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Winners and Losers from a Commodities-for-Manufactures Trade Boom

Francisco Costa
Jason Garred
João Paulo Pessoa

THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

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Abstract
A recent boom in commodities-for-manufactures trade between China and other developing countries has led to much concern about the losers from rising import competition in manufacturing, but little attention on the winners from growing Chinese demand for commodities. Using census data for Brazil, we find that local labour markets more affected by Chinese import competition experienced slower growth in manufacturing wages and in-migration rates between 2000 and 2010, and greater rises in local wage inequality. However, in locations benefiting from rising Chinese demand, we observe higher wage growth, lower takeup of cash transfers and positive effects on job quality.

Key words: China, trade, commodities-for manufactures, wages, employment, informality
JEL: F14, F16, O17, Q17

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Francisco Costa is an Assistant Professor of Economics at FGV/EPGE, Brazil. Jason Garred is a PhD student at London School of Economics and a member of the Centre for Economic Performance Globalisation Programme. João Paulo Pessoa is a PhD student at London School of Economics and a member of the Centre for Economic Performance Globalisation Programme.

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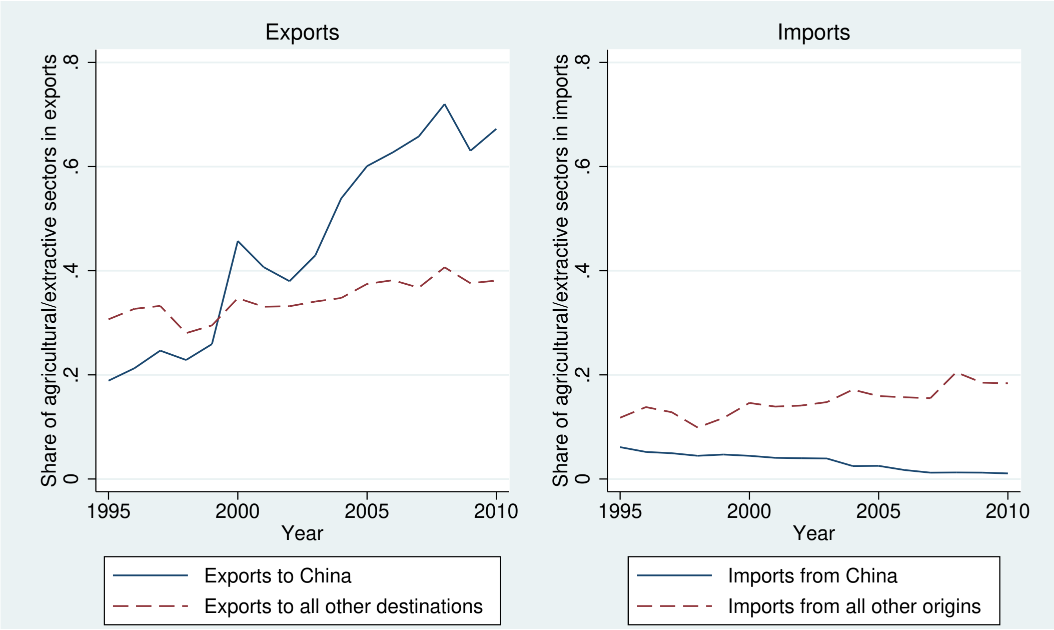
1 Introduction

China's recent emergence as a major force in the world economy is one of the largest economic events of recent times. The combination of China's exceptionally high rates of economic growth, its increasingly deep engagement with the rest of the world via international trade, and the sheer size of its stock of labour, land and capital has generated a set of economic shocks whose influence stretches worldwide. Much of the attention on the effects of China on the economies of other countries has focused on the import competition shock associated with the massive growth of the Chinese manufacturing sector. However, China is also an increasingly large consumer of goods produced abroad: if China has been the source of a large supply shock, it must also have been the source of a large demand shock. We will consider the heterogeneous effects of these supply-side and demand-side 'China shocks' on developing-country labour markets, by examining the case of Brazil.

For developing countries, the 'China demand shock' has taken a distinctive form: increasingly, outside of the manufacturing supply chains of East and Southeast Asia, the goods being sent to China by non-high-income countries are products of the agricultural and extractive sectors. Panel A of Figure 1 shows that while there has been a gradual rise in the share of agricultural and extractive sectors in the exports of non-high-income countries (excluding those in East and Southeast Asia) to destinations other than China, the importance of these industries in their exports to China has changed much more dramatically, rising from less than 20% in 1995 to nearly 70% in 2010. Meanwhile, developing countries' imports from China have become increasingly concentrated in manufactures: Panel B of Figure 1 shows that the share of products of the agricultural and extractive sectors in the imports of non-high-income countries from China, already small (6%) in 1995, had dwindled to 1% by 2010. This shift towards a commodities-for-manufactures trade relationship with China has coincided with a sharp increase in China's overall importance in developing countries' foreign trade (Panel A of Figure 2).

Just as the import side of this boom in trade with China has often been met with suspicion by policymakers and commentators concerned about effects on local industry (see e.g. Economist 2012), China's rising demand for unglamorous agricultural and mining products has similarly not always been treated with enthusiasm. Before a visit to China in 2011, Brazil's president pledged that she would be "working to promote Brazilian products other than basic commodities," amid concern that "overreliance on exports of basic items such as iron ore and soy" might result in 'de-industrialization' (LA Times 2011). Similarly, a former trade minister of Brazil has spoken of the "need to iron out distortions in the trade relationship, in which Brazil sells commodities and China manufactures" (Bloomberg 2011).

In our study of Brazil, we examine the changing labour market outcomes of regions



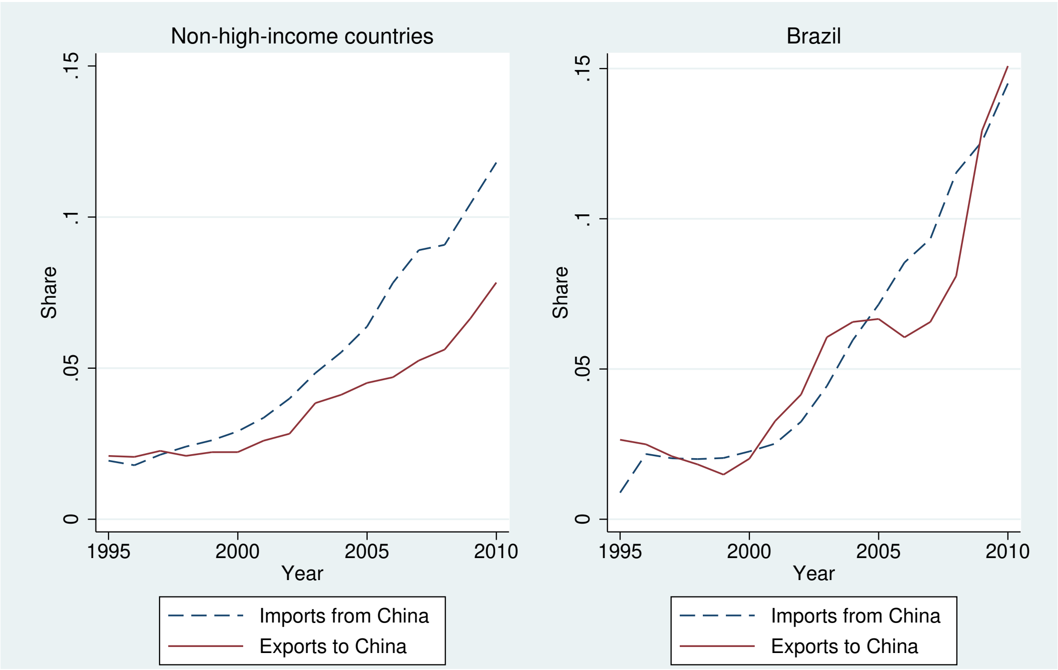
Panel A Panel B

Figure 1: Evolution of the Share of Agricultural and Extractive Sectors in the Exports and Imports of Non-High-Income Countries

Notes. These graphs present the evolution of the share of products of the agricultural and extractive sectors (agriculture, forestry, fisheries/aquaculture and mining) in the exports and imports of non-high-income countries (excluding those in East and Southeast Asia) from 1995 to 2010. *Sources*: CEPII BACI for trade data; definition of high-income countries from the World Bank.

producing manufactures affected by rising Chinese import supply and localities specializing in commodities demanded by China. We find that while labour markets in 'loser' regions indeed appear to have suffered from Chinese import competition via slower growth in manufacturing wages and rising wage inequality, it is also the case that 'winner' regions have gained from Chinese export demand, through faster wage growth, lower takeup of social assistance and shifts in the local economy towards 'good jobs'.

Brazil provides an excellent context for a study of China's impact on developing countries' labour markets for several reasons. First, the importance of China in both the imports and exports of Brazil has risen steeply in recent years, as seen in Panel B of Figure 2. In 2000, Brazil received approximately 2.3% of its imports by value from China and sent 2.0% of its exports to China; by 2010, these shares were 14.5% and 15.1% respectively. Second, the pattern of Brazil-China trade has followed the broad trends outlined above for the wider set of non-high-income countries: Brazilian exports to China are increasingly products of the agricultural and extractive sectors, while Brazilian imports from China have remained concentrated in manufacturing (see Figure 3). Third, Brazil is particularly large and has a diverse geography, generating a set of local labour markets that are highly varied in their comparative advantages, and thus allowing for identification of the heterogeneous effects of trade with China without relying on cross-country



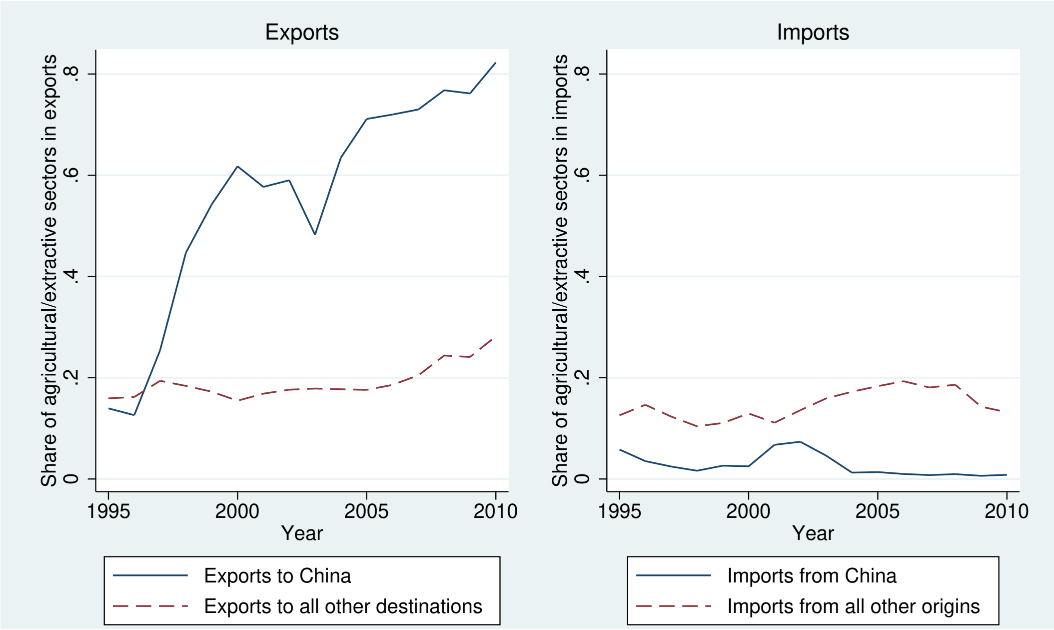
Panel A Panel B

Figure 2: Evolution of the Share of China in the Imports and Exports of Non-High-Income Countries and Brazil

Notes. Panel A presents the evolution of the share of China in the imports and exports of non-high-income countries (excluding those in East and Southeast Asia) from 1995 to 2010. Panel B presents the time series of the share of China in the imports and exports of Brazil from 1995 to 2010. *Sources*: CEPII BACI for trade data; definition of high-income countries from the World Bank.

regressions. Fourth, the Brazilian population census captures a variable of particular relevance in developing countries: informality. This is important both because the informal sector is large – in Brazil, approximately half of the employed population in 2000 were either informal salaried workers or self-employed – and because the (de-)formalization of labour markets is a potentially important but understudied effect of trade shocks affecting developing countries.

In order to identify the effects of demand and supply shocks originating from China on local labour markets in Brazil, we use the shift-share methodology of Bartik (1991), which has previously been applied to the study of trade shocks by Topalova (2007), Autor et al. (2013) and others. This method compares locations with different initial comparative advantages, tracing the fortunes of regions whose basket of industries has been faced with steeper increases in Chinese supply or demand, as compared to locations whose industries have been relatively unaffected by China's emergence. Because some agricultural, extractive and manufacturing industries have been affected more than others by China, we are able to compare regions with identical initial employment shares in each of these three broad categories. For example, our identification strategy relies on comparisons of regions with the same share of employment in agriculture in 2000 but



Panel A Panel B

Figure 3: Evolution of the Share of Agricultural and Extractive Sectors in the Exports and Imports of Brazil

Notes. These graphs present the evolution of the share of products of the agricultural and extractive sectors (agriculture, forestry, fisheries/aquaculture and mining) in the exports and imports of Brazil from 1995 to 2010. *Sources*: CEPII BACI for trade data; definition of high-income countries from the World Bank.

different patterns of specialization across crops. Our measures of Chinese supply and demand shocks are based on changes in actual trade flows between China and Brazil, but we instrument for these variables to ensure that our results capture neither Brazil-specific shocks nor changes in world prices that are not directly due to China. We also run robustness checks that account for the possibility that our results are driven by other region-specific trends.

We consider the changes between 2000 and 2010 in several key characteristics of local labour markets that can be observed using Brazilian census data: wages, employment rates, in-migration rates, informality and occupational skill level, along with participation in one of the largest cash transfer programs in the world, *Bolsa Família*. We find that locations subject to larger increases in Chinese import competition experienced slower growth in manufacturing wages and in-migration rates during this period, as well as a greater rise in local wage inequality. Our estimates suggest that for a local labour market at the 80th percentile of the 'China supply shock', wage growth in manufacturing sectors was lower by 2.4 percentage points over the ten years between 2000 and 2010, while wage inequality rose by an additional 0.8% relative to average 2000 levels. On the other hand, the supply shock does not appear to have been associated with a fall in employment rates. Instead, there is some evidence of a rise in the employment rates of affected locations, though this appears to have involved a shift in the local structure of employment towards unskilled jobs in nontraded sectors and a decline in the share of the workforce in skilled manufacturing jobs.

Meanwhile, in locations more exposed to rising demand from China, average hourly wages increased more quickly during the period of study: a local labour market at the 80th percentile of the shock to Chinese demand experienced wage growth in the agricultural and extractive sectors that was four percentage points higher over the course of the decade. This wage effect appears to have spilled over to workers in other local industries, and to have occurred without an associated increase in wage inequality. *Bolsa Família* takeup rates were also lower in 2010 in regions benefiting more from Chinese demand. Moreover, while there is little evidence of an effect of demand from China on local employment rates, we do observe positive effects on job quality: an increase in the share of formal employment at the expense of informal jobs, and a rise in the proportion of the local workforce in skilled agricultural or extractive sector occupations.

This paper contributes to a growing literature on the worldwide effects of the rise of China. This includes papers that have studied the impact of Chinese import competition on economic variables such as manufacturing employment (Pierce and Schott 2012, Autor et al. 2013), worker earnings (Pessoa 2014), skill upgrading (Hsieh and Woo 2005, Mion and Zhu 2013), firm and product selection (Iacovone et al. 2013) and innovation (Bloom et al. 2011). There are a much smaller number of papers which, like this paper, also take account of demand-side effects. Dauth et al. (2012) take a reduced-form approach, examining the impact of rising imports from and exports to China and Eastern Europe on local labour market variables in Germany. Dauth et al. study a developed-country context in which agricultural and extractive sectors are relatively unimportant, and so focus on the effects of these trade shocks on the manufacturing and services sectors. General equilibrium analyses of China's effect on the world economy (such as Hsieh and Ossa 2011 and di Giovanni et al. forthcoming) also take account of both the supply and demand effects of China on other countries, but these studies summarize the impact of China on aggregate welfare rather than distinguishing between the potentially heterogeneous impacts of rising Chinese import competition and export demand.

Our work also relates to the wider literature studying the impact of trade shocks on labour markets. Several other papers investigate the effect of trade on workers in Brazil (e.g. Gonzaga et al. 2006, Menezes-Filho and Muendler 2011, Helpman et al. 2012, Kovak 2013, Dix-Carneiro forthcoming), with particular attention given to Brazil's early 1990s trade liberalization. Most research on trade and labour markets, including much of the literature on Brazil, is limited to studying workers in formal employment. Our work also fits into the smaller literature on trade and informality, including Goldberg and Pavcnik (2003), Nataraj (2011), McCaig and Pavcnik (2012) and Paz (2014). Finally, our paper contributes to the literature on the local labour market effects of shocks involving nonmanufacturing sectors; one particularly relevant study is Aragón and Rud (2013), who examine the local economic impact of a Peruvian gold mine.

The paper is organized as follows: we first describe our data sources and present our identification strategy in Section 2. We then discuss the results of our empirical analysis in Section 3, and draw conclusions in Section 4. Additional figures and tables are included in an attached appendix.

2 Data and Empirical Strategy

This section describes the data used in the study and outlines our empirical strategy, discussing our baseline OLS specification, instrumental variables and robustness checks.

2.1 Data Sources

We use individual-level labour market and socioeconomic data from the long form Brazilian Demographic Census (*Censo Demográfico*) for 2000 and 2010, sourced from the Brazilian Institute of Geography and Statistics (IBGE); some specifications also use individual-level data from the 1991 census. The data contains a number of labour market variables, including employment status, monthly income from employment and hours worked per week, along with information on migration and other demographic variables; we will discuss the variables we use in our analysis in greater depth below. We restrict our sample to the subpopulation most likely to participate in the labour market, defining the workforce as every individual between 18 and 60 years old. We then aggregate the data to the geographical unit 'microregion', a level of aggregation that has been constructed by IBGE by grouping Brazilian municipalities according to information on integration of local economies. Our sample includes all of the 558 Brazilian microregions, each of which contains an average of 10 municipalities.

We draw information on informality from a question in the census asking employed individuals about their job type: government worker; employee registered at the Brazilian Ministry of Labour and Employment (*com carteira assinada*); employee not registered at the Ministry of Labour and Employment (*sem carteira assinada*); self-employed; or in unpaid work. We include the final three categories in our definition of the informal sector.[1] We also use information on individuals' occupations from the 2000 and 2010

[1] Although a self-employed worker could be registered with the federal government, these cases constitute a small fraction of all self-employed individuals. Publicly available administrative data from the *Relaçao Anual de Informaçoes Sociais* (RAIS) database – the official records of the Ministry of Labour and Employment – show that only 0.9% and 0.8% of the workforce were registered as self-employed in 2000 and 2010, respectively. We observe total rates of self-employment of 18.3% and 15.7% of the workforce in these two years' censes.

censes, defining 'skilled occupations' and 'unskilled occupations' using the definition of occupational skill level from the 2008 International Standard Classification of Occupations (ISCO-08). In particular, we define a skilled occupation as one associated with skill level 3 or 4 in the ISCO-08 classification; this covers managers, professionals, technicians and associate professionals. While the occupational classification in the 2010 Brazilian census is almost identical to ISCO-08, we need to use publicly available concordances between the Brazilian occupational classification CBO-02 and ISCO-88, and between ISCO-88 and ISCO-08, to classify the occupations observed in the 2000 census into skilled and unskilled occupations.

Our data on international trade in goods is from the BACI database developed by Centre d'Etudes Prospectives et d'Informations Internationales (CEPII), which reconciles the data separately reported by importers and exporters in the United Nations Statistical Division's COMTRADE database. CEPII BACI contains the total annual value of bilateral trade at the 6-digit level of the Harmonized System classification for more than 200 countries from 1995 to 2010; we use data for 2000 and 2010 in the analysis below. The CEPII data is denominated in thousands of current US dollars; we convert 2000 values to 2010 US dollars using the US GDP deflator from the US Bureau of Economic Analysis.

Our empirical strategy requires us to classify employed individuals in the 2000 census data and products in the 2000 and 2010 trade data into sectors. In the 2000 Brazilian census, individuals are asked to state their sector of activity according to the 5-digit *CNAE Domicílio* classification.[2] We thus construct a concordance assigning products in the trade data to *CNAE Domicílio* sectors, which requires us to combine some of the traded goods sectors in *CNAE Domicílio* when these cannot be separately identified in the trade data. We are left with a total of 82 traded goods sectors, including 32 agricultural and extractive sectors (22 agricultural sectors, 8 mining sectors, forestry and fishing/aquaculture) and 50 manufacturing sectors; see Table A1 for a full list.[3]

2.2 Baseline Specification

To estimate the heterogeneous impacts of supply and demand shocks at the microregion level, we first create sector-level measures of each shock and then define exposure to a shock according to local comparative advantage across sectors, as measured by the sectoral composition of employment in each microregion in 2000. This is the 'shift-share' methodology of Bartik (1991), as applied to trade shocks by Topalova (2007) and to the effect of China on US labour markets by Autor et al. (2013). Given the existence of

[2]This is defined as the main sector of activity of the firm or other institution of an employed person or the nature of the activity of a self-employed person.

[3]Several products from the Harmonized System classification, mostly waste or scrap (e.g. scrap metal, used clothing) could not be concorded to the *CNAE Domicílio* classification; these products make up less than 1% of Brazilian trade by value.

migration across microregions, which we will show is correlated with the trade shocks we study, our regression results should be interpreted as identifying effects of China on local labour markets as geographical units varying in their initial comparative advantages, rather than effects on the set of workers present in those labour markets in the year 2000.

Our baseline specification is as follows:

$$\Delta y_m = \beta_I IS_m + \beta_X XD_m + W_m^{'}\gamma + \epsilon_m. \tag{1}$$

Here, Δy_m is the change in a given labour market outcome between 2000 and 2010 in microregion m, IS_m and XD_m are microregion-level measures of the import supply and export demand shocks due to China between 2000 and 2010, and W_m is a set of controls.

To construct IS_m and XD_m, we first define an import (export) shock in sector k as the difference in the value of Brazilian imports (exports) from China in sector k between 2000 and 2010, $\Delta I_k = I_{k,2010} - I_{k,2000}$ and $\Delta X_k = X_{k,2010} - X_{k,2000}$, denominated in thousands of 2010 US dollars. We then allocate each shock across microregions according to the fraction of Brazil's workers in sector k sited in a given microregion m in 2000; i.e. $\frac{L_{km,2000}}{L_{k,2000}}\Delta I_k$ and $\frac{L_{km,2000}}{L_{k,2000}}\Delta X_k$, where $L_{km,2000}$ is the number of workers in sector k and microregion m in year 2000, and $L_{k,2000} = \sum_m L_{km,2000}$.[4] Since microregions differ in size, which affects each sector's relevance for the local labour market, we normalize the trade shock by the number of employed workers in each microregion in 2000 (excluding workers employed outside the private sector), giving us the expressions $\frac{L_{km,2000}}{L_{k,2000}}\frac{\Delta I_k}{L_{m,2000}}$ and $\frac{L_{km,2000}}{L_{k,2000}}\frac{\Delta X_k}{L_{m,2000}}$.[5] Finally, we define the total local exposure per worker to each trade shock as the sum of these expressions across sectors, so that our microregion-level measures of the import supply and export demand shocks are, respectively:

$$IS_m = \sum_k \frac{L_{km,2000}}{L_{k,2000}}\frac{\Delta I_k}{L_{m,2000}}$$
$$XD_m = \sum_k \frac{L_{km,2000}}{L_{k,2000}}\frac{\Delta X_k}{L_{m,2000}}.$$

As measured by IS_m and XD_m, the average Brazilian microregion received an import competition shock from China of US$225 per worker and an export demand shock of US$594 per worker.[6] The dispersion of the export demand shock is also larger (with a standard deviation of 1.31 for XD_m as compared to 0.27 for IS_m), though both distribu-

[4]The underlying assumption here is that the trade shock is distributed uniformly across workers in each sector.

[5]The means across microregions of the distributions of these sector-microregion-level variables are shown in columns 3 and 5 of Table A1.

[6]These two figures differ in magnitude even though trade between China and Brazil was approximately in balance in both 2000 and 2010; this is because both measures include a municipality-level per-worker normalization.

tions are highly skewed to the right, as shown in Figure A1. The microregion at the 20th percentile of IS_m received an import supply shock of US$73 per worker, while the supply shock to the microregion at the 80th percentile of IS_m was US$313 per worker. The corresponding figures for XD_m are US$38 and US$647, respectively. Figure 4 shows that the two shocks affected different sets of microregions, as the unconditional distributions of the two measures are nearly orthogonal, with a correlation of 0.07.

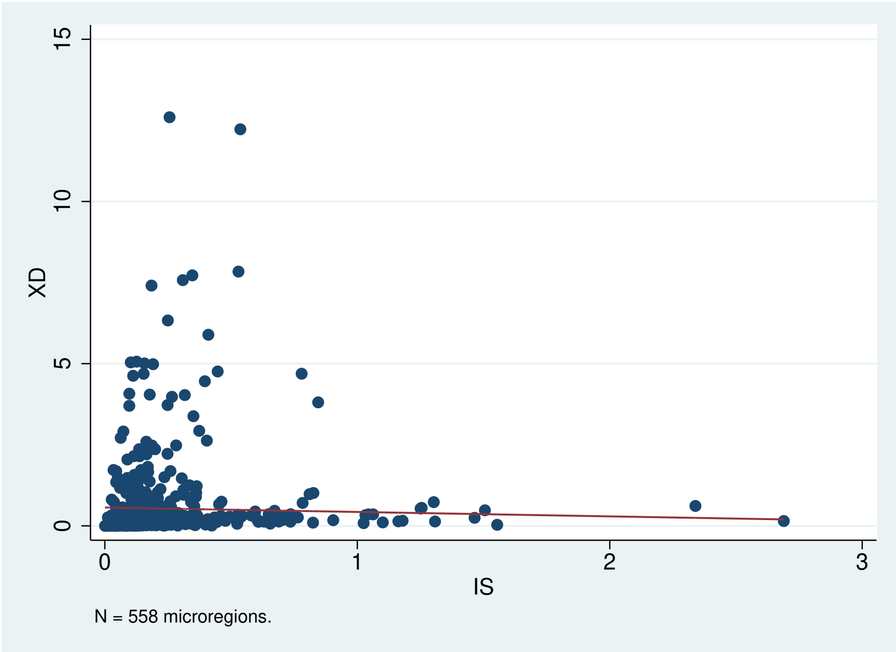


Figure 4: Import Supply vs Export Demand Measures

Notes. This graph presents a scatter plot of the export demand shock measure XD_m against the import supply shock measure IS_m at the microregion level. The line plots the results of a linear regression of XD_m on IS_m. Both variables are denominated in thousands of 2010 US dollars per worker. *Sources*: 2000 Brazilian Census, and CEPII BACI.

Table 1 charts the characteristics of microregions in the top 20% of IS_m and XD_m in 2000, while the geographical distribution of microregions in the top 20% of each of the two measures are plotted in Figure 5. Table 1 shows that the microregions most exposed to Chinese imports tended to have a lower proportion of workers engaged in agriculture and a higher proportion working in manufacturing in 2000 as compared to the average region, as well as a much smaller share of rural residents. On average, these regions also had a larger working-age population, a higher share of the workforce in private sector employment and a greater proportion of workers in skilled occupations than the mean microregion. The average wage in these regions in 2000 was also relatively high.[7]

[7]Unsurprisingly, the three microregions with the highest IS_m are all major industrial centers: Manaus, São José dos Campos and Santa Rita do Sapucaí. The last of these regions is sometimes referred to as the 'Electronic Valley' due to the size of its electronics industry.

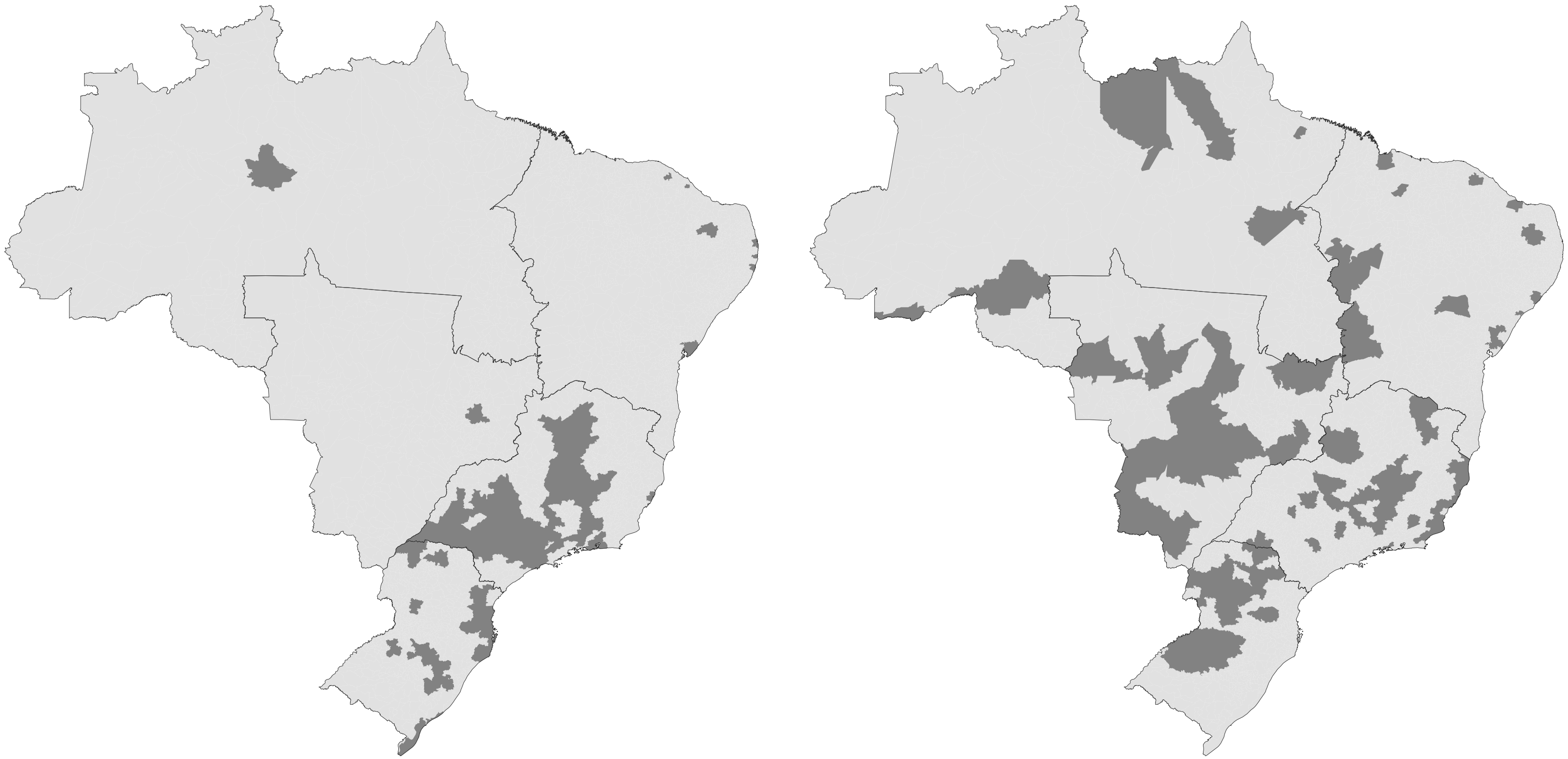
Table 1: Brazilian Microregion-Level Summary Statistics 2000

	2000		
	All microregions	Top quintile of IS_m	Top quintile of XD_m
	(1)	(2)	(3)
Workforce (thousands)	170.952	417.095	138.593
Private sector workers	.589	.624	.608
Agriculture	.167	.078	.161
Extractive	.002	.002	.004
Manufacturing	.068	.123	.069
Nontraded	.352	.421	.375
Formal jobs	.177	.299	.205
Informal jobs	.412	.326	.403
Skilled occupations	.094	.124	.099
Unskilled occupations	.496	.501	.509
Rural residents	.313	.137	.271
Inmigrated in the last 5 years	.083	.084	.088
Average hourly wage (R$)	2.21	3.14	2.46
Skilled occupations	5.07	6.72	5.55
Unskilled occupations	1.70	2.28	1.92
Wage inequality (Gini)	.542	.528	.556

Notes. This table displays descriptive statistics of the Brazilian labour market in 2000, averaged at the microregion level. Column (1) includes all microregions, column (2) includes only microregions among the top 20% of IS_m, and column (3) includes only microregions in the top 20% of XD_m. All figures are shares of the total workforce, except as indicated. The workforce is defined here as the total number of citizens between 18 and 60 years old. Average hourly wage is in current Real. *Sources:* 2000 Brazilian Census, and CEPII BACI.

Table 1 also suggests that the microregions most affected by Chinese export demand were somewhat less populous than the mean microregion and much smaller in population than high-IS_m microregions in 2000. At the same time, microregions with large values of XD_m had an average share of the workforce employed in the private sector, share of workers in formal jobs and average hourly wage somewhat higher than that of the mean microregion, though again smaller than the top quintile of IS_m. They were relatively more rural than the high-IS_m regions as of 2000, and slightly less rural on average than the mean microregion. Unsurprisingly, the average share of workers in the extractive sector was particularly high in these microregions, though the overall size of the extractive sector relative to total local employment was very small even in these locations. In terms of most other labour market variables, regions in the top 20% of XD_m were similar on average to the mean Brazilian microregion in 2000, and in general they were more similar to the average microregion than were the locations in the top quintile of IS_m.[8]

[8]The three microregions with the largest values of XD_m include a major center for the offshore oil industry (Macaé), an important outpost of the iron ore mining complex (Itabira) and a small microregion specialized in soybean production (Não-me-Toque, Rio Grande del Sul).



Panel A - Import Supply

Panel B - Export Demand

Figure 5: Geographical Distributions of Top Quintile of Import Supply and Export Demand Measures

Notes. These maps display the spatial distributions of microregions in the top quintile of the import supply shock measure IS_m and microregions in the top quintile of the export demand shock measure XD_m. The maps also depict the borders between Brazilian regions. *Sources*: 2000 Brazilian Census, and CEPII BACI.

Our baseline specifications also include a set of microregion-level controls W_m; key among these are the share of each microregion's workforce employed in agricultural sectors, extractive sectors and manufacturing sectors in 2000.[9] This means that our results depend on comparisons between microregions with the same initial economic structure (in terms of the distribution of local employment across these three broadly defined categories) but specialized in different particular agricultural, extractive and manufacturing sectors.

This strategy is feasible because the distribution of Brazil-China trade growth is skewed across sectors on both the import and export sides. Approximately 40% of the total growth in Brazil's imports from China between 2000 and 2010 (i.e. $\sum_k \Delta I_k$) is accounted for by electronics (19%), machinery (13%) and electrical equipment (8%). Meanwhile, just three sectors, all of which are agricultural or extractive sectors, were responsible for 82% of the growth in Brazil's exports to China between these two years: mining of non-precious metals (45%), soybeans (23%) and oil and gas (14%).[10] This breakdown actually understates the level of concentration of Brazil's exports to China, since its exports in the 'mining of nonprecious metals' sector are almost exclusively made up of exports of iron ore. This high degree of concentration in a few commodities is a typical pattern of exports to China among developing countries for whom trade with China is important.[11]

The controls in our baseline regressions also include the workforce size, the share of the workforce employed in nontraded sectors, the share employed in informal jobs, and the proportion of rural residents, all measured at the microregion level for the year 2000, along with a cubic polynomial of 2000 microregion-level income per capita. In all regressions, in order to allow for spatial correlation of errors across microregions, we cluster standard errors at the level of the mesoregion. Like the microregion, this geographical unit has been defined by IBGE according to measures of local market integration; there are 138 mesoregions in Brazil. Also, in order to prevent our regression results from being driven by outliers or very small microregions, we assign values of IS_m and XD_m below the 1st

[9] Forestry and fisheries/aquaculture are defined here as agricultural sectors.

[10] To calculate these measures, we take the difference between the 2010 and 2000 values of Brazil's imports from China (or exports to China) in each sector and divide by the aggregate difference between 2010 and 2000 Brazilian imports from China (or exports to China). The resulting figures for each of the 82 traded goods sectors may be found in columns 1 and 2 of Table A1. The value of imports from China actually decreased in several sectors, but their total decline constitutes a tiny proportion of the total difference in imports, so that the total of all positive values only slightly exceeds 1; the same is true of exports to China. As noted above, some Harmonized System codes (mostly waste and scrap) are not concorded to any sector; trade in these products is included in the denominator but not listed in Table A1.

[11] According to the CEPII BACI data, in all 27 non-high-income countries outside East and Southeast Asia for whom exports to China constituted a minimum of 10% of total exports by value in 2010, at least 80% of exports to China were concentrated in three or fewer of the sectors defined in this paper (82 sectors plus a residual 'waste and scrap' category). In 16 of these 27 countries (including Brazil), at least 80% of exports to China were in agricultural and/or extractive sectors; in a further five, at least 80% of exports were concentrated in up to two agricultural or extractive sectors and either the 'basic metals' manufacturing sector or scrap metal.

and above the 99th percentiles to the values of the 1st and 99th percentiles, and weight all regressions by the share of the national workforce in each microregion. We include all 558 Brazilian microregions in all regressions.

2.3 Instrumental Variables and Robustness Checks

Our goal is to identify the causal effect of the two 'China shocks' on local labour market dynamics in Brazil. However, regression equation (1) does not capture causality in the presence of any additional shocks that are both relevant for our dependent variables and correlated with our exposure measures IS_m and XD_m. In particular, given the sector-level variation that underlies our identification strategy, one potential issue would be the existence of Brazil-specific supply or demand shocks in sectors in which Brazil also experienced a relatively large change in trade with China. For example, changes in Brazil-China trade patterns might be capturing sector-specific productivity growth or Engel effects in Brazil rather than changes in China.

Several other studies of the cross-country transmission of shocks have addressed this concern by using an instrumental variables strategy that exploits information on trade between the shocks' country of origin (in this case, China) and countries *other* than the 'destination' country of interest (Brazil).[12] For instance, one might instrument our municipality-level import supply and export demand variables with measures calculated in the same way as IS_m and XD_m, but using the change between 2000 and 2010 in imports from China (or exports to China) for a set of countries that does not include Brazil. A key assumption underlying this approach is that the changes in the pattern of trade between China and these other countries are unrelated to Brazil-specific shocks.

The main issue with this strategy is that it does not account for changes in *world* prices or quantities traded that are not due to China: if the world price of a given product rises due to other factors, or all countries trade more intensively in the products of some sector due to a worldwide technology or demand shock, this will be reflected in the trade flows of all countries. This is a particular issue for our study given its focus on commodities, whose world prices were on an upward trajectory over the course of the decade we study. If, for instance, the share of oil by value increased in the import baskets of all countries between 2000 and 2010 due to rises in its world price, both our baseline regression specification and the IV strategy described above would assign this effect to China. However, while China likely played a pivotal role in changes in world prices in many sectors during this period, we do not want to ascribe world price or quantity changes to China when these actually resulted from other factors.

We thus adapt the IV approach described above by considering changes in China's

[12]This is a standard approach in the 'China shock' literature; see e.g. Bloom et al. 2011, Autor et al. 2013 and Iacovone et al. 2013.

sector-level imports and exports *relative* to those of other countries. To do this, we first define $\tilde{I}_{ikt}$ and $\tilde{X}_{ikt}$ to be the total imports (exports) of country i in sector k in year t from all countries other than Brazil. We then run the following auxiliary regressions, using data on $\tilde{I}_{ikt}$ and $\tilde{X}_{ikt}$ in 2000 and 2010 for all countries available in the CEPII trade data except Brazil:

$$\frac{\Delta \tilde{I}_{ik}}{\tilde{I}_{ik,2000}} = \alpha_k + \psi_{China,k} + \nu_{ik}$$
$$\frac{\Delta \tilde{X}_{ik}}{\tilde{X}_{ik,2000}} = \gamma_k + \delta_{China,k} + \mu_{ik}$$

The left-hand side of the two regressions above is the growth rate of the imports (exports) of a country in a given sector, net of its imports from (exports to) Brazil. The sector fixed effect α_k (or γ_k) then captures the mean growth rate, across countries, of net-of-Brazil imports (or exports) in that sector. The regressions are weighted by 2000 import (export) volumes, so that the values of these fixed effects are not driven by large positive or negative growth rates in countries with small shares of world trade. This means that the China-specific dummies $\psi_{China,k}$ and $\delta_{China,k}$ represent the deviation in the growth rates of China's imports and exports in sector k excluding trade with Brazil, as compared to this weighted cross-country average.

We then relate the resulting estimates $\hat{\psi}_{China,k}$ and $\hat{\delta}_{China,k}$ to the municipality-level shock measure defined in Section 2.2. We first multiply these estimates by the values of Brazil-China imports and exports in 2000, redefining the sector-level 'China shocks' as $\Delta \hat{I}_k \equiv I_{k,2000}\hat{\psi}_{China,k}$ and $\Delta \hat{X}_k \equiv X_{k,2000}\hat{\delta}_{China,k}$. Our instrumental variables are then constructed at the municipality level using these new shock measures in the same way as for IS_m and XD_m:[13]

$$ivIS_m = \sum_k \frac{L_{km,2000}}{L_{k,2000}} \frac{\Delta \hat{I}_k}{L_{m,2000}}$$
$$ivXD_m = \sum_k \frac{L_{km,2000}}{L_{k,2000}} \frac{\Delta \hat{X}_k}{L_{m,2000}}.$$

If Chinese trade with the rest of the world (excluding Brazil) had evolved in the same way as that of the (weighted) average country in each sector, all of these shocks would be equal to zero. In practice, however, this is not the case: the two vectors $\Delta \hat{I}_k$ and $\Delta \hat{X}_k$, like the 'raw' measures ΔI_k and ΔX_k, vary widely across sectors. Indeed, the raw shocks and these IV shock measures are highly correlated, with correlation coefficients of 0.93 for the sector-level import supply shocks ΔI_k and $\Delta \hat{I}_k$ and 0.86 for the export demand

[13]The averages across microregions of the sector-microregion-level variables analogous to those in Section 2.2, but constructed using $\Delta \hat{I}_k$ and $\Delta \hat{X}_k$, may be found in columns 4 and 6 of Table A1.

shocks ΔX_k and $\Delta \hat{X}_k$. Scatter plots of IS_m against $ivIS_m$ and XD_m against $ivXD_m$ are shown in Figure 6.

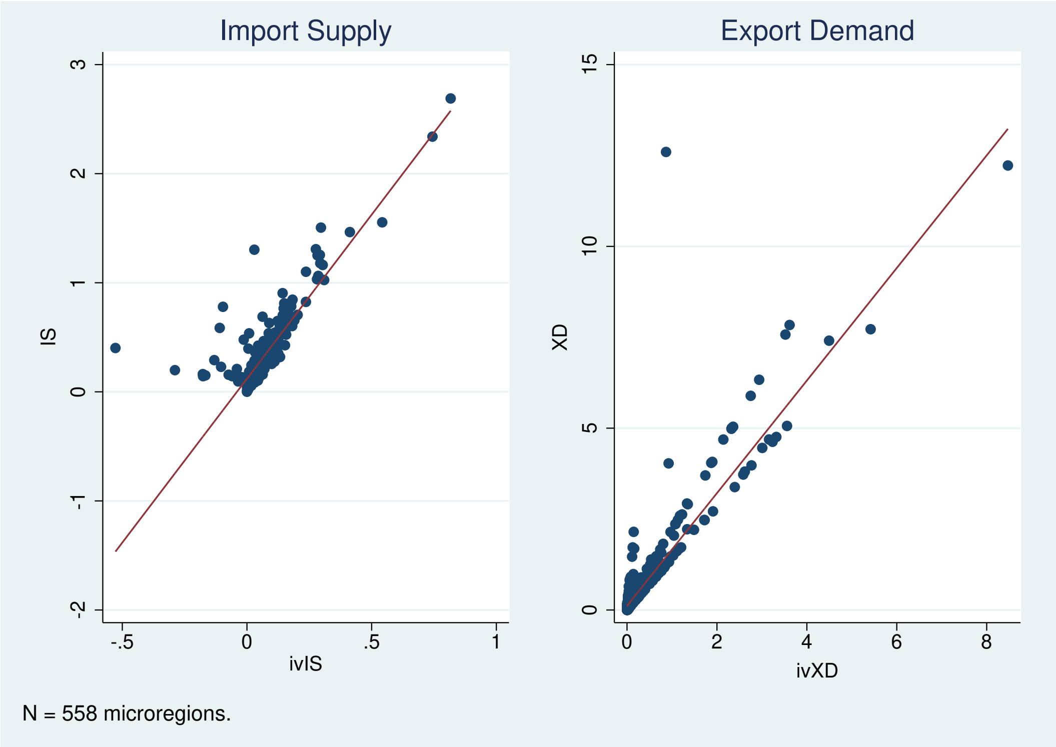


Figure 6: Raw Measures vs Instrumental Variables Measures

Notes. This graph presents scatter plots of microregion-level import supply and export demand shocks (IS_m and XD_m) against the instrumental variables $ivIS_m$ and $ivXD_m$. The lines depict the results of simple regressions of IS_m on $ivIS_m$ (coefficient 1.286, s.e. 0.021 and t-statistic 60.09) and XD_m on $ivXD_m$ (coefficient 2.076, s.e. 0.053 and t-statistic 39.16). *Sources*: 2000 Brazilian Census, and CEPII BACI.

Even if these instrumental variables were to fully capture the sectoral mix of Chinese supply and demand shocks, it is naturally still possible that these shocks were correlated to supply and demand shocks in Brazil during this period. The variable $ivXD_m$ might be particularly vulnerable to this problem, since it is driven mainly by export growth in two nonmanufacturing sectors (soybeans and iron ore).[14] It could bias our results, for example, if Brazil discovered major new sources of iron ore just as China began importing it in much larger quantities. Reassuringly, however, there is evidence that the rise in Brazil-China exports in these two sectors was mainly due to a Chinese demand shock. First, the share of Brazil in world trade by value in the two sectors changed relatively little between 2000 and 2010: Brazil accounted for 23% of world exports of soybeans in 2000 and 27% in 2010, and for 13% of world exports of nonprecious metal ores in 2000

[14]While the oil and gas sector was responsible for 14% of the growth in exports from Brazil to China between 2000 and 2010 (as noted in Section 2.2), its importance is greatly diminished in the IV shock measure, since $\Delta \hat{X}_{oil}$ accounts for only 2% of $\sum_k \Delta \hat{X}_k$. The point in the upper left of the scatter plot of XD_m against $ivXD_m$ (see Figure 6) is the offshore oil center (Macaé) mentioned in Footnote 8.

and 17% in 2010. Meanwhile, China's share of world imports in these two sectors rose much more steeply during this period: from 21% to 56% for soybeans, and from 10% to 45% for nonprecious metal ores. Exports to China accounted for 98% of the growth in the total quantity of soybeans exported from Brazil, and 87% of the growth in the quantity of Brazil's exports of nonprecious metal ores, between the two years.[15]

It is also possible that the outcomes we observe were driven by other circumstances specific to individual Brazilian regions. Indeed, the maps in Figure 5 suggest that the incidence of Chinese trade shocks is spatially correlated within Brazil. We thus run a robustness check in which we add fixed effects for Brazil's five regions to our IV specification, so as to check whether the results are robust to accounting for contemporaneous region-specific trends in the dependent variable Δy_m. That is, in this specification we investigate the within-region effects of the two 'China shocks'.

Finally, we also conduct an additional robustness check to address the concern that any results we observe simply represent the continuation of local labour market trends that began in years before our period of study. For example, Brazil underwent a major trade liberalization episode in the late 1980s and early 1990s that is known to have had a significant impact on affected local labour markets (see e.g. Menezes-Filho and Muendler 2011, Kovak 2013); adjustments resulting from this shock might still have been occurring between 2000 and 2010. Thus, in order to account for pre-sample-period trends, we use data from the 1991 Brazilian census to add a lagged dependent variable to the right-hand side of specifications for which this data is available; that is, we control for microregion-level changes between 1991 and 2000 in the outcome of interest. Because of likely correlation between the lagged dependent variable and the residual ϵ_m, we instrument for this variable using 1991 levels, as suggested by Anderson and Hsiao (1981).[16]

3 Results

In this section, we provide empirical evidence of the heterogeneous effects of the import supply shock and export demand shock from China on local labour markets across Brazil. We begin by considering the effects of these shocks on average hourly wages, wage inequality within local labour markets and takeup of the cash transfer program *Bolsa Família*.

[15]Notably, Bustos et al. (2013) present evidence of non-Brazil-specific technological change in the soybean sector via the development in the US of a genetically modified soybean variety in 1996, and suggest that the adoption in Brazil of this technology in the early 2000s led to increases in agricultural productivity per worker, decreases in the labour intensity of agricultural production, rising manufacturing employment shares and declining manufacturing wages in affected locations. Bustos et al. also discuss a Brazil-specific technological change in the maize sector (*milho safrinha*) which they find is associated with rises in labour intensity, declines in manufacturing employment shares and increases in wages.

[16]Note that the consistency of our estimates then depends on the assumption that 1991 levels are uncorrelated with ϵ_m.

We then look at the impact of the 'China shocks' on migration, employment rates and the pattern of employment across sectors. Finally, we examine the evolution of 'good jobs' and 'bad jobs' in local labour markets affected by the shocks, considering the proportion of the local workforce in formal and informal jobs, and in skilled and unskilled occupations. The coefficients and standard errors in all tables are normalized by multiplying by 100, so that they may generally be interpreted as the effect of a US$1000 increase in imports or exports per worker on changes in the dependent variable in percentage points.[17]

3.1 Wages and Wage Inequality

Table 2 displays the results of microregion-level regressions of differences in log average hourly wages between 2000 and 2010 on IS_m, XD_m and controls. In Panel A, the sample of wage-earners includes workers in all sectors, while Panels B, C and D only consider workers in the agricultural and extractive, manufacturing and nontraded sectors respectively. The OLS estimates in column (1) of Panel A suggest that larger export demand shocks are associated with higher growth in wages over these ten years, and that this effect is statistically significant. Columns (2) through (5) of Panel A show that the result is qualitatively unchanged by our instrumental variables strategy and robustness checks, including specifications with region fixed effects (column (3)), a lagged dependent variable (column (4)) and both of these two additional controls (column (5)). In our preferred specification, column (2), a US$1000 per worker increase in exports to China is associated with higher decadal growth in wages of approximately 1.76 percentage points.

Panels B through D suggest that the largest effect of rising export demand from China was on the set of industries most directly affected by this shock: the agricultural and extractive sectors. The baseline IV specification in column (2) of Panel B indicates that a microregion subject to the average demand shock of US$594 per worker saw wage growth in these sectors that was higher by 3.7 percentage points over the course of the decade. Given that the average wage in agricultural and extractive sectors increased by 52% during this period, a back-of-the-envelope calculation would suggest that the estimated effect of the 'China demand shock' is equal to 7.2% of the observed wage increase in these sectors. Panels C and D indicate that growth in wages in agricultural and extractive sectors also spilled over to other industries, as average wages in the manufacturing and nontraded sectors also grew faster in microregions more exposed to Chinese export demand, though only the result for manufacturing is statistically significant in our preferred specification.

[17]This interpretation is, of course, approximate when the dependent variable is measured as a long difference of logarithms, but exact when the dependent variable is in long differences of shares.

Table 2: Results - Log Average Hourly Wages

	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)
Panel A. All Sectors					
IS_m	-3.46	-3.19	-.70	-3.57	-1.06
	(2.90)	(2.87)	(2.48)	(2.84)	(2.40)
XD_m	1.98***	1.76**	2.26***	1.84***	2.33***
	(.62)	(.74)	(.73)	(.71)	(.71)
Panel B. Agricultural/Extractive Sectors					
IS_m	1.15	-.92	2.40	-6.39	.36
	(6.31)	(7.61)	(7.82)	(6.94)	(7.26)
XD_m	5.98***	6.31***	6.74***	7.02***	6.96***
	(1.93)	(2.29)	(2.08)	(1.93)	(1.93)
Panel C. Manufacturing Sectors					
IS_m	-7.84***	-7.69***	-7.19***	-8.51***	-7.16***
	(1.42)	(1.24)	(1.42)	(1.43)	(1.42)
XD_m	2.93***	2.95***	3.22***	2.78***	3.23***
	(.61)	(.64)	(.68)	(.62)	(.69)
Panel D. Nontraded Sectors					
IS_m	-4.23	-3.85	-1.70	-4.72*	-1.69
	(2.62)	(2.47)	(2.04)	(2.45)	(2.03)
XD_m	.94*	.61	.95*	.93*	.94*
	(.49)	(.50)	(.55)	(.51)	(.53)
Region Fixed Effects			✓		✓
Lag Dep. Variable				✓	✓
1st Stage (KP F-stat.)		334.7	250.3	245.2	195.3

Notes. This table displays estimated effects of Chinese import and export shocks on changes between 2000 and 2010 in log average hourly wages, as captured by β_I and β_X from equation (1). Panel A presents results for all sectors, Panel B for agricultural and extractive sectors, Panel C for manufacturing sectors, and Panel D for nontraded sectors. Each column corresponds to a different regression with specification indicated. In the columns marked with IV, we *instrument* imports from (exports to) China using a measure based on growth in Chinese exports to (imports from) all countries, excluding Brazil, relative to a weighted cross-country average. The unit of observation is a microregion (N=558). Coefficients and standard errors are multiplied by 100, so that the unit of the coefficients is roughly percentage increase. All regressions include a constant and the following *controls*: 2000 workforce, 2000 share of workforce in agricultural sectors, 2000 share of workforce in extractive sectors, 2000 share of workforce in manufacturing, 2000 share of workforce in nontraded sectors, 2000 share of workforce in informal jobs, 2000 share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. Regressions in columns (3) and (5) include region fixed effects, and in columns (4) and (5) include the lag of the dependent variable for the period 1991-2000, instrumented with 1991 levels. All regressions are weighted by share of national workforce. *Standard errors* are clustered by mesoregion, 138 clusters. *Source:* 1991, 2000 and 2010 Brazilian Census, and CEPII BACI. *** p<.01, ** p<.05, * p<.1.

Table 3: Results - Log Average Hourly Wages by Formality and Occupation

	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)
Panel A. Formal Jobs					
IS_m	-6.37***	-5.83***	-3.46*	-4.67***	-2.77
	(1.74)	(1.60)	(1.91)	(1.38)	(1.74)
XD_m	1.45***	1.12**	1.40***	.91**	1.23***
	(.48)	(.47)	(.43)	(.46)	(.42)
Panel B. Informal Jobs					
IS_m	2.47	3.24	6.00	2.55	5.20
	(5.31)	(5.50)	(5.20)	(5.43)	(5.02)
XD_m	2.34**	2.14*	2.64**	2.24**	2.76***
	(1.03)	(1.17)	(1.08)	(1.13)	(1.03)
Panel C. Skilled Occupations					
IS_m	-.62	-.85	.71		
	(3.13)	(3.36)	(3.15)		
XD_m	1.13*	.72	1.16**		
	(.60)	(.64)	(.59)		
Panel D. Unskilled Occupations					
IS_m	-5.22***	-5.14***	-2.22		
	(1.79)	(1.76)	(2.01)		
XD_m	2.33***	2.24***	2.47***		
	(.72)	(.81)	(.67)		
Region Fixed Effects			✓		✓
Lag Dep. Variable				✓	✓
1st Stage (KP F-stat.)		334.7	250.3	245.2	195.3

Notes. This table displays estimated effects of Chinese import and export shocks on changes between 2000 and 2010 in log average hourly wages, as captured by β_I and β_X from equation (1). Panel A presents results for workers in formal jobs, Panel B for workers in informal jobs, Panel C for workers in skilled occupations, and Panel D for workers in unskilled occupations. A skilled occupation is defined as an occupation of skill level 3 or 4 according to the ISCO-08 classification. Each column corresponds to a different regression with specification indicated. In the columns marked with IV, we *instrument* imports from (exports to) China using a measure based on growth in Chinese exports to (imports from) all countries, excluding Brazil, relative to a weighted cross-country average. The unit of observation is a microregion (N=558). Coefficients and standard errors are multiplied by 100, so that the unit of the coefficients is roughly percentage increase. All regressions include a constant and the following *controls*: 2000 workforce, 2000 share of workforce in agricultural sectors, 2000 share of workforce in extractive sectors, 2000 share of workforce in manufacturing, 2000 share of workforce in nontraded sectors, 2000 share of workforce in informal jobs, 2000 share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. Regressions in columns (3) and (5) include region fixed effects, and in columns (4) and (5) include the lag of the dependent variable for the period 1991-2000, instrumented with 1991 levels. All regressions are weighted by share of national workforce. *Standard errors* are clustered by mesoregion, 138 clusters. *Source:* 1991, 2000 and 2010 Brazilian Census, and CEPII BACI. *** p<.01, ** p<.05, * p<.1.

Table 4: Results - Inequality and Social Assistance

	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)
Panel A. Wage Inequality (Gini Coefficient)					
IS_m	1.34***	1.40***	1.12**	1.40***	1.11**
	(.39)	(.41)	(.46)	(.41)	(.46)
XD_m	.07	.06	.09	.06	.09
	(.11)	(.10)	(.12)	(.10)	(.12)
Panel B. Bolsa Familia					
IS_m	-.20	-.15	.07		
	(.30)	(.33)	(.19)		
XD_m	-.25*	-.25**	-.14*		
	(.14)	(.13)	(.07)		
Region Fixed Effects			✓		✓
Lag Dep. Variable				✓	✓
1st Stage (KP F-stat.)		334.7	250.3	245.2	195.3

Notes. This table displays estimated effects of Chinese import and export shocks, as captured by β_I and β_X from equation (1), on two outcomes. In Panel A, the dependent variable is the change in microregion-level wage inequality, as measured by the wage Gini coefficient, between 2000 and 2010. In Panel B, the dependent variable is the share of workforce participating in *Bolsa Familia* in 2010. Each column corresponds to a different regression with specification indicated. In the columns marked with IV, we *instrument* imports from (exports to) China using a measure based on growth in Chinese exports to (imports from) all countries, excluding Brazil, relative to a weighted cross-country average. The unit of observation is a microregion (N=558). Coefficients and standard errors in both panels are multiplied by 100, so that the coefficients in Panel B are in percentage points. All regressions include a constant and the following *controls*: 2000 workforce, 2000 share of workforce in agricultural sectors, 2000 share of workforce in extractive sectors, 2000 share of workforce in manufacturing, 2000 share of workforce in nontraded sectors, 2000 share of workforce in informal jobs, 2000 share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. Regressions in columns (3) and (5) include region fixed effects, and in columns (4) and (5) include the lag of the dependent variable for the period 1991-2000, instrumented with 1991 levels. All regressions are weighted by share of national workforce. *Standard errors* are clustered by mesoregion, 138 clusters. *Source:* 1991, 2000 and 2010 Brazilian Census, and CEPII BACI. *** p<.01, ** p<.05, * p<.1.

Meanwhile, while the results in Panel A suggest that the Chinese import supply shock is not associated with statistically significant changes in average wages overall, Panel C indicates that it did have an effect for manufacturing, the sector most directly affected by Chinese import competition. The IV results in column (2) of Panel C indicate that a microregion exposed to the average import supply shock of US$225 per worker experienced growth in manufacturing wages that was smaller by 1.7 percentage points over this period.

Table 3 breaks down the effects of the shocks on the growth in average wages of workers in formal and informal jobs (Panels A and B), and in skilled and unskilled occupations (Panels C and D). The wage effects of IS_m appear to be concentrated in the formal sector; the estimated coefficient on IS_m is negative for the subcategory of formal jobs and positive (though insignificant) for informal jobs. Also, although the wage effect of Chinese import competition on workers in skilled occupations remains insignificantly different from zero, higher values of IS_m are significantly associated with slower average wage growth for workers in unskilled occupations in the baseline IV specification in Panel D. This result becomes smaller and loses statistical significance after controlling for region-specific trends. Meanwhile, the export demand shock is associated with positive wage growth for all four of these categories – for both skilled and unskilled occupations, and for both formal and informal jobs.

These heterogeneous effects of IS_m on different subgroups of the workforce imply that Chinese import competition may have affected levels of inequality. Indeed, when we consider effects on local wage inequality in Panel A of Table 4, we find that import shocks but not export shocks are associated with relatively higher growth in wage inequality, as measured by the microregion-level wage Gini coefficient. Since we multiply all coefficients by 100, the estimate in column (2) implies that in locations experiencing an import competition shock that was greater by US$1000, the wage Gini coefficient rose by an additional 0.014 between 2000 and 2010; this is equivalent to a 2.6% increase in wage inequality relative to average 2000 levels. The coefficient on XD_m is economically and statistically indistinguishable from zero in each of the specifications; that is, we find no evidence that the demand-side shock contributed to rises in local wage inequality.

In Panel B of Table 4, we consider the impact of the 'China shocks' on social assistance in Brazil, by examining the distribution of takeup of the cash transfer program *Bolsa Família* across microregions in 2010. While participation in *Bolsa Família* was on a very large scale in 2010 – according to the census data, more than 7% of the Brazilian workforce received *Bolsa Família* in this year – the program was implemented only after 2002. Thus, in this case, we use levels rather than long differences on the left-hand side of our regressions, so that the dependent variable is the proportion of the local workforce receiving *Bolsa Família* in 2010.[18] The results suggest that a larger export demand shock is associated with lower takeup of *Bolsa Família* in 2010; according to the baseline IV specification, in a microregion experiencing the average export demand shock of US$594, the proportion of the local workforce receiving *Bolsa Família* in 2010 was lower by 0.15 percentage points. The estimated effects of Chinese import competition on participation in *Bolsa Família* are statistically insignificant in all three specifications.

3.2 Migration and Employment

We next consider whether the two 'China shocks' are also associated with changes in the pattern of migration across microregions, and microregion-level employment rates.

[18] As of 2000, Brazil had a similar program on a much smaller scale, *Bolsa Escola*, with a Brazil-wide participation rate of less than 1%. The results are not affected if we instead use differences between *Bolsa Escola* takeup rates in 2000 and *Bolsa Família* takeup rates in 2010 as the left-hand-side variable.

In Table 5, we display the results of regressions whose dependent variable is the long difference in the proportion of the workforce that migrated into the microregion within the five years before the census.[19] Column (2) reports that the change in the share of recent migrants in the local workforce was 0.89 percentage points lower on average in microregions experiencing a $1000 per worker higher import supply shock; these results are robust across all five specifications. This suggests that in-migration grew by 4.9% less in a microregion exposed to the average increase in import supply from China. The analogous estimate for XD_m is positive, but much smaller in magnitude and statistically insignificant in each of the four IV specifications. The slowdown in local in-migration rates associated with Chinese import competition is reminiscent of the findings of Kovak (2011), who observes a migration response to the Brazilian trade liberalization of the early 1990s using 2000 census data.

Table 5: Results - In-Migration

	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)
IS_m	-.86*	-.89*	-.83**	-.92*	-.83**
	(.44)	(.46)	(.35)	(.54)	(.41)
XD_m	.21**	.11	.17	.13	.17
	(.09)	(.10)	(.12)	(.10)	(.11)
Region Fixed Effects			✓		✓
Lag Dep. Variable				✓	✓
1st Stage (KP F-stat.)		334.7	250.3	245.2	195.3

Notes. This table displays estimated effects of Chinese import and export shocks on changes between 2000 and 2010 in the share of the workforce that in-migrated to the microregion in the previous five years, as captured by β_I and β_X from equation (1). Each column corresponds to a different regression with specification indicated. In the columns marked with IV, we *instrument* imports from (exports to) China using a measure based on growth in Chinese exports to (imports from) all countries, excluding Brazil, relative to a weighted cross-country average. The unit of observation is a microregion (N=558). Coefficients and standard errors are multiplied by 100, so that the coefficients represent percentage point changes. All regressions include a constant and the following *controls*: 2000 workforce, 2000 share of workforce in agricultural sectors, 2000 share of workforce in extractive sectors, 2000 share of workforce in manufacturing, 2000 share of workforce in nontraded sectors, 2000 share of workforce in informal jobs, 2000 share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. Regressions in columns (3) and (5) include region fixed effects, and in columns (4) and (5) include the lag of the dependent variable for the period 1991-2000, instrumented with 1991 levels. All regressions are weighted by share of national workforce. *Standard errors* are clustered by mesoregion, 138 clusters. *Source:* 1991, 2000 and 2010 Brazilian Census, and CEPII BACI. *** p<.01, ** p<.05, * p<.1.

[19] These regressions thus examine changes in the microregion-level pattern of migration in the five years before 2010 as compared to the five years before 2000.

Table 6: Results - Private Sector Employment

	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)
Panel A. All Sectors					
IS_m	.56*	.67*	1.24***	.28	.92***
	(.33)	(.34)	(.33)	(.38)	(.34)
XD_m	.07	.08	.07	.07	.08
	(.11)	(.10)	(.10)	(.12)	(.11)
Panel B. Agricultural/Extractive Sectors					
IS_m	-.39	-.25	-.16	-.01	.06
	(.26)	(.28)	(.32)	(.25)	(.28)
XD_m	.07	.06	-.01	.11	.06
	(.18)	(.18)	(.15)	(.14)	(.13)
Panel C. Manufacturing Sectors					
IS_m	-.20	-.29	.05	.34	.65
	(.52)	(.55)	(.67)	(.56)	(.71)
XD_m	-.06	-.12	-.10	-.16	-.15
	(.10)	(.10)	(.09)	(.10)	(.10)
Panel D. Nontraded Sectors					
IS_m	1.18*	1.21*	1.34*	1.39*	1.43*
	(.63)	(.67)	(.73)	(.72)	(.78)
XD_m	.11	.18	.22	.04	.11
	(.15)	(.16)	(.15)	(.12)	(.14)
Region Fixed Effects			✓		✓
Lag Dep. Variable				✓	✓
1st Stage (KP F-stat.)		334.7	250.3	245.2	195.3

Notes. This table displays estimated effects of Chinese import and export shocks on changes between 2000 and 2010 in the share of the workforce employed in the private sector, as captured by β_I and β_X from equation (1). Panel A presents results for all sectors, Panel B for agricultural and extractive sectors, Panel C for manufacturing sectors, and Panel D for nontraded sectors. Each column corresponds to a different regression with specification indicated. In the columns marked with IV, we *instrument* imports from (exports to) China using a measure based on growth in Chinese exports to (imports from) all countries, excluding Brazil, relative to a weighted cross-country average. The unit of observation is a microregion (N=558). Coefficients and standard errors are multiplied by 100, so that the coefficients represent percentage point changes. All regressions include a constant and the following *controls*: 2000 workforce, 2000 share of workforce in agricultural sectors, 2000 share of workforce in extractive sectors, 2000 share of workforce in manufacturing, 2000 share of workforce in nontraded sectors, 2000 share of workforce in informal jobs, 2000 share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. Regressions in columns (3) and (5) include region fixed effects, and in columns (4) and (5) include the lag of the dependent variable for the period 1991-2000, instrumented with 1991 levels. All regressions are weighted by share of national workforce. *Standard errors* are clustered by mesoregion, 138 clusters. *Source:* 1991, 2000 and 2010 Brazilian Census, and CEPII BACI. *** p<.01, ** p<.05, * p<.1.

Brazilians' willingness to migrate – the census data indicates that the average share of recent migrants across microregions was 8.3% in 2000 and 12.4% in 2010 – might have served to dampen the effects of the trade shocks on microregion-level employment rates. Indeed, while the damaging impact of Chinese import competition on employment status has been an important finding of studies of high-income countries (e.g. Autor et al. 2013 for the US), Panel A of Table 6 shows that we do not observe a negative correlation between IS_m and changes in private sector employment rates of Brazilian microregions from 2000 to 2010. On the contrary, our preferred specification yields a positive coefficient that is marginally statistically significant. The estimate is magnified and becomes significant at the 1% level in the specifications with region fixed effects; this is a puzzling result. Meanwhile, the effect of the 'China demand shock' on the change in the proportion of the local workforce employed in the private sector is very small and statistically insignificant in all five specifications.[20]

Panels B to D of Table 6 provide a breakdown of the changes in employment structure associated with the two 'China shocks', using the difference between 2000 and 2010 in the share of a microregion's working-age population employed in the agricultural and extractive, manufacturing and nontraded sectors as the dependent variables. This analysis yields few statistically significant coefficient estimates. However, Panel D suggests that the finding of rising employment rates in locations competing with Chinese imports appears to have been driven by growth in the share of the workforce employed in nontraded sectors. This result is similar to the findings of Menezes-Filho and Muendler (2011), who observe movement of Brazilian formal sector workers from manufacturing into services after the early 1990s trade liberalization.

3.3 Job Quality

We now examine the effects of China's emergence on the prevalence of 'good jobs' in affected microregions, using two measures of job quality: informality and occupational skill level. We first consider informality, which is widespread in the Brazilian economy: in 2000, more than half of private sector workers were working in the informal sector as defined in this paper. Being part of the informal sector brings disadvantages for workers and firms, since they are not granted some legal rights, such as property rights, and do not benefit from some public services linked to employment.

Table 7 shows that shocks to export demand from China are associated with a shift towards 'good jobs' by this measure: a rise in formal-sector jobs at the expense of the informal sector. The baseline IV results in Panels A and B suggest that a rise in exports to China of US$1000 is associated with an average increase in the proportion of a microre-

[20]When comparing these results to our findings on takeup of *Bolsa Família* in Table 4, it is important to note that eligibility for *Bolsa Família* is not directly conditional on employment status.

gion's workforce in formal jobs that is larger by 0.31 percentage points and an average decline in the share of informal jobs that is greater by 0.24 percentage points, though the result for the informal share is statistically insignificant. The size of these effects is similar across all of the regression specifications in each case.[21]

As discussed in Section 2.1, our measure of occupational skill level, which is based on an international definition, is a dummy variable broadly distinguishing between managerial, professional and technical workers and workers directly involved in production. Panel B of Table 8 shows that the proportion of the workforce in skilled occupations in the agricultural and extractive sectors rose more quickly in areas more affected by Chinese demand, while this was not the case for unskilled occupations in these sectors. Our estimates suggest that a microregion subject to the mean Chinese export demand shock experienced 18.6% higher growth in the share of the workforce employed in skilled agricultural or extractive sector jobs. The results in Panel A indicate that this led to a positive effect of XD_m on the share of workers in skilled occupations overall, though this estimate is not statistically significant.

Meanwhile, Panel C of Table 8 shows that the proportion of the working-age population employed in skilled manufacturing occupations saw a statistically significant decline in locations with higher IS_m: an increase of US$1000 in Chinese imports was associated with a reduction of approximately 0.28 percentage points in this share between 2000 and 2010 in the baseline IV specification. Given that the average share of the workforce employed in skilled occupations in manufacturing grew from 0.8% in 2000 to 1% in 2010, a back-of-the-envelope counterfactual exercise suggests that the share of skilled jobs in the manufacturing sector would have grown 31% more on average if it were not for rising import competition from China. Taken together with the results in Table 3, it thus appears that local labour markets were affected by the 'China supply shock' through declines in both average unskilled wages and skilled manufacturing employment shares.

Tables 7 and 8 also provide additional insight on the nature of the shift towards the nontraded sector in locations more affected by Chinese import competition, as documented in Table 6. Table 8 indicates that growth in the share of nontraded sector employment mainly occurred in relatively unskilled occupations, while Table 7 suggests that these jobs were primarily in the formal sector. This conclusion is supported by the results of regressions with the share of the workforce in formal or informal agricultural/extractive, manufacturing or nontraded jobs on the left-hand side, which may be found in Tables A2 and A3. Across all of the IV specifications, only the regressions for formal jobs in nontraded sectors yield statistically significant coefficient estimates for IS_m.

[21] Tables A2 and A3 show that the estimated effect of XD_m on the proportion of the workforce in formal agricultural or extractive sector jobs is positive in all five specifications, while the estimated impact of XD_m on the share of the workforce in informal jobs in agricultural or extractive sectors is negative in all five specifications. None of these results is statistically significant.

Table 7: Results – Informality

	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)
Panel A. Formal Jobs					
IS_m	.83***	.80***	1.16***	.88**	1.25***
	(.29)	(.29)	(.37)	(.36)	(.44)
XD_m	.36**	.31**	.31**	.32**	.32***
	(.14)	(.15)	(.12)	(.15)	(.12)
Panel B. Informal Jobs					
IS_m	-.28	-.13	.08	.11	.30
	(.38)	(.43)	(.48)	(.39)	(.45)
XD_m	-.28**	-.24	-.24	-.21	-.21
	(.14)	(.16)	(.16)	(.16)	(.16)
Region Fixed Effects			✓		✓
Lag Dep. Variable				✓	✓
1st Stage (KP F-stat.)		334.7	250.3	245.2	195.3

Notes. This table displays estimated effects of Chinese import and export shocks on changes between 2000 and 2010 in the share of the workforce employed in formal and informal private sector jobs, as captured by β_I and β_X from equation (1). Panel A presents results for formal jobs and Panel B for informal jobs. Each column corresponds to a different regression with dependent variable and specification indicated. In the columns marked with IV, we *instrument* imports from (exports to) China using a measure based on growth in Chinese exports to (imports from) all countries, excluding Brazil, relative to a weighted cross-country average. The unit of observation is a microregion (N=558). Coefficients and standard errors are multiplied by 100, so that the coefficients represent percentage point changes. All regressions include a constant and the following *controls*: 2000 workforce, 2000 share of workforce in agricultural sectors, 2000 share of workforce in extractive sectors, 2000 share of workforce in manufacturing, 2000 share of workforce in nontraded sectors, 2000 share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. Regressions in columns (3) and (5) include region fixed effects, and in columns (4) and (5) include the lag of the dependent variable for the period 1991-2000, instrumented with 1991 levels. All regressions are weighted by share of national workforce. *Standard errors* are clustered by mesoregion, 138 clusters. *Source:* 1991, 2000 and 2010 Brazilian Census, and CEPII BACI. *** p<.01, ** p<.05, * p<.1.

Table 8: Results – Occupational Skill Level

	Skilled Occupations			**Unskilled Occupations**		
	OLS	IV	IV	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. All Sectors						
IS_m	-.21	-.04	.10	.77*	.71	1.14**
	(.22)	(.33)	(.38)	(.41)	(.50)	(.55)
XD_m	.05	.07	.07	.02	.01	.00
	(.06)	(.07)	(.08)	(.13)	(.13)	(.14)
Panel B. Agricultural/Extractive Sectors						
IS_m	-.03	-.04*	-.04	-.36	-.21	-.12
	(.02)	(.02)	(.02)	(.25)	(.27)	(.30)
XD_m	.06**	.05*	.05*	.01	.00	-.06
	(.03)	(.03)	(.03)	(.16)	(.17)	(.14)
Panel C. Manufacturing Sectors						
IS_m	-.30**	-.28**	-.26*	.09	-.00	.30
	(.12)	(.13)	(.13)	(.43)	(.48)	(.60)
XD_m	.01	.01	.02	-.08	-.13	-.11
	(.02)	(.02)	(.02)	(.09)	(.09)	(.08)
Panel D. Nontraded Sectors						
IS_m	.11	.27	.38	1.07**	.94*	.96*
	(.20)	(.31)	(.35)	(.54)	(.56)	(.58)
XD_m	-.02	.00	.01	.13	.17	.21
	(.05)	(.06)	(.06)	(.16)	(.18)	(.17)
Region Fixed Effects			✓			✓
1st Stage (KP F-stat.)		334.7	250.3		334.7	250.3

Notes. This table displays estimated effects of Chinese import and export shocks on changes between 2000 and 2010 in the share of the workforce employed in skilled and unskilled occupations, as captured by β_I and β_X from equation (1). Panel A presents results for all sectors, Panel B for agricultural and extractive sectors, Panel C for manufacturing sectors, and Panel D for nontraded sectors. Each column corresponds to a different regression with dependent variable and specification indicated. The dependent variable in columns 1 to 3 is the change in the share of workforce in skilled occupations, and in columns 4 to 6 it is the change in the share of workforce in unskilled occupations. A skilled occupation is defined as an occupation of skill level 3 or 4 according to the ISCO-08 classification. In the columns marked with IV, we *instrument* imports from (exports to) China using a measure based on growth in Chinese exports to (imports from) all countries, excluding Brazil, relative to a weighted cross-country average. The unit of observation is a microregion (N=558). Coefficients and standard errors are multiplied by 100, so that the coefficients represent percentage point changes. All regressions include a constant and the following *controls*: 2000 workforce, 2000 share of workforce in agricultural sectors, 2000 share of workforce in extractive sectors, 2000 share of workforce in manufacturing, 2000 share of workforce in nontraded sectors, 2000 share of workforce in informal jobs, 2000 share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. Regressions in columns (3) and (6) include region fixed effects. All regressions are weighted by share of national workforce. *Standard errors* are clustered by mesoregion, 138 clusters. *Source:* 2000 and 2010 Brazilian Census, and CEPII BACI. *** p<.01, ** p<.05, * p<.1.

4 Conclusion

In this paper, we investigate the effects of China's ascent into one of the world's largest economies on local labour markets in Brazil. As in other developing countries, Brazil's imports from China are dominated by manufactures while most of the growth in its exports to China has been concentrated in agricultural and extractive sectors. We use data from the Brazilian demographic censes of 2000 and 2010 to provide empirical evidence of the heterogeneous effects on Brazilian labour markets of shocks to both Chinese import supply and export demand. Using a shift-share methodology, we compare trends in local labour markets with a similar initial employment structure (proportion of workers in agricultural, extractive and manufacturing sectors) but differently exposed to these two 'China shocks' due to specialization in different specific industries.

We find that local labour markets more affected by Chinese import competition experienced slower growth in manufacturing wages, greater increases in wage inequality and a relative decline in the share of the workforce employed in skilled manufacturing jobs. However, imports from China do not appear to have led to either a fall in employment rates or higher takeup of social assistance (as measured by participation in the *Bolsa Família* program of cash transfers) in affected regions. Meanwhile, in local labour markets experiencing larger growth in Chinese export demand, average hourly wages increased more quickly and without an accompanying increase in wage inequality, while 2010 *Bolsa Família* participation rates were lower. While there is little evidence of an effect of Chinese demand on local employment rates, we do observe positive effects on job quality: an increase in the share of formal employment at the expense of informal jobs, and a rise in the share of the local workforce in skilled agricultural or extractive sector occupations.

Overall, our findings suggest that growth in commodities-for-manufactures trade spurred by the rise of China has created winners as well as losers. Even though the increase in export demand from China has mainly involved the relatively unglamorous agricultural and extractive sectors, local labour markets specialized in these industries appear to have flourished in the presence of this commodity export boom. Moreover, while areas specialized in manufacturing sectors do seem to have suffered from rising Chinese import supply, our findings of slower growth of in-migration rates in more affected regions, along with shifts in the structure of local employment towards nontraded industries, also provide evidence of adjustment in response to competition from China.

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A Additional Figures and Tables

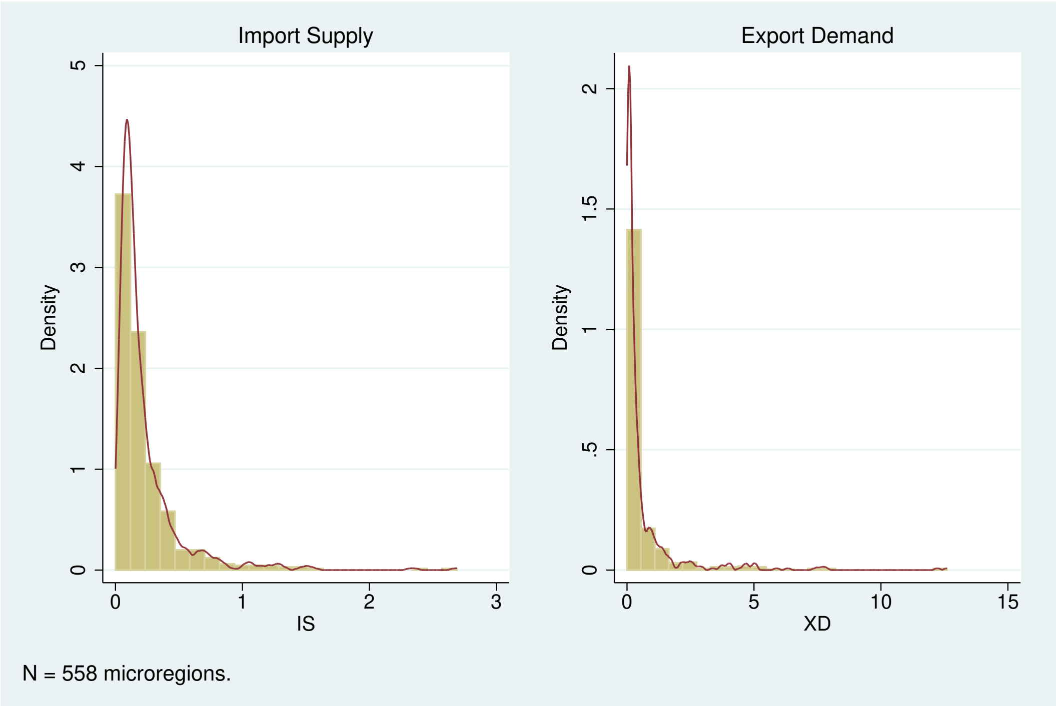

Figure A1: Distributions of Import Supply and Export Demand Measures

Notes. These graphs show the distributions of the import supply and export demand measures (IS_m and XD_m) described in Section 2.2. The solid lines are kernel densities. *Source*: 2000 Brazilian Census, and CEPII BACI.

Table A1: List of Sectors and Additional Summary Statistics (Part 1)

	Import Share	Export Share	Import Supply from China		Export Demand to China	
			Mean	IV	Mean	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Agriculture: rice	-	-	-	-	-	-
Agriculture: maize	-	.000	-	-	.000	-
Agriculture: other cereals	.000	-	.000	.000	-	-
Agriculture: cotton	.000	.005	.000	.000	.013	-
Agriculture: sugar cane	-	-	-	-	-	-
Agriculture: tobacco	.000	.010	.000	.000	.022	.015
Agriculture: soya	-	.229	-	-	.555	.259
Agriculture: manioc	-	-	-	-	-	-
Agriculture: flowers and ornamentals	.000	.000	.000	.000	.000	-
Agriculture: citrus fruits	-	.000	-	-	.000	.000
Agriculture: coffee	-	.000	-	-	.000	.000
Agriculture: cocoa	-	-	-	-	-	-
Agriculture: grapes	-	-	-	-	-	-
Agriculture: bananas	-	-	-	-	-	-
Agriculture: other	.007	.000	.006	.000	.000	.000
Agriculture: bovine animals	-	-	-	-	-	-
Agriculture: sheep	-	-	-	-	-	-
Agriculture: pigs	-	-	-	-	-	-
Agriculture: birds	-	-	-	-	-	-
Agriculture: beekeeping	.000	.000	.000	-	.000	.000
Agriculture: silk	.000	-	.000	-	-	-
Agriculture: other animals	.000	.000	.000	.000	.000	-
Forestry	.000	.000	.000	.000	.000	.000
Fishing and aquaculture	-	.000	-	-	.000	.000
Mining: coal	-.001	.000	-.002	-.018	.000	-
Mining: oil and gas	-	.137	-	-	.219	.015
Mining: radioactive metals	-	-	-	-	-	-
Mining: precious metals	-	-	-	-	-	-
Mining: other metals	.000	.453	.000	-.001	.917	.649
Mining: nonmetals for construction	.000	.001	.000	.000	.001	.002
Mining: precious stones	.000	.000	.000	.000	.001	.001
Mining: other nonmetals	.000	.000	.001	.000	.000	.001
Manuf: meat and fish	.004	.008	.002	.000	.005	.001
Manuf: fruits and vegetables	.002	.003	.002	.000	.003	.000
Manuf: oils and fats	.000	.026	.000	.000	.045	.015
Manuf: dairy products	.000	.000	.000	-	.000	.000
Manuf: sugar	.000	.018	.000	.000	.019	-
Manuf: coffee	.000	.000	.000	-	.000	.000
Manuf: other food	.003	.000	.001	.000	.000	.000
Manuf: beverages	.000	.000	.000	.000	.000	.000
Manuf: tobacco	.000	-	.000	.000	-	-

Notes. This table displays the share of each sector in the total growth of Brazil's imports and exports to China between 2000 and 2010 in columns (1) and (2), the means across microregions of the sector-microregion-level variables used to calculate IS_m and XD_m in columns (3) and (5), and the means across microregions of the sector-microregion-level variables used to calculate $ivIS_m$ and $ivXD_m$ in columns (4) and (6). *Source:* 2000 and 2010 Brazilian Census, and CEPII BACI.

Table A1: List of Sectors and Additional Summary Statistics (Part 2)

	Import Share	Export Share	Import Supply from China		Export Demand to China	
			Mean	IV	Mean	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Manuf: spinning and weaving	.026	.000	.009	.000	.000	.000
Manuf: other textile products	.029	.000	.014	.001	.000	.000
Manuf: apparel	.025	.000	.008	.001	.000	.000
Manuf: leather processing	.000	.011	.000	.000	.014	.000
Manuf: leather products	.001	.000	.000	.000	.000	.000
Manuf: footwear	.003	.000	.001	.001	.000	.000
Manuf: wood products	.001	.001	.001	.000	.001	.002
Manuf: pulp and paper	.003	.039	.003	.000	.041	.002
Manuf: paper products	.001	.000	.000	.000	.000	.000
Manuf: printing and recording	.003	.000	.001	.000	.000	.000
Manuf: coke	.003	-	.040	-.119	-	-
Manuf: refined petroleum	.002	.000	.001	.000	.000	.000
Manuf: nuclear fuel	-	-	-	-	-	-
Manuf: paints and varnishes	.000	.000	.000	.000	.000	.000
Manuf: pharmaceuticals	.018	.001	.004	.002	.000	.000
Manuf: cleaning and hygiene products	.001	.001	.000	.000	.000	.000
Manuf: other chemicals	.065	.008	.026	.014	.004	.003
Manuf: rubber products	.014	.000	.004	.001	.000	.000
Manuf: plastic products	.025	.000	.007	.001	.000	.000
Manuf: glass products	.006	.000	.002	.001	.000	.000
Manuf: ceramic products	.009	.000	.006	.000	.000	.000
Manuf: other nonmetallic mineral products	.003	.000	.001	.000	.000	.000
Manuf: basic metals	.064	.026	.027	.002	.013	.003
Manuf: metal products	.029	.002	.007	.001	.000	.000
Manuf: machinery	.133	.005	.038	.010	.002	.002
Manuf: domestic appliances	.019	.000	.009	.001	.000	.000
Manuf: computing	.073	.000	.033	.017	.000	.000
Manuf: electrical equipment	.080	.001	.023	.005	.000	.000
Manuf: electronics	.192	.001	.065	.024	.000	.001
Manuf: medical instruments	.006	.000	.002	.000	.000	.000
Manuf: measuring instruments	.008	.000	.004	.001	.000	.000
Manuf: optical equipment	.061	.000	.030	.006	.000	.002
Manuf: watches and clocks	.002	.000	.002	.000	.000	.000
Manuf: motor vehicles	.009	.000	.002	.000	.000	.001
Manuf: motor vehicle bodies and parts	.011	.002	.003	.000	.001	.001
Manuf: shipbuilding	.018	-	.016	.000	-	-
Manuf: railway products	.000	.000	.000	.000	.000	-
Manuf: aircraft	.000	.011	.000	-	.012	.005
Manuf: other transport	.009	.000	.007	.001	.000	-
Manuf: furniture	.005	.000	.002	.000	.000	.000
Manuf: other	.026	.001	.008	.001	.000	.000

Notes. This table displays the share of each sector in the total growth of Brazil's imports and exports to China between 2000 and 2010 in columns (1) and (2), the means across microregions of the sector-microregion-level variables used to calculate IS_m and XD_m in columns (3) and (5), and the means across microregions of the sector-microregion-level variables used to calculate $ivIS_m$ and $ivXD_m$ in columns (4) and (6). *Source:* 2000 and 2010 Brazilian Census, and CEPII BACI.

Table A2: Results - Formal Private Sector Jobs

	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)
Panel A. Agricultural/Extractive Sectors					
IS_m	.09	-.00	.06	-.01	.05
	(.12)	(.10)	(.12)	(.11)	(.12)
XD_m	.17	.17	.17	.15	.17
	(.12)	(.13)	(.11)	(.12)	(.11)
Panel B. Manufacturing Sectors					
IS_m	-.27	-.28	-.16	.45	.53
	(.55)	(.57)	(.62)	(.65)	(.73)
XD_m	-.00	-.06	-.06	-.10	-.11
	(.08)	(.08)	(.09)	(.08)	(.10)
Panel C. Nontraded Sectors					
IS_m	1.04**	1.09**	1.26***	.75	1.00**
	(.45)	(.50)	(.43)	(.57)	(.45)
XD_m	.20*	.21	.21	.09	.11
	(.12)	(.13)	(.13)	(.16)	(.14)
Region Fixed Effects			✓		✓
Lag Dep. Variable				✓	✓
1st Stage (KP F-stat.)		334.7	250.3	245.2	195.3

Notes. This table displays estimated effects of Chinese import and export shocks on changes between 2000 and 2010 in the share of the workforce employed in formal private sector jobs, as captured by β_I and β_X from equation (1). Panel A presents results for agricultural and extractive sectors, Panel B for manufacturing sectors, and Panel C for nontraded sectors. Each column corresponds to a different regression with specification indicated. In the columns marked with IV, we *instrument* imports from (exports to) China using a measure based on growth in Chinese exports to (imports from) all countries, excluding Brazil, relative to a weighted cross-country average. The unit of observation is a microregion (N=558). Coefficients and standard errors are multiplied by 100, so that the coefficients represent percentage point changes. All regressions include a constant and the following *controls*: 2000 workforce, 2000 share of workforce in agricultural sectors, 2000 share of workforce in extractive sectors, 2000 share of workforce in manufacturing, 2000 share of workforce in nontraded sectors, 2000 share of workforce in informal jobs, 2000 share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. Regressions in columns (3) and (5) include region fixed effects, and in columns (4) and (5) include the lag of the dependent variable for the period 1991-2000, instrumented with 1991 levels. All regressions are weighted by share of national workforce. *Standard errors* are clustered by mesoregion, 138 clusters. *Source:* 1991, 2000 and 2010 Brazilian Census, and CEPII BACI. *** p<.01, ** p<.05, * p<.1.

Table A3: Results - Informal Private Sector Jobs

	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)
Panel A. Agricultural/Extractive Sectors					
IS_m	-.48**	-.24	-.22	-.12	-.10
	(.23)	(.23)	(.28)	(.22)	(.26)
XD_m	-.10	-.11	-.18	-.07	-.13
	(.12)	(.14)	(.14)	(.12)	(.13)
Panel B. Manufacturing Sectors					
IS_m	.07	-.01	.20	-.00	.21
	(.12)	(.10)	(.13)	(.11)	(.14)
XD_m	-.06*	-.06*	-.04	-.06*	-.04
	(.03)	(.03)	(.03)	(.04)	(.03)
Panel C. Nontraded Sectors					
IS_m	.14	.11	.08	.28	.27
	(.35)	(.38)	(.47)	(.36)	(.46)
XD_m	-.09	-.04	.01	-.05	-.02
	(.14)	(.15)	(.12)	(.15)	(.12)
Region Fixed Effects			✓		✓
Lag Dep. Variable				✓	✓
1st Stage (KP F-stat.)		334.7	250.3	245.2	195.3

Notes. This table displays estimated effects of Chinese import and export shocks on changes between 2000 and 2010 in the share of the workforce employed in informal private sector jobs, as captured by β_I and β_X from equation (1). Panel A presents results for agricultural and extractive sectors, Panel B for manufacturing sectors, and Panel C for nontraded sectors. Each column corresponds to a different regression with specification indicated. In the columns marked with IV, we *instrument* imports from (exports to) China using a measure based on growth in Chinese exports to (imports from) all countries, excluding Brazil, relative to a weighted cross-country average. The unit of observation is a microregion (N=558). Coefficients and standard errors are multiplied by 100, so that the coefficients represent percentage point changes. All regressions include a constant and the following *controls*: 2000 workforce, 2000 share of workforce in agricultural sectors, 2000 share of workforce in extractive sectors, 2000 share of workforce in manufacturing, 2000 share of workforce in nontraded sectors, 2000 share of workforce in informal jobs, 2000 share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. Regressions in columns (3) and (5) include region fixed effects, and in columns (4) and (5) include the lag of the dependent variable for the period 1991-2000, instrumented with 1991 levels. All regressions are weighted by share of national workforce. *Standard errors* are clustered by mesoregion, 138 clusters. *Source:* 1991, 2000 and 2010 Brazilian Census, and CEPII BACI. *** p<.01, ** p<.05, * p<.1.

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