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Labor Market Flows: Evidence from Chile Using Micro Data from Administrative Tax Records*

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Abstract

Using administrative tax records for all formal Chilean firms and employees, we compute and characterize several labor flow measures. Our results show that labor mobility in Chile is large for international standards, with the reallocation rate averaging 37% over the last decade, the highest value among the 25 OECD countries with comparable data. The magnitude of labor reallocation is highly heterogeneous among firms and industries, being highest in Agriculture and Construction. Job reallocation is also high for smaller companies, especially due to high rates of firm creation and destruction, and for firms that pay lower wages. Finally, there is a significant procyclical behavior of workers' entry rate, and, in smaller magnitude, a countercyclical reaction of the exit rate, which is consistent with international evidence that shows job creation to be the main adjustment mechanism over the business cycle.

Resumen

En base a datos administrativos de impuestos para todas las empresas y trabajadores asalariados en Chile, este artículo presenta diversas medidas de flujos laborales. El resultado principal es que la rotación laboral en Chile es alta para estándares internacionales, con un promedio anual de 37% en la última década, el valor más alto entre 25 países de la OCDE. Existe mucha heterogeneidad en la rotación laboral entre firmas e industrias, con los sectores de Agricultura y Construcción mostrando las mayores tasas. La movilidad laboral también es mayor en las empresas más pequeñas, en especial por su alta tasa de creación y destrucción, y también en empresas con menores salarios promedio. Finalmente, se documenta que la tasa de contratación de trabajadores es altamente procíclica, mientras que la tasa de destrucción es moderadamente contracíclica.

1.   Introduction

Labor flows play a crucial role in the behavior of the aggregate economy, allowing adjustment to aggregate, industry-specific, and firm-specific shocks, and reallocating resources towards more productive uses. In general, labor market flexibility improves the economy´s ability to deal with cyclical fluctuations and increases aggregate productivity by leading to a more efficient allocation of workers. Thus, restrictions to labor flexibility can have adverse consequences in the short run and the long run, with higher volatility of output and employment over the business cycle, and smaller productivity growth due to misallocation.

Thus, measuring labor flows with precision provides an important indicator of the operation of the labor market and the overall economy. Additionally, the characteristics of labor flows can also provide indications on the quality of job relationships, the importance of on-the-job learning and human capital accumulation by workers, and the operation of the search and matching process. While the information provided by net labor flows at the firm level is certainly valuable, gross flows, which account separately for hiring and separation flows, provide a much more complete picture. For instance, a firm with zero net flows, which maintains the same number of workers across time, can still experience a complex process of reallocation that can only be captured by analyzing entry and exit flows separately.

This paper provides evidence on gross labor flows at the firm-level in Chile, using census data from administrative tax records provided by the Chilean Internal Revenue Service (SII). This extends the previous literature for Chile, limited by data availability,[1] and allows us to provide novel statistics on aggregate measures of job creation and job destruction. The SII dataset compiles information from tax forms filled by each company on the behalf of its employees. This data allows us to provide a complete description of labor flows in Chile between 2005 and 2014, extending previous papers which had to rely on limited survey data (García and Naudon, 2012, Madeira, 2015, Marcel and Naudon, 2016) or administrative data for only a small subset of the formal labor force (Reinecke and Ferrada, 2005).

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[1] García and Naudon (2012) and Marcel and Naudon (2016) show there are significant flows between the states of employment, unemployment and out of the labor force using the Labor Force Survey (ENE) of the Institute of National Statistics. Reinecke and Ferrada (2005) compute labor flows using company-level data from the Chilean Association of Labor Security (AChS).

The data used in this paper has several advantages relative to earlier literature. First, the dataset completely covers the labor force with a wage contract in Chile. Second, the data is constructed from sworn declarations presented in companies' tax statements, where misreporting has costly legal implications, which makes it more reliable and less prone to measurement error than voluntary surveys.[2] Third, by identifying individual workers within a firm at any point in time, we can compute measures of total entry and exit of workers in the labor force, as well as job creation, destruction and net employment growth by firm.[3] Finally, the SII data registers the employment of workers at each company on a monthly frequency, allowing us to track high-frequency labor adjustments to understand the dynamics of employment after aggregate shocks.

The main conclusions of our analysis are the following. First, job reallocation, measured by the mean of the annual entry and exit rates of workers at the firm level, averaged around 37% in the decade from 2005 to 2014. This implies that in an average year almost 40% of the workers in a given company were newly hired workers, while a similar percentage exited the firm. This average hides a large degree of heterogeneity between companies and individuals, however. Job reallocation is larger for firms in Agriculture and Construction, small firms, and among firms that pay lower average wages. From the perspective of workers, there is a negative correlation between reallocation and the wage level.[4]

Second, the results show that entry rates are strongly procyclical, while exit rates are mildly countercyclical. This implies that job hiring is the main adjustment mechanism to economic fluctuations, which is consistent with empirical evidence reported for the United States by Davis et al. (2012) and with job search models with wage rigidity (Shimer, 2005, 2012).

Third, job reallocation in Chile is high for international standards, being the highest in a sample of 25 OECD countries. Although explaining the differences in labor markets of each country lies outside the scope of this paper, we conjecture that the high Chilean reallocation rates might relate to factors such as the large degree of sectoral reallocation and the relative importance of fixed term labor contracts.

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[2] The SII dataset has unique identifiers for both persons and companies, allowing us to track individuals over time. Identifiers are anonymized to guarantee confidentiality.

[3] See, for instance, Davis y Haltiwanger (1999).

[4] The wage level is a proxy of skills or job qualifications, since education, age, gender and other information are not reported in the dataset.

The structure rest of the paper is as follows. Section 2 summarizes the data and the methodology used to measure of labor flows. Section 3 analyzes the heterogeneity of job reallocation according to firm characteristics, while section 4 studies the dynamic reaction of labor flows through the economic cycle. Section 5 compares the job reallocation of Chile with other countries where similar data is available. Finally, Section 6 concludes with a review of the major results and questions for future research.

2.   Data description

Our dataset is the combination of the information contained in three different tax forms between 2005 and 2014:

- Form 1887: Annual statement reported by all natural or juridical entities which develop an entrepreneurial activity and pay income according to the Article 42nd Nr 1 of the Law of Taxable Income, which includes wages, overtime wages, labor earnings and any other similar income (excluding disability, pensions and retirement payments). While the statement is annual, it contains information on the monthly payroll of firms, allowing us to identify, for any given month, the employment status of an individual worker.[5]

- Form 22: Statement of annual income presented by companies and individuals for tax purposes, which is compulsory for all companies and workers that received any non-exempt taxable income during the fiscal year. This form also shows the net income of companies that can be subject to capital taxation, based on current or accrued revenues.

- Form 29: This form reports the monthly Value Added Tax (VAT) of the company due to sales from exports, imports, purchases of fixed assets, exempt sales or purchases, and fiscal credits.[6]

Between January 2005 and December of 2014, Form 1887 contains information on a total of 33 million job positions, from which we identify slightly over 9 million workers in 563,000 different companies. From this initial universe, we apply filters to exclude and adjust observations that might prove unreliable or not directly related to the concept of employment traditionally used in the

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[5] The data does not allow us to identify the status of an individual worker who does not appear in Form 1887 in a given month. Hence, we cannot discriminate between unemployment, inactivity, or employment in the informal sector.
[6] This form also shows the industrial sector of each firm according to the ISIC (International Standard Industrial Classification of All Economic Activities, Rev.3) of the United Nations.

literature. First, we exclude all companies that only report a single worker during the entire period, since these companies are more aptly understood as a form of self-employment rather than a productive unit actively hiring and destroying job positions. Second, some workers show "absence gaps" in which they work for a given firm for a certain period, disappear from the dataset for some time, and then show up again at the same initial firm. We consider these observations as a single job relationship if the labor absence is equal or shorter to one year. The idea is that relatively short gaps may correspond to medical leaves,[7] or particular situations such as short-term post-graduate studies, in which there is no interruption of the underlying long-term relationship with the firm. We count job positions at the same company as separate incidents of destruction and creation if the gap was longer than 12 months.

As a third filter, we exclude firms that file reports on an irregular frequency, such as only filing some months or some years with gaps in between. These irregular reports are of dubious quality and may lead to a spurious counting of job creation and destruction through an artificial extensive margin of firm entry and exit. Finally, we exclude firms who report over 50% of their job posts with a duration of just a single month. Table 1 summarizes the number of job positions, workers and firms from applying these three exclusion criteria. The results of the rest of the paper use the sample on the third and final column of this table.[8]

Table 1: Original dataset and exclusion criteria (2005-2014)

	Form 1887	**Form 1887 Excluding Self-Employment**	**Form 1887 Excluding Self-Employment After Matching Forms 22 and 29**
Firms	563,626	428,342	253,598
Workers	9,052,582	9,009,948	7,871,376
Payroll	33,353,199	33,403,506	25,236,086

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[7] For instance, maternity leaves, which were legally extended from 3 months to up to 6 months in the sample period. The data does not contain any information on the workers characteristics, such as age or gender.

[8] We also applied two additional criteria to check the robustness of the results. These exercises are not reported in the article, but it is available from the authors upon request. The first exercise used all the available observations in the dataset, except for companies that only reported a single worker in the entire period. The second exercise only excluded jobs that had an absence period of 12 months or less. The results reported in Section 3 remained similar after implementing these two additional exercises.

3. Aggregate labor reallocation and micro-heterogeneity

There is an extensive empirical literature measuring labor flows,[9] although some studies are limited by the characteristics of the available data. For instance, a widely used dataset for the United States is the *Business Employment Dynamics (BED)*, which is a census of all formal firms in the economy (Davis et al. 2006). However, this dataset only indicates the total number of employed workers in a firm, and therefore can only measure net labor flows for each company, not gross flows (the number of jobs destroyed and created by the company in a given period). This is a significant limitation since, as shown in Davis et al. (2012), the magnitude of gross labor flows is much larger than net flows. For instance, even firms that show net employment growth in a given period have high rates of job destruction in the same period. In reverse, companies with negative growth also have a significant number of hires even as they reduce total employment. Therefore, net flows can hide a significant degree of labor reallocation. In the case of Chile, available data has previously limited most studies to measure gross flows in a similar way as the BED.

To measure gross flows we define the following variables:

$$ER_{ijt} = \frac{Ent_{ijt}}{m_{ijt}}; \ \ SR_{ijt} = \frac{Sep_{ijt}}{m_{ijt}};$$
$$NR_{ijt} = ER_{ijt} - SR_{ijt}; \ \ R_{ijt} = \left(ER_{ijt} + SR_{ijt}\right)/2. \tag{1}$$

$$ER_{jt} = \sum_{i \in J} ER_{ijt}\left(\frac{m_{ijt}}{m_{jt}}\right); \ \ SR_{jt} = \sum_{i \in J} SR_{ijt}\left(\frac{m_{ijt}}{m_{jt}}\right);$$
$$NR_{jt} = ER_{jt} - SR_{jt}; \ \ R_{ijt} = \sum_{i \in J} R_{ijt}\left(\frac{m_{ijt}}{m_{jt}}\right) \tag{2}$$

Equation (1) presents the definitions of the entry rate (ER), separation rate (SR) and reallocation rate (R) for each company I from industrial sector j at time t. m_{ijt} is the mean employment level of firm i from sector j in the periods t-1 and t, Ent_{ijt} is the total entry or hiring of workers of company i in period t (for annual periods this corresponds to the number of workers in December of year t which were not working at the company in December of the previous year t-1) and Sep_{ijt} is the

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[9] See Davis and Haltiwanger (1999).

total number of worker separations or exits (for annual periods this corresponds to the number of workers in December of the previous year t-1 which were no longer working at the company in December of the current year t). The net growth rate (NR) is the difference between the entry and exit rates, and rotation (R) is the average of the exit and entry rates.[10] Equation (2) shows the same definitions for entry, exit, and net growth and reallocation rates for sectors j at time t. Sector j represents any set of firms, such as the entire aggregate economy in the country, a specific economic sector, a set of firms of a given size, labor or wage levels, etc. m_{jt} is the average number of workers in sector j during periods t-1 and t. Sectorial rates are simply weighted averages of the rates of individual firms, with weights given by their number of workers.

Figure 1 shows the distribution of reallocation rates for individual firms in 2007. The extensive margin plays an important role: job reallocation caused by the creation and destruction of firms explains 12% of the entire reallocation in the economy. Furthermore, a large number of firms report neither hiring nor separations in a given year. There is also some discontinuity in the probability of particular reallocation rates, since for companies with a small number of workers the reallocation rates can only take values in a small discrete set (say, a company of 5 workers can only report rates of 20%, 40%, 60%, 80% and 100%).

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[10] The monthly data comes from form F1887. Jobs created in March of 2010 and destroyed in November of 2010, for instance, are not accounted in our measure of annual labor flows rates. Furthermore, we exclude employment in Agriculture (except in the analysis for each industry). These adjustments make our analysis more comparable to the international data, where annual surveys generally miss relations created and destroyed within the year, and usually exclude agricultural employment.

Figure 1: Histogram of job reallocation rates, aggregate economy

a)   All Firms

b)   Firms with 10 workers or more
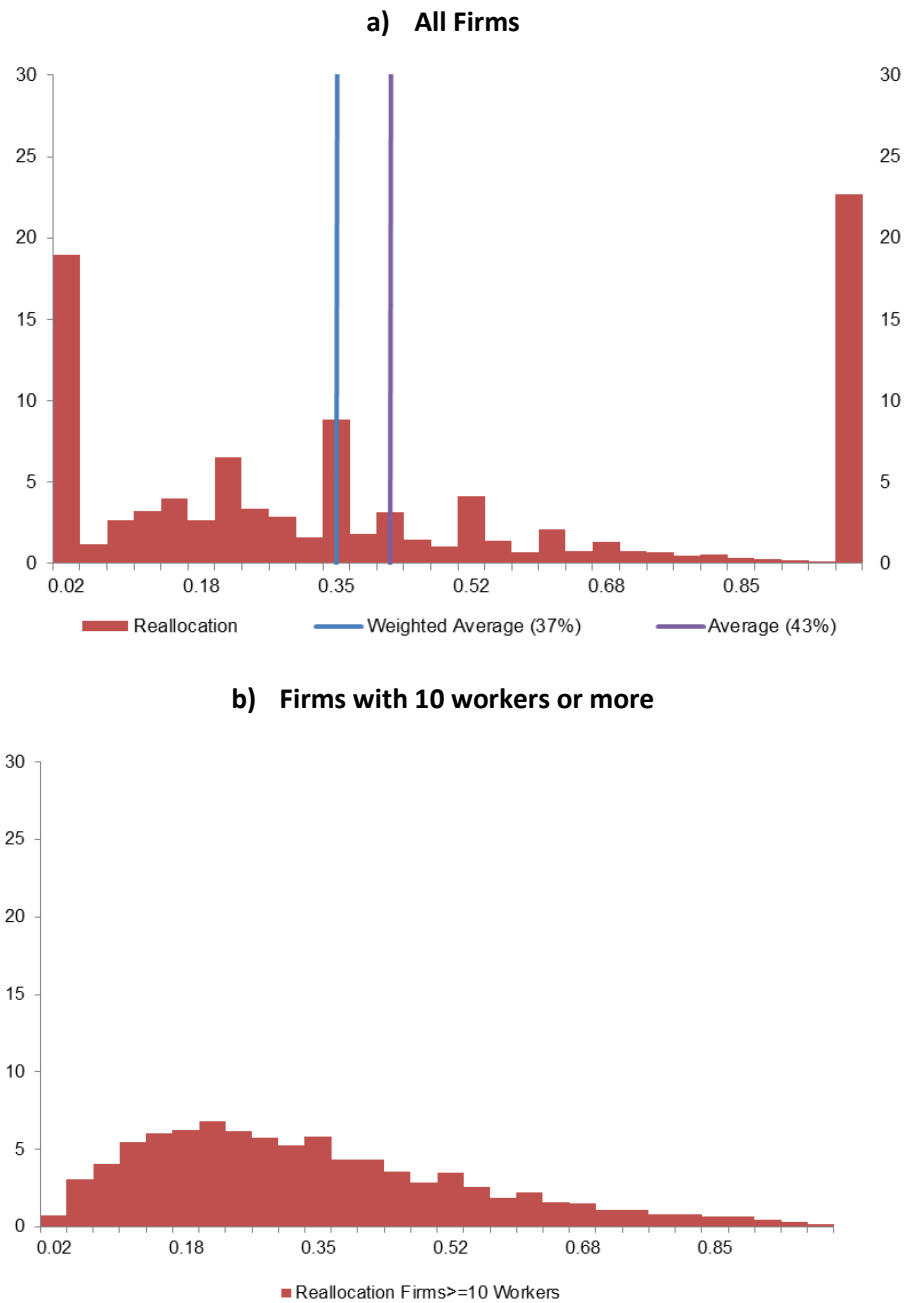
Note: Distribution of reallocation rates for individual firms in 2007. Cross-sectional (weighted and unweighted) averages are reported in parenthesis.

Source: Authors calculations using SII data.

For the universe of companies in 2007, the average reallocation rate was 43%, while the aggregate reallocation rate (which weighs individual companies by their employment size) was 38%. Panel b) of Figure 1 restricts the sample to companies with 10 w orkers or more (over 90% of the total employment) and to companies with a positive reallocation rate that operate in adjacent years (that is, we exclude firms that were not active in 2006 or are not active in 2008 and firms with no hiring or separations). For this subset of firms, the distribution of reallocation rate is approximately unimodal, with the global mode around 20%.

3.1   Reallocation rates by firm size

Figure 2 shows the distribution of the reallocation rates across different firm size categories.[11] Micro and small firms represent a large part of both tails, since these firms are born and die with a small number of workers, and by construction can exhibit less "small" employment adjustments (as a percentage of the company employment level) than larger firms . Medium-sized firms also have more tail activity than large companies do, although to a lower extent than micro and small firms do. Large companies have more activity in terms of gradual employment adjustments and show more presence in reallocation rates that are between 0% and 100% instead of those two extremes. Figure 2 also shows that the average reallocation rate falls with firm size. As confirmed in Section 3.5, this effect is mostly due to the extensive margin of small firms either entering or exiting the market.

## 3.2   Reallocation rates by economic sector

International evidence shows that there are large differences in labor flows across economic sectors, with industries such as Construction and Manufacturing showing higher reallocation rates.[12] Figure 3 shows the distribution of reallocation rates in three relevant economic sectors: Construction, Wholesale and Retail Trade, and Government/Public services, focusing on the interior rate levels

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[11] According to the Chilean INE (Institute of National Statistics, or Instituto Nacional de Estadísticas in Spanish), firms are classified as micro, small, medium, and large according to whether their annual sales are inferior to 2,400 UF, between 2,400 and 25,000 UF, between 25,000 and 100,000 UF, and above 100,000 UF, respectively. As of this date, 1 UF equals roughly 40 USD.
[12] See Bassanini and Garnero (2013).

(that is excluding the tails of 0% and 100% reallocation rates) and on companies with 10 workers or more, as in panel b) of Figure 1.
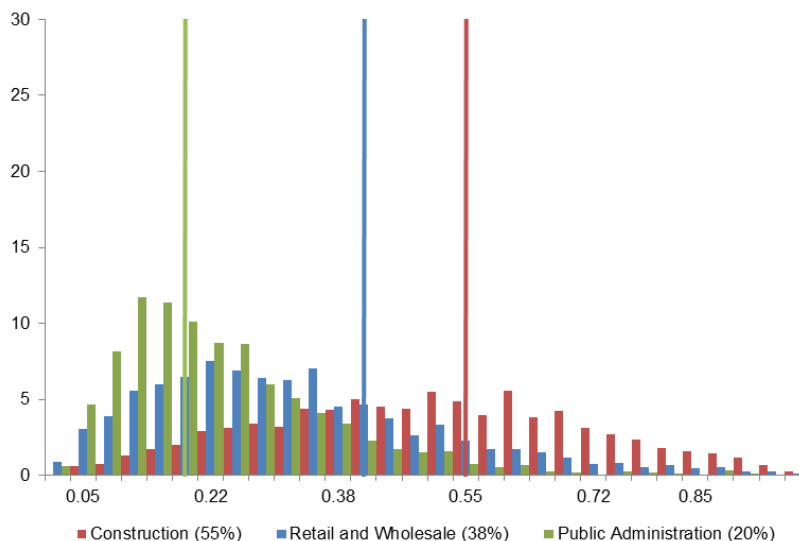
Figure 2: Histogram of job reallocation rates by firm size (sales)
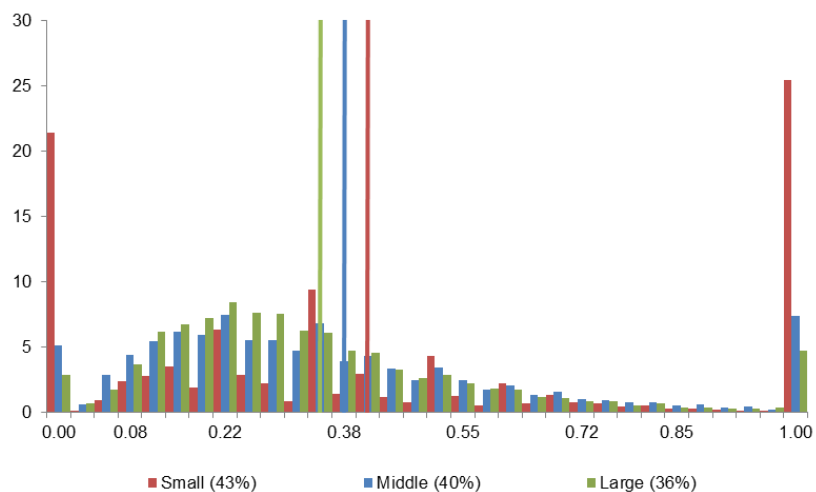
Note: Distribution of reallocation rates across small, middle, and large firms in 2007. Weighted cross-sectional averages are reported in parenthesis.

Source: Authors calculations from SII data.

Figure 3: Histogram of job reallocation rates by economic sector

Note: Distribution of reallocation rates in Construction, Wholesale and retail trade, and Public services in 2007. Nil (0%) and full (100%) reallocation firms are excluded as well as less than 10 workers firms. Weighted cross-sectional averages are reported in parenthesis

Source: Authors calculations from SII data.

Consistent with international evidence, construction has a high reallocation rate of 55%, while Trade has a rate of 38% and Government/Public Services shows a lower reallocation rate of only 20%.

3.4   Reallocation rates by wage level

Intuitively, firms with lower average wages (relative to their economic sector) might exhibit larger reallocation, as their workers should be more prone to leave the firm in search of better matches. To test this hypothesis we show reallocation rates by the firm wage quintiles within its economic sector, with average wages and quintiles measured in December of each year. Figure 4 shows reallocation rates for the first quintile (those of firms with lowest average wages within the industry), the third and the fifth quintile (that is, the median and the highest wage levels) for the aggregate economy in 2007. Clearly, mean reallocation rates tend to fall in firms with higher average wages.

Figure 4: Histogram of job reallocation rates by average firm wages
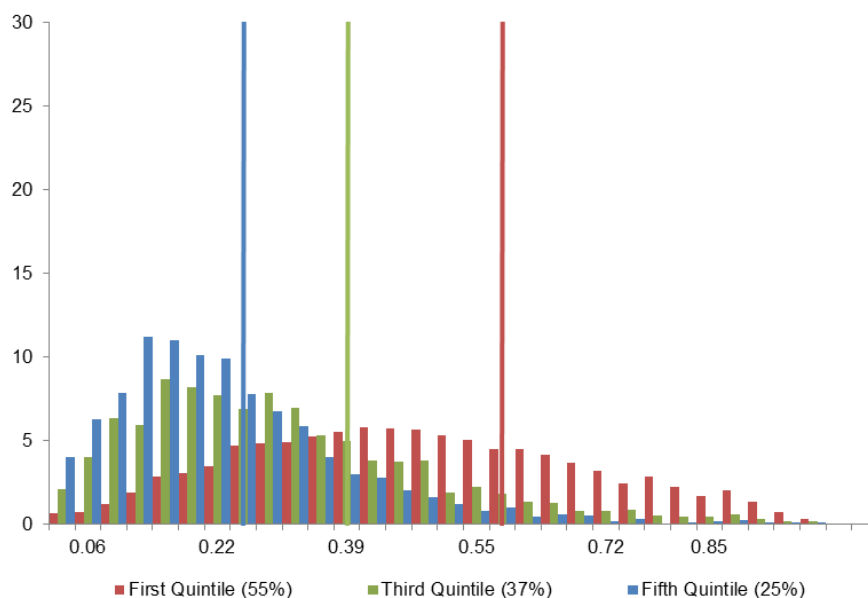
Note: Distribution of reallocation rates in Construction, Wholesale and retail trade, and Public services in 2007. Nil (0%) and full (100%) reallocation firms are excluded as well as those with less than 10 workers. Weighted cross-sectional averages in parenthesis.

Source: Authors calculations from SII data.

An alternative explanation is that job reallocation is larger for less productive, less educated workers.[13] Although we have no information on individual worker characteristics such as education, we can use individual wages as a proxy for worker productivity. We group workers at each moment in time in basis of their tercile of income relative to their economic sector, and then compute the job reallocation of companies with workers in each tercile. Table 2 shows the results of this exercise during the average period of 2005 to 2014. There are large difference in reallocation across income levels, with reallocation reaching 52% for the lowest income workers (first tercile) and just 23% for the highest wage level (third tercile).

Table 2: Labor reallocation by individual workers' wages

Wage Tercile	Entry	Exit	Reallocation
First	0.54	0.5	0.52
Second	0.39	0.33	0.36
Third	0.23	0.22	0.23

Source: Authors calculations from SII data.

3.5   Firm-panel regressions

Table 3 summarizes the mean rates of entry, exit, net growth and reallocation for each economic sector from 2005 to 2014. Net employment growth was above the aggregate average rate for Services (which includes Financial, Public and Personal Services) and Mining. There was, however, a contraction in Agriculture and low growth in Manufacturing.[14] There was also strong net employment growth for large firms, which confirms previous evidence for Chile (Correa and Echavarria, 2013) and contradicts popular notions that small firms are responsible for most of the employment creation in the country.

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[13] See Mincer (1988), Mortensen (1988), and Abowd et al. (1999).

[14] These values have some differences with statistics published by the INE for the period 2005-2014, which report a somewhat lower growth for Services and more moderate reductions in Agriculture and Manufacturing as a % of aggregate employment. However, the INE statistics include all workers and not just workers with formal contracts, so results are not strictly comparable.

We run a multivariate regression to study how reallocation rates depend on different variables such as economic sector (j), firm size (s), and relative wages (w) of each firm i:

$$R_{ijsw,t} = c + \sum_j \beta_j D_{ij,t} + \sum_s \gamma_s D_{is,t} + \sum_s \delta_w D_{iw,t} + \varepsilon_t \qquad (3)$$

Table 3: Labor flows by groups

	Entry	Exit	Net	Reallocation	Reallocation (Average)	Extensive Margin	Share 2005	Share 2014
Panel A: Pooled								
	38.8	35	3.8	36.9	42.5	12.3		
Panel B: Economic Sector								
Agriculture	41.4	44.2	-2.8	42.8	36.6	8.8	10.64	6.15
Mining	29.9	22.3	7.6	26.1	53.1	19.7	0.95	1.41
Manufacture	30.2	29.4	0.8	29.8	38.5	9.9	17.3	13.85
Transport and Communication	34.3	29.7	4.6	32	44	14.3	6.33	7.11
Construction	56.6	53.6	2.9	55.1	58.5	11	11.13	10.83
Retail and Wholesale	39.6	35.4	4.2	37.5	41.4	12.8	21.51	23.47
Financial Services	43.4	38.4	4.9	40.9	41.3	12.2	19.02	22.13
Public Administration	24.1	19.6	4.4	21.8	37.1	15.2	6.73	7.48
Personal Services	33	27.9	5.2	30.4	37.7	16.1	4.93	5.86
Others	30.3	25.3	5	27.8	40.5	13.4	1.45	1.7
Panel C: Firm's Size								
Small	42.8	39	3.8	40.9	43.9	29.8	22.84	17.94
Middle	41.7	38.6	3.1	40.2	36.7	9.8	17.7	15.61
Large	36.7	32.7	4	34.7	34.1	5.9	59.46	66.45
Panel D: Wage Quintile								
First	59.06	51.22	7.84	55.14	59.79	18.75	20	20
Second	43.07	39.86	3.2	41.46	38.84	11.47	20	20
Third	36.17	35.08	1.09	35.62	32.94	10.04	20	20
Fourth	31.23	27.75	3.48	29.49	31.72	8.07	20	20
Fifth	24.66	21.29	3.37	22.98	26.78	7.49	20	20

Note: Share 2005 (2014) is share on total employment in 2005 (2014).

Source: Authors calculations from SII data.

Let $R_{ijsw,t}$ denote the reallocation rate of firm i in sector j, firm size s and wage level w. $D_{ij,t}$, $D_{is,t}$ and $D_{iw,t}$ are dummy variables with value 1 if firm i belongs to sector j, firm size s and wage level w, with parameters β_j , γ_s, y δ_w denoting the impact of these variables on the reallocation rate. Firm size and wage level categories are grouped in deciles, so that each group has 10% of the total number of workers of a given year t. The criterion of using 10% of the total workers in each group makes the results easier to interpret in terms of the overall employment instead of the number of firms.[15] The regressions also include time dummies and for some specifications we add dummies for the entry and exit of firms, plus a dummy for firms with zero reallocation.[16]

We show the estimates of different specifications of equation (3) in Table 4. The regression in the first column includes only time dummies and dummies for each economic sector. All the economic sector dummies are statistically significant, which implies that these sectors have lower reallocation than Construction (which is the default category). Column 2 adds dummies for firm size as given by sales. This regression confirms the hypothesis that larger firms (which usually have more qualified workers and higher wages) have lower levels of job reallocation, showing a monotonic effect across deciles (with the first decile being the omitted dummy).

Column 3 adds dummies for different wage levels, with each group corresponding to the wage decile of the workers in the same economic sector of the firm in a given year. The results show that reallocation falls with higher wage levels. The explanatory power of the regression as given by the R-square coefficient is bigger than for the firm size variables and similar to industrial sectors.

Column 4 uses all controls simultaneously. Reallocation according to industrial sector and the wage level remains similar to Columns 1 and 3. The most significant change is that the coefficients for firm size fall in magnitude after we add the other controls. In addition, the coefficients are relative flat for the deciles 2 to 6 of firm size. There is only a steeper decline in reallocation rates above decile 7 of firm size. The drop in magnitude of the firm-size coefficients suggests that part of the lower

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[15] As is also the case in international data, the distribution of firm size in Chile shows significant asymmetry towards small companies. Since each sales decile contains 10% of the workers, the lowest deciles include smaller firms and will aggregate a larger number of firms.

[16] The regressions also apply weights given by the number of workers in each firm, in order to make the results representative of the overall economy.

reallocation effect of larger firms was in fact due to larger firms paying higher wages (or having more qualified workers), therefore experiencing less rotation.

Column 5 adds a dummy for the extensive margin and Column 6 additionally includes a dummy for firms with zero rotation during the year. Adding these controls has little effect on the results. The wage level dummies fall a bit in magnitude, but remain monotonic and statistically significant. However, coefficients on firm size change after adding the dummies for the extremes of zero rotation (0%) and 100% rotation (firm creation or destruction).

After controlling for these two extremes, small companies actually have lower reallocation rates than the others. Now the reallocation rate has an inverse U pattern with respect to firm size, with reallocation increasing from small to medium-sized firms and then falling again for large firms. Finally, since firm size may depend on the economic sector, Column 7 uses the decile of the number of workers inside each sector as an alternative control (relative to the aggregate economy size deciles), but the results remain unchanged.

As we do not include firm fixed effects, the explanatory power of the last three regressions, which have R-square values above 60%, is quite significant. However, it is possible that some of the relationships found in Table 4 represent statistical correlation rather than economic causality. For instance, it is possible that high wage firms also have a better labor environment, which allows them to have both lower reallocation and higher wages due to improved productivity. It is also likely that high wages reflect higher human capital, which is unobserved in our dataset. This would lead workers with more specific human capital investments in their current jobs to exhibit lower rotation. In this sense, one should view the regressions of Table 4 as suggestive statistical correlations, and not necessarily as the pure effect of the wage level on job reallocation.

Table 4: Labor reallocation, panel regression results

|	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Agriculture	-0.128			-0.127	-0.101	-0.094	-0.094
Mining	-0.287			-0.293	-0.276	-0.276	-0.27
Manufacture	-0.257			-0.255	-0.223	-0.22	-0.22
Transport and Communication	-0.227			-0.229	-0.208	-0.204	-0.202
Retail and Wholesale	-0.17			-0.169	-0.155	-0.148	-0.148
Financial Services	-0.138			-0.136	-0.124	-0.12	-0.12
Public Administration	-0.331			-0.33	-0.3	-0.302	-0.302
Personal Services	-0.239			-0.241	-0.225	-0.214	-0.214
Others	-0.274			-0.27	-0.245	-0.243	-0.241
Firm 2nd Decile		-0.054		-0.03	0.058	0.026	0.011
Firm 3rd Decile		-0.067		-0.029	0.091	0.048	0.038
Firm 4th Decile		-0.083		-0.031	0.101	0.055	0.057
Firm 5th Decile		-0.089		-0.028	0.112	0.064	0.069
Firm 6th Decile		-0.095		-0.026	0.116	0.067	0.071
Firm 7th Decile		-0.12		-0.043	0.105	0.056	0.066
Firm 8th Decile		-0.138		-0.052	0.096	0.047	0.073
Firm 9th Decile		-0.162		-0.064	0.085	0.035	0.055
Firm 10th Decile		-0.23		-0.094	0.066	0.014	0.032
Wage 2nd Decile			-0.055	-0.051	-0.05	-0.047	-0.04
Wage 3d Decile			-0.079	-0.069	-0.075	-0.069	-0.064
Wage 4th Decile			-0.106	-0.091	-0.099	-0.093	-0.089
Wage 5th Decile			-0.128	-0.11	-0.122	-0.114	-0.109
Wage 6th Decile			-0.164	-0.143	-0.145	-0.138	-0.134
Wage 7th Decile			-0.188	-0.166	-0.167	-0.159	-0.157
Wage 8thDecile			-0.215	-0.188	-0.189	-0.181	-0.181
Wage 9th Decile			-0.247	-0.212	-0.217	-0.207	-0.21
Wage 10th Decile			-0.286	-0.245	-0.254	-0.243	-0.249
Dummy creation or destruction					0.636	0.615	0.615
Dummy no rotation						-0.355	-0.342
Constant	0.581	0.506	0.551	0.745	0.549	0.589	0.58
Year Dummy	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Adjusted R2	0.108	0.057	0.107	0.223	0.608	0.637	0.643
Observations	337,202,298	33,005,767	33,720,298	33,005,767	33,005,767	33,005,767	33,720,298

Note: All coefficients are significant at 1%.

Source: Authors calculations from SII data.

4. Cyclical behavior of job creation, destruction and net employment growth

We now use our data to characterize job flows across the business cycle. Figure 5 shows the evolution of hires, exits, and net employment growth at a monthly frequency. As documented by the international evidence, job creation is the key determinant of the cyclical behavior of employment for the period 2005-2013. Focusing on the 2008-2009 recession, job creation exhibits a relatively strong deceleration from 6% to 4.75%, while job destruction mildly accelerates from 5.5% to 5.8% at the worst of the cycle. In the aftermath, job creation recovers in a more sluggish manner than the exit rate (which stays at a low level for a protracted period). Eventually, the exit rate recovers to a higher level consistent with the increase of the entry rate and a more dynamic labor market. Finally, the evolution of employment mimics the behavior of the entry rate (though with lower volatility).

The cyclical pattern of Figure 5 is consistent with those reported in Davis et al. (2012). Using establishment-level data from U.S. for the period 2008-2009, these authors find that the adjustment on the exit margin is smaller than the one of the entry margin. The lower cyclicality of the exit margin is consistent with firms laying off more but employees quitting less during downturns. As a result, the exit margin is more resilient to cyclical conditions than the entry one.[17]

Figure 5: Exit and entry rates over the business cycle
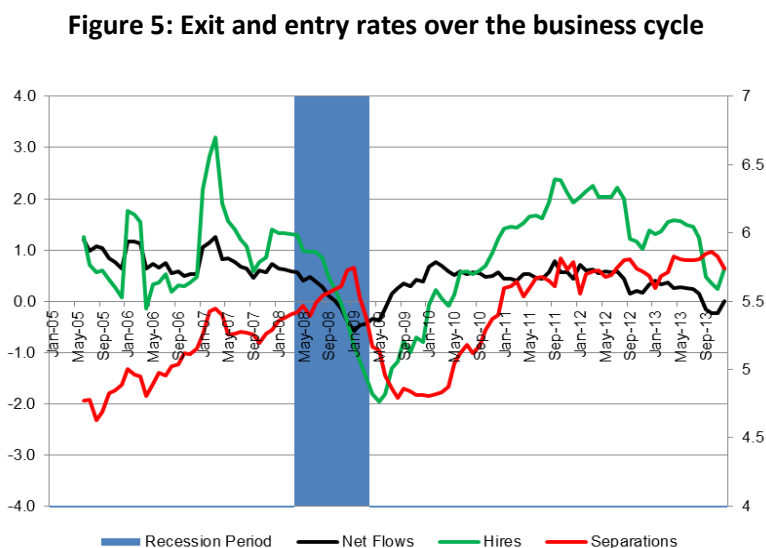
Note: Net Flows, hires, and separations are three months moving averages. All series are seasonally adjusted.

Source: Authors calculations from SII data.

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[17] Form 1887 does not specify the reason for job separations (whether firing or quits).

To quantify the adjustment on the entry and exit margins to cyclical conditions, we consider the following regression model of the monthly frequency of the labor flows (entry, exit and net employment growth) and how these are affected by the overall industrial growth in Chile (as given by the variation of the IMACEC index, a widely used monthly production indicator):

$$F_t = c + \beta_0 \Delta\, Imacec_t + \beta_1 \Delta\, Imacec_{t-1} \ldots + \beta_{11} \Delta\, Imacec_{t-11} + \varepsilon_t \qquad (4)$$

where F_t is either the economy-wide job creation, destruction or net employment growth, β_s is the coefficient for the monthly variation in the aggregate IMACEC activity with a lag of s months, ε is an error term, c is the economy-wide flow when the economy is not growing, t is the unit of time (year/month), and Δ is the difference operator.[18]

Figure 6: Cyclical responses of exit and entry rates

a) Exit and entry rates

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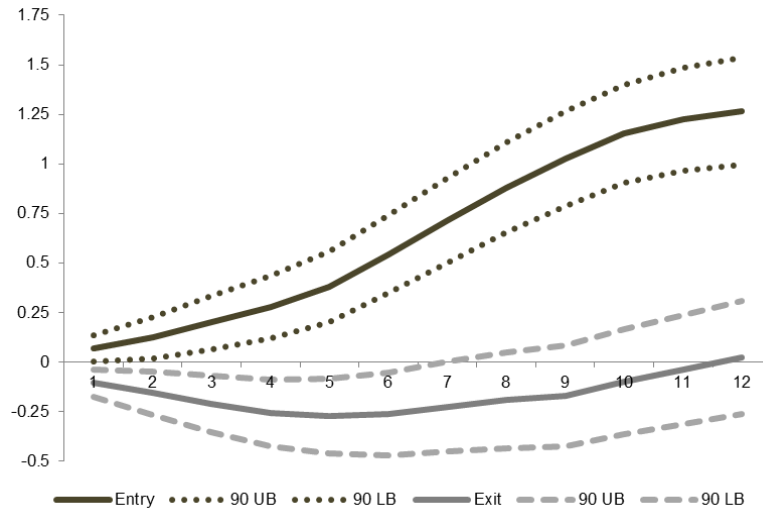
[18] The regression also includes seasonal dummies, and dummies for the months of March and April 2010, in the aftermath of the massive earthquake of February 27 2010..

b) Net Creation
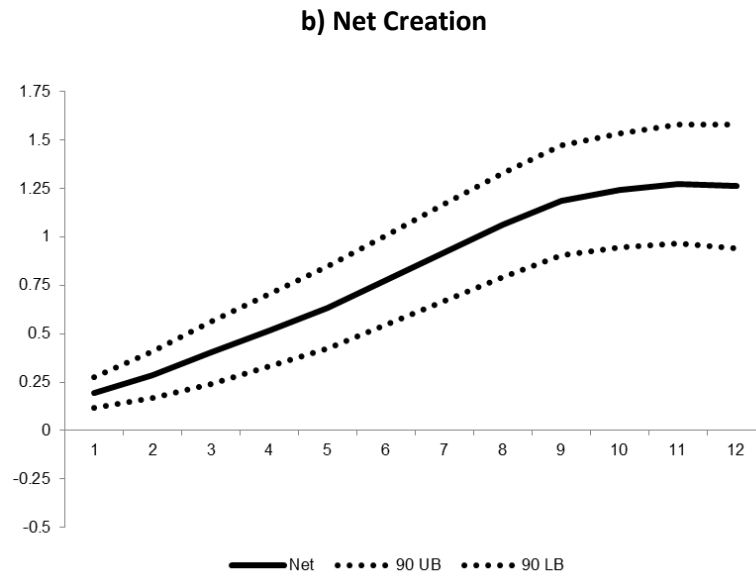
Source: Authors calculations from SII and Central Bank data.

Figure 6 shows the cumulative response of flows to an innovation in IMACEC activity s periods ago. At a 12-month horizon, the cumulative response of net employment growth rate to activity is not statistically different from one, with full adjustment of employment to activity taking place up to three quarters after the innovation in activity. In addition, the cyclical behavior of employment mimics the behavior of the entry rate. The exit rate reacts with the expected sign, but with low statistical significance. Therefore, most of the business cycle action in the labor market is due to entry. Lastly, the findings of Figure 6 are consistent with the predictions of recent search models of the labor market, such as Shimer (2005 and 2012). In particular, our results are suggestive of labor hoarding, as the adjustment on the labor market occurs through the entry margin and less so through the exit one. Labor markets adjust with some lag relative to economic activity as a lower job entry slowly increases the pool of non-employed workers over time.

Figure 7: Cyclical responses of exit and entry rates by sector

a) Entry

b) Exit
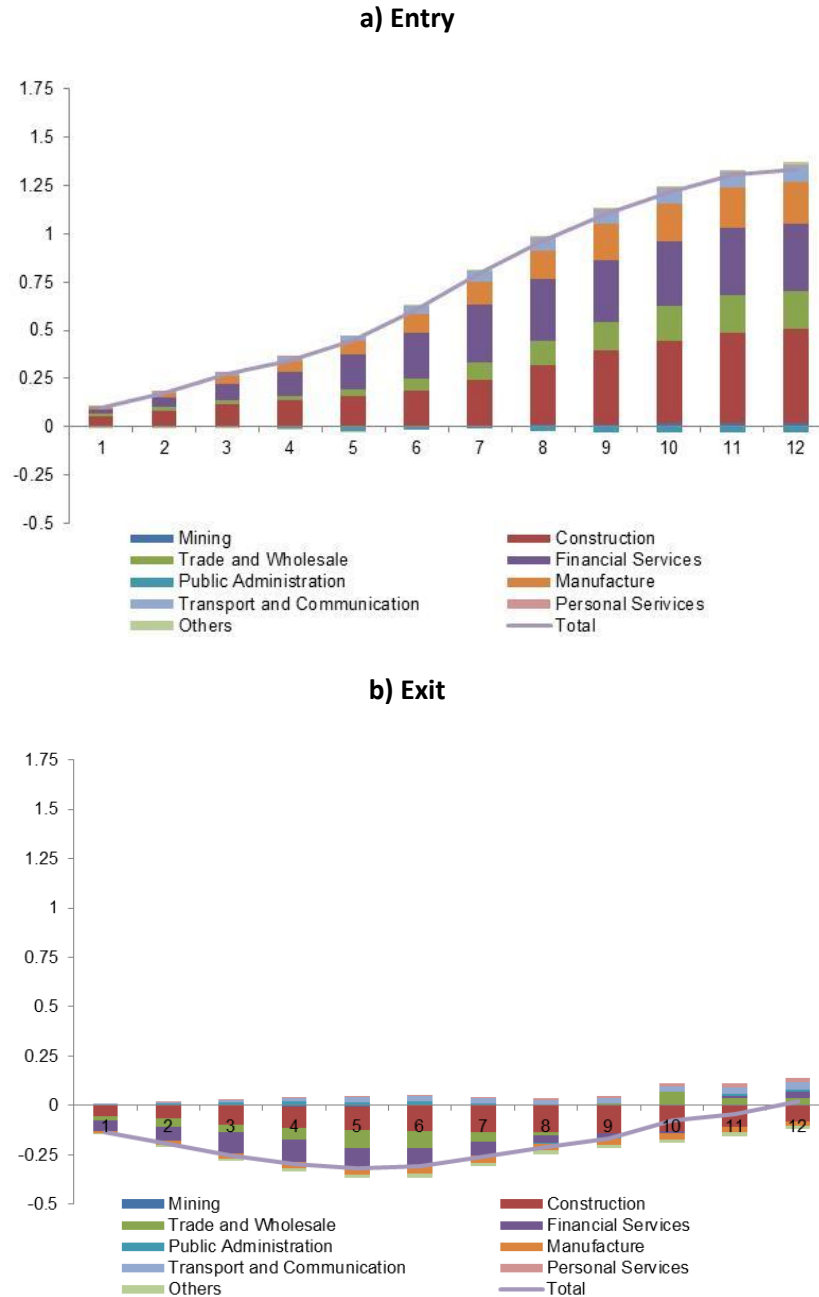
Source: Authors calculations from SII and Central Bank data.

Figure 7 shows a decomposition of the cyclical behavior of the entry and exit margins into sectoral contributions. Within each sector, consistent with the aggregate pattern, the entry rate explains most of the net employment growth. The most startling facts are the contributions of Construction,

Financial Services and Manufacturing to the cyclical behavior of the entry and exit margins. The next section presents evidence that employment in Construction is dominated by fixed-term contracts. Hence, employers in the Construction sector can quickly adjust their employment level to the current economic conditions. Concerning the large contribution of the Financial Services sector, we do not have data to test whether this relates to structural or idiosyncratic factors of the period under analysis, so we leave it as an open question for future research.

5. International comparison

To put our results into perspective, we contrast our findings with the international evidence collected by Bassanini and Garnero (2013) (BG). These authors compute similar labor market flows measures for several countries using the European Union Labor Force Survey (EULFS). Though the EULFS is not census data, it is appealing for cross-country analysis since all countries collect data under the same guidelines and for the same period.[19]

Figure 8 shows that labor market reallocation in Chile is higher than in any country included in the international sample. We first inquire whether methodological differences between the BG data and ours can account for this result. In particular, since the EULFS uses household surveys, it makes sense to think that individuals answer the survey only referring to their main job. However, individuals may have secondary jobs with higher reallocation. As our data contains all employment relationships, if the EULFS underestimates secondary jobs BG measures of reallocation would be biased downwards relative to reallocation calculated for Chile. To eliminate this concern, we constrain our sample to individuals with one employment relationship between two consecutive years.[20] Our baseline results on reallocation rates remain remarkable similar within this sub-sample.

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[19] For USA and Canada, data comes from the *Current Population Survey* and the *Canadian Labour Force Survey*, respectively.
[20] For instance, for the years 2007-2008, we drop all individuals that by December 2007 or December 2008 had more than one employment relationship, and then recalculate the entry and exit rate for 2007 and 2008.

Figure 8: Job reallocation, international comparison
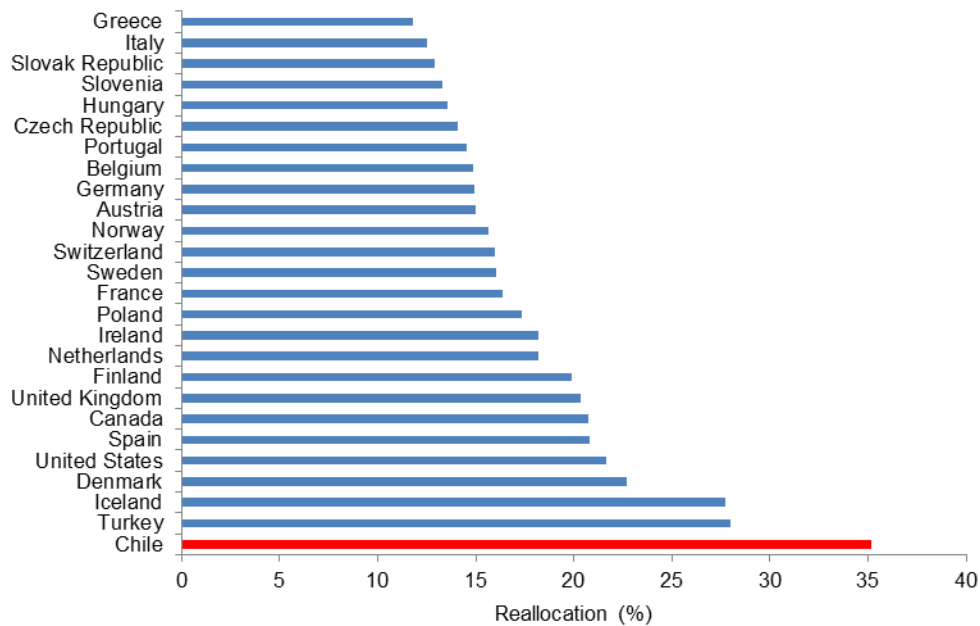
We also compare the duration of Chile's employment relationships using the Chilean New Survey of National Employment (NSNE) (which is methodologically closer to the EULFS) vis-a-vis our Census data. Our metric for the duration of employment relationships is the share of workers with more than one year of tenure in their current employment (by December 2014). The duration of employment under that definition is quite similar between both data sources (68% for the New Survey of National Employment and 64% for the census data). Comparing the duration of employment with OECD countries,[21] Chile is the country with the lowest share of workers with relationships large than one a year. Taken together, these two pieces of evidence give support to the takeaway of Figure 8, i.e. Chile's labor market reallocation is higher than any country included in the BG sample.

Figure 9 shows that for the BG country sample, labor market reallocation relates positively to both the volatility of sectoral employment and the share of employment under fixed-term contracts. In fact, Chile has a much higher volatility of sectoral employment than any other country in the sample, suggesting that this could be a potential explanation for its large job reallocation.

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[21] See OECD: Employment by Job Tenure Intervals, https://stats.oecd.org/Index.aspx?DataSetCode=TEMP_I#

Our dataset does not distinguish across fixed-term and open-ended contracts, but the NSNE reports why the last employment relationship ended.[22] We use this information to compute the share of fixed-term employment contracts in the NSNE across economic sectors, together with our measure of labor market reallocation from our census data. Figure 9 illustrates the comparison with the sample in BS.. The figure suggests that Chile's high labor market reallocation directly relates to the high number of employment relationships under fixed-term contracts.

It is however difficult to infer the correct causality between these variables. Indeed, fixed-term contracts could arise endogenously in equilibrium as the optimal contracts between firms and workers in an environment with large employment reallocation, perhaps due to another structural market feature. For instance, Blanchard et al. (2014) argue that the high labor market reallocation is caused by low levels of human capital. This could therefore be part of the explanation, since income per capita levels in Chile are among the lowest in the OCDE, and so are proxies of human capital obtained from standardized international test scores.[23]

An alternative view holds that the extensive use of short-term contracts is an adaptive response of firms in an environment of strict labor regulations. Indeed, firing costs are large in Chile relative to international standards.[24] Under this view, firms could partly avoid these costs by hiring workers under fixed-term contracts with no severance payments. This view is also supported by the Spanish experience. Several papers document the existence of a segmented labor market in that country, where older workers were hired through indefinite contracts tied to generous benefits and large firing costs. As a way to circumvent regulation, firms tend to hire young workers under short-term contracts.[25]

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[22] The NSNE distinguishes across the following reasons: laid off, contract expiration, retirement, quitting, firm's bankruptcy, and others.

[23] See http://www.oecd.org/skills/piaac/.

[24] The OECD estimates a series of labor market flexibility indicators according to labor market regulation in each country. Chile ranks above the mean in the firing costs category. See http://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection.htm

[25] See Bentolila et al. (2011), Bover et al (2000), Bover and Gómez (2004), Dolado (2015a, 2015b), and Estrada et al. (2002).

Figure 9: Job reallocation, volatility of sectoral employment, and share of fixed-term contracts

a) Reallocation and employment volatility

b) Reallocation and fixed term employment
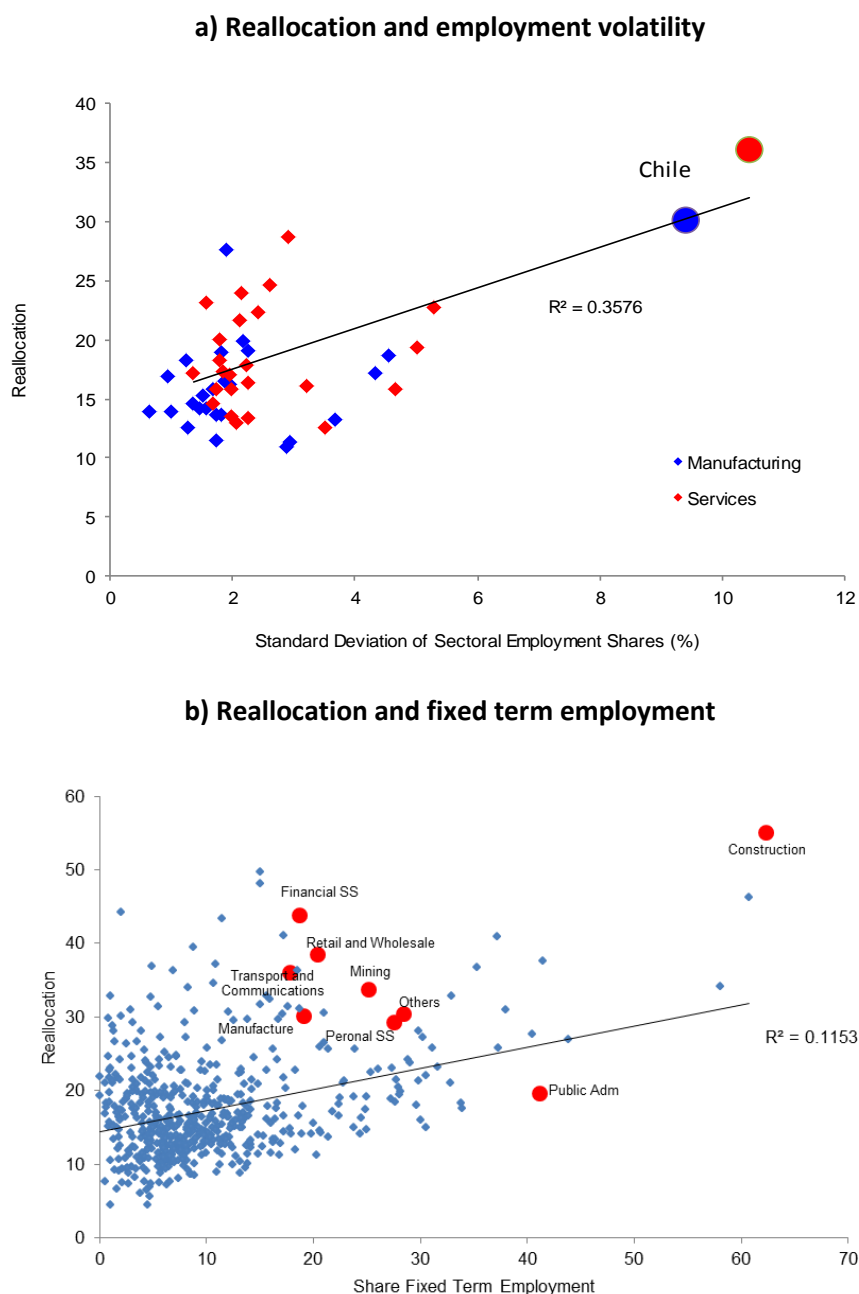
Note: Panel a) dots represent cross-country sectoral reallocation, from Bassanini and Garnero (2013), and standard deviation (2000-2014, annual frequency) of sectoral employment share, from Industrial Labor Organization, pairs. Red and blue dots are manufactures and services, respectively. Large dots correspond to the Chilean economy.

Panel b) blue dots are sectoral reallocation from OECD countries, from Bassanini and Garnero (2013), and share of fixed term employment (data is from OECD) pairs. Red dots correspond to Chilean sectoral reallocation and share of fixed term employment.

Source: Bassanini and Garnero (2013) and authors calculations using data from SII, ILO, OECD, and the Central Bank of Chile.

While this discussion is suggestive, disentangling which of the previous hypotheses is a better characterization of the large degree of labor market reallocation is beyond the scope of this paper, but remains an important open question for future research.

6. Conclusions

This paper studies labor flows in Chile, using administrative data from firm tax returns for 2005-2014. We find that a small number of variables are able to explain a significant part of job reallocation across companies. In particular, labor reallocation is negatively associated with firm size and wage levels, and also differs across economic sectors.

We also show that both hires and separations react to the business cycle, with hiring being procyclical and separations mildly countercyclical relative to aggregate economic activity. The accumulated response functions show that hires have the strongest sensibility and represent the main adjustment mechanism over the business cycle, in line with empirical evidence reported for the United States and with theoretical search models (Shimer, 2005, 2012).

Labor reallocation is high in Chile relative to international standards. While a complete analysis of the determinants of this result remains an area for future research, a comparison of some indicators suggests that Chile has a higher volatility of sectoral employment and a more widespread use of fixed term contracts than other countries, which are two factors associated with higher labor reallocation. Understanding more deeply the impact of legislation on the flexibility of the labor market in Chile remains as an important research question for future work.

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