Economics Bulletin

Volume 41, Issue 3

How does import competition impact job type?

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Abstract

This study investigates how the increase in the import competition experienced by the Brazilian economy during 2000–2012 impacted the type of jobs available in manufacturing. These effects are assessed using an unordered multinomial logit model and detailed household survey data that encompass formal, informal, and self-employed workers. The empirical results indicate that a higher import penetration from China reduces the likelihood of having an informal job relative to a formal job. And a larger import penetration from the rest of the world increases the likelihood of both informal and self-employment relative to formal employment. These estimates are robust to concerns of endogeneity of the import penetration measures through the use of a control function approach.

Citation: Lourenco S. Paz, (2021) "How does import competition impact job type?", *Economics Bulletin*, Vol. 41 No. 3 pp.2063-2073
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Submitted: June 07, 2021. **Published:** September 18, 2021.

1. Introduction

The nexus between import competition and job precarization in developing countries has concerned policymakers and scholars. Job precarization typically takes place through the replacement of formal jobs—that are protected by labor regulations—by either informal jobs or self-employment. While the former simply does not comply with labor regulations, the latter is legal but exposes workers to income volatility (Fields, 2020). Besides reducing workers' welfare, precarization has been found to be an important driver of income inequality (Zuo, 2016). Sehnbruch et al. (2020) point out that this phenomenon is not only ubiquitous in Latin America but also quantitatively important. For instance, the majority of workers in Mexico can be classified as informal according to Conover et al. (2021).

Brazil is an interesting case for two reasons. First, it exhibits a large share of workers with precarious jobs (Paz, 2018). Second, Brazil experienced an increase in the share of formal jobs in manufacturing from 52 to 67 percent between 2000 and 2012. And the share of informal jobs fell from 19 to 12 percent and the share of self-employment dropped from 29 to 21 percent. This period was also marked by a greater import competition in the Brazilian manufacturing sector. Its import penetration grew by 25 percent, and the share of Chinese imports expanded from three to twenty percent (Kapri and Paz, 2019). Since job precarization is widespread in developing countries and the evidence available in the extant literature is ambiguous (Paz, 2014, and Davalos 2019), it is paramount to examine whether this episode of increased import competition actually induced this substantial formalization of the labor force in Brazil.

This study combines two strands of the literature. The first strand—for instance Fields (2020) and Sehnbruch et al. (2020)—suggests that self-employment and informal jobs are related phenomena and should not be studied separately. The second strand focuses on the differential impact of trade exposure depending on the country of origin of the imports, like Facchini et al. (2010) and Paz (2018). This study contributes to the literature by proposing a discrete-choice econometric specification that employs household survey data to assess the effects of import penetration on the worker's likelihood of holding different job types, and whether these effects depend on the origin of the imports.

The empirical results suggest that the effect of imports differ according to the source of imports. In fact, a greater industry-level imports from China reduces the likelihood of informal jobs, whereas larger imports originating elsewhere increase the likelihood of both self-employment and informal jobs. Also, when self-employment as an alternate job type is disregarded in the analysis, the Chinese import penetration is found to have no effect on the informal job likelihood.

2. Data

The dataset used in this study contains information on international trade flows, on Brazilian national accounts, and on household surveys. The international trade flow figures are available at the 1996 six-digit harmonized system and they were extracted from the Comtrade system (United Nations, 2003) for the period between 2000 and 2012. The trade flows of interest are the Brazilian and other Latin American countries' imports from China and from the remaining countries of the world (hereafter called ROW). The Brazilian national accounts data come from IBGE (2015) and encompass data on total output level, imports and exports measured in local

currency. These data are used to compute the import competition measure used in this study, which is the industry-level import penetration. The Chinese (or ROW) import penetration is calculated as the ratio between imports from China (or ROW) and apparent consumption, which is defined as production plus total imports minus total exports.

The labor market data come from the PNAD-Pesquisa Nacional por Amostra de Domicilios (Brazilian household survey) and from the Brazilian demographic censuses of 2000 and 2010, since the PNAD household surveys are not conducted in a census year. These surveys provide information on the workers characteristics such as industry affiliation, earnings, hours worked in a week, self-employment or wage employment, job formality status, age, education, gender, marital status, race, and Brazilian state of residence. The PNAD surveys' questions about these characteristics do not change over time, and they are practically identical to those used in the Brazilian censuses. Nevertheless, the industry classification used changes over time. The 2002–2012 PNADs employ the CNAE-Domiciliar classification. The 2000 Census also uses the CNAE-Domiciliar, whereas the 2010 Census uses the CNAE-Domiciliar 2.0. Such different industry classifications were harmonized by means of correspondence tables from the CONCLA-IBGE website (https://concla.ibge.gov.br/). The classification used by the National Accounts data is the most cursory, and therefore dictates the final classification used in this study. At the end of the day, the classification used here contains 26 manufacturing industries.

Table I presents the summary statistics of the industry level share of informal and self-employed workers. We can see a substantial variability in these series, with some industries having a small share of informal workers while others having a share in excess of 30 percent. The share of self-employed workers exhibits a similar pattern, albeit in some industries more than half of the workers are self-employed.

The overall import penetration grew in excess of 20 percent in 16 out of 26 industries. And the Chinese import penetration expanded in 24 out of 26 industries. Such expansion was induced by China's accession to the World Trade Organization in 2001. Such event increased its access to global markets (Paz, 2018). Note that both the Chinese and the ROW imports grew in this period. Table I show that both the Chinese and the ROW import penetrations show a large inter-industry variation. The maximum Chinese import penetration is 18.21 percent, while the largest ROW import penetration is 55.63 percent.

Table II shows the descriptive statistics of the workers' characteristics according to their job type. These figures indicate that formal workers have on average more years of schooling. Females are more likely to be informal or self-employed. And self-employed workers are on average ten years older than both formal and informal workers. The analysis now turns to the empirical specifications.

3. Empirical methodology

Paz (2014) designed a theoretical model where increased imports makes the smallest firms—which typically employ informal workers—to exit the market. This reduces the employment of informal workers. Yet, the firms that were previously indifferent between hiring either formal or informal workers switch away from formal employment in response to the increased imports. This leads to an ambiguous effect of import penetration on informality.

The empirical methodology developed here differs from the extant empirical literature by considering self-employment as an additional margin of adjustment for trade shocks. Even though

self-employment is characterized by low attachment between worker and employer, it is legal and has a much smaller cost than a formal labor contract (Almeida et al., 2020). Following Paz (2019), the industry-level import penetration is broken down into Chinese ($IP_{j,t}^{China}$) and ROW ($IP_{j,t}^{ROW}$) import penetrations because their impact may differ since China is labor-abundant relative to Brazil, while the ROW is not. Another reason to expect a different effect of imports according to their origin comes from Facchini et al. (2010). They find that Chinese-made goods are closer substitutes to Brazilian-made goods than those imported from high-income countries.

The types of job (Y_{ijst}) held by worker *i* in industry *j* in state *s* and year *t* are formal (*o*=1, base outcome), informal (*o*=2), or self-employment (*o*=3), which are modeled as an unordered multinomial logit specification shown in equation (1).

$$y_{ijst,o}^{*} = \alpha_o + \beta_{1,o} IP_{jt}^{China} + \beta_{2,o} IP_{jt}^{ROW} + \Psi_o \text{Characteristics}_{ijst} + \gamma_{j,o} + \theta_{s,o} + \delta_{t,o} + u_{ijst,o} \quad (1)$$

$$P(Y_{ijst} = 0) = \frac{1}{1+e^{y_{ijst,1}^{*}}+e^{y_{ijst,2}^{*}}} \text{ and } P(Y_{ijst} = o) = \frac{e^{y_{ijst,o}^{*}}}{1+e^{y_{ijst,1}^{*}}+e^{y_{ijst,2}^{*}}}, o = 1, 2$$

where $y_{ijst,o}^{*}$ is the latent dependent variable; $\text{Characteristics}_{ijst}$ is a vector of worker's characteristics: age, age squared, years of education; indicators for female, married, black, Asian, high school degree, and college degree; γ_j, θ_s, and δ_t are industry, state-of-residence, and year effects, respectively; and $u_{ijst,o}$ is the error term.

There may be omitted factors affecting both the outcomes and the import penetrations that would render estimates biased. For instance, an unexpected import penetration growth that is counteracted by Brazilian government-imposed safeguards. According to the WTO Antidumping Gateway there were close to 100 antidumping procedures in Brazil in this period, and a quarter of them against Chinese producers. This econometric issue in the non-linear econometric model used here can be addressed through a control function approach developed in Liu et al. (2010). It consists of estimating the residuals of a linear regression of the endogenous regressors on the excluded instruments and on the other control variables from equation (1). These residuals are then added to equation (1) as control variables in order to account for the previously overlooked correlation between the endogenous regressors and the error term.

The excluded instruments are based upon an idea from Iacovone et al. (2013) that there are supply-driven components of Brazilian imports that are unrelated to the Brazilian economy. This means that the Chinese share of imports of third countries is an excluded instrument for the Chinese import penetration in Brazil. These third countries are those in Latin America that exhibit small trade ties with Brazil, namely Mexico, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Jamaica, Nicaragua, Panama, and Peru. The correlation between this excluded instrument and the Chinese import penetration is 0.574. Similarly, an excluded instrument for the ROW import penetration is the share of the imports of those third countries sourced in high-income countries, namely Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, USA, and United Kingdom. The correlation between this excluded instrument and the ROW import penetration is 0.299.

Table III shows the OLS regressions of the endogenous import competition regressors on the excluded instruments and additional controls. Columns (1) and (2) show the estimates for the sample containing all types of labor contracts, while the sample used in the specification reported

in columns (3) and (4) do not contain self-employed workers. The excluded instruments' coefficients are statistically significant and have the expected signs. The control function terms included in equation (1) are the predicted residuals of these specifications.

4. Results

Table IV reports the multinomial logit estimates of equation (1) for self-employment and informal job outcomes in the odd- and even-numbered columns, respectively. The first set of estimates does not include the control function terms, as can be seen in columns (1) and (2). The estimates in column (1) are interpreted as follows. A percentage point increase in the Chinese import penetration reduces the likelihood of self-employment relative to a formal job by a factor of 0.956, whereas a similar change in the ROW import penetration increases such likelihood by a factor of 1.01. In column (2), only the ROW import penetration had a positive and statistically significant impact on the likelihood of an informal job relative to a formal job.

The estimates in columns (3) and (4) of Table IV include the control function terms that are the estimated residuals of the specifications reported in columns (1) and (2) of Table III. Since these are generated regressors, the standard errors of these specifications are estimated by a 500-repetition bootstrap following the procedure provided by Liu et al. (2010). In column (3), both control function terms are statistically significant, whereas only the residual from column (2) of Table III (for the ROW import penetration) is significant in column (4). These results indicate the presence of omitted variable bias in the estimates without the control function terms in columns (1) and (2) of Table IV. Column (3) shows that the Chinese import penetration is not statistically significant. This means that it does not impact the likelihood of self-employment anymore, while the impact of the ROW import penetration remained significant and enlarged by a factor of 1.018. In column (4), the Chinese import penetration is now significant, and its negative coefficient implies a reduction in the likelihood of an informal job relative to a formal job by a factor of 0.983. The ROW import penetration impact remains positive and significant, and its impact increased to a factor of 1.16. Hence, the effects of imports depend upon their country of origin, as in Kapri and Paz (2019).

The next exercise consists of evaluating the robustness of the previous results when self-employment is overlooked as an alternate job. Columns (1) and (2) of Table V present Logit specifications where the dependent variable is "1" if the worker has an informal job or "0" if she has a formal job. Note that the sample used in these new estimates does not encompass self-employed workers. Column (5) reports the estimates without control function terms. We can see that the Chinese import penetration is not statistically significant, albeit ROW import penetration is positive and significant. The specification reported in column (6) contains the control function terms that are the residuals of the specifications reported in columns (3) and (4) of Table III. The estimates in column (6) of Table V show a positive and statistically significant coefficient for the ROW import penetration, and the Chinese import penetration is not statistically significant.

By contrasting the results in Table IV with those in Table V, we can see that not considering self-employment as a job alternate leads to biased estimates even when a control function approach is used to address the endogeneity of trade exposure measures. In this study, the omission of self-employment altered the negative impact of Chinese import penetration on the likelihood of holding an informal job to a case of no effect at all.

5. Conclusions

This study examines the effects of import competition on manufacturing job type in Brazil using household-level survey data for the 2000-2012 period. It makes two contributions to the literature. The first is the use of a discrete choice model to account for the different types of jobs available (formal, informal, and self-employment) and of a control function approach developed by Liu et al, (2010) to address the endogeneity of the import competition measures. Second, it measures import competition as the Chinese import penetration and the rest of the world import penetration, since the effects of imports may differ according to their origin (Kapri and Paz, 2019).

The estimated coefficients indicate that a higher import penetration from China reduces the likelihood of having an informal job relative to having a formal job, while a larger import penetration from the rest of the world fosters both informality and self-employment. Hence, the effects of import do depend on their source. Furthermore, when self-employment as an alternate job type is overlooked in the analysis, the estimates become biased, and the Chinese import penetration is found to have no effect on the informal job likelihood.

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Table I. Industry-level descriptive statistics.

Variable	Mean	Std. Dev.	Minimum	Maximum
Share of informal workers	.138	.074	.004	.347
Share of self-employed workers	.103	.138	0	.557
Chinese import penetration	1.412	2.48	0	18.219
ROW import penetration	12.633	11.007	0	55.636
LA share of imports from China	.081	.097	0	.44
LA share of imports from high income countries	.63	.166	.041	.973

Notes: ROW means rest of the world. LA means Latin American countries. Household survey weights used in the calculation of the shares of informal and self-employed workers.

Table II. Workers' descriptive statistics according to job type.

Variable	Mean	Std. Dev.	Minimum	Maximum
Formal				
Age	32.422	10.17	15	65
Female	.285	.451	0	1
Married	.56	.496	0	1
Black	.066	.249	0	1
Asian	.006	.074	0	1
Years of school	7.955	3.668	0	19
High school degree	.253	.435	0	1
College degree	.038	.192	0	1
Self-employed				
Age	40.266	11.493	15	65
Female	.542	.498	0	1
Married	.662	.473	0	1
Black	.055	.229	0	1
Asian	.006	.08	0	1
Years of school	6.424	3.763	0	19
High school degree	.165	.371	0	1
College degree	.017	.129	0	1
Informal				
Age	30.232	11.603	15	65
Female	.343	.475	0	1
Married	.461	.498	0	1
Black	.068	.251	0	1
Asian	.006	.077	0	1
Years of school	6.461	3.589	0	19
High school degree	.139	.346	0	1
College degree	.015	.121	0	1

Note: Household survey weights used.

Table III. Control function OLS regressions.

Regressors \ Dependent Variable	(1) Chinese imp. penetration$_t$	(2) ROW imp. penetration$_t$	(3) Chinese imp. penetration$_t$	(4) ROW imp. penetration$_t$
Latin American countries' Chinese share of imports$_t$	11.074***	-11.267**	11.031***	-10.663**
	(2.789)	(4.411)	(2.736)	(4.717)
Latin American countries' high-income countries share of imports $_t$	-3.274	-11.884**	-3.481	-10.195*
	(2.241)	(5.259)	(2.712)	(5.986)
Age	-0.002	-0.006**	-0.002	-0.005*
	(0.002)	(0.003)	(0.002)	(0.003)
Age^2	0.000	0.000**	0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Female	-0.028*	-0.024	-0.013	-0.006
	(0.015)	(0.021)	(0.014)	(0.016)
Married	-0.005	0.019***	-0.004	0.021***
	(0.004)	(0.007)	(0.004)	(0.007)
Black	0.008	-0.008	0.006	-0.007
	(0.005)	(0.008)	(0.006)	(0.008)
Asian	-0.080	0.170**	-0.094	0.181**
	(0.057)	(0.075)	(0.062)	(0.080)
Years of schooling	0.003	-0.003	0.004*	-0.002
	(0.002)	(0.002)	(0.002)	(0.003)
High school	-0.089*	0.119*	-0.094*	0.124*
	(0.050)	(0.066)	(0.049)	(0.066)
College	-0.058	-0.000	-0.069	0.034
	(0.049)	(0.077)	(0.053)	(0.073)
Sample has self-employed workers?	Yes	Yes	No	No
F-statistics	6,822	2,856	2,888	10,214
R-squared	0.821	0.965	0.814	0.965
Observations	1,105,930	1,105,930	921,280	921,280

Notes: ***p<0.01, **p<0.05, *p<0.1. Constant, year, industry, and state fixed effects are included in the model. Standard errors clustered at the industry level. Household survey weights used.

Table IV. Discrete-choice specification (Multinomial Logit) of equation (1).

Regressors \ Outcome	(1) Self-employment	(2) Informal job	(3) Self-employment	(4) Informal job
Chinese imp. penetration$_t$	-0.045***	-0.002	-0.007	-0.017***
	(0.003)	(0.003)	(0.005)	(0.004)
ROW imp. penetration$_t$	0.010***	0.030***	0.018**	0.148***
	(0.002)	(0.002)	(0.008)	(0.008)
Age	-0.016***	-0.212***	-0.016***	-0.211***
	(0.002)	(0.001)	(0.002)	(0.002)
Age^2	0.001***	0.003***	0.001***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Female	0.733***	0.324***	0.733***	0.332***
	(0.007)	(0.008)	(0.007)	(0.007)
Married	0.275***	-0.138***	0.275***	-0.143***
	(0.007)	(0.006)	(0.007)	(0.006)
Black	-0.324***	-0.100***	-0.323***	-0.099***
	(0.013)	(0.011)	(0.013)	(0.011)
Asian	0.270***	0.352***	0.273***	0.330***
	(0.039)	(0.037)	(0.039)	(0.036)
Years of schooling	-0.029***	-0.091***	-0.029***	-0.090***
	(0.001)	(0.001)	(0.001)	(0.001)
High school	-0.034***	-0.173***	-0.030***	-0.189***
	(0.010)	(0.011)	(0.010)	(0.010)
College	-0.252***	0.304***	-0.252***	0.303***
	(0.024)	(0.022)	(0.022)	(0.022)
Residual column (1) Table 3			-0.068***	0.003
			(0.007)	(0.006)
Residual column (2) Table 3			-0.017*	-0.128***
			(0.009)	(0.008)
Log likelihood	-781174	-781174	-780971	-780971
Observations	1,105,930	1,105,930	1,105,930	1,105,930

Notes: ***p<0.01, **p<0.05, *p<0.1. Constant, year, industry, and state fixed effects are included in the model. Standard errors are bootstrapped for columns (3) and (4), and clustered at industry level elsewhere. Household survey weights used.

Table V. Discrete-choice specification (Logit) of equation (1) without self-employment.

Regressors \ Outcome	(1) Informal job	(2) Informal job
Chinese imp. penetration$_t$	0.002	0.001
	(0.003)	(0.004)
ROW imp. penetration$_t$	0.030***	0.153***
	(0.002)	(0.009)
Age	-0.223***	-0.222***
	(0.002)	(0.002)
Age^2	0.003***	0.003***
	(0.000)	(0.000)
Female	0.351***	0.356***
	(0.007)	(0.007)
Married	-0.132***	-0.138***
	(0.007)	(0.006)
Black	-0.091***	-0.090***
	(0.011)	(0.012)
Asian	0.350***	0.326***
	(0.038)	(0.037)
Years of schooling	-0.098***	-0.098***
	(0.001)	(0.001)
High school	-0.172***	-0.188***
	(0.011)	(0.010)
College	0.346***	0.342***
	(0.023)	(0.024)
Residual column (3) Table 3		-0.012**
		(0.005)
Residual column (4) Table 3		-0.132***
		(0.009)
Log likelihood	-394338	-394225
Observations	921,280	921,280

Notes: ***p<0.01, **p<0.05, *p<0.1. Constant, year, industry, and state fixed effects are included in the model. Standard errors are bootstrapped for column (2) and clustered at industry level elsewhere. Household survey weights used.