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<http://dx.doi.org/10.1787/5k480c265kq1-en>



OECD Trade Policy Papers No. 149

Different Partners, Different Patterns: Trade and Labour Market Dynamics in Brazil's Post-Liberalisation Period

David Kupfer, Marta Castilho,
Esther Dweck, Marcelo Nicoll

A product of the International Collaborative Initiative on
Trade and employment (ICITE)

JEL Classification: F16

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Abstract

DIFFERENT PARTNERS, DIFFERENT PATTERNS: TRADE AND LABOUR MARKET DYNAMICS IN BRAZIL'S POST-LIBERALISATION PERIOD

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This paper seeks to evaluate to what extent the greater external exposure of the Brazilian economy in the past decade has contributed to the evolution of employment in the country. This investigation has been undertaken in two ways. First, the total employment variation was decomposed in order to identify the contribution of the final demand components – exports in particular – to this evolution. The decomposition was carried out using the Input-Output Matrix (IOM) methodology and, due to the availability of the estimated IOMs for Brazil, the exercise focused on the period 2000-07. Then, based on the labour content of trade, we estimated the volume of direct employment associated with exports, according to the skill level of workers and to the geographical composition of Brazilian exports, focusing in particular on the years 2002 and 2008. The paper finds that Brazilian exports expanded vigorously in the 2000s and contributed positively to employment generation, though this contribution was relatively small. Largely as a consequence of technological change and shifts in the composition of trade, the jobs created by exports only amounted to about 15% of those created by domestic demand and the export-related jobs were predominantly low skilled jobs.

Keywords: Trade, exports, employment.

JEL classification: F16 (Trade and labour market interactions).

Acknowledgements

The OECD-led International Collaborative Initiative on Trade and Employment (ICITE) is a project that brings together ten international organisations in an effort to deepen our understanding of the linkages between trade and jobs and to develop policy-relevant conclusions. ICITE is mobilising resources world-wide in an extensive programme of research, dialogue and communications. Participating organisations include: ADB, AfDB, ECLAC, IADB, ILO, OAS, OECD, UNCTAD, World Bank and WTO. Drawing on the ICITE research programme, a series of OECD-ICITE Trade Policy Working Papers is being published that includes thematic papers and country case studies.

This paper has been developed in co-operation with the United Nations Economic Commission for Latin America and the Caribbean as an input to the ICITE project. The views expressed are those of the authors and do not necessarily reflect those of the OECD, OECD member country governments or partners of the ICITE initiative.

Table of contents

Executive Summary.....	5
1. Introduction: trade liberalisation and the labour market in Brazil.....	6
2. Composition and evolution of the Brazilian labour market in the 2000s.....	11
3. Evolution of Brazilian exports in the 2000s: a decade of strong growth.....	15
3.1 Changes in the sectoral and geographic composition of Brazilian exports.....	16
3.2 Differences in the sectoral composition of Brazilian exports to its main partners.....	19
4. Contribution of exports for job creation in Brazil.....	23
4.1 Causes of employment growth in the 2000s.....	23
4.2 Labour coefficients: the changes in the number of jobs associated with agricultural and industrial production.....	24
4.3 The direct labour content of Brazilian exports.....	26
4.4 Indirect labour content of Brazilian exports.....	28
4.5 Different trading partners, different effects on employment.....	29
5. Conclusions.....	30
Annex Table.....	32
References.....	33
Annex. Methodological notes and data description.....	36

Tables

Table 1. Evolution of total employment by skill level and sector, 2000 and 2008.....	12
Table 2. Evolution of Brazilian foreign trade, 2000-10.....	14
Table 3. Evolution of the Brazilian export structure, 2000-08 (as % of total).....	16
Table 4. Composition of Brazilian exports according to partners, 2010.....	19
Table 5. Shares of the main Brazilian partners in total exports per industry, 2010.....	20
Table 6. Decomposition of employment changes by source and by skill levels, 2001 to 2007 (number of jobs).....	21
Table 7. Labour content of production: direct employment to output ratio, by skill level and sectors, 2002-08 (in 2008 prices).....	22
Table 8. Direct employment associated with exports, by skill level and industry, 2000 and 2008.....	24
Table 9. Direct and indirect employment associated with Brazilian exports, 2005.....	25
Table 10. Direct employment associated with exports according to trade partner (number of jobs).....	26

Figures

Figure 1. Evolution of total employment in Brazil, 2002-08.....	12
Figure 2. Evolution of total employment in Brazil by skill levels, 2002-08.....	13
Figure 3. Evolution of imports, exports and the degree of openness of the Brazilian economy, 2000-10.....	15
Figure 4. Evolution of Brazilian exports by destination, 2000-10.....	15
Figure 5. Structure of Brazilian exports according to partners and to the degree of processing of exported goods, 2000-10 (as % of total bilateral exports).....	18
Figure 6. Sectoral employment by skill levels, 2008 (% of total).....	22
Figure 7. Evolution of Brazilian employment associated with exports, by trading partner and skill level, 2002 and 2008.....	27

Boxes

Box 1. Export incentive policies and their impact on employment: The automotive industry's case.....	10
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EXECUTIVE SUMMARY

This paper seeks to evaluate to what extent the greater external exposure of the Brazilian economy in the past decade has contributed to the evolution of employment in the country. This investigation has been undertaken in two ways. First, the total employment variation was decomposed in order to identify the contribution of the final demand components – exports in particular – to this evolution. The decomposition was carried out using the Input-Output Matrix (IOM) methodology and, in line with the availability of the estimated IOMs for Brazil, the exercise focused on the period 2000-07. Then, based on the labour content of trade, we estimated the volume of direct employment associated with exports, according to the skill level of workers and to the geographical composition of Brazilian exports, focusing on the years 2002 and 2008.

The number of jobs directly associated with Brazilian exports was equal to roughly 5% of total employment in the economy. If indirect employment is considered, the number of jobs associated with exports more than doubles. However, even considering labour indirectly associated with exports, the volume of employment associated with exports did not keep pace with the sharp rise in the volume of exports during the 2000s. The number of jobs associated with exports grew by a mere 2% between 2002 and 2008, a rate below the growth of total employment (18%) and far below the 200% expansion in the volume of export. This development was the result of a combination of technical change that led to a significant decline of labour content of production and the changing composition of exports.

On average in industrial and agricultural sectors, a 20% decline of the employment-to-production ratio was observed. This trend affected 9 of the 16 sectors assessed. The reduction was particularly strong in agriculture, in part due to the increasing mechanisation in this sector, among other factors. Overall in the economy, the reduction in labour content was relatively large for less skilled jobs and was accompanied by a generalised trend in the economy towards an increased demand for skills.

Regarding the composition of Brazilian foreign trade, the recent growth was characterised by substantial change in the sectoral and geographic composition of exports. On the one hand, demand for manufactured goods declined relative to demand for basic products (agricultural and mineral commodities). On the other hand, geographic dispersion of Brazilian exports increased owing to the decline in importance of the United States as a destination market, and the strengthening of other markets, among which China stands out. The change in the sectoral composition of exports is closely related to the change in geographic distribution, as on the one hand exports of manufactured goods to the United States declined, and on the other hand, exports of Brazilian commodities to China increased.

Such changes in the export profile have significant implications in terms of the number of jobs created and the demand for skills. The majority of jobs created in relation to exports is low skilled (67% of the total), a percentage higher than that for total employment in the economy. Of the key destinations for Brazilian exports, those that create relatively large volumes of jobs are the European Union and China, and these jobs are largely less skilled. Employment associated with exports to China grew most and by the end of the period was equal to 17% of jobs directly associated with total exports. In the case of MERCOSUR, in 2008 jobs created by exports were only equal to 6% of total jobs created by Brazilian exports, yet with a higher level of skills required. Overall, these developments represent a striking change in the influence of exports on the demand for labor in Brazil.

1. Introduction: trade liberalisation and the labour market in Brazil¹

The end of the 1980s marked a change in the orientation of economic policy in Brazil. Import substitution was abandoned as a development strategy and macroeconomic stability was targeted as a strategic objective. These changes led to adoption of new public policies such as a privatisation programme for state-controlled companies and initiatives for deregulation of the economy. In terms of commercial policies, this marked the beginning of a process to liberalise imports and reduce subsidies for exports and domestic production. These policies were adopted in a context of severe fiscal limitations, increasing inflation and a shift towards liberal economic policies in many Latin American countries.

The process of trade liberalisation in Brazil began in 1988 with the elimination of selected non-tariff barriers (NTBs) applied to imports.² In 1990, the new government announced a series of measures aiming to reduce state intervention in the economy and promote higher competitiveness for Brazilian products. Among these, the programme for import liberalisation held a central role. It had a principal objective of rationalising and streamlining the structure of protection by making tariffs the principal instrument employed. For this reason, the remaining NTBs (quantitative prohibitions and controls) were eliminated, together with the majority of the special import regimes. As for the customs duties, a schedule of reductions was established with implementation to be phased in by 1994 when duties were set to range from 0% to 40% with a modal duty of 20%.³ Some products with high technological content (e.g. information technology and fine chemical products), high dependence on integrated supply chains (e.g. automotive industry) or low competitiveness (e.g. consumer electronics) still faced relatively high tariff rates – ranging from 30% to 35%. These levels seem nevertheless comparable with the levels of protection observed in other countries at a similar level of development (Kume, Piani and Souza, 2003). (Box 1 presents a review of such policies with respect to the automobiles sector.)

The process of Brazilian trade liberalisation began on a unilateral basis, but the schedule for liberalisation and the final tariff structure were modified to be compatible with the implementation of the common external tariff (CET) negotiated under the MERCOSUR. In 1995 the CET entered into force even though there remained several exceptions and differences among the four partners.⁴

¹ For correspondence with the authors contact Marta Castilho at: castilho@ie.ufrj.br. A previous version of this paper was published in parallel by UN ECLAC and is available here: <http://www.eclac.org/publicaciones/xml/2/48162/DiferentesParceirosdiferentesPadroes.pdf>.

² At that time, the nominal import tariff was 43% (simple average). Tariffs were characterised by significant dispersion and were often accompanied by non-tariff instruments (both formal and informal). Among the formal instruments there were, for example, requirements for prior import authorisation and quotas for determined products. Among the informal instruments, the best known was the so-called “CACEX drawer”, i.e. excess time it took to receive authorisation from CACEX (Banco do Brasil’s Carteira de Comércio Exterior) - a government agency responsible for the implementation of trade policy. It has been alleged that the time lag was inversely proportional to the priority given to imports of the products considered (Guimarães, 1993).

³ For a detailed presentation of commercial reforms in Brazil, see Kume, Piani and Souza (2003) or Pereira (2006).

⁴ There are differences between the tariff structures of Argentina, Brazil, Paraguay and Uruguay, reflecting to a great extent differences in their productive structures; the positions of the four countries do not converge in many sectors, which led to the adoption of national lists of exceptions to the CET. Berlinski et al. (2005) described in detail the negotiations to establish the CET and its alterations up to 2004.

The evolution in the level of effective protection reflected the change in Brazilian import policies. The average effective tariff for the economy decreased from 45% in 1990 to around 25% in 2005.⁵ The evolution of effective protection throughout this period was not linear, having varied according to the changes in nominal tariffs, structure of the economy and domestic taxation system.⁶

The effects of trade liberalisation were felt particularly strongly in the second half of the 1990s. The years 1990-94 were marked by serious macroeconomic instability. The adoption of the “Real Plan” in June 1994 caused a sharp currency appreciation, resulting in drastically reduced competitiveness of Brazilian products, which had consequences for the trade balance. At the same time, the availability of cheaper imports encouraged Brazilian companies to adopt modernisation strategies, including through the acquisition of capital goods and the use of imported inputs. As a consequence, there was an increase in the productivity of Brazilian industry (e.g. Bonnelly, 2002). However, according to Kupfer (2005), this increase reflected to a large extent, a “selective and temporary renovation of equipment or productive processes that had been very much outdated” (p. 209), and not a “permanent” change in the competitive environment or in corporate strategies of the companies operating in the domestic market.

The adjustments in productivity and technological updating in Brazilian industry led to a strong reduction in employment and an increase in informality. In fact, the observed reduction in the share of industrial employment in total employment was larger than the corresponding reduction in the share of industry in the Brazilian GDP. The indicators for employment by occupation and hours paid in industry demonstrate that the rationalisation of production caused a great reduction in the quantity of jobs. The levels of employment at the end of the 1990s were maintained during part of the 2000s indicating that there was no reabsorption of the unemployed manual labour during the second half of the last decade. That is, the expected movement of workers from import-competing sectors to exporting sectors did not occur to a sufficient degree to absorb excess labour.

The studies that analyse Brazilian trade liberalisation in the 1990s are either ambiguous or contradictory in their estimates of employment and remuneration outcomes. In general, they do not appear to confirm the predictions of traditional trade theory, according to which trade liberalisation should have contributed to an improvement in the wage distribution in a country abundant in low-skilled labour, as Brazil was thought to be. This is due to the multiplicity of factors that must be considered when analysing the relationship between trade liberalisation and employment in Brazil.

One aspect worth highlighting is the consolidation of employees’ rights and the social welfare system in the 1988 Constitution. Several of the reforms enshrined in the Constitution referred to the pension system, and had an impact on labour costs and the labour market in general; these were implemented progressively and entered into force in the early 1990s.⁷ Other features of the Brazilian labour market in the 1990s that appear to have played a notable

⁵ Estimates for the level of effective protection are found in Kume, Piani and Miranda (2008) for the period 1990-2000 and in Castilho, Urraca and Naidin (2010) for 2000-05.

⁶ Brazil’s use of indirect cascade taxes (PIS/PASEP, CONFINS) involved differentiated application of tax requirements on domestic and imported products up to 2004 and gave the latter a price advantage of around 10% (in comparison, the effective net tax tariff was 15.8% in 2000).

⁷ Soares, Servo and Arbache (2001) call attention to the following measures: reduction in the age and in the time of contribution to the pension (and consequent increase in the social welfare contribution, raising the cost of employment), “universalisation” of rural pensions and the creation of the Single Juridical Regime, in which were incorporated most of the civil service employees.

role in shaping post-liberalisation employment outcomes include: i) the decline in the formal labour market and increase in unemployment in the metropolitan areas; ii) the increase in the wage gap between those with and without university education (Green, Dickerson and Arbache, 2001), iii) the convergence of salaries in the industrial sector, and iv) the strong heterogeneity in the country's labour market by sector and skill level.

In the recent decade, Brazilian foreign trade has expanded vigorously, reaching USD 383 billion in 2010. Overall, exports increased a little more than imports throughout the decade with a short reversal in the trend during the years 2006-08. This situation is mostly due to increased growth in the domestic market and a real exchange rate appreciation. The trade balance has nevertheless remained positive since 2001, with exports playing a role as an important factor underlying the strong performance of the national economy for the greater part of the decade.

This recent rise in exports has been characterised by a significant change in the sectoral composition and the geographic distribution of Brazilian exports, with the two aspects being related. Throughout the decade – and in particular since 2007 – the share of primary products (agricultural and mineral commodities) in Brazil's total exports rose, while the share of manufactured goods fell. Meanwhile, the geographic dispersion of Brazilian exports increased, with a relative decline in importance of the United States as a destination market and strengthening of other markets, in particular China. This geographic reorganisation of exports is closely related to the change in Brazil's sectoral trade profile, as we shall see in Section 2.

The contribution of exports to the dynamism of the Brazilian economy in this period is undeniable. Still, while the number of jobs associated with exports grew, the gains were relatively modest. Jobs directly associated with exports are relatively few if compared with the total employment in the economy (around 5% of the total number of jobs in the economy). The number of such export-associated jobs increased only 2% between 2002 and 2008, against increases of around 18% in the total number of jobs and more than 200% in the amount of exports.

In terms of qualifications of manual labour, there was a tendency towards increased average qualification for employees across the economy as well as for employees associated with exports. Across the national labour market, the semi-skilled category became the largest (44% of the total), whereas 67% of jobs directly generated by exports continue to have low qualifications. This difference is mainly driven by specialisation patterns emerging in the Brazilian economy with high growth in the unskilled-labour intensive sectors (e.g. agricultural products, food and drinks).

An assessment of skill intensity of exports by trading partner reveals a pattern of variation in line with the product mix being exported. For example, the strong growth in the exports to China, mainly of mineral and agricultural products, generated a substantial number of jobs, albeit at low skill levels. In contrast, an increase in Brazilian exports to MERCOSUR or to the United States would generate less employment than in the case of China, but in the former cases it would be employment at a higher skill level.

According to traditional theoretical forecasts, trade-induced labour dislocation should be temporary as workers shed from import-competing sectors are absorbed by expansion in more competitive exporting sectors. Furthermore, according to the Stolper-Samuelson Theorem, trade liberalisation enables an increase in returns to the abundant factor of production. In the Brazilian case, one could expect an improvement in wages for the relatively abundant unskilled labour and, consequently, a reduction in overall wage inequality.

However, international reports and studies on Brazil appear to question these theoretical predictions. For example, Goldberg and Pavcnik (2007) in their analysis of labour market outcomes in various developing countries outline why in practice globalisation, or trade openness, appears to have increased inequality, rather than reduced it as theory would seem to suggest.⁸ The authors conclude that several factors not considered by traditional literature are important to understanding this relationship. They highlight the importance of trade in intermediate goods, international capital flows, factor immobility in the short term, and heterogeneity of companies. Furthermore, they call attention to the hypothesis of trade-induced skill-biased technological change (Skill-Enhancing Trade Hypothesis, according to Robbins, 1996), which supposes that “the trade liberalisation brought benefits to the more qualified workers, through the importation of capital goods and complementary technologies to qualified workers while substituting the low skilled workers” (Soares, Servo and Arbache, 2001, p. 12). In this sense, it is desirable that specific studies are carried out in each country and period to take into account, among other things, the specificities of each country and historical moment.

This paper seeks to evaluate the extent to which the greater external exposure of the Brazilian economy in the recent decade has contributed to the evolution of employment in the country. This investigation has been undertaken in two ways. First, total employment variation was decomposed in order to identify the contribution of the final demand components – exports in particular – to its evolution. The decomposition was carried out using Input-Output Matrix (IOM) methodology and, in line with the availability of the estimated IOMs for Brazil, the exercise was carried out for the period 2000-07. Then, using the labour content of trade, we estimated the volume of direct employment associated with exports, according to the education level of workers and the geographical composition of Brazilian exports. (See the Annex for further information on the methodology and data.)

The paper is divided into five sections. Following this introduction, the next two sections analyse the evolution and composition of the Brazilian employment and trade, respectively. The fourth section is dedicated to estimates of the impact of trade on Brazilian employment in the recent decade. The last section presents the principal conclusions.

⁸ Goldberg and Pavcnik (2007, p. 40) note, “What is more surprising is that the distributional changes went in the opposite direction from the one suggested by conventional wisdom: while globalisation was expected to help the less skilled who are presumed to be the locally relatively abundant factor in developing countries, there is overwhelming evidence that these are generally not better off, at least not relative to workers with higher skill or education levels.”

Box 1. Export incentive policies and their impact on employment: The automotive industry's case

During the 1970s and 1980s a number of tax and credit incentives were granted to a variety of productive industries, with the intention of encouraging Brazilian exports and raising the country's international economic relevance. The key government body for managing these policies and other support related to exports and imports (financing, promotions, tax incentives) was the Banco do Brasil's Carteira de Comércio Exterior (CACEX) – the foreign trade policy maker. One large support measure was the Brazilian Special Export Program (BEFEIX), which provided tax incentives. In the wake of the introduction of more liberal economic policies in Brazil and Latin America more generally, the Collor government (1990-92) wound up CACEX and the BEFEIX program. The objective was to encourage competition by domestic manufacturing industry (Castilho, 2007).

In relation with these developments, Sectoral Chambers became influential in Brazil in the late 1980s. Initially, they served as chambers for business leaders and government officials. Their stated aim was to "prepare sectorial competitiveness diagnoses, detect the causes of existing distortions, and recommend strategies for corrections" (Anderson, 1999, pg. 2). In practice, until the Collor Plan 2 in 1990, the Sectoral Chambers served primarily as a mechanism to fight inflation. From mid-1991, the Sectoral Chambers admitted labor representatives and "the chambers adopted a tripartite nature which would provide a substantial difference in quality to this institutional arrangement, as opposed to its previous version" (Anderson, 1999, pg. 7).

In literature on the topic of this period of reform,⁹ the Sectoral Chambers are seen as having been particularly useful in relation to such industries as toys, textiles and clothing, shipbuilding, and tractors and agricultural machinery. But, the automotive industry was the most famous case, not only owing to its relevance in the Brazilian economy but also because of the breadth of the policies undertaken by this Sectoral Chamber and the importance of the participation by the metal workers' union of the Greater São Paulo area in the discussions.

According to Santos and Burity (2002, pg. 7), in 1991 the automotive industry was stagnant, with production similar to the 1970s and with declining exports. Under these circumstances, a recovery plan was prepared for the industry, which materialised in steps adopted by the Automotive Sectoral Chamber. Among the more relevant steps were the reduction in the tax burden (the federal excise tax, IPI, and state sales tax, ICMS), reduction of profit margins by the assembly plants as well as producers of auto parts and dealerships, reduced prices for cars, increased loan facilities for trucks and buses, loans for private cars, and job maintenance. With regard to job maintenance, Anderson (1999) tells us that by virtue of the participation of workers in the Automotive Sectoral Chamber, workers' real wages in the Greater São Paulo area did not fall between 1991 and 1995, although jobs had declined significantly between 1990 and 1992, and after 1995. Employment remained relatively stable between 1992 and 1995, while the Automotive Agreement was in effect.

While the Automotive Agreement had a positive effect on production (after twelve years of stagnation the industry boosted production and sales, and practically worked under full capacity in 1995), this was not the case for the country's trade balance. The recovery of domestic production was not associated with a proportionate increase in exports (which in 1992 were only slightly above 1989 exports). Moreover, the expansion of production was supported by growing imports, according to Sarti (2002). Therefore, an industry with a favorable trade balance prior to the lifting of restrictions on imports started to face substantial trade deficits, with the worst year being 1995 with a deficit of almost BRL 2.8 billion.

Under the circumstances and given the uncertainties in connection with "economic stability, the demand for automobiles, in addition to competition by our neighbours in Argentina" (Santos; Burity, 2002, pg. 8), the industry pressured the Brazilian government to revise its policy in order to restructure and expand activity in the sector (Sarti, 2002, pg. 55). This was the origin of a new Automotive Policy. The Automotive Policy's key aim was to expand the industry – which in 1995/1996 was working at full steam – and restructure it with the purpose of raising competitiveness and productivity. With this in view, investments of about USD 4.7 billion were made via capital expenditures (Sarti, 2007). Considering all the steps taken by the Automotive Policy – tax incentives to encourage new companies, higher taxes on vehicle imports for companies without production facilities in the country, and lower IPI tax for the purchase of capital goods – support to the industry between 1996 and 1999 totaled roughly USD 20 billion, raising its production capacity from 2 million to 3.5 million units (Casotti and Goldenstein, 2008). The counterpart to this comprehensive incentive program was planned to be "a 60% average rate of local production for those companies with facilities in the country and 50% for new ones, plus a system to offset imports with exports (Santos and Burity, 2002).

⁹ For more details, see Arbix (1995) and Diniz (1993).

Box 1. Export incentive policies and their impact on employment: The automotive industry's case (continued)

The Automotive Policy's impact on Brazil's foreign trade was manifested as a steady decline in the trade deficit until 1999, when the industry once again produced a surplus. According to Sarti (2002), this outcome was due largely to the substantial decrease in imports by the industry, which dropped from a USD 3.8 billion level in 1998 to USD 1.9 billion on average (1999-2001). On the other hand, exports rose from USD 1.3 billion (1993-96) to USD 2.6 billion (1997-2001).

Owing to the industry's importance for exports (roughly 4.5%) and domestic employment, the Automotive Plan regulated foreign trade in automobiles and protected domestic markets. However, imported auto parts were not given the same treatment and import duties dropped from 16% to 4.8% during the period of the Automotive Policy. The result was a trade deficit in this area of the automotive industry.

The Automotive Policy was ended in 1999 and in 2000 Brazil entered into the Mercosur Automotive Policy, which sought to harmonise the automotive policies of Brazil, Argentina and Uruguay. This agreement provided for integration of the automotive industry by putting into place a system of offset exchanges and quotas allowing vehicle imports at zero import duties. In addition, Brazil granted tax exemptions on imports to exporters of finished goods, which occurred to a lesser degree with auto parts. Other agreements were entered into with Chile and Mexico, greatly expanding exports to these countries. Exporting activities by the automotive industry improved during the 2000s. After remaining more or less stable in value from 2000 to 2003 (a shade below USD 3 billion), there was a sharp rise during 2004-08 when a peak of a little over USD 8 billion was obtained. In 2009, owing to the crisis, the volume of exports dropped to below the 2005 level.

The economic impact and overall results of the post-Mercosur Automotive Policy may be measured in terms of direct jobs created and of the effects on the productive chain. Based on data from the country's input-output matrices, Castilho (2011a) found that of the roughly 10.7 million direct and indirect jobs created through Brazil's exports in 2005, only 2.6% were in the automotive industry. Thus, while the policies promoted export activities, its job creation capacity proved to be limited. Moreover, 2.2% of the 2.6% result from "auto parts and vehicle accessories, precisely the automotive industry's segment that benefits the least from the Automotive Policy." There were no changes in these data as compared to 2000.

Based on the above, it may be asserted that Automotive Sectoral Chamber and the Automotive Policy in its various guises were instrumental in protecting domestic industry and encouraging it to put in place structural changes with a view to improving competitiveness and productivity. As a result, productive capacity expanded, the industry produced more items locally, and the performance of exports improved, with its peak in 2008. The more relevant export markets were in Latin America, such as Argentina and Mexico. Nonetheless, despite the favorable impact on the automotive supply chain, direct and indirect job creation based on exports was feeble (Castilho, 2011a).

2. Composition and evolution of the Brazilian labour market in the 2000s

The labour market in Brazil underwent a period of significant dynamism for most of the first decade of the 2000s. Expansion in the number of jobs was accompanied by a reduction in the informal economy, growth in the average wage and an increase in the skill level of the workers. The resulting expansion of income exerted a positive impact on domestic economic growth by reinforcing household consumption and this contributed to a reduction in income inequalities in Brazil from 2004.¹⁰

Between 1996 and 2007, the number of jobs¹¹ in the Brazilian workforce grew 35%, increasing from 65.4 million to 88.1 million. The services sectors were most responsible for the generation of jobs, followed by agriculture, and animal and vegetal extraction activities.¹²

¹⁰ For more details, see Kupfer, Laplane and Hiratuka (2010).

¹¹ The number of those employed includes formal and informal workers.

¹² In this section, two approaches to sectoral disaggregation have been utilized. The first, comprising ten sectors, is utilized to show the growth and the change in composition of employment in the economy. The second is more disaggregated, comprising 30 sectors, and was utilised to evaluate the changes in the quality of work in terms of productivity and education.

Manufacturing accounted for a smaller share of new jobs than these sectors, though the manufacturing share was significantly larger than that of the mineral extraction sector. (This is not particularly surprising given that mineral extraction sectors tend to be highly capital intensive.)

Figure 1 shows the recent evolution of employment in Brazil. The number of employees exceeded 90 million in 2008, reflecting growth of 18% since 2002. As a result, the unemployment rate fell significantly – from 13% in 2002 to 9.4% in 2008.¹³ The gender composition of employment did not change significantly, although throughout the period, a tendency for female participation to increase was observed (Figure 1).

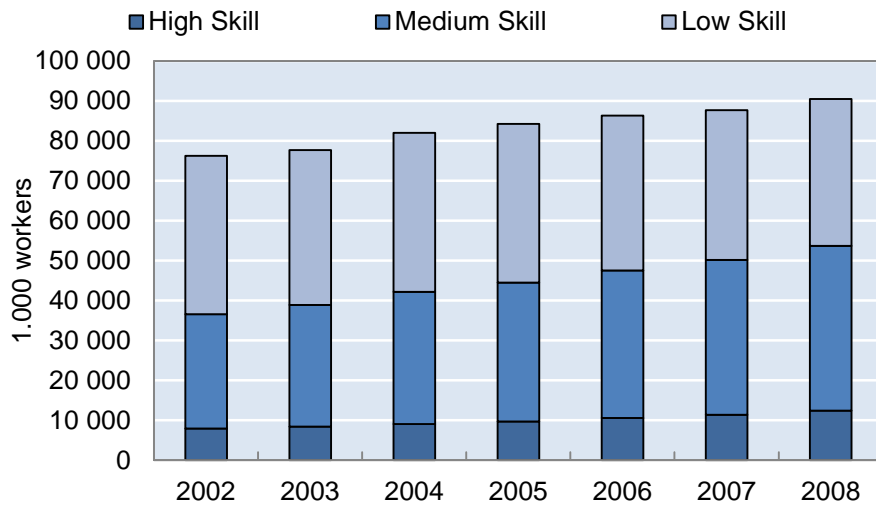
Figure 1. Evolution of total employment in Brazil, 2002-08



Source: PNAD/IBGE (Instituto Brasileiro de Geografia e Estatística). KLEMS. Authors' elaboration.

Recent changes in terms of labour qualifications are presented in Figure 2. The number of employees with few years of study (i.e. lower qualifications) declined by 8% between 2002 and 2008, while the number of employees with medium and higher qualifications expanded by 44% and 57%, respectively. As a consequence, the less qualified employees, who accounted for more than half the total employment at the beginning of the decade, currently represent around 40% of the total. Medium qualified workers are the largest group, representing around 46% of the total. The most qualified group, despite its expansion, still only accounts for 13.7% of total jobs.

¹³ This calculation was made by the *Instituto de Estudos do Trabalho e Sociedade* (IETS) from the micro-information of the National Research using Domestic Sampling (PNAD/IBGE). See www.iets.org.br.

Figure 2. Evolution of total employment in Brazil by skill levels, 2002-08

Source: PNAD/IBGE. KLEMS. Authors' elaboration.

Among the three main sectors of the economy, it is the service sector that absorbs the largest – and increasing – number of workers (Table 1). In 2008, 58% of the jobs were located in the service sector, as compared to 55% in 2002. Of the remaining jobs, 14.5% were in agriculture and fishing, and 27.5% in industry. Both of these sectors nevertheless lost importance in terms of employment during the period: agriculture contracting by two percentage points and industry by one percentage point.

Within Brazilian industry, two sectors employed more than two million workers in 2008: textiles (2.3 million), and food and drinks (2.7 million). They are the most labour-intensive sectors, but contrary to what one might expect, they are not the most abundant in low-skilled labour. Instead, semi-skilled workers in these sectors, just as in the industry as a whole, are the largest, and rising, group. The sectors in which unskilled labour had the highest employment shares were agriculture and fishing and, among industrial sectors, mining and quarrying of energy products and wood and cork. From the point of view of higher skilled workers, the pulp and paper sector, chemical, rubber, plastics and fuel sector as well as food, beverage and tobacco were those with the highest proportion of skilled employees.

Table 1. Evolution of total employment by skill level and sector, 2000 and 2008

Number of jobs

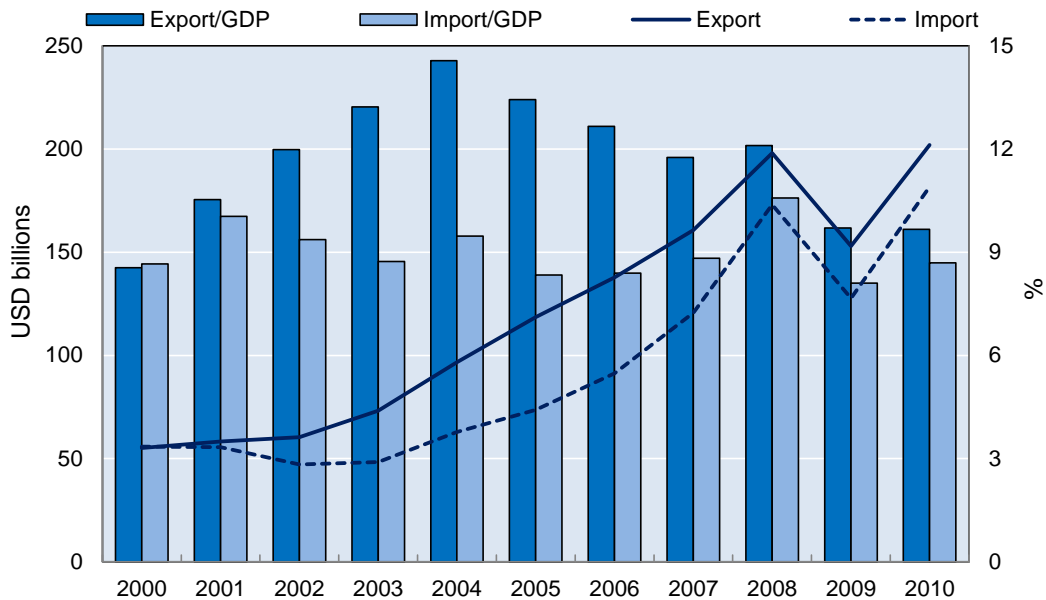
Activities KLEMS	2002				2008			
	Employment	High skill	Medium skill	Low skill	Employment	High skill	Medium skill	Low skill
AGRICULTURE, HUNTING AND FORESTRY	14 812 446	104 507	1 536 804	13 171 135	14 982 619	225 600	2 580 312	12 176 707
FISHING	312 081	1 973	34 080	276 028	386 034	3 882	58 289	323 863
MINING AND QUARRYING OF ENERGY PRODUCING MATERIALS	39 911	11 588	20 594	7 729	78 526	27 653	47 141	3 732
MINING AND QUARRYING EXCEPT ENERGY PRODUCING MATERIALS	208 504	12 901	59 091	136 512	274 773	27 893	128 591	118 289
FOOD , BEVERAGES AND TOBACCO	1 654 424	104 200	763 657	786 567	2 265 878	172 696	1 161 104	932 078
TEXTILES AND TEXTILE	2 291 346	71 228	1 000 307	1 219 811	2 736 917	126 200	1 483 465	1 127 252
LEATHER, LEATHER GOODS AND FOOTWEAR	693 602	20 828	284 958	387 816	822 169	36 903	472 239	313 027
WOOD AND OF WOOD AND CORK	530 278	12 759	161 357	356 162	485 651	13 760	180 192	291 699
PULP, PAPER, PAPER PRODUCTS, PRINTING AND PUBLISHING	780 551	164 697	446 220	169 634	957 518	229 232	562 336	165 950
CHEMICAL, RUBBER, PLASTICS AND FUEL	918 560	154 303	473 526	290 731	1 182 391	197 456	687 542	297 393
OTHER NON-METALLIC MINERAL	610 856	28 912	213 738	368 206	656 862	52 724	325 744	278 394
BASIC METALS AND FABRICATED METAL	990 377	77 107	492 266	421 004	1 417 364	126 883	879 638	410 843
MACHINERY, NEC	484 149	61 984	267 517	154 648	590 528	76 623	398 339	115 566
ELECTRICAL AND OPTICAL EQUIPMENT	362 724	68 705	217 077	76 942	498 866	91 152	353 054	54 660
TRANSPORT EQUIPMENT	468 906	60 285	279 874	128 747	777 811	122 872	543 887	111 052
MANUFACTURING NEC; RECYCLING	865 233	29 825	416 814	418 594	1 025 842	70 577	534 339	420 926
TOTAL OF INDUSTRY	10 899 421	879 322	5 096 996	4 923 103	13 771 096	1 372 624	7 757 611	4 640 861
SERVICES	50 267 677	6 936 830	21 946 446	21 384 401	61 348 029	10 813 909	30 864 438	19 669 682
TOTAL OF EMPLOYMENT	76 291 625	7 922 632	28 614 326	39 754 667	90 487 778	12 416 015	41 260 650	36 811 113

Source: PNAD/IBGE. KLEMS.

3. Evolution of Brazilian exports in the 2000s: a decade of strong growth

Brazilian foreign trade expanded strongly during the 2000s (Figure 3), reaching a historical record of USD 383 billion in 2010. Despite this record, the degree of openness (the ratio between the total trade and the GDP) of the Brazilian economy – whose average for the decade was above 20% – and Brazil's share in world trade – around 1% – continue to be low relative to other leading countries.

Figure 3. Evolution of imports, exports and the degree of openness of the Brazilian economy, 2000-10



Source: SECEX, OMC, BACEN. Authors' calculations.

The increase in trade flows was extremely intense, especially between 2003 and 2008. For the entire decade, the accumulated variation of total trade (imports plus exports) was 245%. Export growth was a little higher than import growth. But, while exports grew more rapidly up to 2005, in the following years, imports increased faster than exports due to the strong growth in the Brazilian economy. The increasing overvaluation of the Brazilian currency also contributed to the trade balance evolution (Table 2). The trade surplus grew significantly from 2001 until 2006, when it exceeded USD 46 billion, but, after that, the sharp growth in the imports led to a reduction in the trade surplus to USD 20 billion in 2010. Relative to the total trade, the trade surplus reached its highest value in 2005, when it represented 25% of the sum of exports and imports. Until the end of the decade, the decline in the balance in relative terms was still more pronounced than in absolute terms due to the expansion of both imports and exports. In 2010, the trade surplus represented only 5% of commercial flows.

Table 2. Evolution of Brazilian foreign trade, 2000-10

	EXPORTS (FOB)		IMPORTS (FOB)		TRADE BALANCE USD bi	Exports to GDP ratio (%)	Imports ¹ over GDP (%)	Share of Brazilian exports in world exports	Share of Brazilian imports in world imports
	USD bi	% annual	USD bi	% annual					
2000	55.1	14.8	55.9	13.3	-0.7	8.5	8.7	0.9	0.9
2001	58.3	5.7	55.6	-0.4	2.7	10.5	10.0	1.0	0.9
2002	60.4	3.7	47.2	-15.0	13.2	12.0	9.4	1.0	0.7
2003	73.2	21.1	48.3	2.3	24.9	13.2	8.7	1.0	0.7
2004	96.7	32.1	62.8	30.0	33.8	14.6	9.5	1.1	0.7
2005	118.5	22.6	73.6	17.1	44.9	13.4	8.3	1.2	0.7
2006	137.8	16.3	91.4	24.1	46.5	12.7	8.4	1.2	0.8
2007	160.6	16.6	120.6	32.0	40.0	11.8	8.8	1.2	0.9
2008	197.9	23.2	173.0	43.4	25.0	12.1	10.6	1.3	1.1
2009	153.0	-22.7	127.7	-26.2	25.3	9.7	8.1	1.3	1.1
2010	201.9	32.0	181.6	42.2	20.3	9.7	8.7	1.4	1.3

Note: ¹ Imports CIF.

Source: SECEX, OMC, BACEN. Authors' calculations.

The trajectory of Brazilian foreign trade in the 2000s was interrupted by the financial crisis of 2008. Brazilian foreign trade was mostly affected through a crisis-induced change in investors' and consumers' expectations, declines in credit availability, and contraction in international demand. Both external sales and purchases reduced, with a higher decline in exports. Commodity prices, which had shown a rising trend until the period just prior to the crisis, fell less intensively than the export quantities and there was a rapid recovery during 2009 and 2010.

Given the timing of the crisis and its impact on the Brazilian economy, its effects on foreign trade were felt especially in 2009. The recovery of trade and growth in Brazil in 2010 raised trade flows above the 2008 levels, strengthening some of the trends observed already in 2006 such as a shift in the geographic composition of exports and a reduction in trade surplus, discussed in the following section.¹⁴

3.1 Changes in the sectoral and geographic composition of Brazilian exports

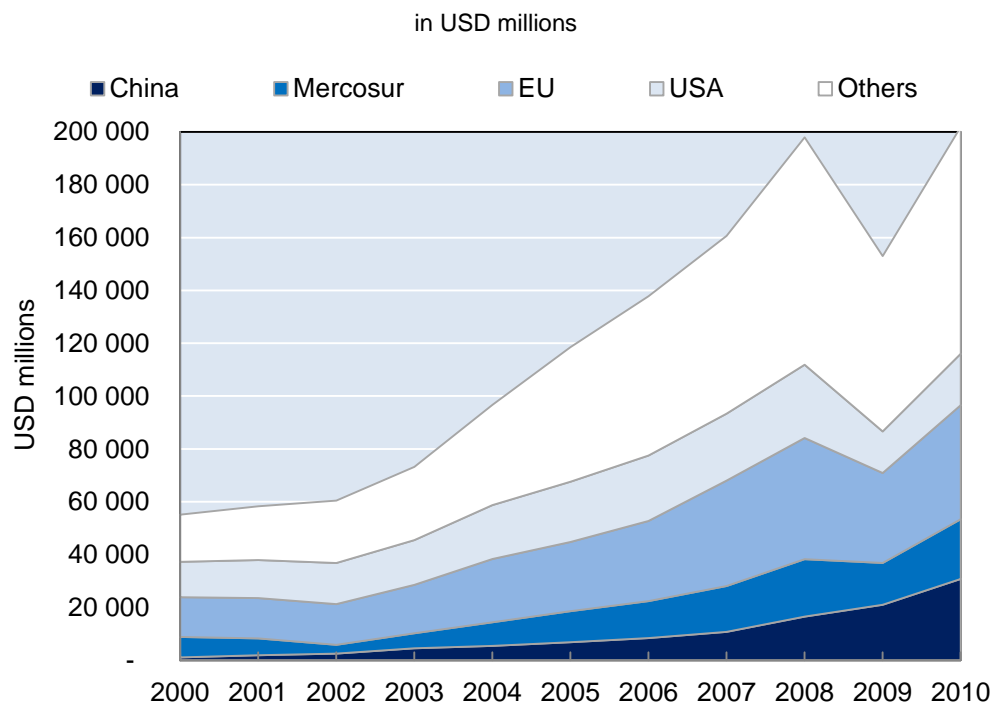
In addition to the significant changes in the overall volumes of Brazilian exports, two notable shifts in the pattern of trade could be observed during the 2000s. First, the geographical dispersion of Brazilian exports (imports also demonstrated this characteristic) expanded in recent years. This diversification was responsible for a significant decrease in importance for Brazil's traditional trading partners – the United States and to a lesser extent, the European Union – and an increase in the importance of other developing countries from Asia, Africa and Latin America. Figure 4 shows the evolution of exports to the principal trading partners between 2000 and 2010. (A more detailed country breakdown is given in the Annex.)

China is presently the principal destination of Brazilian exports (accounting for 15% of total exports in 2010). The growth in exports to China is impressive considering that its share

¹⁴ For greater detail about trade and the crisis, see Castilho (2011b) and Rios and Iglesias (2009).

was less than 2% in 2000. By contrast, the United States, to whom Brazil used to export around a quarter of its merchandise exports at the beginning of the decade, saw its share reduced to 10% of the total in 2010. During the same period, the reduction in the share of exports toward the European Union was less substantial, but nonetheless corresponds to a drop of five percentage points. In contrast, Brazilian exports to the Latin American economies intensified until the crisis in 2008 when the trend reversed. Exports to MERCOSUR countries, on the other hand, lost in importance throughout the decade, reversing slightly after the crisis. Argentina, for example, used to be the second destination for Brazilian exports, but has now dropped to third place.

Figure 4. Evolution of Brazilian exports by destination, 2000-10



Source: SECEX, OMC, BACEN. Authors' calculations.

Secondly, during this decade, the weight of goods – both primary and manufactured goods – whose production relies heavily on natural resources increased. This trend has been accompanied by a parallel increase in concentration of exports in terms of variety of products exported.¹⁵ This is related to the change in geographical distribution of exports (explained in detail below), whereby the shares for destination markets for manufactured goods declined (e.g. United States) and the shares for countries demanding basic and semi-manufactured products increased (e.g. China).

Table 3 shows the sectoral evolution of Brazilian exports between 2000 and 2008. In this period, the sectors whose shares grew most dynamically were food, beverages and tobacco

¹⁵ A simple comparison illustrates the observed changes in concentration and composition of Brazilian exports. In 2000, four groups of products (HS classification) with the greatest volume of exports were vehicles (87), machinery and equipment (84), airplanes (88) and iron and steel (72) comprised 28.6% of total exports. In 2010, the four principal product groups were minerals (26), mineral fuels (27), sugars (17) and vehicles (87) and they comprised a higher proportion of the total exports (37.5%).

(8.3 percentage point increase) and mining and extraction of energy producing materials sectors (6.7 percentage point). The increase in the share of the latter was driven by an exponential growth in oil exports whose value rose twentyfold between 2000 and 2010. As a result, this sector, initially having a very small share (1.3% of total exports) became a significant exporting sector, accounting for 9% of total exports. Although the rise in international prices partially explains the observed growth in Brazilian exports, the volume of exports also grew significantly as did domestic production.

The rise of agricultural and mineral commodity prices, driven by the increasing world (especially, Chinese) demand¹⁶, began in 2003 and benefited Brazilian exports directly and indirectly. At first, up to the middle of the decade, exports of raw materials and manufactured goods both grew at a similar pace. The exports of manufactured goods were directed to a great extent to the Latin American countries and other developing countries, which had also benefited from the increase in commodity prices. Starting in 2005, manufacturing exports started running out of steam, while commodity exports maintained a strong rate of expansion. As a consequence, agricultural or mineral products increased their share in total exports from 39.2% in 2000 to 49.1% in 2008 (excluding oil), with food exports growing the most to reach 17.7% in 2008.¹⁷

Considering manufactured products, only chemical products, plastics and rubber did not have their share in total exports reduced over the decade. The decline in the overall export share of manufacturing is particularly evident when we exclude oil exports from the total. The most significant declines arose in the traditional sectors (i.e. textiles and clothing, shoes and wood products), in addition to electrical and optical equipment. The latter has been particularly affected by competition from Asia, aggravated by the strong exchange rate appreciation and moving of production facilities of some multinational companies to other countries (e.g. Nokia transferred a factory from a tax-free zone of Manaus to Mexico with a considerable impact on Brazilian cell phone exports). The exportation of transport equipment also lost importance during the decade. In 2000, this was the principal sector of Brazilian exports (19.1% of the total) due to exports of vehicles and airplanes. Exports of airplanes were strongly reduced in early 2000s, whereas the export of vehicles saw its share decline more intensively after the crisis in 2008. In that year, the transport equipment sector represented only 11.8% of total exports.

¹⁶ It is not only the increase in global demand that explains the rise in commodity prices in general. Speculative operations and investments for real assets also contributed to the evolution of prices throughout the decade.

¹⁷ Although the data used here cover the period until 2008 only, this trend continued more strongly in the following years.

Table 3. Evolution of the Brazilian export structure, 2000-08 (as % of total)

Activities KLEMS	2000	2005	2008
AGRICULTURE, HUNTING AND FORESTRY	8.4	8.5	10.2
FISHING	0.1	0.0	0.0
MINING AND QUARRYING OF ENERGY PRODUCING MATERIALS	1.3	4.3	8.0
MINING AND QUARRYING EXCEPT ENERGY PRODUCING MATERIALS	6.1	6.1	8.3
FOOD , BEVERAGES AND TOBACCO	9.4	17.8	17.7
TEXTILES AND TEXTILE	2.3	1.7	1.2
LEATHER, LEATHER AND FOOTWEAR	4.9	2.7	1.8
WOOD AND OF WOOD AND CORK	2.9	2.5	1.4
PULP, PAPER, PAPER , PRINTING AND PUBLISHING	5.2	3.0	3.0
CHEMICAL, RUBBER, PLASTICS AND FUEL	10.7	11.9	12.4
OTHER NON-METALLIC MINERAL	1.7	1.5	1.1
BASIC METALS AND FABRICATED METAL	13.5	12.2	11.8
MACHINERY, NEC	6.3	6.3	5.4
ELECTRICAL AND OPTICAL EQUIPMENT	6.4	4.9	3.8
TRANSPORT EQUIPMENT	19.1	15.4	13.2
MANUFACTURING NEC; RECYCLING	1.7	1.2	0.8

Note: Columns may not sum precisely to 100% due to rounding.

Source: IBGE. Authors' calculations.

3.2 Differences in the sectoral composition of Brazilian exports to its main partners

Figure 5 provides a breakdown of exports into basic and processed goods according to trading partners for the years 2000 and 2010. This highlights the differences in the structure of Brazilian exports to the different partners and reflects three very different specialisation patterns. Towards the top of the two panels in the figure are countries to which Brazil sells mostly manufactured and processed goods, while towards the bottom are export destinations receiving mostly basic products. The European Union, presiding in the middle of the scale, has tended to have a more balanced structure of imports from Brazil, with products divided almost equally between the two groups of goods, which remained relatively unchanged since 1980s.

The group of countries importing largely manufactured goods from Brazil includes MERCOSUR and Latin American Integration Association (ALADI) countries¹⁸, as well as other developing countries not covered here, such as the African countries.¹⁹ In the case of neighbouring MERCOSUR countries, almost all exports consist of manufactured goods and these countries form an important market for the Brazilian manufacturing industry. Such a composition of intra-MERCOSUR trade is largely a function of the MERCOSUR trade agreement. Yet, it should be kept in mind that even before it came into force Brazilian exports to these countries were also predominantly in manufactured goods (89%).²⁰

¹⁸ ALADI member countries are Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Ecuador, Mexico, Paraguay, Peru, Uruguay and Venezuela.

¹⁹ Brazilian sales to Africa are also concentrated in manufactured goods, equal to 69% of the total (SECEX, 2008 data).

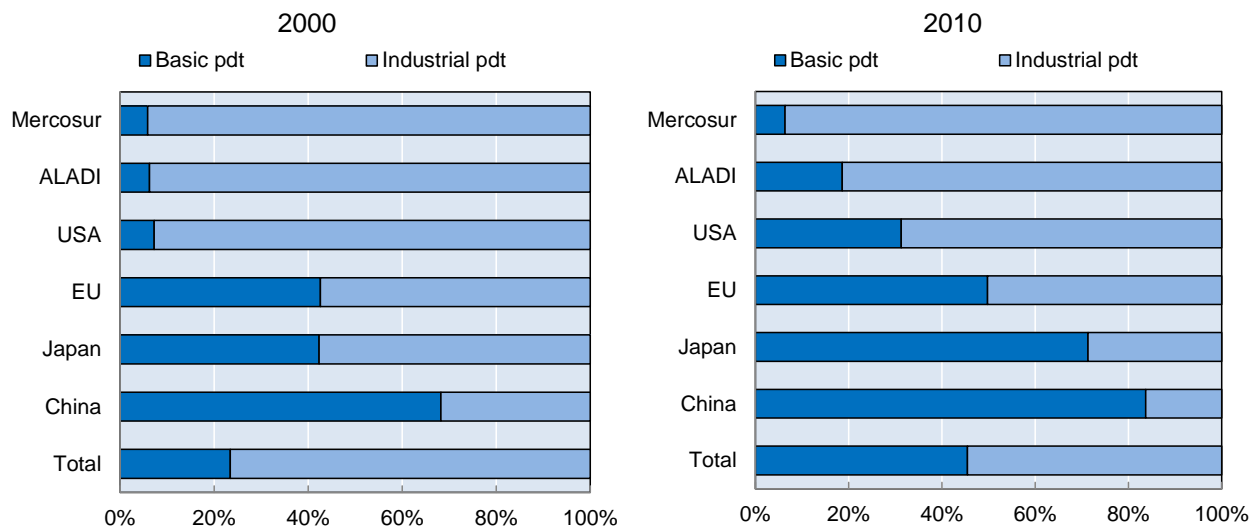
²⁰ Please note that in intra-regional trade the weight of manufactured goods in Brazilian exports and the weight of agricultural goods in Brazilian imports is relatively high. In other words, though the weight of intra-industry trade is important in intra-regional trade (owing to the automotive and chemical industries), the areas of specialisation in inter-industry trade reflect the greater level of industrial development in Brazil.

In the case of other Latin American countries – the ALADI countries and others – the share of manufactured goods in Brazilian exports is significant and often exceeds 80% of total exports. The sectoral structure is somewhat different among these countries, with large differences arising in some cases due to differing oil import needs of specific countries (e.g. Chile being an importer). In the case of the United States, manufactured goods have a significant weight – 68% of the total – albeit this share decreased over time (e.g. 92% in 2001). A part of this decline may be attributed to the relative rise of oil exports from Brazil into the United States.

The countries in the second group have in common considerable shares of basic goods in exports from Brazil. This group includes developed countries such as Japan as well as developing countries such as China. In Asia in general, Brazil features as a growing supplier of basic goods and as a consumer of manufactured goods. This trend is particularly striking in the case of exports to China, with 84% consisting of basic goods. When China purchases manufactured goods from Brazil, these are also less elaborate (i.e. rated as semi-manufactured goods), currently representing 12% of bilateral exports. Manufactured goods in turn constitute only 4.5% of total exports (2010 data). The change in the composition of exports to China was very intense during the 2000s, when the weight of manufactured goods declined from 18.8% to 4.5%, being more than offset by the growth in primary goods exports. In fact, Brazil-China trade patterns resemble those more typical of North-South trade relations rather than South-South trade relations.²¹ Finally, as noted previously, the European case is fairly unique and consistent over time, as the weight of basic and manufactured goods remained balanced during the decade. By virtue of the European Union's weight, this is an important market for Brazilian manufactured goods.

²¹ In fact, there is a downgrading of Brazilian exports even within sectors or value chains. Castilho (2007) examines this intensification and stresses that owing to the priority by the Chinese government in developing processing activities in the country, there was a change in the composition of the soybean chain, with soy processed into oil and its by-products having been reduced and exports of soybeans expanding. Puga et al. (2004) assert that a similar trend may be noted for mineral goods: Brazilian exports of steel goods as part of the mineral chain have shifted to concentrate on less elaborate goods.

Figure 5. Structure of Brazilian exports according to partners and to the degree of processing of exported goods, 2000-10 (as % of total bilateral exports)



Note: ALADI is the acronym for the Latin American Integration Association (<http://www.aladi.org/nsfweb/sitiolng/>).

Source: SECEX. Authors' elaboration.

Brazil's export specialisation by sector in relation to its principal trading partners is shown in Table 4, which presents a breakdown of exports to MERCOSUR, United States, European Union and China into 16 sectors for 2010. There is a marked contrast between the Brazilian exports to MERCOSUR and those going to China. While exports to Latin American neighbours are concentrated in manufactured goods, including those sectors that produce more elaborated goods, in the case of China, 83% of exports are centred on mining activities, agriculture, beverages and food. Exports are hence more concentrated and focus in particular on less elaborate goods. (Even within metallic and agricultural sectors, China imports relatively more raw materials than processed goods). In the cases of the United States and the European Union, the export structure is between both extremes. The share of manufacturing exports to the United States is greater than in the case of the European Union; yet, owing to a larger absolute volume of exports going to Europe, that market remains quite important to a number of Brazilian manufacturing industries, such as chemicals or paper and pulp.

Table 4. Composition of Brazilian exports according to partners, 2010

as % of total bilateral exports

Activities KLEMS	Mercosur	USA	EU	China	Total
AGRICULTURE, HUNTING AND FORESTRY	1.1	3.6	17.7	31.1	10.2
FISHING	0.0	0.0	0.0	0.0	0.0
MINING AND QUARRYING OF ENERGY PRODUCING MATERIALS	0.2	15.6	6.1	12.2	8.0
MINING AND QUARRYING EXCEPT ENERGY PRODUCING MATERIALS	2.5	0.6	9.4	30.7	8.3
FOOD , BEVERAGES AND TOBACCO	3.4	6.2	19.8	8.5	17.7
TEXTILES AND TEXTILE	2.4	1.3	0.4	0.3	1.2
LEATHER, LEATHER AND FOOTWEAR	1.1	2.5	2.7	1.8	1.8
WOOD AND OF WOOD AND CORK	0.3	2.8	2.3	0.6	1.4
PULP, PAPER, PAPER , PRINTING AND PUBLISHING	2.3	3.6	4.8	4.6	3.0
CHEMICAL, RUBBER, PLASTICS AND FUEL	28.4	13.8	11.0	1.6	12.4
OTHER NON-METALLIC MINERAL	1.2	2.7	0.6	0.1	1.1
BASIC METALS AND FABRICATED METAL	10.1	16.7	10.1	4.1	11.8
MACHINERY, NEC	9.0	5.8	3.1	1.3	5.4
ELECTRICAL AND OPTICAL EQUIPMENT	8.4	4.9	1.9	0.6	3.8
TRANSPORT EQUIPMENT	28.6	18.8	8.9	2.5	13.2
MANUFACTURING NEC; RECYCLING	1.0	1.1	1.1	0.0	0.8
TOTAL	100.0	100.0	100.0	100.0	100.0

Source: SECEX, IBGE. Authors' calculations.

The Latin American market is in fact the most important for Brazilian manufactured goods, except for those intensive in natural resources. As may be seen in Table 5, MERCOSUR is the main market for the following industries: chemicals, other machinery, electrical and optical equipment, and transport equipment, in addition to textiles and clothing. The United States is the second largest destination market for these industries, followed by the European Union. In contrast, exports to China of these goods have weakened. Brazilian exports to China are concentrated in agricultural and mineral raw materials sectors. Comparing Brazil's exports to MERCOSUR, the United States and the European Union reveals that exports to the latter two were relatively more natural-resource intensive manufactured goods (such as paper and pulp, or basic metals and metallic goods), while more labour-intensive goods went to the former (such as textiles, clothing, and footwear).

Table 5. Shares of the main Brazilian partners in total exports per industry, 2010

as % of total exports by each industry

Activities KLEMS	China	US	EU	Mercosur	Rest of the World	Total
AGRICULTURE, HUNTING AND FORESTRY	25.1	5.2	40.8	1.2	27.6	100.0
FISHING	0.2	49.8	38.0	0.1	11.8	100.0
MINING AND QUARRYING OF ENERGY PRODUCING MATERIALS	12.5	28.5	17.9	0.3	40.8	100.0
MINING AND QUARRYING EXCEPT ENERGY PRODUCING MATERIALS	30.2	1.0	26.5	3.6	38.7	100.0
FOOD , BEVERAGES AND TOBACCO	3.9	5.1	26.2	2.3	62.5	100.0
TEXTILES AND TEXTILE	2.0	16.3	7.7	24.7	49.3	100.0
LEATHER, LEATHER AND FOOTWEAR	8.0	19.6	35.1	7.2	30.0	100.0
WOOD AND OF WOOD AND CORK	3.3	29.1	39.4	2.7	25.4	100.0
PULP, PAPER, PAPER , PRINTING AND PUBLISHING	12.5	17.8	38.0	9.1	22.6	100.0
CHEMICAL, RUBBER, PLASTICS AND FUEL	1.1	16.2	20.7	27.0	35.1	100.0
OTHER NON-METALLIC MINERAL	0.5	35.5	13.6	13.3	37.2	100.0
BASIC METALS AND FABRICATED METAL	2.9	20.7	20.1	10.1	46.3	100.0
MACHINERY, NEC	2.0	15.9	13.8	19.9	48.5	100.0
ELECTRICAL AND OPTICAL EQUIPMENT	1.4	19.1	11.7	26.2	41.7	100.0
TRANSPORT EQUIPMENT	1.5	20.9	15.9	25.7	35.9	100.0
MANUFACTURING NEC; RECYCLING	0.4	20.1	32.1	15.0	32.5	100.0

Source: SECEX, IBGE. Authors' calculations.

4. Contribution of exports for job creation in Brazil

This section considers the contribution of exports to job creation in terms of employment and skill level. Estimates are produced using two approaches. First, employment is disaggregated using the Input-Output Matrix in order to obtain the contribution of exports to employment change (Section 4.1).²² Second, the number of work posts created by exports is estimated, assuming that this figure is proportional to the amount of labour employed in countrywide production. Labour coefficients are calculated as employment in a given sector divided by the value of production (i.e. normalised to state how many employees are required to produce BLR 1000000 of output), which is the inverse of labour productivity. This is then applied to infer employment embodied in exports (Section 4.2). Section 4.3 completes this analysis with information taken from studies by Castilho (2011a) on indirect employment arising from exports. This considers not only employment arising from exporting activities, but also employment in activities that supply them. Section 4.4 then explains how different specialisation patterns of Brazilian exports by destination country have different results in terms of volume and employment profile.

4.1 Causes of employment growth in the 2000s

An exercise in decomposition of growth in employment based on the IOM allows us to detect which portion of the change of total employment – roughly 15 million – results from the change in each component of final demand: domestic demand (composed of investment, government consumption and household consumption), net overseas demand (the difference between exports and imports), technical change (associated with productivity adjustments and growth of the employment coefficient), and changes in inventories. This exercise was possible for the period from 2000 to 2007 thanks to the availability of input-output matrix data (IBGE).

The results presented in Table 6 demonstrate the importance of domestic demand for the growth of employment between 2000 and 2007, in particular with regard to growth in household consumption. The contribution of domestic demand is strongest in the medium-skill

²² For further details on this disaggregation method, please see Kupfer, Freitas and Young (2004).

class, but also substantial for the other two skill levels. On the other hand, the productivity adjustment represented by technological change contributed negatively to the change in employment, in particular for less skilled jobs. With 7 million jobs created, the contribution of net exports – i.e. the balance of trade – was small in relation to domestic demand, but roughly the size of the contribution of investment and government expenditure. Owing to the export profile – as we will see in the coming sections – specialisation in the Brazilian economy induces an export skill profile different from the economy as a whole, in which less skilled employment is more important.

Table 6. Decomposition of employment changes by source and by skill levels, 2001 to 2007 (number of jobs)

	Investment	Government Consumption	Household Consumption	Exports	Imports	Technological Change	Changes in Inventories
High skill	489 822	2 519 672	2 840 585	517 633	84 514	-2 320 748	21 426
Medium skill	2 660 817	3 531 854	11 820 537	2 557 253	354 725	-8 706 526	104 639
Low skill	2 976 569	1 529 537	12 127 454	3 202 499	491 473	-21 598 919	-35 321
Total	6 127 208	7 581 063	26 788 576	6 277 386	930 712	-32 626 193	90 744

Source: IBGE. Authors' elaboration.

4.2 *Labour coefficients: the changes in the number of jobs associated with agricultural and industrial production*

This section presents a comparison of the direct employment content by sector based on the employment-to-production ratios (labour coefficients). It highlights differences in the use of labour among industries, presented according to skill levels and through time in Table 7. This highlights the contribution of exports to job creation in the country. There was a decline from 2002 to 2008 in the average employment content in the primary and secondary sectors²³ (though in 2005 a slight growth was noted). But this decrease – of over 20% – was the result of a significant drop in the average employment content for less skilled labour (-34%), a change that was not offset by an increase in the employment content with respect to medium and high skilled labour (11% and 15%). Figure 6 gives the labour composition by sector and skill level for 2008.

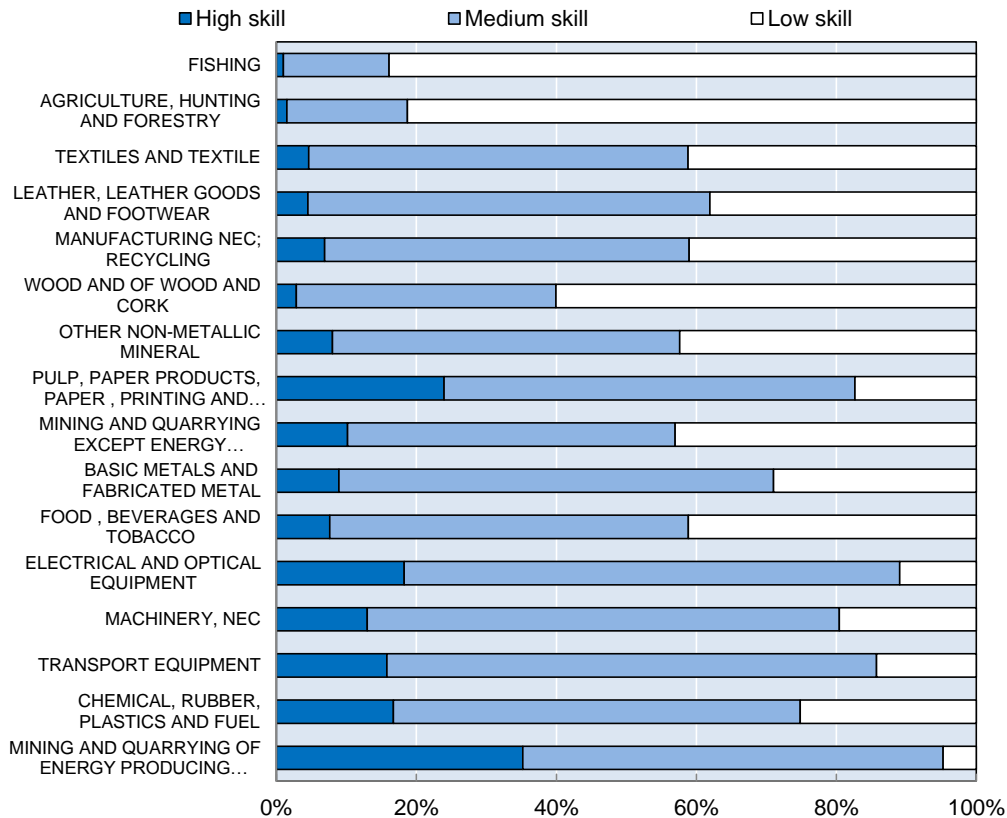
The amount of labour required to produce BRL 1 million (direct labour coefficient) varies substantially across industries, with an average score of 13.1 in 2008. Agricultural and fishing activities stand out for their very high labour coefficients: 54.5 and 102.2 in 2008, which reflects high labour intensity of these sectors. Other industries that are relatively labour intensive (as expressed in by an above-average labour coefficient) are the textiles and clothing (34.2), footwear (30.8), wood and wood products (21.8), other manufactured goods and non-metallic minerals (23.1) sectors. The industries that require more labour are also those that employ more low-skilled labour. For example, over 80% of the labour employed in agriculture and fishing is less skilled, as is over half of the employment in wood and wood products. At the other extreme are the natural resources and mining industry for energy generation, where the labour coefficient is only 0.6 and medium and high skilled labour dominates. The remaining industries have labour coefficients that range from 2.6 to 11.3 and the employees are largely of medium skill.

²³ The category “primary and secondary sectors” refers to the sum of agriculture, livestock, fishing, extractive industry and manufacturing (it excludes services).

Table 7. Labour content of production: direct employment to output ratio, by skill level and sectors, 2002-08 (in 2008 prices)

	2002				2005				2008			
	Employment	High skill	Medium skill	Low skill	Employment	High skill	Medium skill	Low skill	Employment	High skill	Medium skill	Low skill
AGRICULTURE, HUNTING AND FORESTRY	67.9	0.5	7.0	60.1	70.0	0.5	9.6	59.7	54.5	0.8	9.4	44.2
FISHING	95.5	0.6	10.4	84.3	118.0	0.6	15.4	101.9	102.2	1.0	15.4	85.5
MINING AND QUARRYING OF ENERGY PRODUCING MATERIALS	0.6	0.2	0.3	0.1	0.5	0.1	0.3	0.1	0.6	0.2	0.4	0.0
MINING AND QUARRYING EXCEPT ENERGY PRODUCING MATERIALS	12.1	0.7	3.4	7.8	9.2	0.6	3.3	5.3	7.6	0.8	3.5	3.3
FOOD , BEVERAGES AND TOBACCO	6.2	0.4	2.8	2.9	6.4	0.3	2.8	3.2	6.4	0.5	3.3	2.6
TEXTILES AND TEXTILE	30.8	0.9	13.3	16.2	33.4	1.2	16.2	15.8	34.2	1.6	18.4	14.0
LEATHER, LEATHER PRODUCTS AND FOOTWEAR	23.5	0.7	9.6	13.0	27.8	0.8	14.5	12.3	30.8	1.4	17.6	11.7
WOOD, PRODUCTS OF WOOD AND CORK	26.0	0.6	7.8	17.3	23.5	0.7	7.8	14.6	21.8	0.6	8.0	12.9
PULP, PAPER, PAPER PRODUCTS, PRINTING AND PUBLISHING	10.6	2.2	6.0	2.3	9.9	2.4	5.8	1.6	11.3	2.7	6.6	2.0
CHEMICAL, RUBBER, PLASTICS AND FUEL	2.9	0.5	1.5	0.9	2.8	0.5	1.5	0.8	2.6	0.4	1.5	0.7
OTHER NON-METALLIC MINERAL	17.5	0.8	6.1	10.5	15.9	0.8	6.5	8.5	13.1	1.0	6.5	5.5
BASIC METALS AND FABRICATED METAL	7.6	0.6	3.7	3.2	5.7	0.4	3.0	2.2	6.6	0.6	4.1	1.9
MACHINERY, NEC	6.2	0.8	3.4	2.0	6.5	0.8	4.0	1.7	4.3	0.6	2.9	0.8
ELECTRICAL AND OPTICAL EQUIPMENT	4.6	0.9	2.7	1.0	4.9	0.8	3.4	0.6	5.2	1.0	3.7	0.6
TRANSPORT EQUIPMENT	3.6	0.5	2.2	1.0	3.2	0.4	2.2	0.6	3.4	0.5	2.4	0.5
MANUFACTURING NEC; RECYCLING	23.2	0.8	11.0	11.0	25.2	1.3	12.6	10.9	23.1	1.6	12.0	9.4

Source: IBGE. Authors' elaboration.

Figure 6. Sectoral employment by skill levels, 2008 (% of total)


Source: SECEX and PNAD/IBGE. Authors' elaboration.

4.3 *The direct labour content of Brazilian exports*

The increase in Brazilian exports did not result in a strong increase in employment. Total employment directly created by exports rose only by 2% between 2002 and 2008, while total employment increased by roughly 18% in the period. Exports, however, expanded by over 200%. Note that this considers only employment created *directly* by exports (Table 8).

This difference may be explained, on the one hand, by the decline in employment to production ratios (labour coefficients) for production in nine of the 16 industries analysed. Several industries, relevant in terms of exports and jobs, saw a steep decline in their labour coefficients. On the other hand, exports of goods with a low labour content rose significantly. This is the case for mining and quarrying of energy producing materials and food and beverages, which saw their share in total exports rise from 10.8% in 2002 to 25.7% in 2008.

In terms of skills, employment associated with exports reflected the same trajectory as total employment. A comparison between 2002 and 2008 indicates a substantial decline in low skilled jobs (-13%) and growth of over 30% for medium and highly skilled employment. The drop in less skilled employment is widespread and occurs in almost every sector except for food and beverages.

Table 8. Direct employment associated with exports, by skill level and industry, 2000 and 2008

Activities KLEMS	Number of jobs				Number of jobs			
	2002				2008			
	Employment	High skill	Medium skill	Low skill	Employment	High skill	Medium skill	Low skill
AGRICULTURE, HUNTING AND FORESTRY	1 888 996	13 262	195 016	1 671 380	2 002 053	30 071	343 936	1 623 060
FISHING	17 760	112	1 937	15 685	5 358	54	806	4 480
MINING AND QUARRYING OF ENERGY PRODUCING MATERIALS	5 849	1 689	3 003	1 127	17 545	6 179	10 533	834
MINING AND QUARRYING EXCEPT ENERGY PRODUCING MATERIALS	175 707	10 701	49 016	113 236	228 908	23 106	106 522	97 988
FOOD , BEVERAGES AND TOBACCO	344 669	21 397	156 811	161 516	409 525	31 045	208 730	167 559
TEXTILES AND TEXTILE	152 628	4 685	65 793	80 231	143 693	6 598	77 562	58 937
LEATHER, LEATHER PRODUCTS AND FOOTWEAR	269 241	8 013	109 628	149 199	203 949	9 111	116 588	77 281
WOOD, PRODUCTS OF WOOD AND CORK	215 290	5 119	64 741	142 902	109 108	3 057	40 029	64 799
PULP, PAPER, PAPER PRODUCTS, PRINTING AND PUBLISHING	107 055	22 405	60 703	23 077	122 528	29 209	71 653	21 145
CHEMICAL, RUBBER, PLASTICS AND FUEL	96 446	16 013	49 140	30 171	118 441	19 659	68 453	29 609
OTHER NON-METALLIC MINERAL	78 511	3 689	27 270	46 978	52 013	4 154	25 667	21 936
BASIC METALS AND FABRICATED METAL	242 525	18 602	118 756	101 565	281 083	25 014	173 415	80 995
MACHINERY, NEC	96 212	12 194	52 626	30 422	84 165	10 891	56 618	16 426
ELECTRICAL AND OPTICAL EQUIPMENT	75 232	14 185	44 819	15 886	70 852	12 946	50 143	7 763
TRANSPORT EQUIPMENT	153 248	19 603	91 006	41 864	162 532	25 573	113 196	23 113
MANUFACTURING NEC; RECYCLING	93 765	3 182	44 468	44 658	65 447	4 486	33 962	26 753
TOTAL	4 013 135	174 850	1 134 733	2 669 895	4 077 200	241 151	1 497 810	2 322 679
<i>% of total employment (Brazil)¹</i>	5.2	2.2	4.0	6.7	4.5	1.9	3.6	6.3

Notes: ¹ total employment (services included) of Brazilian economy.

Source: IBGE.

4.4 Indirect labour content of Brazilian exports

The analysis in this paper has so far shown employment changes associated directly with exports. However, trade-related activities can also increase demand in sectors of the domestic economy that are not directly engaged in trade (e.g. support services, upstream industries), thereby leading to employment spillover effects. In order to provide an estimate of the magnitude of these effects in the Brazilian economy, we refer to the analysis by Castilho (2011a) focusing specifically on this aspect.

For the year 2005, Castilho (2011a) provides an estimation of the indirect employment generated by exports. For industry, agriculture and fishing, she finds that the number of indirect jobs is equivalent to 170% of the number of direct jobs. However, the importance of indirect employment varies widely across sectors. Table 9 shows the results for direct and indirect employment associated with exports and provides evidence that some areas create primarily direct jobs – agriculture is the most striking example – while others have a much larger share in total employment generated by exports through indirect channels. Such is the case with food and beverages, which account for roughly 30% of indirect employment (while only 10% of direct employment), and chemicals with 10% contribution to indirect employment created by industrial and agricultural exports (but only 2% share in direct employment gains).

Table 9. Direct and indirect employment associated with Brazilian exports, 2005 (number of jobs)²⁴

	Direct employment		Indirect employment	
	Number of employees	% of total	Number of employees	% of total
AGRICULTURE, HUNTING AND FORESTRY	2 254 084	54.4	3 224 681	30.1
FISHING	27 221	0.7	33 574	0.3
MINING AND QUARRYING OF ENERGY PRODUCING MATERIALS	6 121	0.1	216 062	2.0
MINING AND QUARRYING EXCEPT ENERGY PRODUCING MATERIALS	71 079	1.7	134 176	1.3
FOOD , BEVERAGES AND TOBACCO	434 481	10.5	3 273 126	30.6
TEXTILES AND TEXTILE	175 416	4.2	353 606	3.3
LEATHER, LEATHER PRODUCTS AND FOOTWEAR	221 048	5.3	289 441	2.7
WOOD, PRODUCTS OF WOOD AND CORK	189 746	4.6	295 237	2.8
PULP, PAPER, PAPER PRODUCTS, PRINTING AND PUBLISHING	44 828	1.1	168 775	1.6
CHEMICAL, RUBBER, PLASTICS AND FUEL	90 545	2.2	1 091 769	10.2
OTHER NON-METALLIC MINERAL	894	2.2	124 105	1.2
BASIC METALS AND FABRICATED METAL	115 158	2.8	654 767	6.1
MACHINERY, NEC	118 551	2.9	250 239	2.3
ELECTRICAL AND OPTICAL EQUIPMENT	74 738	1.8	12 994	1.2
TRANSPORT EQUIPMENT	134 439	3.2	349 224	3.3
MANUFACTURING NEC; RECYCLING	99 756	2.4	112 979	1.1
TOTAL	4 146 611	100.0	10 701 701	100.0

Source: IBGE and SECEX. Extracted from Castilho (2011a).

²⁴ These data are equivalent to multiplying the coefficient of labour by the direct and indirect exports, calculated by multiplying the trade values by the inter-sectoral impact matrix, known as the Leontief matrix. For greater detail, see the original text (Castilho, 2011a).

4.5 Different trading partners, different effects on employment

Brazil's export specialisation by sector differs by trading partner as does the associated employment intensity and skill intensity due to the type of products exported. For example, an increase in exports to a partner that imports highly labour intensive goods – e.g. some manufactured goods – may exert a stronger positive influence on Brazilian employment, than an increase in exports to a partner that imports less labour intensive goods – e.g. some commodities. An analysis based on the employment-to-production ratios taking into account the mix of exports from a country provides a simple but fairly robust indicator of employment effects of exports, at least in the short to medium term.²⁵ In this section, the labour content of Brazilian exports is estimated based on bilateral trade flows with the country's main trade partners.

The level and skill-mix of employment directly related to exports can vary significantly by destination market (Table 10 and Figure 7). Exports to the European Union account for the largest volume of employment among Brazil's trade partners. This is due to, on the one hand, the European Union's weight in Brazil's total trade (21% of the total in 2010), and, on the other hand, the substantial share of labour intensive goods, agriculture in particular, in exports. In this case, low skill jobs dominate (64% of the total). In case of China, employment associated with exports grew rapidly and, by 2008, accounted for 15.8% of jobs directly associated with total exports. Among Brazil's destination markets, the employment mix directly related to exports to China has the highest share of low skill employment (72%). In MERCOSUR's case, owing to the importance of low labour content manufactured goods in exports, the volume of jobs created by exports to these partners is quite low, representing in 2008 only 6.4% of total exports employment. With respect to MERCOSUR, the export jobs are predominantly medium skilled and only 32% of them are low skilled. Unsurprisingly, given the decline in exports to the United States, its share in directly export-related employment dropped from 19.4% in 2002 to 10.3% in 2008. In terms of skill level, exports to the United States generated relatively high shares of medium and high skill jobs, which is a profile closer to that of MERCOSUR than to those of the EU or China.

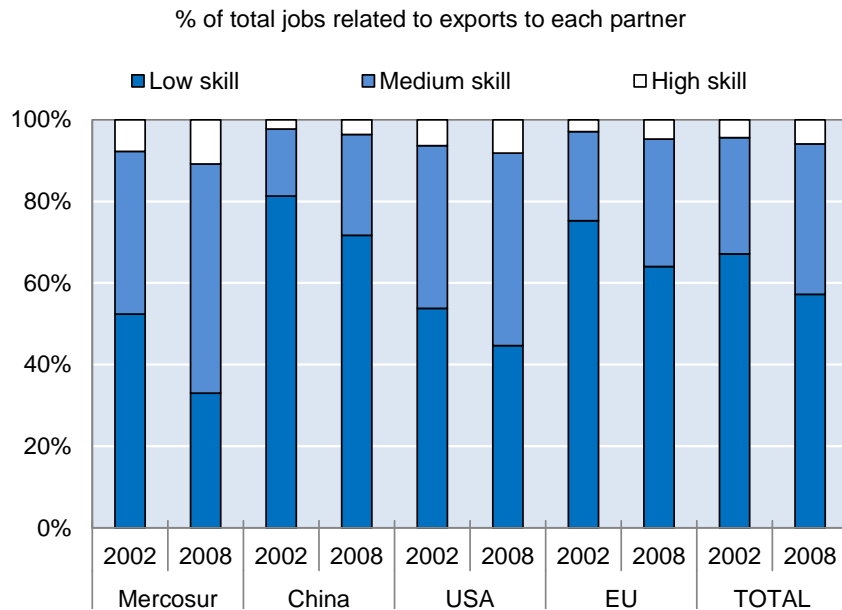
Table 10. Direct employment associated with exports according to trade partner (number of jobs)

		High skill	Medium skill	Low skill	TOTAL	% total
Mercosur	2002	10 812	55 487	72 978	139 277	3.5
	2008	28 132	145 943	85 658	259 733	6.4
China	2002	8 016	59 009	290 975	358 000	9.0
	2008	22 878	158 721	459 770	641 368	15.8
USA	2002	49 191	308 201	415 712	773 104	19.4
	2008	34 408	198 141	187 812	420 361	10.3
EU	2002	43 907	329 054	1 137 069	1 510 029	37.9
	2008	61 853	410 460	839 806	1 312 120	32.3
TOTAL	2002	174 850	1 134 733	2 669 895	3 979 477	100.0
	2008	241 151	1 497 810	2 322 679	4 061 641	100.0

Source: IBGE and Secex. Authors' calculations.

²⁵ Naturally, this analysis is not intended to provide a comprehensive economic assessment. It does not take into account the effects on wages and prices, for example.

Figure 7. Evolution of Brazilian employment associated with exports, by trading partner and skill level, 2002 and 2008



Source: IBGE and Secex. Authors' calculations.

5. Conclusions

Brazilian exports expanded vigorously in the 2000s and contributed positively to employment generation, though this contribution was relatively small compared to employment gains from domestic demand. Indeed, the increase in domestic demand and, particularly, in household consumption, was a key factor in the employment expansion. This expansion was characterised by a general increase in the skill content of employment. Mainly as a consequence of shifts in the composition of trade, the jobs created by exports amounted to only about 15% of those created by domestic demand and the export-related jobs were predominantly low skilled.

In 2008, the number of jobs directly associated with exports was equal to roughly 5% of total employment in the economy. If indirect employment is considered, the number of jobs associated with exports more than doubles. However, even considering labour indirectly associated with exports, the volume of employment associated with exports did not keep pace with the sharp rise in the volume of exports during the 2000s. This was the result of a combination of technical change (especially in some sectors such as agriculture) that led to a significant decline in the labour content of production and the changing composition of exports.

The recent growth in Brazilian exports was characterised by substantial change in the composition of exports by sector and geographic destination. On the one hand, manufactured goods lost importance in light of the advance of the basic products (agricultural and mineral commodities) in the mix. On the other hand, the geographic dispersion of Brazilian exports increased owing to the decline in importance of the United States as a destination market, and the strengthening of other markets, among which China stands out. The change in the sectoral composition of exports is closely related to the change in geographic distribution, as illustrated by the decline in demand for Brazilian manufactured exports in the United States and the increase in demand for Brazilian commodities in China.

Such changes in the export profile have significant implications in terms of the number of jobs created and the demand for skills. The majority of jobs created in relation to exports is low skilled (67% of the total), a percentage higher than that for total employment in the economy. Of the key destinations for Brazilian exports, those that create relatively large volumes of jobs are the European Union and China, and these jobs are largely less skilled. Employment associated with exports to China grew most and by the end of the period was equal to 17% of jobs directly associated with total exports. In the case of MERCOSUR, in 2008 jobs created by exports were only equal to 6% of total jobs created by Brazilian exports, yet with a higher level of skills required. Overall, these developments represent a striking change in the influence of exports on the demand for labour in Brazil.

Annex Table

Composition of Brazilian exports according to partners, 2000 – 10 (% of total)

Countries / Period	2000/ 2001	2005/ 2006	2009	2010
Mercosur	12.7	10.2	10.3	11.2
Argentina	10.1	8.6	8.4	9.2
Uruguay	1.2	0.7	0.9	0.8
Paraguay	1.4	0.9	1.1	1.3
ALADI	9.9	12.4	9.2	9.2
Bolivia	0.6	0.5	0.6	0.6
Colombia	1.0	1.4	1.2	1.1
Chile	2.3	3.0	1.7	2.1
Peru	0.6	1.0	1.0	1.0
Mexico	3.2	3.4	1.7	1.8
Venezuela	1.7	2.3	2.4	1.9
European Union	26.7	21.9	22.2	21.4
Germany	4.5	4.3	4.0	4.0
Spain	1.8	1.8	1.7	1.9
Italy	3.6	2.8	2.0	2.1
France	3.0	2.1	1.9	1.8
North America	29.2	24.0	11.3	10.8
United States	27.2	18.5	10.2	9.6
Asia	11.9	15.7	25.8	27.9
China	2.7	6.1	13.2	15.2
India	0.5	0.8	2.2	1.7
Japan	4.0	2.9	2.8	3.5
South Korea	1.2	1.5	1.7	1.9
Middle East	3.0	4.0	4.9	5.2
Africa	3.0	5.3	5.7	4.6
TOTAL (in USD million)	55 572	125 772	152 995	201 915

Note: ALADI is the acronym for the Latin American Integration Association (<http://www.aladi.org/nsfweb/sitiolng/>).

Source: SECEX. Authors' elaboration.

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Annex

Methodological notes and data description

The present study uses two different methodologies to evaluate the extent to which the greater external exposure of the Brazilian economy in the 2000's has contributed to the evolution of employment in the country.

The first methodology was used to determine the contribution of final demand components to employment growth (section 4.1). The analytical framework of this work consists of the input-output model, upon which was developed the methodology of structural decomposition analysis (SDA). In general, this methodology aims at quantifying the contribution of explanatory factors of a particular variation. This kind of analysis has its origins in the work of Leontief, Chenery and Carter (see also Rose & Casler, 1996) and since then it has been used in and improved by several studies, particularly those that investigate changes in employment.

The present paper applies the methodology presented in detail in Kupfer, Freitas and Young (2004) (see also Miller and Blair, 2009), in which the authors measured the contribution of domestic demand, exports, imports and technological change to the change in employment in the Brazilian economy between 1990 and 2001. While the contribution of the first two factors stems from its variation, in the case of imports, the contribution of variation in the coefficients of domestic final demand related content and those of imported inputs associated with the intermediate demand is considered. Concerning the latter element, the change in employment resulting from technological change corresponds to changes in the array of both total requirements of inputs and the coefficients of occupation of various productive activities. Direct and indirect requirements are considered in the analysis.

The data used for the structural decomposition comes from the input-output matrices. The latest IO matrices compiled by IBGE are those of 2000 and 2005. For the other years, we used those estimated by the Industry and Competitiveness Research Group (GIC/IE-UFRJ), on the basis of partial information published in the Resources and Uses Tables of the System of National Accounts, run by IBGE, combined with the structural information contained in the two matrices published by IBGE for 2000 and 2005 years.

The second methodology - based on the labor content of trade - was employed to estimate the volume of direct and indirect employment associated with exports, according to the skill level of workers and the geographical composition of Brazilian exports (sections 4.2 to 4.5).¹

Factor content calculation is a simple methodology in which an estimate is made of the amount of labor contained in the goods exported and imported, corresponding to the jobs generated in the export sectors and those "lost" or "threatened" in the sector competing with imports. The calculation is carried out on the basis of employment multipliers, which are normally estimated from local production (employment/currency unit) and then applied to the trade flows of a given country.

¹ The presentation of the labor content reproduces partially the "Methodological notes" from Castilho (2005).

This methodology derives from the techniques for breaking down the factors that explain the variation in employment. Starting from the accounting identities

$$C = Q - X + M \quad \text{and} \quad P = Q/E'$$

where the variables represent consumption (C), production (P), exports (X), imports (M), productivity (P) and employment (E), for sector *i* (not shown), the following is obtained:

$$\Delta E = (1/P_0) [\Delta C + \Delta X - \Delta M - E_0 \Delta P]$$

In order to evaluate the impact of trade on employment, supposing that changes in the external sector do not affect consumption and productivity, then the variation in employment will correspond to the variation in the trade balance multiplied by the employment multiplier (inverse of productivity). This methodology has various limitations, such as the assumption that there is no interaction between the various terms in the first equation and the disregard for price effects. In spite of its several limitations, most economists continue to use this methodology and, as Cortes, Jean and Pisani-Ferry (1996, p. 21) say, analysts still consider it a “good starting-point”.

The coefficients may be direct or indirect, depending on whether or not the use of intermediate goods is taken into account by means of the technical coefficients provided by the input-output matrices. The calculation of factor content may take account of one or two production factors, depending on the purpose of the study. The calculation of the use of a single factor, as we have done here, aims at examining the effect of variations in the level of trade on the stock of the factor in question.

To calculate the labor content of Brazil's exports its main trading partners are disaggregated, according to the level of schooling of the workers, for the years 2002 and 2008. We take into account not only sales and purchases of final goods, but also the use made of intermediate goods. For this, we first calculate the total amount effectively exported by each sector, taking into account the inputs used, and then the direct employment coefficient is applied. The calculation is as follows:

$$E_{jx1} = N_{jxj} * [A_{jxj} * X_{jx1}]$$

where *E* is the amount of labor in each sector *j* contained in “direct” and “indirect” exports; *N* is a diagonal matrix in which the terms of the main diagonal correspond to the direct employment coefficients contained in *N*, while *A* is the Leontief matrix of technical coefficients for *j* sectors and *X* is the vector of sectoral exports.

In the present study, we present the indirect and direct labor content of exports for total exports (all destinations), extracted from Castilho (2011a), and the direct labor content of exports when disaggregated by trade partners.

The Brazilian trade data come from SECEX/MDIC. Production data and the Input-Output Matrix (2005) are estimated by IBGE. Data on employment, according to the skill level of workers, are provided by the National Household Survey (PNAD-IBGE).