Quantifying the Effects of Trade Liberalisation in Brazil: A Computable General Equilibrium Model (CGE) Simulation

Sónia Araújo,

Dorothee Flaig

OECD

Organisation de Coopération et de Développement Économiques
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QUANTIFYING THE EFFECTS OF TRADE LIBERALISATION IN BRAZIL: A CGE MODEL SIMULATION

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ABSTRACT/RÉSUMÉ

Quantifying the Effects of Trade Liberalisation in Brazil: a Computable General Equilibrium Model (CGE) Simulation

Brazil remains a fairly closed economy, with small trade flows relative to its share of world income. This paper explores the effects of three possible policy reforms to strengthen Brazil's integration into global trade: a reduction in import tariffs, less local content requirements and a full zero-rating of exports in indirect taxes. A simulation analysis using the OECD Multi-Region Trade CGE model suggests that current policies are holding back exports, production and investment in Brazil. The model simulations suggest significant scope for trade policy reforms to strengthen industrial development and export competitiveness. Results also show that the expansion of investment and production would be accompanied by significant employment gains. Moreover, employment growth is higher for low-skilled occupations, implying that a major trade and tax policy reform aiming at liberalising trade flows would particularly help those at the lower end of the income distribution.

JEL classification codes: F13; F47; F61; F62; F66.
Keywords: Brazil, Trade Policy, Global Value Chains, CGE modelling.

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L'impact de la libéralisation du commerce au Brésil : modélisation EGC et simulations

Le Brésil reste une économie relativement fermée, avec des flux commerciaux faibles par rapport à sa part dans le revenu mondial. Ce document examine les effets de trois reformes politiques qui permettraient au Brésil de renforcer son intégration dans le commerce mondial: une baisse des barrières tarifaires à l'importation, une réduction des exigences en contenu local et un taux zéro sur les impôts indirects pour les exportations. L'analyse de simulations utilisant le modèle EGC de commerce Multi-Régions de l'OCDE suggère que les politiques actuelles freinent les exportations, la production et l'investissement au Brésil. Les simulations du modèle suggèrent un rôle important pour des réformes de la politique commerciale visant à renforcer le développement industriel et la compétitivité des exportations. Les résultats suggèrent aussi que l'expansion de l'investissement et de la production serait accompagnée par des gains d'emplois significatifs. En outre, la croissance de l'emploi serait plus élevée pour les emplois peu qualifiés, ce qui implique qu'une réforme majeure des politiques commerciales et fiscales visant à libéraliser le commerce aiderait particulièrement les populations aux plus faibles revenus.

Classification JEL: F13, F47, F61, F62, F66.
Mots clefs: Brésil, Politique Commerciale, Chaînes de Valeur Mondiales, Modélisation EGC.

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QUANTIFYING THE EFFECTS OF LOWERING BARRIERS TO TRADE IN BRAZIL: A CGE MODEL SIMULATION

By Sónia Araújo and Dorothee Flaig[1]

Introduction

Brazil remains a fairly closed economy. The degree of openness, measured as the sum of exports and imports over GDP, is small relative to that of other emerging market economies (Figure 1). In addition, Brazil's participation in Global Value Chains (GVCs), a major feature of international trade and business in the past two decades, is low independently of the metric used. First, the share of foreign value-added content of exports is the second lowest among the BRIICS and it has not followed the common upward trend observed in developed and emerging economies alike. Second, Brazil's score on the GVC participation index, which has been constructed by the OECD to measure backward and forward participation in GVCs, is one of the lowest among emerging economies. Third, about 65% of the value-added created in manufacturing GVCs is generated for the domestic market rather than meeting final demand abroad (OECD, 2013; Reis and Almeida, 2014).[2]

2.   Backward participation in GVCs refers to the share of foreign value-added in a given country exports while forward participation in GVCs measures the use of domestically produced inputs in third economies' exports. The GVC participation index is less correlated with the country size than the foreign value-added content of exports. For instance, the foreign content of US exports is about 15% but US participation in GVCs rises to almost 50% when the use of US intermediates in other economies' exports is taken into account (OECD, 2013).

Figure 1. **The degree of openness of the Brazilian economy is small**

Total trade to GDP, in per cent, 2014
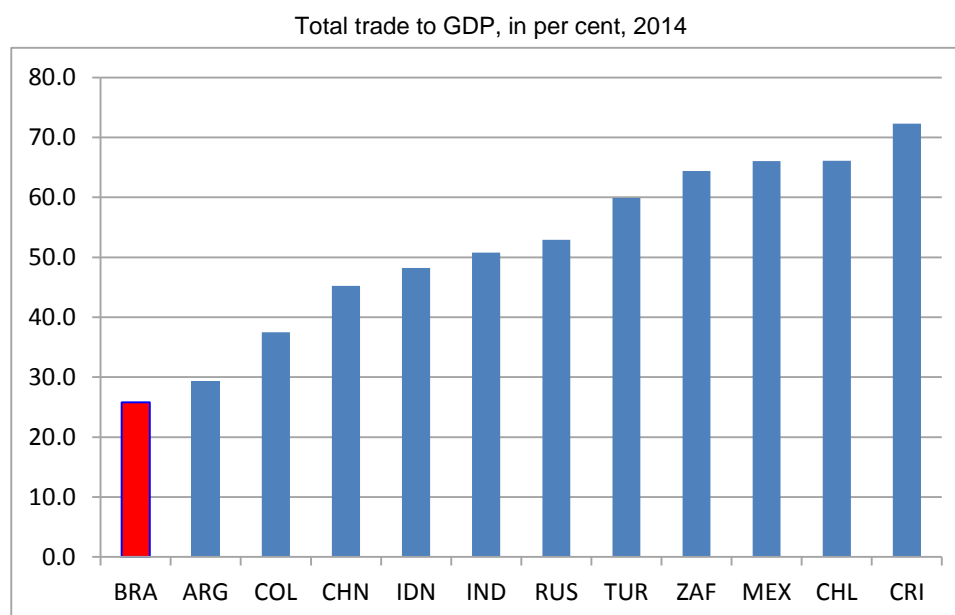
This paper argues that reducing barriers to trade in Brazil could lead to a stronger integration into the global economy. This is the conclusion of a simulation exercise gauging the economy-wide effects of a unilateral reduction in barriers to trade using a multi-region computable general equilibrium (CGE) model developed at the OECD, METRO. Due to its general equilibrium nature, METRO tracks the effects of a policy change throughout the economy and the global effects of trade liberalisation in Brazil. By contrast, partial equilibrium approaches may provide a more detailed analysis of the impact of a policy change on specific sectors or market segments, but are unable to offer a comprehensive view of the effects outside a target sector.

The paper investigates the effects of liberalising trade flows on Brazilian exports, imports, production, employment, investment and consumption, while also documenting sector specific effects in the composition of production and exports and the adjustment path of the economy. The following policy shocks are considered: i) a reduction in the level of import tariffs, ii) a reduction in local content requirements (LCRs) and iii) effectively applying a zero-rating of exports in indirect taxes. Key results of this simulation exercise are summarised in Box 1.

The results shown in the paper constitute conservative estimates on two grounds. First, the simulations do not consider the entire breadth and scope of Brazil's border and within-borders measures constraining trade flows, in part due to modelling limitations. Among inside borders restrictions, for instance, this study only includes a subset of prevailing local content rules, which are the ones that were established after the onset of the global economic crisis until 2014, therefore excluding the ones imposed prior to 2008. As the methodology used to calculate the impact of local content rules takes mainly into consideration their effect on existing import flows, it disregards the effects of pre-existing local content rules, hereby underestimating the total effect of these policies on the Brazilian economy. Also, no reliable quantitative information is available at the moment neither on barriers to trade in services nor on non-tariff barriers to trade (NTBs) measured as tariff equivalents, which could be used as a policy input by METRO. These have been increasingly applied by Brazil and include anti-dumping and sanitary and phytosanitary measures (Carneiro, 2015). Second, in its current version, METRO does not allow considering issues such as imperfect competition, increasing returns to scale, or dynamic effects, and can hence only account for part of the effects resulting from more open trade. As further productivity improvements are likely to result

from exploiting economies of scale and learning effects over time, CGE models that are able to capture these effects typically gauge larger welfare gains deriving from trade liberalisation (Robinson and Thierfelder, 2002). METRO's current version is only able to capture gains accruing from a more efficient allocation of existing resources, including a higher labour demand able to absorb those unemployed.

Besides the additional opportunities for trade among *existing* firms that trade liberalisation brings about, a trade and tax policy reform will also strengthen competition within sectors. This is particularly relevant for the case of Brazil, where evidence suggests that the level of competition is low, which reduces the incentives for productivity improvements, technology adoption or innovation (OECD, 2015a, Chapter 1). A major trade liberalisation and tax policy reforms would likely lead to a significant transformation of Brazil's industrial landscape, reallocating resources towards more productive firms, freeing resources currently held by less efficient ones. These benefits, which go far beyond the benefits accruing to existing firms, have remained largely unexploited in the trade liberalisation episode of the early 1990s, where productivity benefits mainly reflected direct efficiency gains accruing from an increase in intermediate inputs and equipment imports (Schor, 2004; Lisboa et al., 2010).

From a trade policy standpoint, the analysis in this paper only considers a unilateral reduction of trade barriers. In reality, however, Brazil could use its own trade liberalisation to negotiate improvements in market access for its exporters, which would further strengthen the effects of lower trade barriers on exports and production. Taking these points together, the overall benefits to be expected from a comprehensive trade liberalisation agenda are likely to exceed those estimated by the model significantly.

This paper is structured as follows. Section 1 provides an overview of trade and tax policies that hamper the openness of the Brazilian economy. Section 2 describes the policy changes simulations and presents METRO, the global multi-region CGE model developed at the OECD. Section 3 discusses the results.

Box 1. Simulation Results: summary

Simulation results show that liberalising trade would bolster exports, with the largest effects occurring in manufacturing sectors:

- Aggregate exports would rise by about 20%. Lifting importtariffs, zero-rating exports and reducing some of the existing local content requirements would generate a rise in exports in all sectors but oil and gas.

- Exports of electronic and transport equipment, leather products, motor vehicles, machinery and equipment and non-ferrous metals could be raised up to between 40% and 60% Simulation results also show that lifting impediments to trade would allow a deeper integration of the Brazilian economy in Global Value Chains.

- The largest gains in exports at the aggregate level would stem from eliminating tariffs on imports of intermediate goods and applying the zero-rating of exports in indirect taxation but the relative impact of the three policies on trade, production and employment are sector specific.

- The benefits stemming from lower barriers to trade on the efficiency of the economy are clear: lowering barriers to trade allow firms to use a higher share of foreign intermediate goods in production. Final goods are in turn sold at lower prices, enhancing the competitiveness of Brazilian exports and also benefitting Brazilian households. Lower barriers to trade also reduce the cost of capital, spurring investment and supporting further expansion of production going forward.

- The simulation results also suggest that trade liberalisation would have positive employment effects. Reducing the three kinds of barriers to trade mentioned above would add about 1 and half million jobs to the economy. Importantly, job creation is higher for lower skilled occupations, benefiting those at the lower end of the income distribution.

- The effects of trade liberalisation on labour demand at the sector level depend largely on the specific policy shock. Only in the textile and gas sectors job loss is higher than 5%. While zero-rating exports reallocates resources away from the gas sector, it mitigates job losses in all other sectors where jobs are lost following a reduction in import tariffs and LCRs.

- Stronger benefits would accrue from a wide-ranging trade liberalisation as opposed to pursuing a partial reform, removing only one of the policy instruments curbing trade. For instance, taking these conservative estimates, cutting tariffs, local content requirements and zero-rating indirect taxes levied on exports simultaneously would increase aggregate household income and production by about 1.6% and 1.8%, respectively, while eliminating tariffs alone would lead to less than half this effect.

- Likewise, gains in exports, production, jobs and household income are considerably lower in the short term relative to the medium/long term scenario in which factors of production have shifted across sectors. This result highlights the importance of having in place institutional settings that facilitate resource reallocation in order to reap the gains brought by trade liberalisation.

A Bird's Eye View on Brazilian Trade Policy

Like in many other countries, Brazil has used trade policy to promote industrial development, including the diversification of production and technological upgrading. Additional policies were also put in place to support this objective, including subsidised credit and other targeted subsidies (Thorstensen and Ferraz, 2015). While import tariffs and other barriers to trade are applied to a wide range of final goods imports, policy is more selective with respect to intermediate goods. For some of these, trade barriers are low while domestic production of inputs from key sectors such as steel, chemicals and petrochemicals has been promoted by industrial policies, including through public enterprises (Menezes Filho and Júnior, 2013). This strategy has had mixed results at best, and today Brazilian manufactured products are lacking competitiveness and market shares in world markets are small. All in all, Brazil has remained a marginal player in world trade. Before the partial trade liberalisation that took place in the early 1990s, non-tariff barriers to trade (NTBs) were used even more widely and nominal tariffs were higher (Kume and Sousa, 2003).

Tariffs on Imports

In the last two decades there has been only moderate progress in reducing tariffs. In fact, today's tariff profile is not much different from the one resulting from the tariff reform programme of the early nineties and the Mercosul negotiations. The 1991 reform reduced the modal tariff from 40% to 20%, and the mean tariff from 42% in 1988 to 12% in 1994. The tariff reform programme was accompanied by additional measures that contributed to the partial opening of the Brazilian economy. One important aspect was the elimination of import bans affecting 1300 products (known as "Anexo C"), alongside with the majority of Special Regimes (Hay, 1997).

Since 1994, import tariffs in most sectors have averaged around 10% and 20%, after having fallen from very high levels in some sectors, for instance, from 90% to 20% in wearing apparel and from 48% to 14% in machinery and equipment. However, products with higher technological content (software and fine chemicals), with longer production chains (automobiles) or low competitiveness relative to products from Asian economies (consumer electronics) are subject to higher tariff rates of between 30% to 35%. There have subsequently been several small occasional amendments, including tariff hikes for many products included in the Mercosur list of exceptions (capital goods, computing and telecoms) in 1995, a generalised increase of 3% in 1997 and a temporary tariff increase for 100 products in 2012 (Hay, 1997; Castilho et al., 2015). As of 2004, two indirect taxes began to be levied on imports, whereas before they were only levied on domestic production (Baumann and Kume, 2013).[3]

Overall, Brazil still applies high import tariffs relative to other countries. Among BRICS' countries, Brazil applies the highest mean import tariff on non-agricultural products and the second highest overall

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3.   These taxes are the "Contribuição para Financiamento da Seguridade Social" (Cofins) and the "Programa de Integração Social/Programa de Formação do Patrimônio do Servidor Público" (PIS/PASEAP).

(Thorstensen and Ferraz, 2015). In 2014, the mean non-weighted tariff was 11.7% and the maximum was 55%, albeit applied to only two products. The second highest tariff rate is 35%, applied to about 500 products across several sectors, predominantly in textiles and automotive vehicles. The modal tariff was 14% and the median 12% (Castilho et al., 2015). At the sector level, Brazil applies tariffs above 10% in textiles, wearing apparel, leather, wood products, ferrous metals, motor vehicles, machinery and equipment and other manufacturing (weighted averages). Other manufacturing sectors have tariffs between 5 and 10%. There are no or small import tariffs below 2% applied to coal, oil, gas, minerals and petrochemicals products. On what regards bilateral trade policy, Brazil has adopted a strategy of regional integration, and has lowered trade barriers against other Latin American economies through preferential agreements offering tariff reductions, while maintaining higher protection against other regions.

Local Content Requirements

Brazil is also imposing local content requirements to an increasing number of products (Mattos, 2013). Local content requirements (LCRs) are demands made to a firm or sector to purchase domestically a given share of inputs or goods and services for investment purposes. LCRs fall under the larger category of so-called "localisation barriers" to trade that favour domestic industry at the expense of foreign competitors. LCRs measures are put in place largely with a view of supporting industrial and technological development and associated employment gains they purportedly could bring (OECD, 2014).

Many studies assessing of the impact of LCRs have generally concluded that although these policies may achieve some of their short run objectives, they undermine industrial competitiveness over the long run (Hufbauer, 2013). Although LCRs increase in a first stage the production of domestic inputs, the increased demand for domestic inputs is also associated with a price increase, as the domestic upstream supplier is more expensive than its foreign counterpart. In turn, these higher input prices flow on to the price of domestic final products, harming the competitiveness of downstream producers, ultimately reducing production and demand (Grossman, 1981).

LCRs also lead to a suboptimal allocation of resources that further dent efficiency, as the price hike associated with the change from cheaper foreign suppliers to more expensive domestic suppliers causes a substitution away from these now more expensive goods in the rest of the economy. The negative effects on efficiency can be made even worse in the event of market power by rent-shifting from domestic downstream producers to foreign competitors and domestic upstream producers. In imperfect competitive markets, Belderbos and Sleuwaegen (1997) show that the imposition of an LCR can generate a shift in economic rents from downstream industries to upstream suppliers that is larger than the amount of rents shifted from domestic to foreign downstream firms that occurs due to the increase in the consumption of foreign final goods, which were made relatively cheaper by the imposition of the LCR. Thus LCRs increase inefficiency in the industry and can grant further market power, which reduces output. The higher prices also reduce consumer surplus.

On what regards the dynamic benefits of LCRs, there is no clear-cut evidence supporting the claim that learning by doing gains accruing from experience associated with higher production levels or the attainment of scale economies could lower production costs significantly to outweigh the inefficiency costs brought by LCRs (Tomsik and Kubicek, 2006).

A recent OECD study, which uses METRO to analyse the impact of LCRs across the targeted economies, finds that they raise domestic production costs in the industry targeted, leading to an increase in output prices (OECD, 2014). In turn, the increase in prices raises costs to producers further along the production chain, reducing the competitiveness of industries across the economy. The increase in prices in the targeted industry also causes a substitution away from these now more expensive goods. While LCRs force firms to buy intermediate inputs from domestic sources, households are not under such constrain.

Hence, as LCRs push up the prices of domestically produced goods, households increase their imports of final goods.

The OECD study finds that Brazil is second only to Indonesia in the number of LCRs imposed since the onset of the global crisis in 2008 (OECD, 2014). The study documents 17 LCRs in-force in Brazil: 9 concerning input measures, 6 involving government procurement and 2 imposing ownership/local partnerships obligations (see Annex 1 in this paper). LCRs on input markets might have strong distorting effects on the economy as they deter integration in global value chains, limiting the choice of inputs, including cheaper and/or higher quality inputs, which will in turn dent the competitiveness of domestic production in foreign markets. As a consequence, domestic producers will focus on servicing the domestic market. The costs of the inefficiency fall on domestic consumers, especially when the targeted sector is a monopoly, as confirmed by Guimarães (2013) when analysing Brazil's domestic market for petroleum products, dominated by Petrobras. Instead, the costs of LCRs embedded in the contracts of production sharing in the pre-salt oil-fields fall directly on the federal budget, as concessionaries are reimbursed for the costs of investments undertaken in the exploitation, evaluation, development, production and deactivation of facilities (Guimarães, 2013).

The quantitative analysis presented in this paper follows the approach of the aforementioned OECD study on the effects of LCRs on international trade flows (OECD, 2014). The study restricts the analysis to LCRs in the areas of market access and price preference measures, but does not consider LCRs in government procurement. Seven LCRs in Brazil follow under the first category and the methodology used to modelling their impact throughout the economy is described in Box 2.

Box 2. Simulating the Impact of Local Content Requirements

This box describes the LCRs imposed by the Brazilian authorities whose effects are quantified in this simulation. For a discussion of selection criteria which LCRs to include in the METRO framework, see OECD (2014).

- **National Broadband Programme**: In 2012, the Brazilian authorities created a special tax regime for the implementation, expansion, and modernisation of its National Broadband Programme (*Programa Nacional de Banda Larga)*. Under this programme, no Federal excise tax and social contributions is levied when network equipment and components are sourced domestically. A similar exemption is in place for Brazilian companies that provide services for civil works in support of the Broadband Programme. When quantifying this LCR, it was considered that electrical equipment is the relevant goods commodity, and construction services and communications services are the relevant service commodities impacted by the LCR. No specific LCR level is discussed, but the tax rebate is provided on any domestic goods and services used in the National Broadband Programme. The simulation removes the sales tax on domestic intermediates used in the communications industry. The policy database suggests a sales tax rate for electrical equipment of 11.5%, 2.6% for construction and 6.1% for communications.

- **Special regime for the development of a fertilizer industry**: In 2013, the Brazilian authorities created a special regime for the development of infrastructure for the fertilizer industry. Similar to the National Broadband Programme, the federal excise tax and social contributions are removed on sales of services, new machines and construction materials used in an infrastructure expansion to produce fertilizer. The fertilizer industry forms part of the broader sector for chemicals, rubber, and plastics production. Based on revenue figures provided in Pinto (2011), the Brazilian fertilizer industry accounted for 9.50% of the Brazilian chemicals industry in 2009. The World Input Output Database (WIOD) shows that, at basic prices, the Brazilian chemicals industry accounted for approximately for 77% of the combined chemicals, rubber, and plastics sector in 2009. This suggests that the Brazilian fertilizer industry accounts for 7.3% of the Brazilian chemicals, rubber, and plastics sector. Other machinery, electrical equipment and construction are assumed to be the relevant input commodities and services targeted with the LCR. No specific LCR level is discussed (again it was to be announced by the executive), but the tax rebate is provided on any domestic goods and services used in programme. Assuming a 100% LCR would affect approximately USD 74.5 billion in imports. The simulation removes the sales tax on domestic intermediates giving them a price advantage over foreign inputs. The policy database suggests that the intermediate tax rates for other machinery and equipment is 8.2%, electrical equipment is 11.5%, and construction is 2.6%.

- **Motor-vehicle parts and production**: In 2012, the Brazilian authorities issued regulations related to the industrial and trade regime for the automotive sector. The regulations, amongst other things, require at least 10 of 12 production steps for light vehicles, and 12 of 14 production steps for heavy vehicles to be completed domestically. Combining these production processes suggests that 22 of 26 production steps are required to be completed in Brazil. Assuming a proportional value for each step, the LCR would amount to 85%. The Brazilian motor vehicle industry purchases USD 52.5 billion in intermediate inputs, of which 80% are sourced domestically. Implementing the LCR requires 85% local content, which would affect USD 2.3 billion in imported inputs.

- **Oil and gas**: In 2013, an LCR went into full effect in Brazil's 11th licensing round for oil and gas. Bids are assessed based on the following criteria: signature bonus (40 percent), the mandatory exploration program (40 percent), and the minimum local content equipment (20 percent) of each bidder. Different minimum LCRs are applied to the exploration and development phases of oil and natural gas production, which also depend on the location of fields. For modelling purposes, based on information in Morais (2015), a simple average of 70% of these varying LCRs was applied to oil and gas production.

- **Telecommunications industry**: Regulation requires the overall level of local content in the equipment used in 4G networks to be at least 70% from 2017 onwards. The telecommunications sector is within the post and telecommunications sector in the OECD Trade Model. It has not been possible to determine telecommunication's share of that broader sector. This means the modelling of these LCR measures will be broader than the stated measure. Most of the equipment that will be used in these 4G networks is likely to come from the electronic equipment and machinery and equipment sectors. Currently in the database that supports the model, 62% of the inputs from these sectors into the communications sector are sourced locally. Applying a 70% LCR to these inputs would affect USD 146 million in imports.

- **Audio-visual services**: Brazil's "new" media law (Law 12.485) requires all channels to retransmit 3.5 hours of Brazilian content per week in primetime, half of which must be produced by Brazilian independent producers. It also requires the direct participation of a Brazilian advertising agency. Additionally, the draft regulations require hiring personnel through a Brazilian company located in Brazilian territory, permitting Brazilian producers to own their creation of audiovisual products and derivative products, as well as the licensing rights. Based on the 3.5 hours per week, the LCR was 23.34%. TV falls within the ROS sector in the METRO model that has the existing level of local content in the Brazilian recreation and other services sector of about 95.4%.

- **Renewables**: BNDES, Brazil's Development Bank, provides loans to wind-turbine development if investment projects meet LCRs of 40-60%. Furthermore, BNDES' method to license and verify the local content of wind turbines manufactured in Brazil sets targets to gradually increase the number of domestic components in the equipment. In 2013, BNDES announced the disqualification for financing purposes of six foreign wind turbine suppliers, as they did not comply with FINAME's loan program, which at the time required 60% local content.[1] Manufacturers of wind turbines with step-up gear box are expected to meet at least three of four criteria demanded to comply with the LCR, one of which implies that at least 70% of steel plates used to manufacture towers are manufactured in Brazil or apply domestically-reinforced concrete. As towers are a complimentary input, it was applied an average of 70% LCR to this sector. Manufacturers of wind turbines without a step-up gearbox are required instead to manufacture wind turbines in their own plants using a domestic silicon steel plate magnetic copper and copper coil, manufacturers of wind turbines with a

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1.   FINAME is a subsidiary of BNDES whose resources are earmarked for financing purchases and sales operations, including exports of Brazilian machinery and equipment, as well as imports of goods of the same nature produced overseas.

Taxes Levied on Exports

In the METRO database, taxes levied on exports comprise both export taxes and indirect taxes on exports that Brazilian exporters are not able to claim back. Export taxes are applied only to very few specific products, which have little economic relevance, such as raw hides and skins to all destinations and cigarettes containing tobacco and arms and ammunition destined to countries in the Caribbean, Central or

South America (WTO, 2013). While the quota for cigarettes and ammunition sold to Latin America is very high, 150%, the export tax applied to raw hides and skins sold worldwide is comparatively lower, 9%.

However, and unlike in most countries, Brazilian exports are not zero-rated in indirect taxes. Although indirect taxes are not listed among trade impediments, their application to exports at a high level puts Brazilian exporters at a competitive disadvantage with foreign competitors in international markets, constituting therefore a *de facto* barrier to exports.

Although the Constitutional amendment No. 42/2003 exempts exports from indirect taxes, in practice, administrative hurdles and limiting instruments, including those provided for in the *Lei Kandir* and in individual State legislations, prevent exporters from recovering indirect taxes levied along the production chain (de Siqueira, Nogueira and de Souza, 2010; Vieira and Mourão, 2015).

Brazilian entrepreneurs face several indirect taxes, the four largest being the ICMS, IPI, Cofins, and PIS/Pasep. Credits for intermediate inputs follow the so-called "physical credit" principle, by which tax credits are granted only for inputs embodied in the final good sold, instead of "financial credit" principle, which would generate a credit for any acquisition made. In addition, indirect taxes are cumulative as PIS/COFINS is often applied on the value of a good already including ICMS tax already paid on it, making the two taxes cumulative.

Exporters are also not successful in claiming credits for inter-state indirect taxes already paid, in particular the ICMS (*Imposto sobre Operações relativas à Circulação de Mercadorias e Prestação de Serviços de Transporte Interestadual e Intermunicipal e de Comunicação*), the largest indirect tax. The ICMS is a State tax levied on the transportation of goods and services. Each state applies its own tax code, tax base and tax rates. Difficulties in the coordination of different State tax administrations, complexities of the tax system associated with crediting the value of tax already paid and fears of uncompensated revenue loss by States lead to positive taxation of exporters (FIESP, 2009).

As raw and processed agriculture products pay no or a very low ICMS rate and manufacturing goods involve longer production chains, the latter tend to accumulate more indirect taxes relative to products with little or no transformation. Different ICMS tax rates applied to different products and cumulative taxation lead to a severe distortion of relative prices which in turn causes important resource misallocation, with resources shifting away from manufacturing into raw materials and agribusiness.[4] Also, it incentivises business activities to vertically integrate production stages into a single firm, which is likely to bring inefficiencies, an in opposite direction to today's organisation of production in value-chains (Mendes, 2014). Finally, it directs final consumption towards relatively cheaper imported goods, which are not subject to cumulative taxation in their country of origin.

In short, by protecting the domestic market, import tariffs and local content rules reduce the incentives to raise efficiency and invest in innovation to raise quality or product differentiation and it also prevents domestic producers from sourcing from the lowest cost or better quality input suppliers. Failing to zero-rate exports increases producer prices, setting Brazilian exports at a competitive disadvantage relative to international competitors. Today, Brazil's GDP value represents more than 3% of the world economy, but its export market share is around 1.2%, a figure that has remained almost unchanged in the past two decades (Figure 2). In spite of highly protected, industry share in total value added has been unchanged in the past 20 years and Brazil's industrial sector is actually small for a middle income economy (Figure 3). Moreover, the share of manufacturing in total value added has actually declined in the past 10 years, while labour productivity in manufacturing has stayed constant at very low levels (Figure 4; OECD, 2015a).

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4.   For a discussion of the how the high burden of indirect tax system weighs on industry competitiveness in Brazil see Arnold (2016) and OECD (2015a).

Figure 2. **Brazil's share of world trade is low relative to its GDP**

Share of exports and imports on world's total exports and imports, respectively
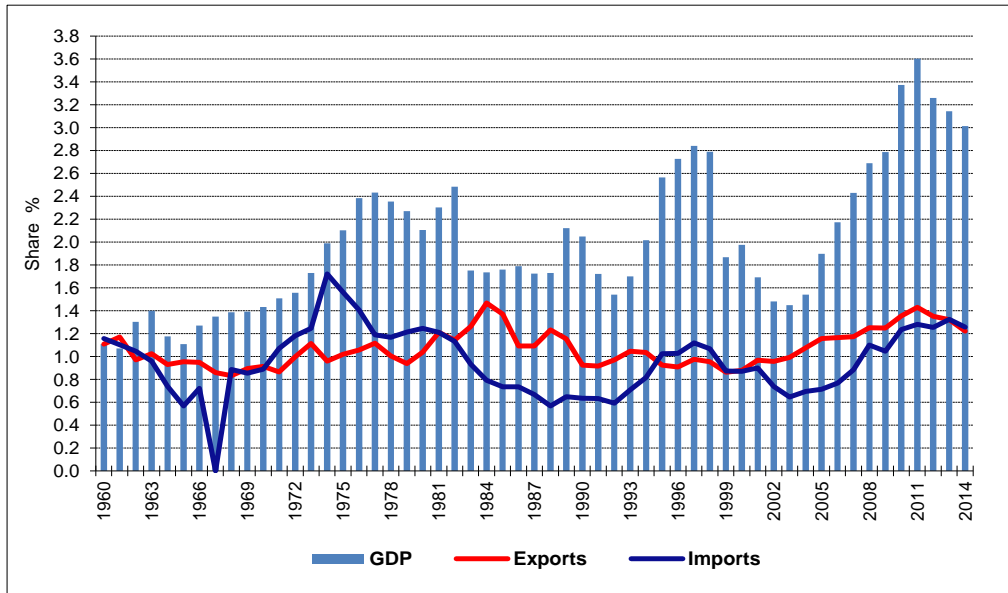
Source: Secretaria de Comércio Exterior (SECEX) do Ministério do Desenvolvimento, Indústria e Comércio Exterior (MDIC), World Bank Development Indicators.

Figure 3. **Brazil's industrial sector is small for an upper middle income country**

Share of industry in total value added in middle income countries, in per cent, 2012
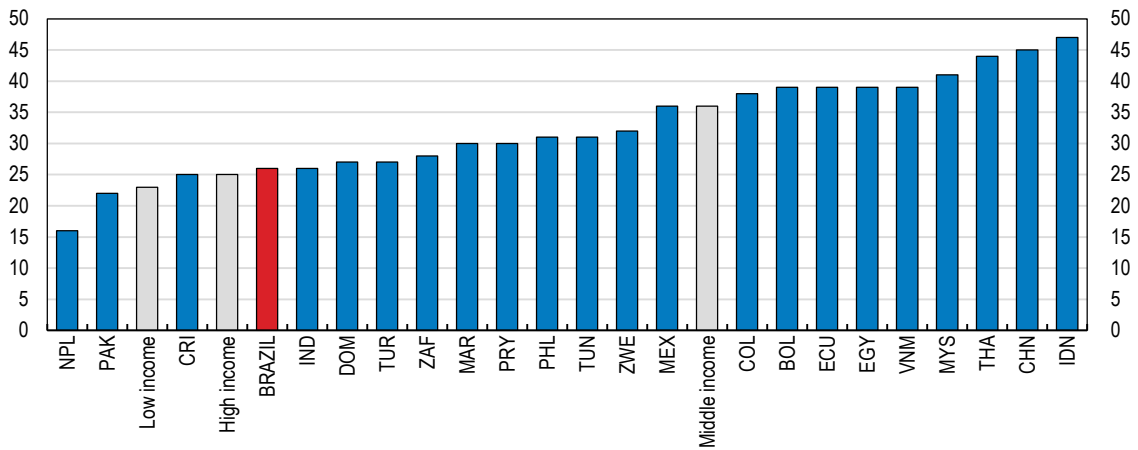
Source: World Bank.

Figure 4. **Manufacturing productivity is low and stagnant**

Labour productivity in thousands of constant 2005 USD per employee
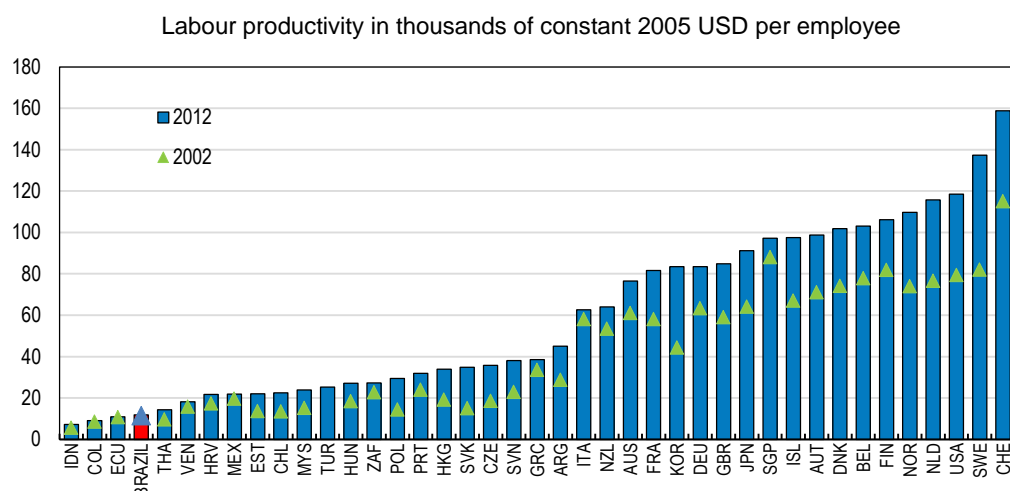
Source: World Bank, ILO, IBGE.

Simulating the Impact of Trade Liberalisation

Policy Scenarios

The simulations intend to gauge the economic impact of lifting or reducing the three policy instruments that hinder the integration of the Brazilian economy in the world economy, discussed in the previous section: import tariffs, local content requirements (LCRs) and taxes levied on exports, which in the Brazilian case stem mostly from a non-zero-rate of exports. As the LCRs that are part of this simulation constitute only a subset of total LCRs in the Brazilian economy, their impact is simulated together with import tariffs.[5] In total, five simulations scenarios are run, combining different sets and sizes of the policy shocks:

- *OECD minimum tariffs on imports of intermediate goods and no LCRs*: a reduction of import tariffs on goods used in downstream production processes to the minimum levels applied in OECD countries and an elimination of sector specific local content requirements while maintaining tariffs on goods destined to final consumption. This scenario implies Brazil adopting the tariff rates of Switzerland and Norway on industrial goods used in intermediate stages of production and those of Australia and New Zealand for agriculture and the food industry, all of which are nearly zero. Focusing on intermediate goods import tariffs alone allows quantifying the effect of those barriers that are likely to have an impact on the competitiveness of domestic production and hence exports.

- *OECD minimum import tariffs and no LCRs*: a reduction of import tariffs on all goods to the minimum levels applied in OECD countries and eliminating sector-specific local content requirements. This scenario roughly corresponds to Brazil applying the low tariff rates of Switzerland and Norway on industrial goods and those of Australia and New Zealand to agriculture and the food industry, all of which are nearly zero.

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5. For a survey of LCRs in Brazil, see OECD (2014).

- *Zero-rating of exports*: This scenario involves Brazil zero-rating exports in indirect taxes. Although an elimination of export taxes is included in this scenario, their economic insignificance means that this scenario is effectively about eliminating indirect taxes levied on exports.

- *Full liberalisation*: this scenario comprises a simultaneous reduction of all import tariffs to the minimum level applied in OECD countries, eliminating sector specific local content requirements and applying zero-rating of exports.

- *Adopting Chile's trade policy*: this scenario implies aligning Brazilian policies in the three areas discussed with those of Chile. It is about half-way towards full liberalisation as Chile applies higher import tariffs than the OECD minimum tariffs used in the two simulations outlined above, even considering the many bilateral free trade agreements Chile has signed. However, Chile applies lower import taxes than Brazil in most products, except for coal, oil, minerals, petroleum and coal products and electricity.[6] In addition, Chile does not grant preferential tariff rates to import from Latin America, which results in higher tariffs than Brazil for some imports from Latin American countries, notably in the following sectors: agriculture, food, wearing apparel, wood products and motor vehicles. As to what regards indirect taxes, Chile levies a regular destination-based value-added tax (VAT) which implies it zero-taxes exports and provides refunds for VAT paid on the inputs used in producing the exported goods and services, the only exception being that VAT levied on fixed assets is not fully creditable in Chile, as in other Latin American countries.

Data on the three policy areas come from the following sources:

Data on import tariffs and taxes on exports are based on GTAP v8 database, which draws on the MacMap database of the International Trade Centre (ITC).[7] Information on LCRs is sourced from OECD (2014).

The METRO model

The study of the impact of trade liberalisation is undertaken using the OECD CGE model, METRO (Box 3 and OECD, 2015b). METRO is a comparative static, constant returns to scale multi-region Computable General Equilibrium model that captures inter-industry effects while tracking differences in trade patterns by individual country and sector.

The strength of METRO is that it is particularly well suited for analysing trade flows and adjustments following policy shocks in a world where supply chains determine trade flows. To do so, besides tracking bilateral trade flows, METRO distinguishes trade flows by end use, i.e., whether an imported product is used as an intermediate input, for final consumption (household or government consumption) or as a capital good. Disaggregated trade flows by end-use category are sourced from the OECD BTDIXE 2013 edition for manufacturing and agricultural sectors and from the OECD Inter-Country Input-Output Model (May 2013) for services sectors.

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6.   This statement is valid for aggregate tariffs related to the sectors depicted in the model database. While these aggregates provide a picture of the overall level of protection, there might be exceptions at the detailed HS6 level where tariffs are typically applied.

7.   See Narayanan et al. (2012). Tariffs are weighted averages of bilateral tariffs applied at the HS6 product level.

Disaggregating trade flows by end use allows taking cross-sector effects into consideration, such as import tariff cuts in inputs used in the production of a good in another sector, as there are important indirect effects through the supply chain to consider as part of the size of the supply response.[8] In the METRO model, gains from trade liberalisation depend on crucial parameters, such as sector contributions to aggregate values, input-output relationships among sectors of production, elasticities of substitution between inputs, imports and domestic production and trade partners, and the relative size of impediments to trade among sectors.

METRO uses the GTAP database for most of the modelling of sectoral relationships and international linkages, including trade elasticities (Narayanan et al., 2012). These elasticities, whose values are subject to insecurity, influence how strong quantities react to price changes and thus influence the size of the outcomes. The model employs 4 sets of trade elasticities, two sets each for imports and exports, where each set governs the substitutability between imports/exports and domestic produce on the lower level and the substitutability between trade partners on the upper level.

This paper departs from the METRO database – and GTAP – in that it specifies higher elasticities of substitution between imports from different regions and also between aggregate imports and domestic production. Indeed, GTAP elasticities are implausibly low and have been rejected by Liu et al. (2002) in a back-casting exercise using a simplified version of the GTAP model.

Moreover, the estimates have been computed using 1994 trade data (Hertel et al., 2004; Hummels, 1999), since that time the trade landscape has been marked by ongoing important advances in transportation and communication technologies, which led to the so-called "second unbundling", a further slicing of production processes into global value chains and intensified international trade flows (Baldwin, 2006). Around that time, Brazil was undergoing a process of trade liberalisation, which opened-up the economy to some extent.

Harrison et al. (2004) study the effects to the Brazilian economy of different policy options under the Mercosur trade negotiations, using significantly higher elasticities. Their choice of elasticities finds some support in the estimates of Riedel (1988) and Athukorala and Riedel (1994), and produce results for terms of trade changes that are closer to the results of Chang and Winters (2002).[9] At the same time, Harrison et al. (2004) focus on a long adjustment period of about 10 years, while in this paper, the time horizon the adjustment to policy shocks are assumed to take place over a period of about 3 to 5 years. For this reason, this paper adopts an intermediate choice and doubles the elasticities of substitution between imports from different regions and also the elasticities between aggregate imports and domestic production. With respect to the original GTAP values, these elasticities are about two times higher, but they are still about 3 times lower than the ones used by Harrison et al.(2004), so they remain a conservative choice of the ease of substitutability between foreign suppliers and between those and domestic production, even in a fairly closed economy such as Brazil. Taking cautious estimates as in this paper is justified due to the considerable uncertainty around the values of trade elasticities.

The policy simulations are also performed using GTAP lower elasticities values as a sensitivity test and results are reported in the sensitivity section of this paper. While lower elasticities lower the production, exports, employment and consumption gains from lifting impediments to trade, as expected, the qualitative results of the alternative policy shocks do not change.

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8.   The magnitude of the effect of trade liberalisation on exports also crucially depends on the market share of the exporter and the elasticity of import demand. The OECD model takes all these effects into account.

9.   In Harrison et al. (2004) the elasticity of substitution between imports from different regions is assumed to be 30, and the higher level elasticity between aggregate imports and domestic production to be 15. Unlike Harrison et al. (2004), the elasticities in our paper are sector specific.

Box 3. **METRO: The OECD CGE Model**

The OECD Model "METRO" is a computable general equilibrium model (CGE) derived from the Social Accounting Matrix (SAM) - based CGE model GLOBE developed by McDonald, Thierfelder and Walmsley (2013). METRO is a direct descendant of an early US Department of Agriculture model (Robinson et al., 1990) and NAFTA (Robinson et al., 1993) and follows trade principles deriving from the 1-2-3 model (de Melo and Robinson, 1989; Devarajan et al., 1990).

As any general equilibrium model, METRO requires a complete specification of all economic activity and explicit recognition of inter-sector linkages. This approach is therefore ideal for examining the whole of economy impact of a change in policy. The novelty and strength of the OECD Trade Model lies in the disaggregation of imports based on use categories. Commodities and thus trade flows are distinguished by use category into commodities destined for intermediate use, for use by households, for government consumption as well as investment commodities - as opposed to the widely applied proportionality assumption. This feature makes METRO particularly well-suited to analyse global value chains. For a detailed description of the model, see OECD (2015b).

METRO is based on the Global Trade Analysis Project (GTAP) database, version 8, with a base year of 2007. The original database consists of 57 sectors and 56 country/regions and 4 factors of production, with labour further disaggregated into 5 groups, according to their skill level. For the purpose of this study several commodity sectors were aggregated into an "Agriculture" sector and a "Food" sector and trading partners were allocated to 7 regions (Table 1) as the objective of the paper is not to quantify changes in bilateral trade relationships. Annex 2 lists the regional aggregation undertaken in this simulation.

Table 1. **Regions, sectors and factors of production**

Regions	Sectors		Factors
Brazil	Agriculture	Electronic equipment	Labour:
Latin America	Coal	Machinery and equipment	Officials and Managers
North America	Oil	Manufactures nec.	Technicians
OECD Asia	Gas	Electricity	Clerks
Non-OECD East Asia	Minerals	Gas distribution	Service/Shop workers
Emerging South East Asia	Food products	Water	Agricultural and unskilled
OECD EU	Textiles	Construction	Capital
Rest of the world	Wearing apparel	Trade	Land
	Leather products	Other transport	Other natural resources
	Wood products	Sea transport	
	Paper prod., publishing	Air transport	
	Petroleum, coal production	Communication	
	Chemical, rubber and plastic products	Financial services	
	Mineral products	Insurance	
	Ferrous metals	Business services	
	Metals	Recreation and oth. services	
	Metal products	Other services (Government)	
	Motor vehicles and parts	Dwellings	
	Transport equipment		

Like GLOBE, the underlying approach in the METRO multi-region model is the construction of a series of single country CGE models that are linked through trade relationships. As is common in CGE models, the price system is linear homogeneous, which implies that simulations provide relative, not absolute, price changes. Each region has its own *numéraire*, typically the Consumer Price Index (CPI), and an exchange rate (an exchange rate index of reference regions serves as model *numéraire*). Thus, price effects inside a country are fed through the model as a change relative to the country's numéraire, and prices between regions change relative to the reference region. The Model also contains a "dummy" region to allow for inter-regional transactions where full bilateral information is not available, i.e. data on trade and transportation margins. Imports compete with domestic goods, and producers' decisions to export are based on relative price differentials between domestic and foreign markets.

> The model distinguishes activities which produce commodities. Activities maximise profits and form output from primary inputs (i.e. land, natural resources, labour and capital), combined using a constant elasticity of substitution (CES) technology, and intermediate inputs in fixed shares (Leontief technology). Households are assumed to maximise utility subject to a Stone-Geary utility function, which allows for the inclusion of a subsistence level of consumption. All commodity and activity taxes are expressed as *ad valorem* tax rates and taxes are the only income source to the government. Government consumption is in fixed proportions to its income and government savings are defined as a residual. Closure rules for the government account allow for various fiscal specifications.[10] Total savings consist of savings from households, the internal balance on the government account and the external balance on the trade account. The external balance is defined as the difference between total exports and total imports in domestic currency units. While income to the capital account is defined by several savings sources, expenditures by the capital account are based solely on commodity demand for investment.

Underlying Economic Conditions

CGE models resemble a closed system of economic flows and markets must be balanced. So-called closure rules specify how markets balance. This is necessary as similarly to other CGE models, METRO has more variables than equations. The baseline simulations are carried under the following medium and long term underlying economic conditions, emulating a steady-state type equilibrium to which the economy converges after a specific policy shock:

- Following the standard norm, the current account balance is constant and a floating exchange rate adjusts so as to balance the current account. Without this assumption, welfare calculations are not meaningful, as a changing balance of trade would mean getting or giving a free lunch to the rest of the world. For instance, in a comparative static model, a country could run a balance of trade deficit indefinitely after a policy shock, without ever having to pay it back.

- Investment expenditure is determined by the volume of savings, i.e. savings are a fixed share of final demand, allowing investment volumes to adjust to changing final demand.

- Governments are assumed to maintain spending constant relative to final demand and the tax rates adjust to maintain that balance. In this exercise, income tax revenues are adjusted to maintain the share of government expenditures constant. In practice, this means that to make up for revenue losses from reduced import taxes and indirect taxes levied on exports, the Brazilian government would increase income tax to maintain the budget balance constant at its pre-policy shock level, thereby reducing households' disposable income, ceteris paribus.

- In factor markets, capital, land and natural resources are fully employed and mobile across sectors. Labour is assumed mobile across sectors and there is unemployment. Labour supply is set perfectly elastic and factor prices are fixed until full employment is reached. There is perfect competition in goods markets.

The sensitivity of results to these underlying assumptions about the behaviour of the economy is tested by re-running the policy simulations and allowing each of the macroeconomic conditions to change at a time:

- Assuming a fixed exchange rate and a flexible current account balance

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10. The default assumption for the government account is a fixed internal balance and fixed government expenditures. Income tax is variable to clear the government account. Similarly, any of the other tax rates could be set free to balance the government account. Alternatively to the volume of government demand, the government share of final demand or the value of government expenditure could be fixed. Another setting could assume, for example, a flexible internal balance and fixed tax rates.

- Assuming full employment

- Assuming investment driving savings, where the investment share in final demand is fixed and the saving rate is allowed to vary

- Assuming that government expenditure changes to balance the budget.

Results

Macroeconomic Effects

All policy measures towards liberalising trade would raise aggregate exports, production, employment, investment as well as households' income and consumption (Tables 2 and 3). Adopting Chile's trade policy would produce a similar effect but the largest gains would accrue from full trade liberalisation. Total exports would be about 16% if Brazil were to adopt Chile's trade policy and 19% higher in the absence of all trade barriers, including local content requirements and input taxes on exports. Taking the year of 2014 as a reference, such trade reforms would boost exports by around 42 billion dollars and 50 billion dollars, respectively.

Table 2. **Macroeconomic impact of removing barriers to trade in Brazil**

Summary of outcomes, percentage change[1]

	OECD minimum import tariffs on intermediate goods and no LCRs	OECD minimum import tariffs and no LCRs	Zero rating of exports	Full liberalisation	Adopting Chile's trade policy
Exports	7.69	11.70	5.88	18.75	15.90
Intermediates	6.16	10.79	5.65	17.55	14.65
Household consumption	7.55	10.97	-0.14	10.93	8.92
Imports	8.28	12.80	6.06	19.98	17.04
Intermediates	14.25	10.02	6.27	17.44	14.41
Household consumption	-6.29	15.81	6.22	23.43	20.54
Household Income	0.69	0.70	0.83	1.62	1.17
Production	0.62	0.41	1.16	1.74	1.26
Investment	0.59	1.05	0.99	2.13	1.74
Labour demand	0.61	0.53	0.89	1.53	1.03
Investment Price Index	-0.40	-1.12	-0.41	-1.59	-1.51
Producer Price Index	-0.08	0.00	-0.03	-0.03	-0.04

1. Production refers to output in agriculture, industry and service sectors. Investment refers to total private and public sector investment.

International Trade

The largest contribution to export growth stems from the lower tariffs on intermediate goods used in production of goods and services in Brazil, reflecting a gain in competitiveness due to cheaper imported inputs.[11]

The boost in exports of intermediate goods and services (Table 2, third row) and exports for final consumption (Table 2, fourth row) are approximately of the same magnitude when import protection is reduced (i.e. a cut on tariffs and LCRs) while zero-taxing exports would mainly have an impact on raising

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11. Recall that the scenario "OECD minimum imports tariffs and no LCRs" implies the elimination of all import tariffs, included those levied on intermediate goods.

exports of intermediate goods and services. This result is driven by the current structure of Brazilian trade and hence by the static nature of the model. More than half of final consumption exports are comprised of agriculture and food products, which benefit from no or very low ICMS tax rate, the largest indirect tax. Instead, nearly 70% of exports of intermediate goods are manufactured goods, characterised by longer production chains, hence tending to accumulate more indirect taxes along the production process.

Emulating Chile's policy structure would also lead to an increase in exports of nearly 16%. This is close to the overall export gain Brazil would achieve by completely dismantling trade barriers as Chile is a small open economy with a low degree of trade protection. The large difference in the increase in exports between a scenario in which the entire structure of Chile's policies is adopted relative to the full liberalisation scenario stems from Brazil's heavy indirect taxation of exports.

The rise in exports and imports are of similar size in all policy scenarios but this finding is not robust to changes in the model elasticities (see section "Sensitivity analysis"). Imports for household (final) consumption would decrease only in the scenario where import tariffs on intermediate goods are eliminated together with some of the current LCRs. Reducing input prices for domestic producers lowers production costs for Brazilian producers, boosting competitiveness, and maintaining tariffs on imports of final goods provides an additional incentive for Brazilian consumers to substitute consumption of foreign products for domestic production.

Employment, production and investment

Liberalising trade flows would add 1.47 million jobs to the economy. All labour categories would benefit from increased employment in all policy simulations (Table 3). Moreover, employment increases are relatively large for agricultural and other low skilled workers and the two skilled labour categories. Full liberalisation increases employment in these categories by up to 1.9%. As the economy expands, employment effects are positive but smaller in labour categories that are predominantly employed in services sectors such as service shop workers and clerks.

Table 3. **Employment effects, % change and number of workers**

Policy scenarios Job categories	OECD minimum import tariffs on intermediate goods and no LCRs	OECD minimum import tariffs and no LCRs	Zero-rating of exports	Full liberalisation	Adopting Chile's trade policy
% change in employment					
Technicians	0.71	0.56	1.15	1.84	1.23
Officials and Managers	0.72	0.56	1.22	1.92	1.29
Clerks	0.59	0.44	0.92	1.47	0.99
Service/Shop workers	0.56	0.46	0.78	1.31	0.85
Agriculture and unskilled	0.60	0.63	0.80	1.53	1.08
Total	0.61	0.53	0.89	1.53	1.03
change number of workers (millions)					
Technicians	0.06	0.05	0.10	0.16	0.10
Officials and Managers	0.09	0.07	0.16	0.25	0.17
Clerks	0.06	0.04	0.09	0.14	0.10
Service/Shop workers	0.20	0.16	0.27	0.46	0.30
Agriculture and unskilled	0.18	0.19	0.24	0.46	0.33
Total	0.59	0.51	0.86	1.47	0.99

A liberalisation of Brazil's trade increases overall production. The largest effect in terms of individual policies comes from zero-taxing exports but the reduction of tariff on intermediate goods and LCRs has an important positive effect on production as well. Production increases more under this latter scenario

relative to a policy shock that eliminates all import tariffs, as domestic producers keep having final goods markets shielded from foreign competition and households buy domestic products made relatively cheaper by lower input prices. However, lower overall import tariffs feed into the whole Brazilian production chain, resulting into a greater reduction in the investment price index and higher investment, hereby supporting greater increases in production going forward. A higher increase in exports when all import tariffs are eliminated relative to a cut in tariffs only for intermediate goods provides additional support for the larger benefits of sweeping trade liberalisation policies.

The expansion of economic activity is supported by increased investment in all policy scenarios, which is highest when exporters are able to obtain a zero rating of exports and all import tariffs and LCRs are eliminated.

Production increases by about 1.3% when Brazil adopts Chile's policies, and the difference relative to the full liberalisation scenario arises from Chile maintaining relatively high tariffs for imports from emerging-south East Asia and OECD Asia, which results in lower imports from these regions and lower efficiency gains.

Household Consumption

Household income rises in all simulations, with the largest gains being reaped under the full liberalisation scenario (Table 2). Factor incomes are higher for all five labour categories in the model, capital, land and natural resources.[12] Owners of land and natural resources experience the largest income gains, of 4% and 9% respectively, when all trade barriers are eliminated. Income of high skilled workers increases by more than income of unskilled (agriculture and unskilled) and low skilled workers (clerks, service and shop workers). Capital income increases by less than labour income, 0.8%. However, the distributional effects from the policy are not clear: while owners of land clearly benefit from the liberalisation, poorer households that are likely to be more affected by unemployment and sell low skilled labour benefit from increasing employment. While income from high skilled workers increases by more, higher income households are also likely to receive a larger part of income from returns from capital where the effects are lower.

Sector Level Effects[13]

A full liberalisation of trade in Brazil increases exports in all sectors but oil and gas, with the largest gains occurring in manufacturing sectors (Table A3.1. in Annex 3). The larger boost in manufacturing exports relative to other sectors is in fact the most telling outcome of this exercise. Simulation results show that the sectors with largest boost in exports include sectors such as electronics and motor vehicles which have been subject to strong trade protection (Figure 5). As expected, largest gains stem from a generalised removal of impediments to trade. Applying a zero-rating for exports alone lowers the relative cost of manufacturing relative to other sectors, and manufacturing goods become cheaper to produce and to export. However, maintaining import barriers does now allow manufacturing sectors to source inputs from abroad, and as a result limited domestic inputs are diverted from agriculture and energy sectors towards manufacturing. Simulation results also point to a rising integration of the Brazilian economy into GVCs, evidenced by a rise in both imports and well as exports of intermediate goods (Figures 6 and 7).

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12.   Detailed results on factor income gains are available upon request to the authors.

13.   Given the specificities of Chile's policy instruments, in particular, the application of higher tariffs on trade with Latin American countries than Brazil in a few sectors, and the non-full-zero rating of exports, this section does not focus on the effects of Brazil applying Chile's policies.

Exports would be supported by rising output in almost all sectors, including non-tradables. Manufacturing sectors, and among which non-ferrous metals, transport equipment and leather products would witness the largest increases in production and labour demand (Tables A3.3 and A3.4). Importantly, and in spite of growth in other sectors, the agriculture sector continues to thrive. Although zero-rating exports removes the distortionary effects against manufacturing, eliminating still existent tariff protection in agriculture would more than compensate for this structural shift of resources towards manufacturing. In spite of the agriculture sector being fairly open relative to other economic activities in Brazil, import tariffs are still high on average on a number of products such as vegetable and fruit products and plant based fibres.

Figure 5. **Effects on exports**

Sectors with an increase in exports of at least 20%

■ Full liberalisation ■ Zero rating of exports ■ OECD minimum imports tariffs and no LCRs ■ OECD minimum imports tariffs on intermediated goods and no LCRs
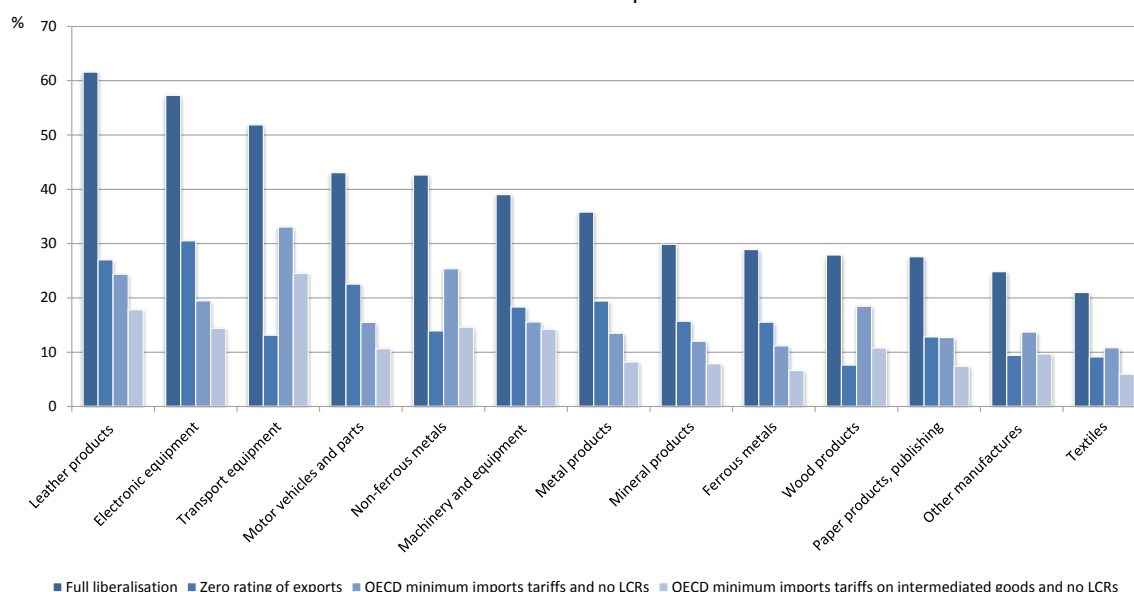
Figure 6. **Global Value Chains: Integration via imports of intermediate goods**

Full liberalisation scenario, increase in imports of at least 20%
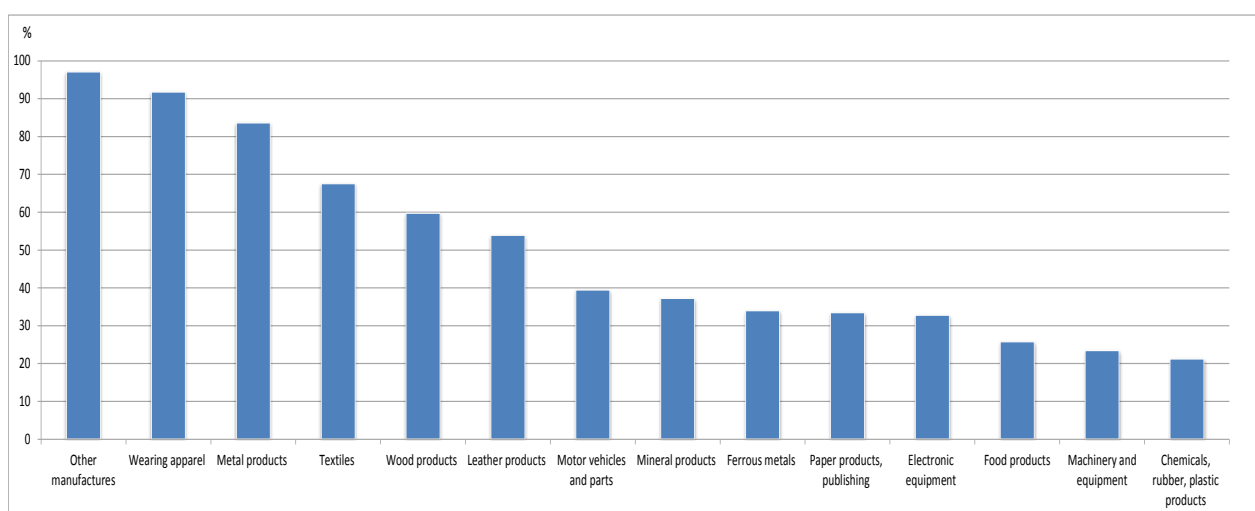
Figure 7. **Global Value Chains: integration via exports**

Full liberalisation scenario, % change

A. Intermediate Goods

B. Final Consumption Goods
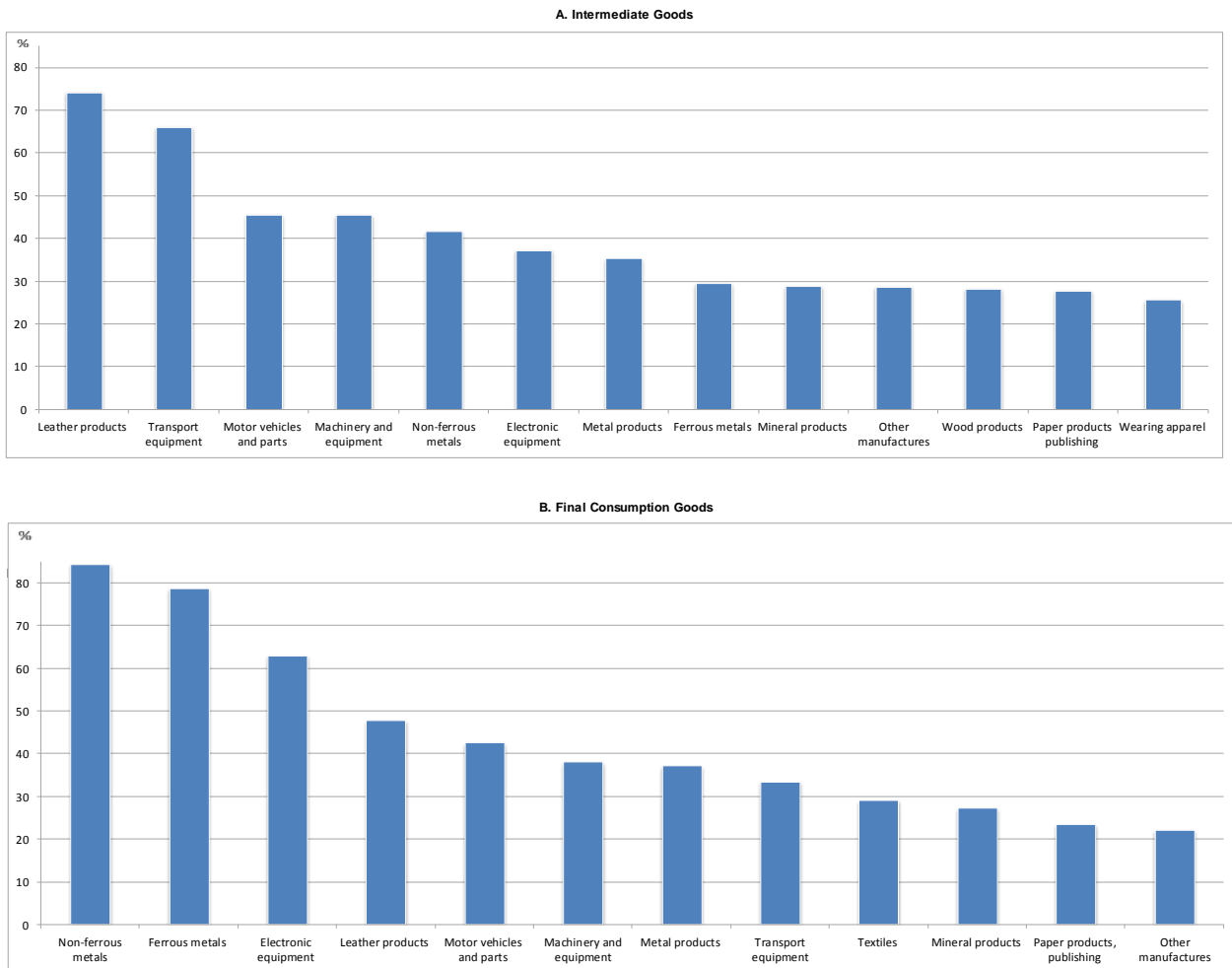
Figure 8 shows the three sectors with the largest increases and decreases in labour demand. Full trade liberalisation increases employment in all but 8 sectors.[14] While 10% of jobs in textiles would be lost, followed by the gas sector where employment would contract by 6.6%, effects are much smaller in other sectors, which would lose less than 3% of jobs (Figure 8 and Table A3.4). By contrast, labour demand would expand by more or around than 20% in the non-ferrous metals, transport equipment and leather products sectors.

As exports and production are boosted by more under the full liberalisation scenario, it is also not surprising that the highest employment gains and lowest employment losses would also accrue under the full liberalisation scenario in most of the manufacturing sectors. In sectors that lose jobs, only the gas sector would register a gain in jobs if import tariffs were eliminated but indirect taxes levied on exports were maintained. By contrast, in manufacturing sectors registering job losses under the full trade liberalisation scenario (combining the overall effect of the three policy instruments), zero-rating exports

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14.   These sectors are textiles, gas, other manufactures, wearing apparel, machinery and equipment, electronic equipment, chemical, rubber and plastic products and metal products.

alone would boost labour demand. This result reflects the distortions in resource allocation against manufacturing brought by difference in the incidence of indirect taxation across sectors.

Figure 8. **Largest employment effects**

in % change
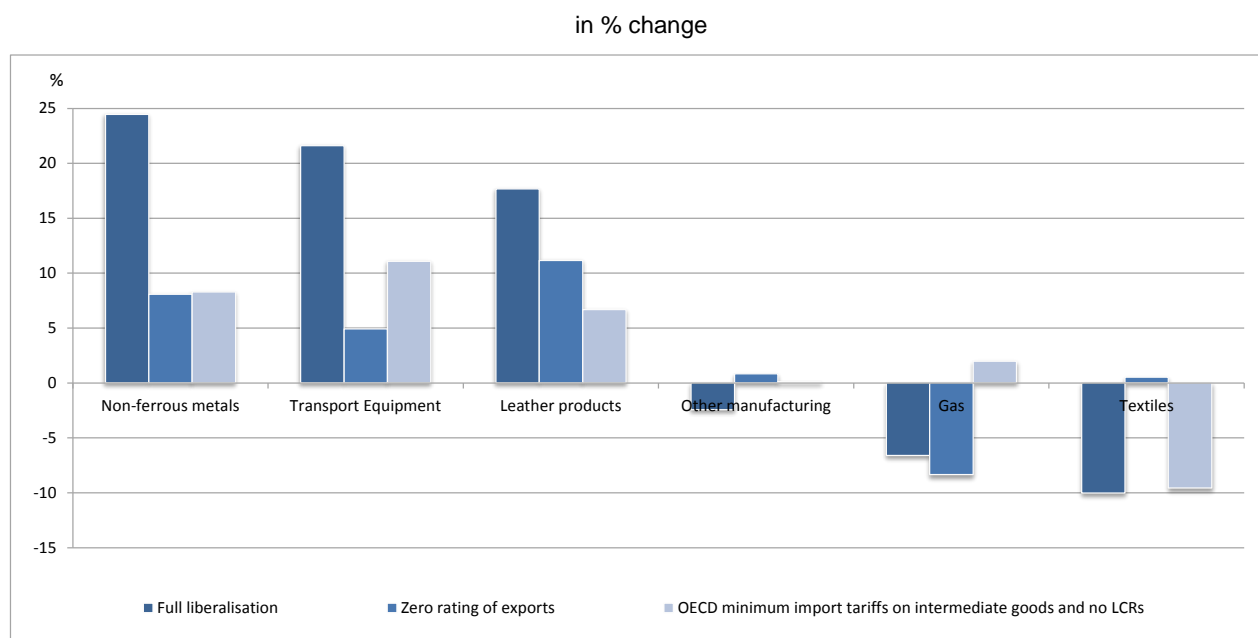
Trade Structure

Panel A in Figure 9 shows strong regional differences in accessing the Brazilian market following trade liberalisation. Under the full liberalisation and eliminating import tariffs and some LCRs, Non-OECD East Asia always realises the largest market increase, of more than 40%, followed by OECD Asia, of nearly that magnitude. This result follows from Brazil importing mainly manufacturing goods from these regions, which are subject to relatively high tariffs. Imports from Europe, emerging-south East Asia and North America also increase but the overall effect is smaller as these regions initial pattern of exports to Brazil also comprises a sizeable share of services, which decline following trade liberalisation. Latin America considerably loses market share in Brazil, which results from the erosion of current trade preferences. Thus, Latin America's initial preferential treatment and subsequent decline following liberalisation is an indication of trade diversion caused by the current Brazilian trade policy.

The reduction of tariffs and LCRs increases exports relatively uniformly among regions whereas full liberalisation increases export ties especially with Latin America and North America (Figure 9, Panel B). As Brazil's export specialisation differs across destination markets, zero-taxing exports has a larger effect on export destinations of mainly manufacturing goods, i.e. North America and Latin America, relative to Europe, which imports from Brazil a wider range of goods, including raw agriculture and food products, minerals and business services, on top of manufacturing.

The effects on the regional distribution differ if Brazil were to impose Chilean policies. This outcome is due to Chile's trade policy of applying relatively high tariffs for imports from emerging-south East Asia and OECD Asia, resulting in considerably lower imports from these regions compared to a full liberalisation scenario.

Figure 9. **Bilateral trade effects**

in % change

A. Imports

B. Exports
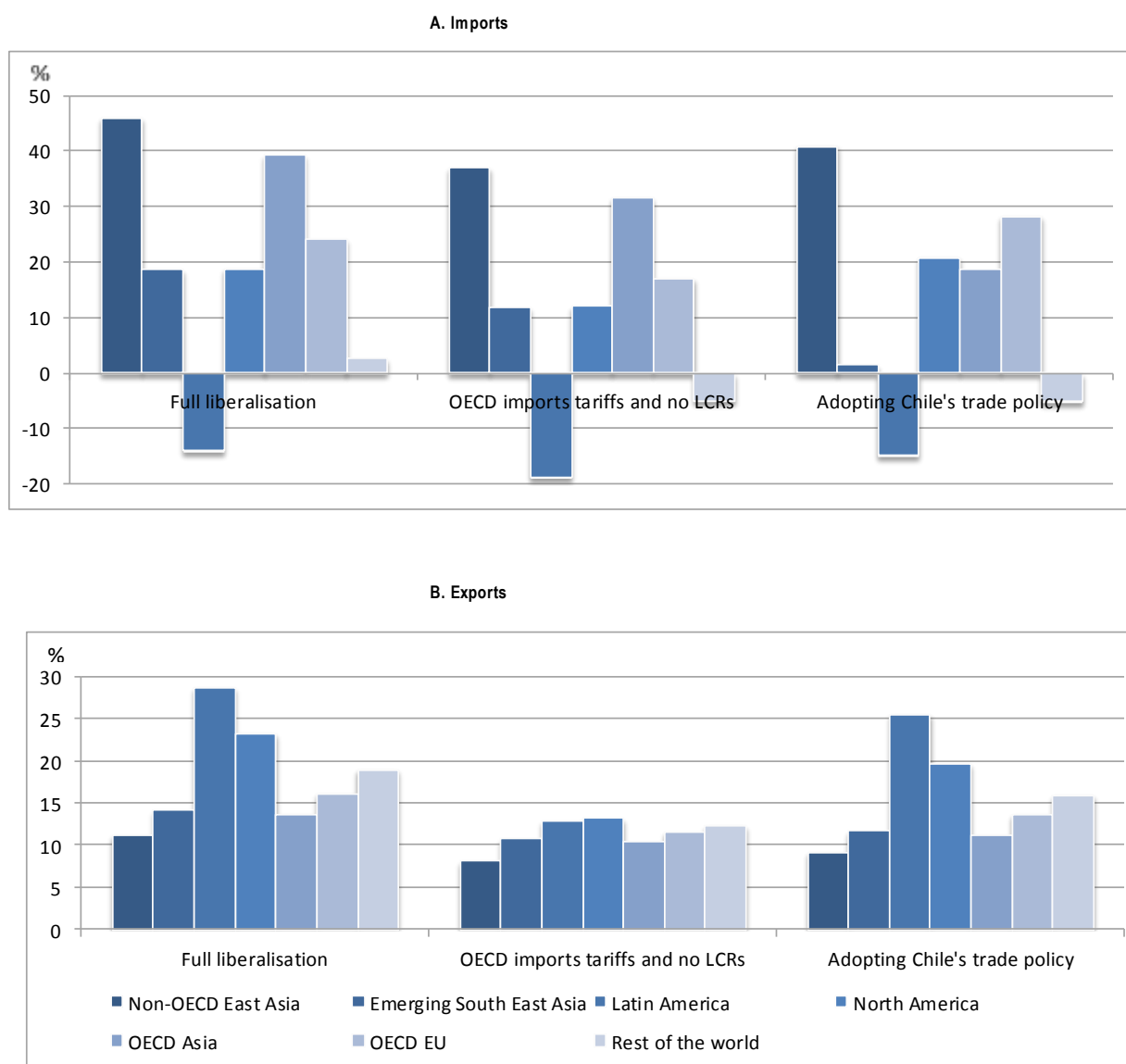
Adjustment Costs

Trade liberalisation changes the structure of the economy and this adjustment process take time. In the short term the economy might face issues in adjusting to changes in factor demand and consumption patterns. Figure 10 presents effects from trade liberalisation in the short term where factors are assumed immobile and government consumption and investment is predefined. In the short run scenario, imports and exports increase 15% and 17%, less than in the medium-long run full liberalisation scenario. Brazilian production can realise only one quarter of its increase while households' income only increases by half of the medium-long term. These differences are mainly driven by the restricted mobility of factors in the short term. Despite increasing wages in booming sectors following the impossibility to absorb unemployed workers, the effects on household income are less positive in the short run compared to the medium and long run as workers from shrinking economic sectors are not able relocate to other sectors. These

adjustment costs show that reaping the benefits of trade liberalisation needs complementary policies that support resource reallocation across sectors and towards more efficient firms. These include flexible labour markets, housing policies that facilitate workers' geographical mobility, as well as policies that stimulate entrepreneurship and investment.

Figure 10. **Short-term effects**

Full liberalisation, %change
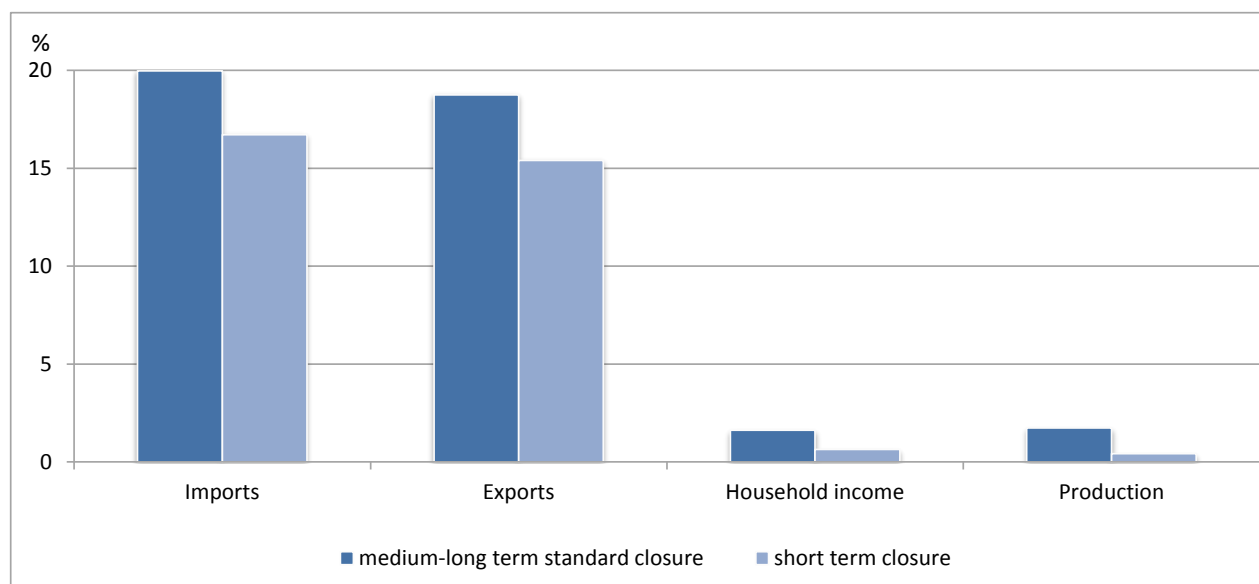
Sensitivity Analysis

This section evaluates the sensitivity of the results described thus far to different model assumptions, in particular, trade elasticities and the so-called closure rules on what regards i) employment, ii) the saving rate, iii) government spending and iv) the exchange rate.

Influence of trade elasticity values on results

This study doubles GTAP trade elasticities in its baseline simulation, recognising both the uncertainty around trade elasticities' estimates and the fact that GTAP elasticities have been considered too low by many practitioners. Table 4 shows the sensitivity of the results to employing the lower GTAP elasticities. As expected, the size of effects changes. However, while size changes, the relative impact and the underlying mechanisms stay the same. Higher trade elasticities increase trade effects and subsequently increase production and welfare effects. Doubling trade elasticities more than doubles import flows into Brazil in all simulations, whereas the effect is not as strong on exports.

Allowing wages to vary by assuming full employment

The analysis so far assumed unemployment in all labour categories in Brazil, taking 2014 unemployment figures from IBGE (Instituto Brasileiro de Geografia e Estatística). Alternatively, when factors are assumed fully employed, wages are flexible to reflect factor demand. Trade and all other effects are slightly smaller with full employment compared to the standard setting with unemployment (Table 5). With full employment, expanding sectors now need to source workers from other sectors and wages increase in the booming sectors to attract workers. Accordingly, the price decrease from lower input prices is dampened through increasing wages.

Table 4. **Macroeconomic effects, sensitivity to trade elasticities**

Full trade liberalisation, % change

	Benchmark elasticities	GTAP elasticities
Exports	18.75	10.1
Imports	19.98	8.94
Household Income	1.62	1.26
Production	1.74	1.31
Investment	2.13	1.56
Investment Price Index	-1.59	-1.41
Producer Price index	-0.03	-0.04

Capital markets: fixing the saving rate to allow for changes in the share of investment in final demand

The standard closure follows the so-called Keynesian approach with investment driven savings. Investment is defined as fixed share of domestic final demand, government savings do not change and households adjust the amount they save to investment demand. Alternatively this assumption can be changed into a more neo-classical view, where the economy is savings driven. Results show that the specification of this assumption does not influence the model results (Table 5).

Government account: the budget balance is kept by allowing the level of spending to vary with government income defined by inflexible tax rates.

Government income is assumed flexible in the standard closure with the income tax balancing income and expenditure differences and thus directly bouncing all possible budgetary effects directly on households. This closure choice has the advantage of not directly introducing sectoral biases in the model outcome. However, it might overestimate the burden on households.

When government income is fixed, welfare effects are larger than income effects and significantly larger than in the standard closure. With fixed income government expenditure needs to adjust to maintain the internal balance. As trade liberalisation reduces government income from import tariffs and indirect taxes, overall government income decreases and so does government expenditure, by -3.2%. This in turn has a strong effect on government activity, which is concentrated nearly exclusively in government services, a highly labour intensive sector that does not directly profit from trade liberalisation. The consumption increase of households brought by keeping income tax rate constant is not strong enough to overcome the negative effect of decreasing government expenditure and total demand increases less compared to the standard closure. It is worth noticing that trade effects as well as investment and production prices indexes are not affected by this closure swap and the differences are purely related to internal reallocation of resources and model closures describing different options on fiscal policy.

Fixed exchange rate flexible current balance

The model employs an exchange rate that allows for adjustments to relative income levels between regions. Together with the balance of the current account this exchange rate defines the foreign exchange market. When the current account balance is fixed, as in the standard closure, the exchange rate adjusts to relative income levels between regions. In the real world, or in a dynamic model, changes in the current account imply transfers between periods. In a static model this mechanism is not available and when the current balance is flexible, this would mean either getting or giving a free lunch to the rest of the world. Table 5 shows this effect: a strong increase in imports is matched with a relatively small increase in

exports. The size of this export effect can be interpreted as the pure cost reduction effect. To finance the current account balance deficit, which increases 53%, foreign investment flows into Brazil increase investment in Brazil by 9.8%. As result, domestic production increases, households are better off and GDP increases stronger than before. Again, it is important to notice that this effect is not governed through some kind of interest rate and that there is no mechanism of inter temporal transfers in the static model. This scenario thus is likely to overestimate benefits from the trade liberalisation. The standard closure surely depicts a more conservative scenario and even this conservative simulation shows overall beneficial effects.

Table 5. **Macroeconomic effects for various economic assumptions**

Full liberalisation simulation, % changes

	Benchmark closure	Full employment	Fixed savings rate	Fixed government income	Fixed exchange rate
Exports	18.75	18.07	18.76	18.72	13.64
Imports	19.98	19.31	19.99	19.94	25.60
Household Income	1.62	0.67	1.62	1.12	2.27
Production	1.74	0.83	1.74	1.38	2.13
Investment	2.13	1.14	2.20	1.73	9.87
Investment Price Index	-1.41	-1.54	-1.40	-1.44	-1.34
Producer Price index	-0.03	-0.01	-0.03	-0.03	0.01

Conclusion and discussion

In view of the high trade barriers in Brazil, this paper aims at quantifying the impact of liberalising trade flows by acting on three important policy channels: tariffs on imports, local content requirements and indirect taxes levied on exports. The quantification exercise is undertaken using METRO, a multi-region computable general equilibrium model developed at the OECD. The results from this quantification exercise suggest that Brazil's current levels of trade protection hold back industrial production and export competitiveness.

Assessing the impact of trade liberalisation is a policy question better answered by a CGE model, as CGE models are able to track the impact of a policy change on the whole economy, identifying relative effects and understanding the adjustment path. The strength of METRO is the underlying trade structure. By differentiating production and consumption of commodities by use, and thus the resulting trade flows by use category, METRO allows to analyse the impact of trade liberalisation on Brazil's participation in GVCs.

Barriers to international trade limit potential growth and export competitiveness via several channels. First, by shielding the domestic industry from international competition, Brazilian firms face lower incentives to innovate or achieve efficiency gains, which in turn hurt their external competitiveness. Second, local content requirements and import tariffs limit the sourcing options of Brazilian producers, making intermediate inputs and capital goods more expensive, hampering cost and quality competeness and in a more dynamic setting, learning from imports, all dampening competitiveness and productivity gains.

The benefits stemming from lower barriers to trade on the efficiency of the economy are clear: lowering barriers to trade allow firms to use a higher share of foreign intermediate goods in production.

Final goods are in turn sold at lower prices, enhancing the competitiveness of Brazilian exports and also benefitting Brazilian households. Lower barriers to trade also reduce the unitary cost of capital, spurring investment and supporting further expansion of production going forward.

Although the economic effects on the overall economy are positive, it is useful to identify the winners and losers at the sectoral level, in order to devise policies that facilitate resource mobility, in particular labour, as the gains from lifting impediments to trade can only be reaped if the economy is flexible enough to smooth the structural adjustment that follows trade liberalisation. In addition, policies that reduce the fragmentation of regulation in Brazil, contributing to a more integrated economy and housing policies that reduce mobility costs would also be supportive of labour reallocation and allow reaping the benefits brought by free trade.

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ANNEX 1. LCR MEASURES IMPLEMENTED BY BRAZIL BETWEEN 2008 AND 2014[1]

Year	Description
2009	Brazilian Development Bank BNDES provides loans to wind-turbine development if they meet LCRs of 40-60%. Not all developers are using the LCR program. Of the 4,316MW contracted in the 2009 and 2010 tenders, BNDES only financed 1,342MW.
2010	The Buy Brazil Act (Law No. 12.349/2010) establishes preferences for Brazilian goods and services in government contracts, to be determined by the President, though not in excess of 25 percent above the price of foreign goods and services. For strategic IT and communications technology contracts, tenders are restricted to goods and services developed with national technology. The procurement rules were further tightened as part of the Brasil Maior plan.
2010	Brazilian Development Bank BNDES financing (up to 100 percent for small and medium enterprises and up to 80 percent for larger companies) requires new capital goods (machinery and equipment) to meet national content indexes, in weight and value, equal to or greater than 60 percent, following the Basic Production Process (Processo Produtivo Básico), which entails a minimum set of operations necessary to certify the end product as Brazilian-made. Among other features, this requires certain components to be acquired from local manufacturers. Circular No. 55/2010 prohibited BNDES financing for the acquisition of airplanes; it also changed the financing system for the acquisition of new capital goods.
2010	US companies seeking to enter Brazil's insurance and reinsurance market must establish a subsidiary, enter into a joint venture, or acquire or partner with a local company. Market entry for banks is subject to case-by-case approval. The Brazilian reinsurance market was opened to competition in 2007. However, in December 2010 and March 2011, the Brazilian National Council on Private Insurance (CNSP) effectively rolled back market liberalisation. Resolution 225 requires that 40 percent of all reinsurance risk be placed with Brazilian companies. In addition, Resolution 232 allows insurance companies to place only 20 percent of risk with affiliated reinsurance companies.
2011	Brazil's "new" media law (Law No. 12.485) requires all channels to retransmit 3.5 hours of Brazilian content per week in primetime, half of which must be produced by Brazilian independent producers. It also requires the direct participation of a Brazilian advertising agency. Additionally, the draft regulations require personnel to be hired through a Brazilian company located in Brazilian territory.
2011	On December 9, 2011, the National Land Reform and Settlement Institute (INCRA) published new rules covering the purchase of Brazilian agricultural land by foreigners. Under the new rules, the area bought or leased by foreigners cannot account for more than 25 percent of the overall area in its respective municipal district. Additionally, no more than 10 percent of the land in any given municipal district may be owned or leased by foreign nationals from the same country. Congressional approval is required before large plots of land can be purchased by foreigners, foreign companies, or Brazilian companies with a majority of foreign shareholders.
2012	On April 15, 2012, Brazil issued Decree 7761/2012 setting regulations on the new industrial and trade regime for the automotive sector: Transport equipment manufacturers must meet at least three of four criteria across investment in R&D; investment in engineering; completing a high share of production domestically, and carrying out energy-efficiency evaluations for 25% of cars. A gradual stepping-up regional/local content requirement will be allowed for newcomers across 10 years.
2012	Several Decrees have been approved establishing preference margins for certain national products in tendering procedures: 8%-25% on medical products; 14%-17% on some tractors, transport trucks, fighting vehicles, road equipment, and ambulances; 20% on textiles, apparel, footwear, paper money for printing, locomotives, wagons, trains and car parts for railways, and discs for coins; 25% on some information technology related products, and 29% on drills and tractors.
2012	The procurement plan of the Brazilian healthcare program establishes up to 25 percent preferences for Brazilian medical technologies or medications in government contracts, in an effort to support indigenous industry.

Year	Description
2012	Law No. 12715 established REPNBL-Redes, the special taxation regime of the National Broadband Programme for the Establishment of IT Broadband Supporting Networks. This measure provides tax benefits to locally manufactured and locally developed technologies used in Brazil's national broadband plan.
2012	The tender proposal (Edital de 2,5 GHz e 450 MHz CP 4/2012) approved by the Brazilian Agency of telecommunications (ANATEL) for the sale of 450 MHz and 2.5 GHz frequencies increases the requirements for national content, raising the minimum level of Brazilian telecommunications equipment. During 2015–16, the overall level of national content required in the development of 4G telecommunications networks is scheduled to jump to 65 percent (including 15 percent investment in Brazilian technology) and from 2017 onward the level jumps to 70 percent (including 20 percent investment in Brazilian technology).
2012	Preference in government procurement favouring local bidders (20% preference margin) on certain semi-finished products of iron, steel or non-alloy steel (disco para moeda) NCM 7207.19.00; 7326.90.90) locally produced.
2013	"Special Tax Regime for the National Broadband Plan for Implementation of Telecommunication Networks (REPNBL-Redes)" stipulating certain production steps or technology activities in Brazil.
2013	Law No. 12794 of 2 April 2013 established REIF, the Special Regime of Incentives for the Development of Infrastructure for the Fertilisers Industry. Tax benefits are conditional upon fulfilment of requirements of investment in R&D and technological innovation and of a minimum percentage of local content in relation to the overall value of the project.
2013	An LCR went into full effect in Brazil's 11th licensing round for oil and gas in April 2013; bids are assessed based on the following criteria: signature bonus (40 percent), the mandatory exploration program (40 percent), and the minimum local content equipment (20 percent) of each bidder.
2013	On August 5, 2013, the National Development Bank of Brazil, BNDES, published a resolution that extends the Program for Sustaining Investment (PSI) applicable to capital goods until 2014. This measure is part of Plano Brasil Maior. The PSI finances operations at subsidized interest rates ranging from 3.5% to 5%. The interest rate reduction applies only to goods produced in Brazil by manufacturers or suppliers holding a credit line in the form of a BNDES card (cartão BNDES). The average general rate without the subsidy is 9%, depending on the size of the enterprise.To obtain a manufacturer BNDES card, the applicants are required to comply with a level of at least 60% of the nationalisation index (percentage of national components, relative to the total equipment) or produce goods that are part of a Basic Productive Process (Processo Produtivo Básico).
2013	On May 14, 2013, the Government of Brazil published Decree 8.002, as part of Plano Brasil Maior, establishing preferential treatment of local construction products in public tenders. The preferences are set to expire on December 31, 2015. These preferences are applicable to goods classified under the following headings of MERCOSUR's Harmonized System: 8429, 8430, 8424, 8432, 8433, 8701 and 8716.

1. The information contained in this annex is adapted from OECD (2014).

ANNEX 2. REGIONAL AGGREGATION USED IN THIS STUDY

Regional aggregation in this study	Countries/Regions in METRO
Brazil	
OECD Europe	Austria; Belgium; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Luxembourg; Netherlands; Norway; Poland; Portugal; Slovak Republic; Slovenia; Spain; Sweden; Switzerland; United Kingdom.
North America	Canada; United States.
Latin America	Argentina; Chile; Mexico; Venezuela.
Non-OECD East Asia	China; Hong-Kong; Taipei
Emerging/Southeast Asia	Cambodia; Indonesia; India; Malaysia; Philippines; Singapore; Thailand; Vietnam.
OECD Asia	Australia; Japan; New Zealand; South Korea.
Rest of the World (ROW)	METRO ROW; Bulgaria; Cyprus[1,2]; Kazakhstan; Israel; Latvia; Lithuania; Malta; Romania; Russia; Saudi Arabia; South Africa; Turkey.

1. Note by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

2. Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

ANNEX 3. DETAILED RESULTS

Table A3.1. **Effects on exports by sector, % change, baseline elasticities**

	OECD minimum import tariffs on intermediate goods and no LCRs	OECD minimum import tariffs and no LCRs	Zero-rating of exports	Full liberalisation	Adopting Chile's trade policy
Agriculture	4.33	7.43	-4.78	2.21	1.03
Oil	2.12	3.57	-6.50	-3.35	-8.41
Gas	-0.05	-0.07	-0.03	-0.12	-0.18
Minerals	2.71	4.36	3.41	7.92	6.37
Food products	6.28	10.48	-6.37	3.08	1.60
Textiles	5.57	10.50	9.09	19.95	19.13
Wearing apparel	11.87	15.23	1.78	17.12	14.12
Leather products	16.86	23.49	26.99	58.22	53.67
Wood products	10.35	18.12	7.57	26.77	23.83
Paper products, publishing	7.05	12.41	12.80	26.53	24.35
Petroleum, coal products	1.47	2.36	7.56	10.04	4.82
Chemicals, rubber, plastic products	6.38	11.65	5.15	16.99	14.53
Mineral products	6.28	10.89	15.68	27.96	25.52
Ferrous metals	7.71	11.86	15.46	29.40	26.30
Non-ferrous metals	14.67	25.44	13.92	42.99	36.01
Metal products	7.83	13.18	19.35	34.69	31.88
Motor vehicles and parts	10.19	15.10	22.45	41.64	38.84
Transport equipment	23.87	32.49	13.08	50.00	43.53
Electronic equipment	13.84	19.00	30.48	55.38	51.32
Machinery and equipment	13.57	15.06	18.27	37.08	33.17
Other manufactures	9.19	13.29	9.42	23.45	21.09
Electricity	6.31	11.24	-6.03	4.30	2.45
Gas manufacture distribution	0.46	0.75	-0.60	0.06	-0.21
Water	6.39	11.24	-6.93	3.04	1.64
Construction	3.02	5.23	-2.66	2.18	1.52
Trade	4.39	7.54	-4.50	2.46	1.51
Other transport	4.12	6.67	-3.70	2.52	0.94
Sea transport	5.37	9.42	-5.61	2.80	0.88
Air transport	3.77	6.23	-3.91	1.87	0.12
Communication	4.40	7.57	-4.81	2.09	1.21
Financial services	4.04	7.20	-4.79	1.79	0.96
Insurance	4.09	7.35	-4.99	1.68	0.84
Business services	4.83	8.50	-5.23	2.51	1.54
Recreation and other services	5.67	10.02	-6.14	2.85	1.63

Table A3.2. **Effects on imports by sector, % change**

	OECD minimum import tariffs on intermediate goods and no LCRs	OECD minimum import tariffs and no LCRs	Zero-rating of exports	Full liberalisation	Adopting Chile's trade policy
Agriculture	1.45	1.16	4.38	5.54	3.38
Oil	-1.31	-2.39	8.05	5.80	-11.83
Gas	-1.56	-2.97	14.69	14.78	28.48
Minerals	-1.10	-2.06	4.12	2.58	2.67
Food products	4.35	14.54	6.94	22.78	17.20
Textiles	59.61	56.28	7.83	67.63	49.25
Wearing apparel	-10.06	94.89	8.89	112.16	88.45
Leather products	2.32	117.70	6.72	130.80	101.45
Wood products	43.91	47.80	7.74	59.40	55.08
Paper products, publishing	25.99	23.13	6.61	31.58	30.08
Petroleum, coal products	-0.27	-0.89	2.85	2.14	3.02
Chemicals, rubber, plastic products	13.40	13.03	6.91	21.15	19.36
Mineral products	30.29	28.38	6.29	36.83	31.25
Ferrous metals	30.15	22.15	7.79	32.72	28.64
Non-ferrous metals	0.89	-7.58	6.66	-0.45	0.31
Metal products	64.70	66.57	9.21	82.59	76.56
Motor vehicles and parts	25.43	27.67	4.08	33.13	29.12
Transport equipment	4.21	6.77	4.64	12.63	10.91
Electronic equipment	18.40	24.41	7.89	34.47	30.43
Machinery and equipment	2.64	25.86	4.46	30.83	29.17
Other manufactures	8.23	86.94	8.92	103.91	100.09
Electricity	-4.46	-7.98	8.06	0.04	0.89
Gas manufacture distribution	-2.00	-3.38	4.63	1.46	2.59
Water	-5.42	-9.55	7.81	-2.05	-0.93
Construction	-4.22	-6.75	4.89	-1.95	-1.04
Trade	-3.76	-6.82	5.38	-1.49	-0.73
Other transport	-3.38	-5.95	4.83	-1.10	0.07
Sea transport	-2.43	-4.73	4.22	-0.04	0.74
Air transport	-2.53	-4.84	4.10	-0.64	0.53
Communication	-3.61	-6.63	5.27	-1.41	-0.68
Financial services	-3.48	-6.62	5.57	-1.07	-0.42
Insurance	-3.52	-6.60	5.28	-1.35	-0.66
Business services	-3.56	-6.57	5.26	-1.32	-0.59
Recreation and other services	-3.15	-5.80	4.23	-1.57	-0.87

Table A3.3. **Effects on sector level production, % change**

	OECD minimum import tariffs on intermediate goods and no LCRs	OECD minimum import tariffs and no LCRs	Zero-rating of exports	Full liberalisation	Adopting Chile's trade policy
Agriculture	1.23	1.85	-0.94	0.75	0.40
Oil	0.97	1.46	-1.16	0.32	1.71
Gas	1.47	3.02	-8.48	-7.42	-16.97
Minerals	2.28	3.52	3.42	7.22	5.73
Food products	1.48	1.81	-0.80	0.83	0.41
Textiles	-8.92	-9.65	0.46	-9.61	-6.76
Wearing apparel	1.86	-1.49	0.52	-1.07	-1.08
Leather products	7.38	4.09	11.53	18.95	17.77
Wood products	3.27	5.77	4.00	10.26	8.72
Paper products, publishing	0.38	0.96	2.26	3.45	2.78
Petroleum, coal products	0.54	0.55	1.91	2.60	0.69
Chemicals, rubber, plastic products	-2.01	-1.64	0.59	-1.06	-1.46
Mineral products	0.33	1.01	3.02	4.32	3.78
Ferrous metals	1.09	0.46	6.77	8.27	7.08
Non-ferrous metals	8.02	13.44	8.01	23.71	19.41
Metal products	-2.62	-3.63	2.82	-0.66	-1.01
Motor vehicles and parts	-0.05	0.53	7.11	8.94	8.22
Transport equipment	12.08	15.11	5.72	22.91	19.64
Electronic equipment	-1.85	-3.16	2.18	-0.66	-0.66
Machinery and equipment	3.43	-6.94	4.66	-1.05	-1.99
Other manufactures	0.54	-2.75	0.80	-2.14	-2.43
Electricity	1.45	2.00	1.79	4.16	3.22
Gas manufacture distribution	1.41	1.88	2.06	4.32	2.83
Water	0.56	0.32	0.98	1.41	0.99
Construction	0.61	0.99	0.94	2.02	1.65
Trade	0.61	0.39	0.91	1.41	1.02
Other transport	0.79	0.58	1.06	1.76	1.17
Sea transport	3.34	5.38	-2.35	2.57	1.13
Air transport	1.37	1.54	0.06	1.67	0.78
Communication	0.73	0.47	0.77	1.32	0.95
Financial services	0.59	0.29	0.85	1.24	0.86
Insurance	0.47	0.33	0.34	0.69	0.39
Business services	1.39	1.75	0.04	1.82	1.31
Recreation and other services	0.55	0.45	0.31	0.76	0.41

Table A3.4. **Effects on sector labour demand**

	OECD minimum import tariffs on intermediate goods and no LCRs	**OECD minimum import tariffs and no LCRs**	**Zero-rating of exports**	**Full liberalisation**	**Adopting Chile's trade policy**
Agriculture	1.39	2.12	-0.99	0.95	0.54
Oil	1.45	2.16	-1.02	1.18	2.52
Gas	1.97	3.77	-8.36	-6.61	-16.28
Minerals	2.54	3.89	3.64	7.87	6.25
Food products	1.66	2.21	-0.72	1.31	0.73
Textiles	-9.57	-10.10	0.51	-10.04	-7.15
Wearing apparel	0.48	-2.65	0.39	-2.44	-2.12
Leather products	6.68	3.34	11.15	17.67	16.59
Wood products	3.00	5.53	4.04	10.05	8.38
Paper products, publishing	0.22	0.93	2.34	3.52	2.72
Petroleum, coal products	2.31	3.57	1.27	5.00	4.04
Chemicals, rubber, plastic products	-2.25	-1.62	0.56	-1.06	-1.48
Mineral products	0.32	1.25	2.98	4.54	4.01
Ferrous metals	0.99	0.58	6.77	8.45	7.19
Non-ferrous metals	8.27	14.00	8.06	24.44	20.04
Metal products	-2.94	-3.86	2.81	-0.88	-1.32
Motor vehicles and parts	-1.81	-1.12	6.52	6.49	5.90
Transport equipment	11.07	14.77	4.92	21.61	18.40
Electronic equipment	-2.76	-3.86	1.99	-1.58	-1.56
Machinery and equipment	2.44	-7.71	4.42	-2.09	-3.03
Other manufactures	0.12	-3.07	0.82	-2.44	-2.79
Electricity	1.95	2.66	2.39	5.53	4.24
Gas manufacture distribution	2.76	4.24	1.61	6.28	4.69
Water	0.85	0.71	1.47	2.36	1.64
Construction	0.37	0.83	1.00	1.93	1.48
Trade	0.63	0.49	1.15	1.78	1.24
Other transport	1.02	1.22	0.89	2.24	1.81
Sea transport	3.82	6.25	-2.35	3.46	2.04
Air transport	1.99	2.69	-0.14	2.62	1.93
Communication	0.88	0.68	1.10	1.91	1.33
Financial services	1.04	0.80	1.52	2.51	1.74
Insurance	0.88	0.79	0.94	1.83	1.17
Business services	1.63	2.05	0.49	2.63	1.84
Recreation and other services	0.50	0.46	0.37	0.84	0.44