Data Repository*.

Appendix I

A.1. Regional aggregation

The correspondence with the GTAP9 Data Base (Narayanan et al., 2015) is:

Region/country	Description
1.China	China, Hong Kong
2.Japan	Japan
3.United States	United States
4.European Union	Austria, Belgium, Denmark, Finland, France, Germany, Italy, United Kingdom, Greece, Ireland, Luxembourg, Netherlands, Portugal, Spain, Sweden, Czech Republic, Hungary, Malta, Poland, Romania, Slovakia, Slovenia, Estonia, Latvia, Lithuania, Bulgaria, Cyprus, Croatia.
5.Latin America	Mexico, Brazil, Argentina, Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela, Rest of South America, Costa Rica, Guatemala, Nicaragua, Panama, Honduras, El Salvador, Rest of Central America, Dominican Republic, Jamaica, Puerto Rico, Trinidad and Tobago, Caribbean.
6. Asia-Pacific	Cambodia, Lao People's Democratic Republic, Malaysia, Taiwan, Philippines, Singapore, Thailand, Vietnam, Rest of Southeast Asia, Korea, Indonesia, Brunei Darussalam.
7.Rest of the World	India, Bangladesh, Rest of South Asia, Rest of East Asia, Pakistan, Sri Lanka, Nepal, Mongolia, Kyrgyzstan Rest of Western Africa, Rest of Central Africa, Rest of South Central Africa, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Tanzania, Rwanda, Uganda, Zambia, Zimbabwe, Rest of Eastern Africa, Egypt, Morocco, Tunisia, Rest of North Africa, Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Ghana, Guinea, Nigeria, Senegal, Togo, Mauritius, Botswana, South Africa, Namibia, Rest of South African Customs Union Australia, New Zealand, Rest of Oceania Canada, Rest of North America Albania, Russia, Belarus, Ukraine, Rest of Eastern Europe, Kazakhstan, Rest of Former Soviet Union, Armenia, Azerbaijan, Georgia, Switzerland, Norway, Rest of EFTA, Rest of Europe Iran, Bahrain, Israel, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, Turkey, Rest of Western Asia, Rest of the World

A.2. Sectoral aggregation

The correspondence of sectors included in Table 2 with the GTAP9 Data Base sector listing (Narayanan et al., 2015) is:

Sector	Description
1. Agricultural products	Paddy rice Wheat Cereal grains nec Vegetables, fruit, nuts Oil seeds Sugar cane, sugar beet Plant-based fibres Crops nec Bovine cattle, sheep and goats, horses Animal products nec Raw milk Wool, silk-worm cocoons Forestry

	Fishing
2.Mining products	Coal Oil Gas Minerals nec
3.Food products	Bovine meat products Meat products nec Vegetable oils and fats Dairy products Processed rice Sugar Food products nec Beverages and tobacco products
4.Textiles	Textiles Wearing apparel Leather products
5.Electronic equipment	Electronic equipment Machinery and equipment nec
6.Chemical and pharmaceutical industry	Chemical, rubber, plastic products
7.Other manufactures	Wood products Paper products, publishing Petroleum, coal products Mineral products nec Ferrous metals Metals nec Metal products Motor vehicles and parts Transport equipment nec Manufactures nec
8.Electricity and gas	Electricity Gas manufacture, distribution
9.Construction	Construction
10.Trade	Trade
11.Government services	Public Administration, Defence, Education, Health
12.Other services	Water Transport nec Water transport Air transport Communication Financial services nec Insurance Business services nec Recreational and other services Dwellings

Appendix II

As a general rule, the notation in the model is as follows: endogenous variables are denoted by capital letters, exogenous variables by capital letters with a bar, and parameters by small Latin and Greek letters. There are 12 (*i,j* = 1,...,12) production sectors and each sector produces one good. The world economy is divided into 7 countries and regions (*r,s* = 1,…,7). In each country, the public and private sectors have been detached. There are 3 productive factors (*pf* = labour, capital and specific; *F*=labour, capital; *S*=specific). All endogenous variables, and the exogenous variables and parameters, are listed in Tables A.1 and A.2 below. The description of the model is as follows.

Production

Technology presents constant returns to scale and firms apply a competitive pricing rule. For two sectors (Agriculture and Mining products), natural resources is a fixed specific factor, so decreasing returns to scale are present. The nested production function of good *i* in country *r* is:

$$Y_{ir} = min\left(II_r^i, VA_r^i\right)$$

where:

$$VA_r^i = \left(\sum_f \theta_{ir}^f \left(Q_{ir}^{pf}\right)^{1-\sigma_i^{VA}}\right)^{\frac{1}{1-\sigma_i^{VA}}}$$

$$II_r^i = min(II_{i1r}, \dots, II_{i12r})$$

$$II_{ijr} = \left(\theta_{ijr}^d \left(II_{ijr}^Y\right)^{1-\sigma_i^d} + \left(1-\theta_{ijr}^d\right)\left(II_{ijr}^m\right)^{1-\sigma_i^d}\right)^{\frac{1}{1-\sigma_i^d}}$$

Since the top nest is a Leontief function, the zero-profit condition for sector *i* in country *r* is:

$$PROFIT_{ir}^Y = P_{ir}^Y\left(1-t_{ir}^O\right) - \theta_f P_{ir}^f - \sum_{j=1}^{12}\theta_j P_{jr}^i = 0$$

where, according to the nested structure, the unit cost of the value added composite produced by sector *i* in country *r* is a CES function:

$$P_{ir}^f = \left(\sum_f \theta_{ir}^f \left(P_{ir}^{pf}\right)^{1-\sigma_i^{VA}}\right)^{\frac{1}{1-\sigma_i^{VA}}}$$

$$P_{ir}^{pf} = \begin{cases} P_r^F\left(1+t_{ir}^F\right) \\ P_r^S\left(1+t_{ir}^S\right) \end{cases}$$

where *F* and *S* denote labour and capital, and the specific factor, respectively.

The intermediate input price in $PROFIT_{ir}^Y$ is an aggregate of national and imported intermediate input prices:

$$P_{jr}^i = \left(\theta_{ijr}^d\left(1+t_{ijr}^{fd}\right)^{1-\sigma_i^d}\left(P_{jr}^Y\right)^{1-\sigma_i^d} + \left(1-\theta_{ijr}^d\right)\left(1+t_{ijr}^{fm}\right)^{1-\sigma_i^d}\left(P_{jr}^m\right)^{1-\sigma_i^d}\right)^{\frac{1}{1-\sigma_i^d}}$$

These zero-profit conditions are used to derive the demand functions, by applying Shephard's lemma on cost functions.

Next, we introduce the corresponding market clearing equations, with demands in the left-hand side and supplies in the right-hand side. The factor demands Q_{ir}^{pf} for capital, labour and the specific factor are represented in the left-hand side and they are, respectively:

$$\sum_{i=1}^{12}\left(Y_{ir}\left(\frac{\partial PROFIT_{ir}^{Y}}{\partial P_r^{labour}}\right)\right) = \overline{EVOM_r^{labour}}(1-U_r)$$

$$\sum_{i=AGRI,IND}\left(Y_{ir}\left(\frac{\partial PROFIT_{ir}^{Y}}{\partial P_r^{S}}\right)\right) = \overline{EVOM_r^{S}}$$

The market equilibrium conditions for domestic and imported intermediate inputs are:

$$Y_{ir}\left(\frac{\partial PROFIT_{ir}^{Y}}{\partial P_{jr}^{Y}}\right) = II_{ijr}^{Y}$$

$$Y_{ir}\left(\frac{\partial PROFIT_{ir}^{Y}}{\partial P_{jr}^{m}}\right) = II_{ijr}^{m}$$

Finally, the goods market equilibrium conditions are:

$$C_{ir}^{C} + G_{ir}^{G} + I_{ir}^{I} + \sum_{j=1}^{12} II_{ijr}^{Y} + \sum_{\substack{s=1 \\ s\neq r}}^{7} EXP_{irs} - IMP_{ir} = Y_{ir}$$

where:

$$C_{ir}^{C} = C_{ir}^{Cd} + C_{ir}^{Cm}$$

$$G_{ir}^{G} = G_{ir}^{Gd} + G_{ir}^{Gm}$$

$$I_{ir}^{I} = I_{ir}^{Id} + I_{ir}^{Im}$$

$$IMP_{ir} = C_{ir}^{Cm} + G_{ir}^{Gm} + I_{ir}^{Im} + \sum_{j=1}^{12} II_{ijr}^{m}$$

Consumption

The final demand functions are derived from the maximization of the representative consumer's nested welfare function (or the equivalent dual problem, the minimization of the expenditure function $PC_r C_r^{priv}$). The welfare functions are:

$$C_r^{priv} = \prod_{i=1}^{12}\left(C_{ir}^{C}\right)^{\theta_{ir}^{C}}$$

where:

$$C_{ir}^{C} = \left(\theta_{ir}^{C}\left(C_{ir}^{Cd}\right)^{1-\sigma_i^d} + \left(1-\theta_{ir}^{C}\right)\left(C_{ir}^{Cm}\right)^{1-\sigma_i^d}\right)^{\frac{1}{1-\sigma_i^d}}$$

subject to the budget constraints:

$$INCOME_r^{priv} = P_r^{labour}\left(\overline{EVOM_r^{labour}}\right)(1-U_r) + P_r^{capital}\left(\overline{EVOM_r^{capital}}\right) + P_r^{s}\left(\overline{EVOM_r^{S}}\right)$$

$$INCOME_r^{priv} = PRIVSAV_r + PC_r C_r^{priv}$$

where:

$$PRIVSAV_r = PI_r\overline{C_r^{privsav}}$$

$$PC_r C_r^{priv} = \sum_{i=1}^{12} P_{ir}^C \, C_{ir}^C$$

$$P_{ir}^C = \left(\theta_{ir}^C \left(1 + t_{ir}^{Cd}\right)^{1-\sigma_i^d} \left(P_{ir}^Y\right)^{1-\sigma_i^d} + \left(1 - \theta_{ir}^C\right)\left(1 + t_{ir}^{Cm}\right)^{1-\sigma_i^d} \left(P_{ir}^m\right)^{1-\sigma_i^d} \right)^{\frac{1}{1-\sigma_i^d}}$$

The solution to the dual optimization problem with the expenditure functions yields the demand functions for final private demand of domestic and imported goods, so the market equilibrium for these goods are:

$$C_r^{priv} \left(\frac{\partial PC_r C_r^{priv}}{\partial P_{ir}^Y} \right) = C_{ir}^{Cd}$$

$$C_r^{priv} \left(\frac{\partial PC_r C_r^{priv}}{\partial P_{ir}^m} \right) = C_{ir}^{Cm}$$

Public sector

Public consumption is represented through a Leontief nested function:

$$G_r^{pub} = min\left(G_{1r}^G, \ldots, G_{12r}^G\right)$$

where:

$$G_{ir}^G = \left(\theta_{ir}^{Gd} \left(G_{ir}^{Gd}\right)^{1-\sigma_i^d} + \left(1 - \theta_{ir}^{Gd}\right)\left(G_{ir}^{Gm}\right)^{1-\sigma_i^d} \right)^{\frac{1}{1-\sigma_i^d}}$$

subject to the budget constraints:

$$INCOME_r^{pub} - PG_r G_r^{pub} = PUBSAV_r$$

$$INCOME_r^{pub} = REV_r^O + REV_r^{fd} + REV_r^{fm} + REV_r^f + REV_r^{Cd} + REV_r^{Cm} + REV_r^{Gd} + REV_r^{Gm} + REV_r^{Id} + REV_r^{Im} + REV_r^{ms} - REV_r^{xs}$$

where the different revenues, denoted by *REV*, come from several taxes:

$$REV_r^O = \sum_{i=1}^{12} t_{ir}^O \, P_{ir}^Y Y_{ir}$$

$$REV_r^{fd} = \sum_{i=1}^{12} \sum_{j=1}^{12} t_{ijr}^{fd} \, P_{ir}^Y II_{ijr}^Y$$

$$REV_r^{fm} = \sum_{i=1}^{12} \sum_{j=1}^{12} t_{ijr}^{fm} \, P_{ijr}^m II_{ijr}^m$$

$$REV_r^f = \sum_{i=1}^{12} \left(t_{ir}^S P_r^S \left(\overline{EVOM_r^S}\right) + t_{ir}^{capital} P_r^{capital} \left(\overline{EVOM_r^{capital}}\right) + t_{ir}^{labour} P_r^{labour} \left(\overline{EVOM_r^{labour}}\right)(1 - U_r) \right)$$

$$REV_r^{Cd} = \sum_{i=1}^{12} t_{ir}^{Cd} \, P_{ir}^Y C_{ir}^{Cd}$$

$$REV_r^{Cm} = \sum_{i=1}^{12} t_{ir}^{Cm} \, P_{ir}^m C_{ir}^{Cm}$$

$$REV_r^{Gd} = \sum_{i=1}^{12} t_{ir}^{Gd} P_{ir}^{Y} G_{ir}^{Gd}$$

$$REV_r^{Gm} = \sum_{i=1}^{12} t_{ir}^{Gm} P_{ir}^{m} G_{ir}^{Gm}$$

$$REV_r^{Id} = \sum_{i=1}^{12} t_{ir}^{Id} P_{ir}^{Y} I_{ir}^{Id}$$

$$REV_r^{Im} = \sum_{i=1}^{12} t_{ir}^{Im} P_{ir}^{m} I_{ir}^{Im}$$

$$REV_r^{ms} = \sum_{i=1}^{12} \sum_{\substack{s=1 \\ s \neq r}}^{7} t_{isr}^{ms} \left(P_{is}^{Y}(1 - t_{isr}^{xs}) EXP_{isr} + \sum_{j=1}^{12} P_{jisr}^{t} TRN_{jisr} \right)$$

$$REV_r^{xs} = \sum_{i=1}^{12} \sum_{\substack{s=1 \\ s \neq r}}^{7} t_{irs}^{xs} P_{ir}^{Y} EXP_{irs}$$

and:

$$PG_r G_r^{pub} = \sum_{i=1}^{12} P_{ir}^{G} G_{ir}^{G}$$

$$P_{ir}^{G} = \left(\theta_{ir}^{Gd} \left(1 + t_{ir}^{Gd}\right)^{1-\sigma_i^d} \left(P_{ir}^{Y}\right)^{1-\sigma_i^d} + \left(1 - \theta_{ir}^{Gd}\right) \left(1 + t_{ir}^{Gm}\right)^{1-\sigma_i^d} \left(P_{ir}^{m}\right)^{1-\sigma_i^d} \right)^{\frac{1}{1-\sigma_i^d}}$$

$$PUBSAV_r = PI_r C_r^{pubsav}$$

The solution to the dual optimization problem with the expenditure functions yields the demand functions for final public demand of domestic and imported goods used in the next equation conditions:

$$G_r^{pub} \left(\frac{\partial PG_r G_r^{pub}}{\partial P_{ir}^{Y}} \right) = G_{ir}^{Gd}$$

$$G_r^{pub} \left(\frac{\partial PG_r G_r^{pub}}{\partial P_{ir}^{m}} \right) = G_{ir}^{Gm}$$

Investment and savings

The aggregate gross capital formation enters the model as an exogenous component of final demand. It can be interpreted in this static framework as a component of final demand representing future consumption:

$$\overline{I_r} = min(I_{1r}^{I}, \dots, I_{12r}^{I})$$

where:

$$I_{ir}^{I} = \left(\theta_{ir}^{Id} \left(I_{ir}^{Id}\right)^{1-\sigma_i^d} + \left(1 - \theta_{ir}^{Id}\right) \left(I_{ir}^{Im}\right)^{1-\sigma_i^d} \right)^{\frac{1}{1-\sigma_i^d}}$$

subject to:

$$PRIVSAV_r + PUBSAV_r + PC_{num} VB_r = PI_r \overline{I_r}$$

$$PI_r\bar{I_r} = \sum_{i=1}^{12} PI_{ir}\, I_{ir}^{I}$$

$$PI_{ir}^{I} = \left(\theta_{ir}^{Id}\left(1+t_{ir}^{Id}\right)^{1-\sigma_i^d}\left(P_{ir}^{Y}\right)^{1-\sigma_i^d} + \left(1-\theta_{ir}^{Id}\right)\left(1+t_{ir}^{Im}\right)^{1-\sigma_i^d}\left(P_{ir}^{m}\right)^{1-\sigma_i^d}\right)^{\frac{1}{1-\sigma_i^d}}$$

$$\sum_{r=1}^{7} PC_{num} VB_r = 0$$

The solution to the dual optimization problem yields the demand for gross domestic formation of domestic (I_{ir}^{Id}) and imported goods (I_{ir}^{Im}):

$$\bar{I_r}\left(\frac{\partial PI_r\bar{I_r}}{\partial P_{ir}^{Y}}\right) = I_{ir}^{Id}$$

$$\bar{I_r}\left(\frac{\partial PI_r\bar{I_r}}{\partial P_{ir}^{m}}\right) = I_{ir}^{Im}$$

Foreign sector

The choice among imports from several sources involves the maximization of the Armington aggregate subject to the foreign sector constraints (or the dual problem, i.e., minimization of the cost of the Armington aggregate). The Armington aggregate is:

$$IMP_{ir} = \left(\sum_{s} \theta_{isr}^{m}(EXPA_{isr})^{1-\sigma_i^m}\right)^{\frac{1}{1-\sigma_i^m}}$$

where:

$$EXPA_{isr} = min\left(EXP_{isr}, TRM_{jisr}\right) \qquad j = TRN$$

$$\sum_{i=1}^{12}\sum_{\substack{r=1\\ r\neq s}}^{7}\sum_{\substack{s=1\\ s\neq r}}^{7} TRM_{jisr} = \sum_{r=1}^{7} \theta_j^T Y_{jr}$$

The constraints related to the foreign sector in this open economy are:

$$\sum_{i=1}^{12}\sum_{\substack{s=1\\ s\neq r}}^{7} Pt_{isr}^{m}\, EXPA_{isr} + PC_{num} VB_r = \sum_{i=1}^{12} P_{ir}^{m}\, IMP_{ir}$$

where:

$$Pt_{isr}^{m} = \theta_{isr}^{m} P_{isr} + \sum_{j} \theta_j^T P_{jisr}^{t}$$

$$P_{isr} = P_{is}^{Y}(1-t_{isr}^{xs})(1+t_{isr}^{ms})$$

$$P_{jisr}^{t} = P_j^T(1+t_{isr}^{ms})$$

$$P_j^T = \prod_{r=1}^{7}\left(P_{jr}^{Y}\right)^{\theta_r^T}$$

$$P_{ir}^{m} = \left(\sum_{s} \theta_{isr}^{m}(P_{isr})^{1-\sigma_i^m}\right)^{\frac{1}{1-\sigma_i^m}}$$

Labour market constraint

The equilibrium in the labour market is given by the previously shown market clearing condition:

$$\sum_{i=1}^{12}\left(Y_{ir}\left(\frac{\partial PROFIT_{ir}^{Y}}{\partial P_r^{labour}}\right)\right)=\overline{EVOM_r^{labour}}(1-U_r)$$

and the restriction related to unemployment:

$$\frac{P_r^{labour}}{PC_r}=\left(\frac{U_r}{\overline{U_r}}\right)^{\beta}$$

where $\beta < 0$.

Simulations

In the main text, we perform three simulations in order to reach a level of real government expenditure in health and social services of 20% of the Chinese total public expenditure. These simulations involve some changes in the previous equations, which are as follows. Recall that, in each simulation, "country *r*" refers to China.

(1) Scenario of endogenous government deficit in country *r*, holding all tax rates constant. The parameter $ADJUST_r$ is 1 at the benchmark and takes a lower value in the simulation, so that the new expanded real public expenditure G_r^{pub*} increases. This increase leads to a decrease in public savings $PUBSAV_r$ since tax rates do not change, even though the public income $INCOME_r^{pub}$ can change endogenously:

$$INCOME_r^{pub}-PG_rG_r^{pub*}=PUBSAV_r^{adjust}$$

where:

$$G_r^{pub*}=min\left(G_{1r}^{G},\ldots,\overline{G_{11r}^{G}},G_{12r}^{G}\right)$$

$$PUBSAV_r^{adjust}=ADJUSTr\ PUBSAV_r$$

The new level of public expenditure in health and social services is fixed exogenously as a component of $\overline{G_{11r}^{G}}$.

(2) Scenario of increase in direct taxes on labour in country *r*, with an increased public expenditure in health and social services. The variable $ADJUST_r$ is 1 at the benchmark and takes a value above 1 in the simulation, so that the benchmark ad valorem labour tax rates rise. Public savings $\overline{PUBSAV_r}$ remain constant, even though the public income $INCOME_r^{pub}$ can change endogenously:

$$P_{ir}^{f}=\left(\sum_{f}\theta_{ir}^{f}\left(P_{ir}^{pf}\right)^{1-\sigma_i^{VA}}\right)^{\frac{1}{1-\sigma_i^{VA}}}$$

$$P_{ir}^{pf}=\begin{cases}P_r^{labour}\left(1+ADJUST_r\ t_{ir}^{labour}\right)\\ P_r^{capital}\left(1+t_{ir}^{capital}\right)\\ P_r^{S}\left(1+t_{ir}^{S}\right)\end{cases}$$

$$REV_r^{f}=\sum_{i=1}^{12}\Big(t_{ir}^{S}P_r^{S}\left(\overline{EVOM_r^{S}}\right)+t_{ir}^{capital}P_r^{capital}\left(\overline{EVOM_r^{capital}}\right)+ADJUST_r\ t_{ir}^{labour}P_r^{labour}\left(\overline{EVOM_r^{labour}}\right)(1-U_r)\Big)$$

$$INCOME_r^{pub} - PG_r G_r^{pub*} = \overline{PUBSAV_r}$$

where:

$$G_r^{pub*} = min\left(G_{1r}^G, \dots, \overline{G_{11r}^G}, G_{12r}^G\right)$$

The new level of public expenditure in health and social services is fixed exogenously as component of $\overline{G_{11r}^G}$.

(3) Scenario of increase in indirect taxes in country *r*, with an increased public expenditure in health and social services. The variable $ADJUST_r$ is 1 at the benchmark and takes a value above 1 in the simulation, so that the benchmark ad valorem indirect tax rates rise. Public savings $\overline{PUBSAV_r}$ remain constant, even though the public income $INCOME_r^{pub}$ can change endogenously:

$$P_{ir}^C = \Bigg(\theta_{ir}^C \left(1 + ADJUST_r t_{ir}^{Cd}\right)^{1-\sigma_i^d} \left(P_{ir}^Y\right)^{1-\sigma_i^d} + \left(1 - \theta_{ir}^C\right)\left(1 + ADJUST_r t_{ir}^{Cm}\right)^{1-\sigma_i^d} \left(P_{ir}^m\right)^{1-\sigma_i^d} \Bigg)^{\frac{1}{1-\sigma_i^d}}$$

$$REV_r^{Cd} = \sum_{i=1}^{12} ADJUST_r \; t_{ir}^{Cd} \; P_{ir}^Y C_{ir}^{Cd}$$

$$REV_r^{Cm} = \sum_{i=1}^{12} ADJUST_r \; t_{ir}^{Cm} \; P_{ir}^m C_{ir}^{Cm}$$

$$INCOME_r^{pub} - PG_r G_r^{pub*} = \overline{PUBSAV_r}$$

where:

$$G_r^{pub*} = min\left(G_{1r}^G, \dots, \overline{G_{11r}^G}, G_{12r}^G\right)$$

The new level of public expenditure in health and social services is fixed exogenously as a component of $\overline{G_{11r}^G}$.

Table A1
Endogenous variables

Symbol	Definition
$ADJUST_r$	Adjustments in simulations, for country *r* (benchmark=1)
C_{ir}^{C}	Final private consumption of good *i* in country *r*
C_{ir}^{Cd}	Final private consumption of good *i* in country *r*, origin domestic production
C_{ir}^{Cm}	Final private consumption of good *i* in country *r*, origin imports
C_r^{priv}	Aggregate final private consumption in country *r*
C_r^{pubsav}	Aggregate public savings in country *r*
EXP_{irs}	Exports of good *i* from country *r* to country *s*
$EXPA_{irs}$	Exports of good *i* from country *r* to country *s*, including transportation margins
G_{ir}^{G}	Final public consumption of good *i* in country *r*
G_{ir}^{Gd}	Final public consumption of good *i* in country *r*, origin domestic production
G_{ir}^{Gm}	Final public consumption of good *i* in country *r*, origin imports
G_r^{pub}	Aggregate final public consumption in country *r*
G_r^{pub*}	Counterfactual aggregate final public consumption in country *r*
I_{ir}^{I}	Investment (gross capital formation) in goods produced by sector *i* in country *r*
I_{ir}^{Id}	Investment (gross capital formation) in goods produced by sector *i* in country *r*, origin domestic production
I_{ir}^{Im}	Investment (gross capital formation) in goods produced by sector *i* in country *r*, origin imports
II_{ijr}	Intermediate inputs from sector *j* used by good *i* in country *r*
II_r^{i}	Aggregate intermediate inputs used by good *i* in country *r*
II_{ijr}^{Y}	Intermediate inputs from sector *j* used by good *i* in country *r*, origin domestic production
II_{ijr}^{m}	Intermediate inputs from sector *j* used by good *i* in country *r*, origin imports
IMP_{ir}	Imports of good i in country *r*
$INCOME_r^{priv}$	Private income in country *r*
$INCOME_r^{pub}$	Public income in country *r*
P_{isr}	Price (unit cost) of good *i* exported from country *s* to country *r*, excluding transportation margins
P_{ir}^{C}	Price (unit cost) for private consumption of good *i* in country *r*
$P_r^{capital}$	Price (unit cost) for capital in country *r*
P_{jr}^{i}	Price (unit cost) for aggregate intermediate input *j* used by good *i* in country *r*
P_{ir}^{f}	Price (unit cost) for aggregate factors used in good *i* produced at country *r*
P_r^{F}	Price (unit cost) for factor *F* (= labour, capital) in country *r*
P_{ir}^{G}	Price (unit cost) for public consumption of good *i* in country *r*
P_{ir}^{I}	Price (unit cost) for investment in sector *i* in country *r*
P_r^{labour}	Price (unit cost) for labour in country *r*
P_{ir}^{m}	Price (unit cost) for good *i* imported and used in country *r*
P_{ir}^{pf}	Price (unit cost) for factor *pf* (= labour, capital, specific) used in good *i* in country *r*
P_r^{S}	Price (unit cost) for specific factor *S* in country *r*
P_j^{T}	World price (unit cost) for transportation margins (*j*=*TRN*)
P_{jisr}^{t}	Price (unit cost) for international transportation (*j*=*TRN*) margins in good *i* traded from country *s* to country *r*, including tariffs
P_{ir}^{Y}	Price (unit cost) for good Y_{ir}
PC_{num}	Price (unit cost) for aggregate final private consumption in numeraire country
PC_r	Price (unit cost) for aggregate final private consumption in country *r*
PG_r	Price (unit cost) for aggregate final public consumption in country *r*
PI_r	Price (unit cost) for aggregate savings in country *r*

Pt_{isr}^{m}	Price (unit cost) of exports from country *s* to country *r*, including transportation margins
$PRIVSAV_r$	Private savings in country *r*
$PROFIT_{ir}^{Y}$	Unit profits for Y_{ir}
$PUBSAV_r$	Public savings in country *r*
Q_{ir}^{pf}	Quantity demanded of factor for good *i* in country *r*
REV_r^{Cd}	Revenue in country *r* from taxes on final private consumption of domestic goods
REV_r^{Cm}	Revenue in country *r* from taxes on final private consumption of imports
REV_{ir}^{f}	Revenue in country *r* from factor taxes
REV_r^{fd}	Revenue in country *r* from taxes on domestic intermediate inputs
REV_r^{fm}	Revenue in country *r* from taxes on imported intermediate inputs
REV_r^{Gd}	Revenue in country *r* from taxes on final public consumption of domestic goods
REV_r^{Gm}	Revenue in country *r* from taxes on final public consumption of imported goods
REV_r^{Id}	Revenue in country *r* from taxes on investment of domestic goods
REV_r^{Im}	Revenue in country *r* from taxes on investment of imported goods
REV_r^{ms}	Revenue in country *r* from tariffs
REV_r^{O}	Revenue in country *r* from output tax
REV_r^{xs}	Export subsidies in country *r*
TRM_{jisr}	Transportation (*j*=*TRN*) margin for good *i* exported from country *s* to country *r*
U_r	Unemployment rate in country *r*
VA_r^i	Aggregate value added used by good *i* in country *r*
VB_r	Foreign savings in country *r*
Y_{ir}	Quantity of good *i* produced in country *r*

Table A2
Exogenous variables and parameters

Symbol	Definition
$\overline{C_r^{privsav}}$	Aggregate private savings in country *r*
$\overline{EVOM_r^{capital}}$	Capital endowment in country *r*
$\overline{EVOM_r^{labour}}$	Labour endowment in country *r*
$\overline{EVOM_r^{S}}$	Specific factor *S* endowment in country *r*
$\overline{G_{11r}^{G}}$	Counterfactual public expenditure in health and social services in country *r*
$\overline{I_r}$	Aggregate gross capital formation in country *r*
$\overline{U_r}$	Benchmark unemployment rate
$t_{ir}^{capital}$	Taxes on capital for good *i* in country *r*
t_{ir}^{Cd}	Taxes on private consumption for good *i* in country *r*, origin domestic production
t_{ir}^{Cm}	Taxes on private consumption for good *i* in country *r*, origin imports
t_{ir}^{F}	Taxes on factor *F* (=labour, capital) for good *i* in country *r*
t_{ijr}^{fd}	Taxes on domestic intermediate input *j* for good *i* in country *r*
t_{ijr}^{fm}	Taxes on imported intermediate input *j* for good *i* in country *r*
t_{ir}^{Gd}	Taxes on public consumption for good *i* in country *r*, origin domestic production
t_{ir}^{Gm}	Taxes on public consumption for good *i* in country *r*, origin imports
t_{ir}^{Id}	Taxes on investment for good *i* in country *r*, origin domestic production
t_{ir}^{Im}	Taxes on investment for good *i* in country *r*, origin imports
t_{ir}^{labour}	Taxes on labour for good *i* in country *r*
t_{isr}^{ms}	Tariff for good *i* exported from country *s* to country *r*
t_{ir}^{O}	Output taxes for good *i* in country *r*
t_{ir}^{S}	Taxes on specific factor *S* for good *i* in country *r*
t_{isr}^{xs}	Export subsidy for good *i* exported from country *s* to country *r*
β	Parameter of flexibility of the real wage to the unemployment rate
θ	Share parameters
σ_i^{d}	Armington elasticity of substitution domestic-imported components in good *i*
σ_i^{m}	Armington elasticity of substitution among imported components in good *i*
σ_i^{VA}	Elasticity of substitution among factors in good *i*

Table 1
Some indicators of health expenditure in selected countries, 2016

	Current health expenditure as % of GDP	General government health expenditure as % of GDP	General government health expenditure as % of general government expenditure
Brazil	11.8	3.9	9.9
Canada	10.5	7.7	19.0
China	5.0	2.9	9.1
France	11.5	9.6	17.0
Germany	11.1	9.4	21.4
India	3.7	0.9	3.1
Indonesia	3.1	1.4	8.3
Japan	10.9	9.1	23.4
Mexico	5.5	2.9	10.4
Russia	5.3	3.0	8.2
Spain	9.0	6.4	15.1
Turkey	4.3	3.4	9.6
United States	17.1	14.0	39.5

Source: World Health Organization, *Global Health Expenditure Database*.

Table 2. Regions and sectors

Regions	Sectors
China	Agricultural products
Japan	Mining products
United States	Food products
European Union	Textiles
Latin America	Electronic equipment
Asia-Pacific	Chemical and pharmaceutical industry
Rest of the World	Other manufactures
	Electricity and gas
	Construction
	Trade
	Government services
	Other services

Table 3. Elasticities of substitution

	Factors	Domestic production-imports	Intra-imports
Agricultural products	0.255	2.499	4.866
Mining products	0.200	5.159	11.298
Food products	1.120	2.521	5.127
Textiles	1.260	3.783	7.584
Electronic equipment	1.260	4.176	8.342
Chemical and pharmaceutical industry	1.260	3.300	6.600
Other manufactures	1.260	3.067	6.349
Electricity and gas	1.260	2.800	5.600
Construction	1.400	1.900	3.800
Trade	1.680	1.900	3.800
Government services	1.260	1.900	3.800
Other services	1.315	1.911	3.803

Table 4. Regional variables

	Unemployment rate (%)	Public gross capital formation (% of total GCF)
China	4.296	0.105
Japan	4.500	0.155
United States	9.000	0.209
European Union	9.581	0.151
Latin America	6.708	0.121
Asia-Pacific	4.418	0.162
Rest of the World	4.924	0.150

Table 5. Simulation results: Effect on macroeconomic variables (% change from benchmark)

A. Government deficit endogenous

	China	Japan	United States	European Union	Latin America	Asia-Pacific	Rest of the World
GDP	0.351	0.002	0.017	0.015	−0.032	−0.006	−0.062
Employment	0.186	0.002	0.008	0.012	0.003	0.005	0.006
Unemployment (p.p.)	−0.178	−0.002	−0.007	−0.010	−0.003	−0.005	−0.006
Real wage rate	0.605	0.000	0.016	0.010	−0.014	0.006	−0.018
Compensation of employees	0.792	0.002	0.024	0.021	−0.011	0.011	−0.012
Gross operating surplus	−0.046	0.003	0.019	0.016	−0.016	0.004	−0.027
Government deficit/GDP (p.p.)	1.274	0.000	−0.001	−0.002	0.000	0.000	0.000
Exports	−0.543	−0.135	−0.088	−0.086	−0.119	−0.125	−0.128
Imports	−0.851	−0.105	−0.026	−0.053	−0.074	−0.097	−0.118

B. Increase in direct taxes on labour

	China	Japan	United States	European Union	Latin America	Asia-Pacific	Rest of the World
GDP	−2.001	0.070	0.013	0.054	−0.118	−0.010	−0.080
Employment	−1.297	0.010	0.015	0.014	0.014	0.036	0.015
Unemployment (p.p.)	1.241	−0.009	−0.014	−0.013	−0.013	−0.035	−0.014
Real wage rate	−2.377	0.068	0.026	0.051	−0.079	0.023	−0.033
Compensation of employees	−3.643	0.078	0.041	0.066	−0.065	0.059	−0.018
Gross operating surplus	0.620	0.075	0.025	0.066	−0.064	0.074	−0.014
Government deficit/GDP (p.p.)	0.005	0.000	0.000	−0.001	0.002	0.001	0.001
Exports	−0.911	−0.128	−0.145	−0.088	−0.209	−0.131	−0.166
Imports	−1.765	0.015	−0.035	0.011	−0.148	0.012	−0.079

C. Increase in indirect taxes

	China	Japan	United States	European Union	Latin America	Asia-Pacific	Rest of the World
GDP	−0.103	−0.033	0.004	0.010	−0.038	−0.080	−0.042
Employment	−0.480	−0.001	0.004	0.006	0.004	−0.002	0.003
Unemployment (p.p.)	0.459	0.001	−0.004	−0.005	−0.004	0.002	−0.003
Real wage rate	1.011	−0.031	0.009	0.011	−0.023	−0.065	−0.019
Compensation of employees	0.526	−0.032	0.013	0.016	−0.019	−0.067	−0.016
Gross operating surplus	−0.342	−0.032	0.008	0.011	−0.020	−0.060	−0.017
Government deficit/GDP (p.p.)	0.004	0.000	0.000	0.000	0.001	0.001	0.001
Exports	−0.996	−0.188	−0.127	−0.118	−0.166	−0.213	−0.121
Imports	−1.504	−0.115	−0.055	−0.078	−0.082	−0.169	−0.091

Table 6. Sectoral results
(% change from benchmark)

A. Government deficit endogenous

	Employment	Output	Prices	Exports	Imports
Agricultural products	−0.332	−0.216	0.144	−1.837	0.145
Mining products	−0.881	−0.564	−0.450	−2.451	−1.864
Food products	−0.269	0.105	0.161	−0.876	0.572
Textiles	−0.726	−0.458	0.214	−0.994	0.856
Electronic equipment	−1.924	−1.580	0.151	−1.027	−1.030
Chemical and pharmaceutical industry	−0.648	−0.231	0.132	−0.940	0.310
Other manufactures	−1.738	−1.315	0.054	−0.597	−0.857
Electricity and gas	−0.878	−0.399	−0.070	0.063	0.035
Construction	−2.946	−2.704	0.188	−0.753	−1.983
Trade	−0.861	−0.321	0.224	−0.746	0.361
Government services	6.234	6.347	0.386	−1.432	5.729
Other services	−0.617	−0.147	0.196	−0.256	−0.832
Total	0.186	–	–	−0.543	−0.851

B. Increase in direct taxes on labour

	Employment	Output	Prices	Exports	Imports
Agricultural products	1.843	0.805	−6.452	105.567	−14.603
Mining products	−0.776	−0.646	−0.402	−2.421	−1.832
Food products	−0.923	−1.178	−2.810	14.958	−8.373
Textiles	−3.703	−2.493	0.293	−1.386	−2.063
Electronic equipment	−0.679	−1.562	0.361	−2.139	−0.240
Chemical and pharmaceutical industry	0.372	−0.591	0.028	−0.098	−0.763
Other manufactures	−0.215	−1.171	0.156	−1.028	−0.907
Electricity and gas	−1.718	−1.781	0.266	−1.642	−1.700
Construction	0.410	−0.062	0.376	−1.307	0.484
Trade	−13.622	−3.898	3.800	−11.645	6.042
Government services	5.251	5.087	0.180	−0.602	4.917
Other services	−5.772	−2.520	1.953	−1.267	−2.370
Total	−1.297	–	–	−0.911	−1.765

C. Increase in indirect taxes

	Employment	Output	Prices	Exports	Imports
Agricultural products	−2.034	−1.423	−1.026	18.169	−4.383
Mining products	−0.947	−0.560	−0.282	−1.539	−1.112
Food products	−3.309	−2.554	−0.353	1.957	−4.722
Textiles	−2.022	−1.470	0.199	−0.958	−1.959
Electronic equipment	−1.162	−0.441	0.311	−2.041	−2.451
Chemical and pharmaceutical industry	−1.633	−0.772	0.402	−2.568	0.378
Other manufactures	−1.633	−0.752	0.272	−1.620	−0.940
Electricity and gas	−2.382	−1.399	1.192	−6.486	2.008
Construction	−0.526	−0.009	0.381	−1.427	−1.775
Trade	−3.101	−1.999	0.212	−0.746	−1.281
Government services	5.425	5.657	0.663	−2.458	3.692
Other services	−2.163	−1.198	0.361	−0.430	−1.399
Total	−0.480	–	–	−0.996	−1.504

Table 7
Sensitivity analysis: Effects on Chinese macroeconomic variables
(% change from benchmark)

A. Government deficit endogenous

	GDP	Employment	Government deficit/GDP (p.p.)	Exports	Imports
Benchmark	0.351	0.186	1.274	−0.543	−0.851
σ_i^{VA} = [0.255-1.68]					
$\sigma_i^{'VA}=2*\sigma_i^{VA}$	0.283	0.116	1.270	−0.517	−0.804
$\sigma_i^{'VA}=0.5*\sigma_i^{VA}$	0.442	0.284	1.280	−0.561	−0.878
σ_i^{d} = [1.90-5.159]					
$\sigma'^{d}_i=2*\sigma_i^{d}$	0.301	0.181	1.269	−0.480	−0.766
$\sigma_i^{'d}=0.5*\sigma_i^{d}$	0.389	0.190	1.279	−0.585	−0.905
σ_i^{m} = [3.80-11.298]					
$\sigma_i^{'m}=2*\sigma_i^{m}$	0.259	0.178	1.277	−0.628	−0.986
$\sigma_i^{'m}=0.5*\sigma_i^{m}$	0.483	0.197	1.270	−0.414	−0.647
β = −0.1					
β'=2*β	0.318	0.105	1.282	−0.569	−0.893
β'=0.5*β	0.400	0.305	1.263	−0.504	−0.788

B. Increase in direct taxes on labour

	GDP	Employment	Government deficit/GDP (p.p.)	Exports	Imports
Benchmark	−2.001	−1.297	0.005	−0.911	−1.765
σ_i^{VA} = [0.255-1.68]					
$\sigma_i^{'VA}=2*\sigma_i^{VA}$	−2.274	−1.626	0.006	−1.010	−1.953
$\sigma_i^{'VA}=0.5*\sigma_i^{VA}$	−1.733	−0.932	0.005	−0.792	−1.540
σ_i^{d} = [1.90-5.159]					
$\sigma'^{d}_i=2*\sigma_i^{d}$	−2.061	−1.389	0.005	−1.025	−2.172
$\sigma_i^{'d}=0.5*\sigma_i^{d}$	−1.983	−1.241	0.005	−0.813	−1.471
σ_i^{m} = [3.80-11.298]					
$\sigma_i^{'m}=2*\sigma_i^{m}$	−2.226	−1.390	0.005	−0.994	−1.904
$\sigma_i^{'m}=0.5*\sigma_i^{m}$	−1.699	−1.230	0.005	−0.681	−1.406
β = −0.1					
β'=2*β	−1.672	−0.663	0.004	−0.715	−1.427
β'=0.5*β	−2.588	−2.420	0.007	−1.257	−2.365

C. Increase in indirect taxes

	GDP	Employment	Government deficit/GDP (p.p.)	Exports	Imports
Benchmark	−0.103	−0.480	0.004	−0.996	−1.504
σ_i^{VA} = [0.255-1.68]					
$\sigma_i^{'VA}=2*\sigma_i^{VA}$	−0.232	−0.677	0.004	−0.982	−1.460
$\sigma_i^{'VA}=0.5*\sigma_i^{VA}$	0.061	−0.227	0.003	−0.989	−1.507
σ_i^{d} = [1.90-5.159]					
$\sigma'^{d}_i=2*\sigma_i^{d}$	−0.075	−0.523	0.004	−1.304	−1.917
$\sigma_i^{'d}=0.5*\sigma_i^{d}$	−0.140	−0.457	0.004	−0.800	−1.228
σ_i^{m} = [3.80-11.298]					
$\sigma_i^{'m}=2*\sigma_i^{m}$	−0.274	−0.505	0.004	−1.194	−1.805
$\sigma_i^{'m}=0.5*\sigma_i^{m}$	0.138	−0.451	0.003	−0.736	−1.102
β = −0.1					
β'=2*β	−0.012	−0.259	0.003	−0.923	−1.385
β'=0.5*β	−0.249	−0.830	0.004	−1.112	−1.693

Table 8
Sensitivity analysis: Effects on GDP of world regions
(% change from benchmark)

A. Government deficit endogenous

	Japan	United States	European Union	Latin America	Asia-Pacific	Rest of the World
Benchmark	0.002	0.017	0.015	−0.032	−0.006	−0.062
σ_i^{VA} = [0.255-1.68]						
$\sigma_i^{'VA}=2*\sigma_i^{VA}$	−0.011	0.007	0.007	−0.025	−0.021	−0.045
$\sigma_i^{'VA}=0.5*\sigma_i^{VA}$	0.021	0.031	0.027	−0.042	0.016	−0.087
σ_i^{d} = [1.90-5.159]						
$\sigma'^{d}_i=2*\sigma_i^{d}$	0.013	0.018	0.012	−0.025	0.005	−0.050
$\sigma_i^{'d}=0.5*\sigma_i^{d}$	−0.009	0.015	0.018	−0.036	−0.015	−0.069
σ_i^{m} = [3.80-11.298]						
$\sigma_i^{'m}=2*\sigma_i^{m}$	0.005	0.017	0.017	−0.016	0.007	−0.035
$\sigma_i^{'m}=0.5*\sigma_i^{m}$	0.009	0.017	0.005	−0.056	−0.018	−0.101
β = −0.1						
β'=2*β	0.002	0.015	0.013	−0.035	−0.007	−0.066
β'=0.5*β	0.002	0.019	0.017	−0.028	−0.003	−0.056

B. Increase in direct taxes on labour

	Japan	United States	European Union	Latin America	Asia-Pacific	Rest of the World
Benchmark	0.070	0.013	0.054	−0.118	−0.010	−0.080
σ_i^{VA} = [0.255-1.68]						
$\sigma_i^{'VA}=2*\sigma_i^{VA}$	0.064	0.002	0.051	−0.120	−0.028	−0.068
$\sigma_i^{'VA}=0.5*\sigma_i^{VA}$	0.074	0.024	0.059	−0.116	0.006	−0.093
σ_i^{d} = [1.90-5.159]						
$\sigma'^{d}_i=2*\sigma_i^{d}$	0.080	0.019	0.046	−0.126	−0.002	−0.077
$\sigma_i^{'d}=0.5*\sigma_i^{d}$	0.058	0.009	0.058	−0.107	−0.016	−0.080
σ_i^{m} = [3.80-11.298]						
$\sigma_i^{'m}=2*\sigma_i^{m}$	0.053	0.018	0.052	−0.082	0.002	−0.057
$\sigma_i^{'m}=0.5*\sigma_i^{m}$	0.114	0.007	0.045	−0.177	−0.016	−0.116
β = −0.1						
β'=2*β	0.058	0.006	0.045	−0.105	−0.013	−0.065
β'=0.5*β	0.091	0.027	0.073	−0.139	−0.005	−0.105

C. Increase in indirect taxes

	Japan	United States	European Union	Latin America	Asia-Pacific	Rest of the World
Benchmark	−0.033	0.004	0.010	−0.038	−0.080	−0.042
σ_i^{VA} = [0.255-1.68]						
$\sigma_i^{'VA}=2*\sigma_i^{VA}$	−0.046	−0.002	0.005	−0.030	−0.089	−0.030
$\sigma_i^{'VA}=0.5*\sigma_i^{VA}$	−0.019	0.011	0.018	−0.048	−0.068	−0.057
σ_i^{d} = [1.90-5.159]						
$\sigma'^{d}_i=2*\sigma_i^{d}$	−0.053	0.003	−0.005	−0.039	−0.114	−0.038
$\sigma_i^{'d}=0.5*\sigma_i^{d}$	−0.018	0.004	0.017	−0.039	−0.056	−0.046
σ_i^{m} = [3.80-11.298]						
$\sigma_i^{'m}=2*\sigma_i^{m}$	−0.016	0.007	0.014	−0.023	−0.043	−0.029
$\sigma_i^{'m}=0.5*\sigma_i^{m}$	−0.045	0.000	−0.007	−0.066	−0.130	−0.063
β = −0.1						
β'=2*β	−0.035	0.002	0.008	−0.035	−0.078	−0.037
β'=0.5*β	−0.031	0.008	0.015	−0.044	−0.083	−0.050