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Earnings Cyclicity of New and Continuing Jobs: The Role of Tenure and Transition Length*

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Abstract

This paper contributes to the literature on the effect of the unemployment rate on individual job earnings by using administrative data for the universe of formal wage earners in Chile. A relevant advantage of this dataset relative to previous papers is that provides precise measures of the length of job transitions, as well as the tenure of job keepers. We show that this detailed characterization of the worker's employment status is important to understand the cyclical behavior of earnings. We find that, consistent with the previous literature, earnings of newly created jobs (new hires) are significantly more sensitive to aggregate unemployment than those of continuing jobs (job keepers). However, and contrary to recent evidence for the US, we find that the larger sensitivity of the earnings of new jobs is a feature of both job-to-job transitions as well as hires from up to six months of non-employment. We also find a relevant degree of heterogeneity in the cyclical response of earnings among job keepers, with earnings being less cyclical for workers with longer tenure. These results highlight that the precise length of tenure and job transitions is relevant to correctly understand the cyclicity of wages. Our results are robust to controlling for changes in the workers relative wage position, suggesting that earnings cyclicity is not only an artifact of the behavior of job transitions inside and outside the firm.

Resumen

Este artículo contribuye a la literatura sobre la relación entre la tasa de desempleo y los ingresos a nivel de individuos usando datos administrativos para el universo de empleo asalariado formal en Chile. Una ventaja de estos datos en relación con la literatura previa es que entregan medidas precisas de la duración de las transiciones entre empleos, así como de la antigüedad de las relaciones que continúan. Los resultados muestran que esta caracterización detallada es importante para entender la ciclicidad de ingresos. De manera coherente con evidencia previa, los ingresos de las contrataciones recientes son en promedio más sensibles que las de relaciones laborales vigentes desde períodos anteriores. Sin embargo, y de manera distinta a lo encontrado recientemente para EEUU, la mayor ciclicidad no viene solo de trabajadores que se cambian de manera directa entre trabajos, sino también de aquellos en que la transición entre empleos dura hasta seis meses. También hay un grado importante de heterogeneidad entre aquellos trabajadores que mantienen su empleo, con una menor ciclicidad de ingresos para empleos con mayor antigüedad. Los resultados son robustos a controlar por cambios en la posición salarial relativa de los trabajadores, lo que sugiere

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que la ciclicidad observada en ingresos no proviene exclusivamente del comportamiento de las transiciones de empleo entre firmas y al interior de éstas.

1 Introduction

The cyclical behavior of real wages, which has direct implications for the dynamics of aggregate employment and output in response to shocks, has justifiably been a central topic in the macroeconomics and labor economics literature for decades. Typically, aggregate wage measures appeared to suggest that wages fluctuated little over the cycle, or even that they moved counter cyclically, a notion that seemed to be consistent with traditional Keynesian models with wage rigidities.

However, a large literature starting from Bils (1985) has shown, using data for the US and Europe, that individual-level information can provide valuable insights that are lost with aggregate wage indices¹. A central finding in this literature is that the behavior of aggregate wages not only reflects the evolution of individual wages, but also changes in the skill composition of employment along the business cycle. These changes in the composition of the employment pool can dampen or even revert the effects on the aggregate of the behavior of worker-level wages, leading to relevant differences between the inferences derived from wage indices and those that come from the actual wages of individuals. In particular, estimates of wage cyclicality using individual level data are typically larger than those that come from aggregate indicators.

An important additional insight from this literature is that the wage cyclicality of new hires is substantially larger than the wage cyclicality of workers that keep their job. This finding is consistent with the ideas in Pissarides (2009), who argues that the relevant measure of wage flexibility comes from the behavior of the present discounted value of wages of new hires, rather than from overall wages. Under that interpretation, the wages of new hires are associated to the relevant marginal cost of labor for firms. Therefore, wage flexibility among new hires will facilitate labor adjustment along the cycle.

However, Gertler & Trigari (2009) and Hagedorn & Manovsk (2013) argue that existing empirical studies may be picking up the procyclical nature of the match quality of job-to-job transitions, rather than the actual cyclicality of wages. In this line of argument, recent work by Gertler *et al.* (2020) uses higher frequency data for the US to separate new hires coming from job-to-job transitions from new hires that come out of the unemployment pool. They find that, while the wage cyclicality of workers in job-to-job transitions is quite large, the wage cyclicality of new hires coming out of non-employment is similar to that of keepers. Under their interpretation, this implies that it is not wages themselves that are procyclical, but rather than their apparent cyclicality is driven by the cyclical

¹See, for example, Barlevy (2001); Carneiro & Portugal (2012); Martins *et al.* (2012); Font *et al.* (2015); Stüber (2017); Hahn *et al.* (2018) and Gu *et al.* (2020).

pattern in the quality of job transitions. Therefore, real wages in new employment relationships tend to move up (down) when unemployment is low (high) not because wages for a given job increase, but because direct transitions towards higher quality jobs become more (less) frequent. This affects the estimated response of wages among workers that move across jobs directly -which are more likely to represent voluntary movements up a job ladder towards better jobs- but does not change the response of workers that transition through unemployment -whose movements have no systematic relationship with quality improvements.

This paper contributes to this literature by using tax records for a census of workers and firms in Chile between 2005 and 2016 to address in detail the heterogeneity of labor earnings cyclicity across different types of employment relationships (ERs). A relevant advantage of our data is that it allows us to identify the ERs at a monthly frequency. This provides a detailed characterization of the duration of continuing jobs and the length of job transitions associated to new hires, and expands the previous literature in a relevant dimension. While a significant number of papers have lumped all new hires as a unique category that compares to job keepers, we, as in Gertler *et al.* (2020) or Lydon & Lozej (2018), can separate direct job-to-job transitions from hires out of non-employment. However, we can further separate hires from non-employment by identifying the precise duration of the transitions, arguing that the length of non-employment spell is relevant for the behavior of earnings. Similarly, we exploit the heterogeneity in tenure among job keepers. Detailed information on the within-firm earnings distribution allows us to build proxies that control for transitions across job positions, and to explore heterogeneity in the cyclicity of wages across workers and firms of different types. Importantly, our data has information on the worker's complete labor earnings, including wages as well as other forms of labor compensation. We think that using total earnings provides a better measure of the relevant cost of labor, and its adjustment across the business cycle.

We highlight three main results that are relevant for the recent debate on the relevant margins of wage adjustment throughout the business cycle.

First, and in line with previous literature, we find that the earnings of newly created jobs (new hires) are significantly more sensitive to aggregate unemployment than those of continuing jobs (job keepers). However, and contrary to the recent evidence provided in Gertler *et al.* (2020) for the US, the larger sensitivity of the earnings of new jobs is a feature of both job-to-job transitions as well as hires from relatively short spells of non-employment of up to two quarters.

Second, we find that there is a significant degree of heterogeneity within the set of continuing jobs. While the earnings of job keepers with a long tenure have the lowest degree of cyclicity, the

earnings of continuing workers with short tenures have a significant degree of cyclicity.

Third, we find that results are robust to changes in the worker's relative earnings, suggesting that the cyclicity of earnings is not driven by job improvements or demotions (within the firm or towards a new firm). Moreover, the overall qualitative patterns hold across worker and firm characteristics. We also find that the overall cyclicity of earnings is decreasing on the worker's age and income and on firm size, a result that is largely driven by composition, and that the earnings of male workers are significantly more procyclical than those of women regardless of employment status.

As a bottom line, our results support the notion that individual earnings in Chile are procyclical, and that this result is not solely driven by the cyclicity of direct job transitions.

A final contribution of the paper is to expand the scope of the literature, which has typically focused in data for the US and Europe, with data from an emerging economy. Chile is an interesting case study on the cyclicity of labor compensation for several reasons. First, it is a small open economy that has a relevant exposure to relative price shocks. In that context, the flexibility of wages plays a key role in the labor market's ability to adjust to a volatile environment. Second, Chile has a high level of average turnover by international standards, with large job creation/destruction rates at the firm level and short employment spells/large number of job transitions for individual workers (Albagli *et al.*, 2017). This suggests the existence a very active labor market with large mobility.

The outline of the paper is as follows. Section 2 describes the data. Section 3 presents the empirical strategy and the baseline results for earnings cyclicity for different categories of existing jobs and new hires. Section 4 explores heterogeneity in the cyclical response of wages across firms and workers of different types. Section 5 concludes.

2 Data

Our main source of data is a matched employer-employee dataset provided by the Chilean Internal Revenue Service (SII, by its Spanish acronym) between the years 2005 and 2016². The data covers all firms that operate in the formal sector and all formal wage employment in Chile, which represents roughly 60% of total employment in the country³. Affidavit 1887, reported annually by each firm, records each employee's annual taxable earnings and the detail about the months of the year in which the worker was employed. Annual taxable earnings are the sum of all the forms of worker compen-

²Affidavit N. 1887 of *Servicio de Impuestos Internos*.

³In 2017, the New National Employment Survey (NENE by its Spanish acronym) conducted by the National Statistics Institute showed that formal wage jobs were 57% of total employment.

sation, excluding social security payments. The aggregate figure cannot be separated into individual components, but includes the base salary, incentive pay, bonuses, employer-provided benefits, and overtime pay.

Therefore, for each ER, the data can be used to calculate the worker's monthly average earnings in any given year. This measure of average earnings differs from a pure measure of monthly wages. As discussed in Gu *et al.* (2020), most of the previous literature has not been systematic in distinguishing earnings from wages, and has used both concepts interchangeably. However, we believe that, conceptually, earnings provide a better representation of the relevant economic concept underlying labor compensation, both in terms of the income flow received by the worker and the marginal cost faced by the firm.

To preserve anonymity, each firm and worker in this administrative dataset are assigned unnamed and unique identifiers by SII. This allows us to track each worker's labor history across firms and time (with monthly frequency), as well as the details of the firm's payroll at any given month. Covering the period 2005 to 2016, the original data includes information of about 600,000 firms, 9 million workers, and 36 million employment relationships.

The data is silent about the months in which a worker is not employed in the formal sector. Therefore, we can not distinguish whether non-employed workers -workers that are not present in the dataset in a given month- are unemployed, self-employed, working in the informal sector or inactive, although a simple search model would suggest that during a non-employment spell the best of those alternatives must dominate any potential standing job offer in the formal sector. Given the monthly frequency of the information available for each worker, their employment status at any given month can be identified with a large degree of precision. As in most of the previous literature, we can separate previously employed workers -job keepers- in a firm from new hires. Among new hires, we can use the length of their non-employment spell (if any) to define different groups, from direct job changers that move across jobs in consecutive months to indirect changers that start a new job after some months of non-employment. We can also identify entrants, new hires with no previous formal job in the sample. Given the recent developments in this literature, and the insights in Gertler *et al.* (2020), this detailed characterization of differences in earnings cyclicalities across job transitions will be one of the main contributions of the paper.

The tax dataset is combined with information provided by the Chilean Register Office (*Servicio de Registro Civil e Identificación* in Spanish), to obtain the basic demographic characteristics (gender and date of birth) of each worker in an ER.

Our main interest lies with full-time jobs. However, the data does not have information on hours worked, and we only have direct information on whether ERs are part- or full-time for the years 2015 and 2016⁴. However, since the earnings of full-time employees must be equal or above the minimum (legal) wage, we focus our analysis on ERs that satisfy this condition. Specifically, we only consider ERs whose average monthly earnings in a given year are at least 90% the minimum wage in that year⁵.

Additionally, and in order to avoid the results being affected by the behavior of outliers, we drop extremely high wages in each year (i.e. observations above the percentile 99.95 of the wage distribution in each year).

2.1 Classification of Employment Relationships

As mentioned earlier, our unit of observation are employment relationships, which are categorized annually depending on the individual's job status in the preceding months.

The broader classification simply separates those workers that had the same job in the past year (keepers), from those that are starting a new job (new hires). Formally, **an individual employed in a given firm and year is defined as a:**

- **new hire**, if he was not employed in the same firm in any of the 12 months preceding the beginning of the ER in the year; or is defined as a
- **keeper**, otherwise.

For example, if the first registered month of work of an active ER in 2011 is March, we require that the individual registers at least one month of work in the same firm in the period between March 2010 and February 2011 to be defined as a keeper. Otherwise (i.e. if the individual did not work in the firm in the mentioned period), that ER is defined as a new hire.

As we do not have information of the initial creation date for all employment relationships that existed in 2005, the first year in the sample, we can only separate keepers from changers starting from 2006.

⁴According to data from the National Statistics Institute, in 2017-2019 60% of formal employees worked 45 hours a week, the standard legal hours of a full time-job, while 17% of formal employees worked more than that and therefore got paid extra hours. Evidence from the same data suggests that the cyclicity of hours is relatively muted

⁵We also focus on ERs that last (i.e. ERs that are "active") at least six months out of a 24-month period centered at the beginning of the ER in the year, in order to exclude very short-lived jobs or fixed-term contracts that might not be directly comparable to more stable positions.

Table 1: Descriptive Statistics - ER-Year Observations

	Number of Obs. (000's)	Monthly Earnings (000' CL\$2013)		Months in ER per cal. year		Age (years)		Gender (% Men)
		Mean	Med.	Mean	Med.	Mean	Med.	
All workers	50.333,7	617,3	370,4	8,8	12	38,2	37	67,2%
Keepers	33.254,0	711,9	431,3	10,4	12	39,8	39	64,7%
Keepers (12+m)	25.066,8	778,8	474,3	10,9	12	41,3	41	63,3%
Keepers (6-11m)	3.956,0	534,8	341,9	9,3	12	35,5	33	66,3%
Keepers (1-5m)	4.231,2	481,3	314,5	8,4	11	35,3	33	71,4%
New Hires	17.079,7	433,2	285,9	5,6	5	34,9	33	72,1%
Direct Changers	6.554,4	493,5	315,2	5,6	5	35,4	34	76,0%
N.H. from Non-Emp.	10.525,2	395,7	270,3	5,5	5	34,6	32	69,6%
Changers (1-11m)	6.265,1	367,7	267,4	4,9	4	34,6	32	75,4%
Changers (1-2m)	3.420,9	368,0	270,9	5,0	4	34,6	32	77,9%
Changers (3-6m)	1.434,8	367,3	265,8	4,8	4	34,6	32	75,0%
Changers (7-11m)	1.409,5	367,6	260,6	4,7	4	34,5	32	70,1%
Ent. & Ch. (12+m)	4.260,1	436,9	275,6	6,5	6	34,8	32	61,0%

Notes: Descriptive statistics for the sample of ER-year observations included in the regressions. Though the dataset includes all formal workers and firms in the period 2005-2016, the sample used in the regressions covers to the period 2006-2016, given that information from year 2005 is used to identify the status of ERs in 2006. Includes workers age 18-65 in employment relationships whose wage is above the minimum wage. Earnings are expressed in CL\$ of December of 2013.

Table 1 shows that almost 17.1 million employment relationships are those of new hires, (33.4% of the baseline sample), while 33.3 million employment relationships are associated to keepers (66.6% of the baseline sample). This is, despite the large degree of labor mobility observed in Chile, a significant share of workers are employed in the same firm in two consecutive years.

As we can see from the Table, there are substantial differences between these two categories of ERs. Keepers, for example, remain, on average, 10.4 months per calendar year in the same ER (compared to 5.6 for new hires), and earn, on average, CL\$711.9⁶ thousand per month (compared to CL\$433.2 for new hires). Keepers are also older (39.8 years old on average, versus 34.9 for new hires), a result that is consistent with the notion that job mobility is larger during the first part of the worker's life-cycle. Finally, while 72.1% of new hires are men, the share of male workers drops significantly to 64.7% among keepers.

A second and more detailed categorization of ERs separates new hires between those who moved across jobs in consecutive months (direct changers) and those that come from non-employment⁷. Formally, a *new hire* in a given year is a:

- a **direct changer** if he makes a direct job-to-job transition (with zero months of non-employment between the end of the previous ER and the beginning of the current ER);
- **new hire from non-employment** if he goes through a non-employment spell before the beginning of the ER in the year, including first-time entrants;

As shown in Table 1, almost 38% of ERs related to new hires are associated to direct changers (about 6.5 million observations). Workers in these ERs have consistently larger average earnings than new hires from non-employment (CL\$493 vs CL\$395 thousand, respectively), which suggests that direct transitions are more likely for high-income workers. There are no relevant differences in age, although direct changers are more likely to be men.

Finally, we take advantage of the precision with which we can estimate job transitions to provide a more detailed characterization of both keepers and new hires from non-employment. We think this is a relevant distinction, as there are sound reasons that can lead to heterogeneity in the cyclical response of wages within both groups. Among keepers, longer tenures are an indication of a successful firm-worker match, associated to higher wages and a smaller likelihood of separation (Krolikowski (2017), Jovanovic (1979)). These differences in match quality can potentially also affect the response of

⁶Inflation-adjusted earnings, in prices of December of 2013.

⁷As discussed below, these two types of transitions can be seen as separating voluntary changes - "quits" - from involuntary ones - "fires".

their wages to cyclical conditions. Therefore, we separate keepers into 3 groups, from workers with relatively short tenures that started their relationship recently, to workers with already long tenures who have held their jobs for more than a year:

- **keeper 1-5m**: if at any given year the worker has a tenure at his current job smaller than 6 months;
- **keeper 6-11m** if at any given year the worker has a tenure at his current job of at least 6 months but less than a year;
- **keeper 12+m** if at any given year the worker has a tenure at his current job of at least a year.

Similarly, there can be relevant distinctions between new hires from non-employment. Indirect changes with short recorded job transitions are likely to be very similar to direct changes, and therefore might be more associated to voluntary decisions from part of the worker. In fact, in practice job transitions that take place within 3 months are classified as direct in papers that rely on quarterly data for transitions, as Gertler *et al.* (2020). As the length of transition grows, the behavior of reentry wages will likely vary, as reservation wages for workers who remain unemployed –non-employed in the formal sector– will probably fall, as buffers are depleted and human capital depreciates (Ljungqvist & Sargent (1998)).

Therefore, we identify five sub-categories among new hires from non-employment, depending on the length of the unemployment spell between jobs. Formally, **a changer in a given year is**:

- **changer 1-2m** if he spends 1 or 2 months in non-employment before beginning the ER in the year (i.e. if there is a period of 1 or 2 months between the first registered month of ER in the year and the latest registered month in any other ER);
- **changer 3-6m** if he spends between 3 and 6 months in non-employment before beginning the ER in the year;
- **changer 7-11m** if he spends between 7 and 11 months in non-employment before beginning the ER in the year;
- **changer of 12 or more months** if he goes through a non-employment spell of at least 12 months before the beginning of the ER in the year;
- **entrant** if he does not register a previous ER in the data.

Descriptive statistics show that there are clear differences between keepers. ERs with keepers with tenure of at least a year (a group that also includes workers with very long tenures, of more than a decade) have significantly larger mean earnings (CL\$778 thousand, vs CL\$481 thousand for keepers with the shortest tenure) and are older. They are also the largest group in our sample, accounting for roughly half of all observations.

Among new hires from non-employment, differences between workers that change jobs within the first year appear to be relatively minor. It is interesting to notice that the share of women is the largest among first-time entrants and indirect changers with a longer non-employment spell. This is consistent both with the fact that female labor participation in Chile is increasing, and is larger among younger cohorts, and the fact that women are more likely to move across the extensive margin of labor market participation.

The final sample used for the baseline regressions includes 50 million employment relationships, associated to almost 7 million workers and 360 thousand firms for the period 2006-2016.

While average real monthly earnings in the sample are CL\$617.3 thousand, the median is CL\$370.4 thousand, implying a median-mean ratio of 59.9% for the entire period⁸.

3 Baseline Econometric Specification and Results

This section addresses the core question of the paper, namely how real labor earnings at the individual level are affected by the business cycle. Though with a different set of controls, our basic econometric specification follows the literature inaugurated by Bils (1985). In particular, we estimate the following equation using annual data:

$$\ln w_{ift} = \alpha_i + \eta_{it}^{g,a} + \gamma_f + \theta_{ft}^{fsize} + \sum_{s \in S} \vartheta_s \cdot \mathbb{I}_s + \sum_{s \in S} \delta_s \cdot \mathbb{I}_s \cdot t + \sum_{s \in S} \beta_s \cdot \mathbb{I}_s \cdot unemp_t + \zeta_{ift}^{months} + \varepsilon_{ift} \quad (1)$$

Where:

- $\ln w_{ift}$ is the log average monthly real earning of individual i , working in firm f in year t (nominal annual earnings are divided by the number of months the worker was employed in the year, and deflated with the CPI).

⁸According to US Social Security Administration, the *net compensation* median-average ratio in the US for the same period is about 65.8%. See <https://www.ssa.gov/oact/cola/central.html>

- α_i and $\eta_{it}^{g,a}$ are individual and gender-age fixed effects that account for unobserved heterogeneity correlated with observables at the individual level.⁹
- γ_f and θ_{ft}^{fsize} are firm and firm-size fixed effects¹⁰ that account for heterogeneity correlated with observables at the firm level.
- s is the type of employment relationship in year t , and S is the specific ER-type categorization used in the regression, from an aggregate regression that considers all workers jointly to specifications that distinguish between different types of *keepers* and *new hires*, as discussed in the previous section.
- \mathbb{I}_s is an indicator variable that takes value 1 for type- s ($s \in S$) ERs in year t , and 0 otherwise.
- ϑ_s is a ER-type ($s \in S$) fixed effect, that accounts for systematic differences in wages across ER types.
- δ_s is the annual trend of type- s ERs wages ($s \in S$). We allow such trends to be different for different types of ERs.
- $unemp_t$ is the annual unemployment rate at the national level, calculated by the National Statistics Institute, which is used to capture business cycle conditions at the aggregate level in our baseline exercise.
- β_s captures the effect of a 1 percentage point increase in the unemployment rate on (the log of) the real wage of a type- s ER. As such, the coefficient can be interpreted as the semi-elasticity of type- s ERs' real wage with respect to the aggregate unemployment rate.
- ε_{ift} is a random error term with standard properties.

Finally, a set of additional fixed effects is included in the baseline specification to correct (at least partially) for the effects of potential measurement error in monthly earnings (w_{ift} , computed as the ratio between the ER's annual earnings, W_{ift} , and the reported number of months in which the ER was active during the year, M_{ift}). The error is due to the fact that M_{ift} might be rounded up, so that w_{ift} is a lower bound of the actual monthly earnings.¹¹ The included fixed effects ζ_{ift}^{months} are

⁹We include 6,698,750 individual fixed effects, and $2 \times (65-17) = 96$ gender-age fixed effects.

¹⁰Our regressions include 360,501 firm fixed effects. Based on the firms' monthly average of employees in each year, we define 5 size categories, namely up to 5, 6-10, 11-49, 50-199 and more than 200 workers.

¹¹For example, an individual that works in an ER for 11.5 months in a calendar year is reported as having worked for 12 months, so that the monthly earnings is underestimated by a factor of 0.958 (i.e. $11.5/12$), while the monthly earnings of an

defined by the combination of (a) the number of months in which the ER (worker-firm) is active in a given year, and (b) the number of gaps (i.e. ends-starts) of the ER in the same year.¹²

3.1 Baseline results

Table 2 presents the results of our baseline set of regressions¹³. For ease of exposition we only report the estimated coefficients and standard errors of the semi-elasticities of real wages with respect to the unemployment rate (i.e. the $\beta'_s s$).

The results in column (1) present the simplest regression, which reports the cyclicalities of earnings across all workers, without looking at the differential effects of their job status. The coefficient indicates that, all else equal, a 1 percentage point increase in the unemployment rate reduces (relative to the trend) the real earnings of all workers by 1,59%. This suggests that, on average, formal earnings in Chile are relatively flexible along the cycle, a result that is likely to reflect not only the behavior of base wages but also the dynamics of other components of earnings as benefits and other forms of compensation.

The second column separates workers between keepers, direct changers and new hires from non-employment, in the spirit of the distinction between direct and indirect transitions in Gertler *et al.* (2020). The results show that the earnings of direct changers are significantly more responsive to unemployment than the average elasticity estimated in column (1). The estimation implies that, everything else constant, a 1 percentage point increase in the unemployment rate reduces (relative to the trend) the real earnings of direct changers by 2.31%. This almost doubles the estimated effect for keepers, although that coefficient is still significantly larger than 1 (1.25%). The estimated coefficient for indirect changers, -1.92, although somehow smaller than the one for direct changers, is significantly larger than the estimated coefficient for keepers.

Qualitatively, this pattern seems to differ from the U.S. results in Gertler *et al.* (2020), who argue that, to a significant extent, the larger cyclicalities of the earnings of new hires relative to keepers estimated in the literature comes from the behavior of direct transitions. Under that interpretation, workers holding a job typically choose to move to a better job, a type of opportunity whose avail-

individual that works for 0.5 months in a calendar year is underestimated by a factor of 0.5 (i.e. 0.5/1). The measurement error is, therefore, for a given ER-year, decreasing in M_{ift} and potentially increasing in the number of interruptions (starts or ends) of the ER within the year (given that we do not observe when such interruptions take place and, by default, are assumed to occur by the end/star of a calendar month).

¹²There are 66 of such combinations included as fixed effects.

¹³To implement our empirical strategy, we use the Stata command *reghdfe* (see Correia (2017)), which allows for the inclusion of multiple, high dimensional fixed effects. We opt for excluding singleton observations for which fixed effects cannot be correctly estimated.

Table 2: Semi-Elasticity of Real Earnings to Unemployment Rate: Baseline Specifications

Dep. Var: log of real monthly earnings	(1)	(2)	(3)
All workers	-1.59 (0.01)		
Keepers		-1.25 (0.01)	
Keepers (12+m)			-1.11 (0.01)
Keepers (6-11m)			-1.88 (0.04)
Keepers (1-5m)			-1.87 (0.03)
New Hires: Direct Changers		-2.31 (0.02)	-2.30 (0.02)
New Hires: From Non-Employment		-1.92 (0.02)	
Changers (1-2m)			-2.47 (0.03)
Changers (3-6m)			-2.26 (0.04)
Changers (7-11m)			-1.94 (0.05)
Entrants & Changers 12+m			-1.46 (0.03)

Notes: Robust standard errors in parenthesis. Fixed effect regressions. Regressions include 50,333,682 observations (6,698,750 active workers and 360,501 active firms in the period 2005-2016). The sample includes all formal firms and workers in the period 2005-2016. Information from year 2005 is used to identify the status of ERs in 2006. Coefficients estimated for workers age 18-65 in employment relationships whose wage is above the minimum wage, in the period 2006-2016. All regressions include worker, gender-age, firm and firm size fixed effects. Includes fixed effects that control for measurement error in real monthly earnings (see description in Section 3). Each regression includes, additionally, fixed effects and time trends for each ER type (e.g. regression (2) includes fixed effects and different time trends for keepers, direct changers, and new hires from non-employment).

ability is procyclical. Therefore, cyclicalities in earnings for direct transitions is more a reflection of the cyclicalities of job opportunities, rather than a reflection of earnings flexibility for a given type of job. Our results, in which estimated coefficients for new hires from unemployment are more similar to direct changers than to keepers, do not seem to be aligned to that interpretation. Our results are closer to Lydon & Lozej (2018) for the case of Ireland, although in their case the wage cyclicalities of indirect changers is the largest.

Column (3) suggests that this picture can be more subtle, with varying degrees of cyclicalities both along the job tenure of keepers and length of the transition for new hires. Among keepers, there is a stark distinction between the response of workers with a longer tenure, who have the smallest elasticity along all groups (-1.11) and those workers with a tenure of less than a year, whose behavior is much closer to the one observed among new hires (-1.88). This indicates that the earnings of workers whose employment in the firm over a long horizon is suggestive of a good match have earnings that are relatively more isolated from cyclical fluctuations. The earnings of workers with shorter tenures, who are likely to be more heterogeneous in terms of the unobservable characteristics of the match, are much more sensitive to cyclical conditions. As mentioned earlier, this is consistent with the literature that relates match quality to its survival, such that the larger tenures correlate with more valuable matches (Krolikowski (2017), Jovanovic (1979)), which are likely to be more isolated from shocks.

The heterogeneity between new hires is also very interesting. As expected, the semi-elasticity of real earnings for direct changers (-2.30) is similar to the estimated value for indirect changers within two months, the group that has the largest sensitivity to unemployment (-2.47), and whose transition process is likely to be similar to that of job-to-job movements. However, the sensitivity of workers that have an employment gap of up to 6 months is still large (-2.26), and in fact statistically identical to the one for direct changers. While one can argue that indirect transitions within a couple of months still represent job-to-job movements, it is difficult to argue that such interpretation holds for transitions that occur more than a quarter after separation. This reinforces the idea that earnings cyclicalities in Chile is not solely driven by the behavior of direct transitions.

These results do not imply that the cyclicalities of match qualities does not play a role in this data. In fact, it is interesting to notice that earnings procyclicalities dampens as the length of the transition period lengthens. This is consistent with the notion that the chance of upgrading match quality becomes more acyclical for workers with longer non-employment spells, where new job opportunities become less related to their previous job. This seems to be the case for indirect changers that take

more than a year to find a new job and entrants into the labor market, whose semi-elasticity (-1.46) is significantly smaller than that of all changers within a year, and is in fact much closer to the relatively muted response of keepers with a long tenure.

Overall, these baseline estimates highlight three main results. First, earnings at the individual level in Chile appear to be procyclical: semi-elasticities of real earnings with respect to aggregate unemployment are always bigger than 1 in absolute terms, ranging between -1.1 and -2.5, depending on the type of employment relation. Second, in line with most of the previous literature, the earnings of job keepers are significantly less sensitive than those of new hires, in particular those that change jobs directly. Third, and novel to previous evidence, there is significant heterogeneity within transition types, with job keepers with tenure over a year being 80% less elastic than job keepers with shorter tenures. Among new hires, the elasticity remains relatively high in job transitions that take up to one year, suggesting that earnings procyclicality among new hires is not only an artifact associated to the behavior of workers that change jobs directly. This seems to provide credence to the notion that, at least in Chile, labor earnings are flexible at the relevant margin as defined by Pissarides (2009).

We now turn our attention to several empirical extensions of our baseline estimations that serve two purposes. First, they provide a robustness check on our main results, testing whether they are driven by the behavior of a particular groups of workers, firms or job transitions. Second, they can help to uncover the economic forces driving cyclicity at the individual worker level. Crucially, we find our results hold even after controlling for the changes in the worker's relative earnings, suggesting that changes in earnings are not solely driven by changes in job positions. This is coherent with the notion that the economic mechanisms associated to the cyclicity of earnings do not only operate through job transitions - which can occur both inside and outside the firm- but also through actual movements in earnings for a given position.

4 Extensions and Robustness

In this section, we analyze how the results of our baseline regressions vary for different groups of individuals and firms. The overall result is that, although the levels of earnings cyclicity are heterogeneous across different types of workers and firms, the qualitative patterns across different types of keepers and new hires found in our baseline estimations are robust.

The simplest (and computationally friendly) way to explore heterogeneity is to estimate Equation 1 separately for each subset of observations under consideration (e.g. different categories of individ-

uals or firms). Such methodology, however, would severely affect the estimation of the different sets of fixed effects included in the regressions¹⁴. In order to avoid these shortcomings, we opt for a joint estimation of the coefficients of the different subsets considered in each case. Specifically, we estimate Equation 2 for each set H for which heterogeneous effects are analyzed (for example, the set H could be $H(\text{gender}) = \{\text{Men}, \text{Women}\}$, $H(\text{firm size}) = \{\text{Micro}, \text{Small}, \text{Medium}, \text{Large}\}$, etc.). The equation now includes the interaction between the ER-type indicator \mathbb{I}_s and the individual (or firm) category indicator \mathbb{I}_h (that takes value 1 if the individual (or firm) belongs to category h , $h \in H$). We, therefore, estimate simultaneously the coefficients for each type of ER (s) and each group of individuals (or firms) being analyzed (h). The equation takes the following form:

$$\begin{aligned} \ln w_{ift} = & \alpha_i + \eta_{it}^{g,a} + \gamma_f + \theta_{ft}^{fsize} + \sum_{h \in H} \sum_{s \in S} \vartheta_{hs} \cdot \mathbb{I}_s \cdot \mathbb{I}_h + \sum_{h \in H} \sum_{s \in S} \delta_{hs} \cdot \mathbb{I}_s \cdot \mathbb{I}_h \cdot t \\ & + \sum_{h \in H} \sum_{s \in S} \beta_{hs} \cdot \mathbb{I}_s \cdot \mathbb{I}_h \cdot unemp_t + \zeta_{ift}^{months} + \varepsilon_{ift} \end{aligned} \quad (2)$$

4.1 Changes in relative earnings position

As discussed earlier, a direct interpretation of the results in Gertler *et al.* (2020) is that estimated earnings cyclicity captures the cyclicity of match upgrading in job transitions. A related interpretation, that can be applied more generally to the earnings cyclicity of all types of employment relationships, is that movements in earnings are associated to changes in the worker's job position. These movements can occur within the firm (i.e., promotions) or across firms (moving to a better job at a new firm). Under this line of argument, the apparent flexibility of earnings might be misleading as, for instance, it could simply reflect that opportunities for promotion among job keepers become more abundant during a boom. Earnings for a given position and its associated set of tasks might not change much along the cycle, even though the likelihood of moving across positions does.

Although our dataset has no information on the job title associated to each employment relationship, we can use the information on the within-firm earnings distribution to calculate the changes in the worker's relative earnings position, and use it as a proxy of movements along the firm's organizational structure. We interpret workers that move up the ranking (either within one firm or relative

¹⁴Given, for example, that the same individuals work for firms of different sizes, splitting the sample into specific groups of firms would reduce the number of observations per individual and, therefore, make the estimation of the individual fixed effect less precise. Similarly, a firm may belong to different firm-size categories in different years (or employ individuals that differ in gender or age), making the estimation of the firm fixed effect less precise if the sample is split into those categories.

to their previous firm) as workers that are moving towards a better job position.

Table 3: Semi-Elasticity of Real Earnings to Unemployment by Variation in the Rel. Earnings Position

Dep. Var: log of real monthly earnings	Decreases	Unchanged	Increases
Regression A			
All workers	-1.61 (0.02)	-1.57 (0.02)	-1.31 (0.01)
Regression B			
Keepers (12+m)	-1.13 (0.02)	-1.46 (0.02)	-0.73 (0.01)
Keepers (6-11m)	-2.02 (0.08)	-1.77 (0.07)	-1.61 (0.03)
Keepers (1-5m)	-2.08 (0.07)	-1.78 (0.08)	-1.76 (0.03)
Direct Changers	-2.66 (0.03)	-2.09 (0.09)	-2.16 (0.03)
Changers (1-2m)	-2.65 (0.04)	-2.16 (0.12)	-2.26 (0.04)
Changers (3-6m)	-2.37 (0.06)	-2.07 (0.19)	-2.10 (0.06)
Changers (7-11m)	-2.27 (0.07)	-1.90 (0.19)	-1.73 (0.06)
Changers 12+m	-2.18 (0.06)	-1.45 (0.13)	-1.41 (0.05)

Notes: Robust standard errors in parenthesis. Fixed effect regressions. See notes in Table 2 for details about the sample and the sets of fixed effects included in each regression. Each regression includes, additionally, fixed effects and time trends for each group defined by the combination of ER type (rows) and variation in the relative earnings position (columns). For each ER-year, the variation in the relative earnings position *decreases (increases)* if the upper (lower) bound of the estimated earnings percentile range in a given year is strictly lower (higher) than the lower (upper) bound of the estimated range in the previous year -for keepers- or in the previous firm -for changers. When both ranges overlap, the relative earnings position is considered *unchanged*. See section 4.1 for more details.

In that spirit, Table 3 looks at the cyclicity of earnings depending on the change in the worker's relative wage position. For keepers, the worker's position in the firm's earnings distribution in any given year is compared with his position in the previous year. For changers, the worker's relative earnings position in the destination firm is compared to the relative earnings in her previous firm. This implies that results for new entrants, who have no previous employment records, are not presented¹⁵.

¹⁵As explained earlier, the same sample is used in all the regressions, so that the estimation of fixed effects is not affected. Entrants are included in the regression as a different category, whose coefficient is not reported in the table.

The first panel of Table 3 shows the cyclicalness of earnings for all workers, conditional on the variation in their relative wage position. Earnings cyclicalness is actually smaller among workers that went up the relative earnings ladder, although it is still significantly different than one. The second panel of Table 3 distinguishes between different types of keepers and changers, in line with the main categories in the baseline exercise. The cyclicalness of earnings is consistently larger for workers that moved down the earnings ranking, suggesting that the earnings penalty of job demotion is very countercyclical. However, regardless of the movements across the earnings ranking, cyclicalness patterns have the same qualitative properties as in the baseline exercise: long-term keepers have the lowest elasticity, while the elasticity of indirect changers within the first months is large, and not that different from that of direct changers. This suggests that the main results of the paper are not driven by the cyclical patterns of movements along the earnings distribution within and across firms.

4.2 Cyclicalness by Gender and Age

In this section we explore differences in earnings cyclicalness by age and gender.

In terms of age, we group workers into three categories: young workers in the first part of their worklife (up to 30 years old), prime age workers ages 30 to 45, typically approaching the peak of their career in terms of earnings growth¹⁶, and workers in the second half of their career (45 and older). Results are presented in Table 4. When all types of workers are lumped in a single category, the earnings of older workers appear to be significantly less cyclical. However, a look at worker categories show that this is largely a result of composition, driven by the fact that older workers change jobs less frequently and are more likely to have long tenures. The semi-elasticity for keepers with tenure longer than a year is significantly smaller for older workers, who are also likely to have longer tenures within that group. This suggests that the decreasing pattern observed throughout the first year of tenure is a feature that remains as tenure continues to grow towards additional years.

Conditional on moving, the elasticity of earnings appears to be significantly larger for older workers, especially in the case of transitions through non-employment. This seems consistent with the notion that –due to the destruction of job ladders and a higher opportunity cost of remaining unemployed– involuntary job changes can be more costly for workers with more experience.

It is also interesting to notice that the general qualitative pattern of earnings semi-elasticities continues to hold, with the response being the lowest for both keepers with the longest tenure and the group of entrants and changers with the longest non-employment spells, and the largest for changers

¹⁶See Aldunate (2019) for the case of Chile.

Table 4: Semi-elasticity of Earnings to Unemployment by Worker Age

Dep. Var: log of real monthly wage	Worker Age (years)		
	18-30	30-44	45-65
Regression A			
All workers	-1.77 (0.02)	-1.74 (0.01)	-1.25 (0.01)
Regression B			
Keepers (12+m)	-1.50 (0.03)	-1.30 (0.02)	-0.72 (0.01)
Keepers (6-11m)	-1.68 (0.06)	-2.02 (0.06)	-2.06 (0.08)
Keepers (1-5m)	-1.58 (0.05)	-2.06 (0.05)	-2.12 (0.06)
Direct Changers	-2.05 (0.03)	-2.42 (0.03)	-2.55 (0.04)
Changers (1-2m)	-2.13 (0.04)	-2.63 (0.05)	-2.77 (0.06)
Changers (3-6m)	-1.80 (0.06)	-2.49 (0.07)	-2.75 (0.09)
Changers (7-11m)	-1.52 (0.07)	-2.24 (0.08)	-2.38 (0.10)
Entrants & Changers 12+m	-1.35 (0.04)	-1.62 (0.05)	-1.46 (0.05)

Notes: Robust standard errors in parenthesis. Fixed effect regressions. See notes in Table 2 for details about the sample and the sets of fixed effects included in each regression. Each regression includes, additionally, fixed effects and time trends for each group defined by the combination of ER type (rows) and age category (columns).

within the first two quarters.

Table 5 presents results in terms of gender. As discussed earlier, this an interesting distinction in Chile, a country with low yet growing female participation by international standards. In the aggregate regression, the semi-elasticity of female earnings (-1.06) is almost half that of male earnings (-1.85). Unlike the case of age, this is not a result of composition, as the cyclicalit of female earnings is significantly lower among all types of keepers and changers. Interestingly, the semi-elasticity of direct changers is particularly low among women, even smaller than the one for short-term keepers, although the overall pattern of cyclicalit is similar across both genders. While explaining these differences goes beyond the scope of this paper, they are likely related to factors associated to the degree of attachment to the labor market - which makes the extensive margin of moving out of the labor force more relevant for women- and differences in specialization across occupations and sectors.

Table 5: Semi-elasticity of Earnings to Unemployment by Worker Gender

Dep. Var: log of real monthly wage	Women	Men
Regression A		
All workers	-1.06 (0.01)	-1.85 (0.01)
Regression B		
Keepers (12+m)	-0.73 (0.02)	-1.32 (0.01)
Keepers (6-11m)	-1.36 (0.06)	-2.13 (0.05)
Keepers (1-5m)	-1.56 (0.06)	-1.98 (0.04)
Direct Changers	-1.28 (0.05)	-2.60 (0.02)
Changers (1-2m)	-1.74 (0.06)	-2.65 (0.03)
Changers (3-6m)	-1.58 (0.09)	-2.45 (0.05)
Changers (7-11m)	-1.59 (0.09)	-2.08 (0.05)
Entrants & Changers 12+m	-0.92 (0.04)	-1.78 (0.03)

Notes: Robust standard errors in parenthesis. Fixed effect regressions. See notes in Table 2 for details about the sample and the sets of fixed effects included in each regression. Each regression includes, additionally, fixed effects and time trends for each group defined by the combination of ER type (rows) and gender (columns).

4.3 Cyclicalities by Workers Earnings Level

Table 6 shows differences in cyclicalities across earning levels. We rank individual earnings in terciles, relative to earnings in the same economic sector, year, gender and age. Specifically, we categorize each ER-year observation into three equally-sized groups depending on whether the monthly earnings belong to the first, second, or third tercile of the sector-year-gender-age earnings distribution.

Table 6: Semi-elasticity of Earnings to Unemployment by Earnings Tercile

Dep. Var: log of real monthly wage	Earnings Tercile		
	T1	T2	T3
Regression A			
All workers	-1.44 (0.02)	-1.28 (0.01)	-1.30 (0.01)
Regression B			
Keepers (12+m)	-1.22 (0.03)	-0.97 (0.01)	-0.95 (0.01)
Keepers (6-11m)	-1.38 (0.08)	-1.65 (0.03)	-1.78 (0.04)
Keepers (1-5m)	-1.08 (0.07)	-1.80 (0.03)	-1.85 (0.03)
Direct Changers	-1.71 (0.03)	-1.86 (0.02)	-1.96 (0.03)
Changers (1-2m)	-1.52 (0.04)	-2.00 (0.03)	-2.25 (0.04)
Changers (3-6m)	-1.20 (0.05)	-1.83 (0.05)	-2.35 (0.07)
Changers (7-11m)	-1.19 (0.06)	-1.56 (0.05)	-1.96 (0.07)
Entrants & Changers 12+m	-0.97 (0.04)	-1.30 (0.03)	-1.33 (0.04)

Notes: Robust standard errors in parenthesis. Fixed effect regressions. See notes in Table 2 for details about the sample and the sets of fixed effects included in each regression. Each regression includes, additionally, fixed effects and time trends for each group defined by the combination of ER type (rows) and earnings tercile (columns).

On the aggregate, the cyclicalities of earnings is largest for workers in the first tercile (-1.44), while the other two terciles are very similar (-1.28 and -1.30). However, the larger cyclicalities of the lowest tercile is largely driven by composition, as these workers have shorter tenures and experience more transitions. In fact, conditional on the type of ER, workers in the bottom tercile actually have smaller

semi-elasticities across almost all ERs, with the exception of long term tenures. Moreover, differences in cyclicity between ER types are significantly more muted for workers in the bottom tercile.

Earnings of workers in the upper tercile, on the other hand, are typically more cyclical across all types of ERs, with the exception of longer term keepers, a result that can come both from the characteristics of their jobs and the fact that - as with older workers- a larger share of them hold jobs with tenures that significantly exceed one year. Interestingly, the cyclicity of changers is significantly larger for workers in the upper earnings tercile ¹⁷.

4.4 Heterogeneous Effects by Firm Size

An important feature of our database is that it covers the universe of firms formally operating in Chile, therefore including firms of all sizes. This is an interesting result in itself, as data in most of the previous literature has excluded workers in small firms (less than 50 workers).

We classify firms operating in a given year into four groups, depending on their number of employees¹⁸: (1) 1-9 employees; (2) 10-49 employees; (3) 50-199 employees; and (4) 200 or more employees. Results are presented in Table 7.

Across all firm sizes, earnings cyclicity is the largest for direct changers and indirect changers during the first semester, with the general pattern of cyclicity across ERs typically holding: overall results on cyclicity also hold for small firms.

The fact that aggregate earnings cyclicity is smaller among larger firms (that account for more than 57% of employment) comes solely from the low cyclicity of longer term keepers, where the semi-elasticity is almost half that of smaller firms. This can be linked to the capacity of larger firms to isolate their employees, in particular those that are better matches and have longer tenure, from aggregate and firm-level shocks, as documented elsewhere in the literature¹⁹. This implies that the difference in cyclicity between longer term keepers and new hires is particularly wide in large firms, suggesting that they face a large degree of flexibility for the entry wages of new employees, while at the same time they are able to smooth out the earnings of workers with long tenures.

¹⁷Similarly to the case of women vs men, it is likely that differences between the first and third terciles are partially driven by the role of extensive margin of participation in formal employment.

¹⁸In order to avoid overestimating the number of employees in firms with a large fraction of temporary workers, we define firm size as the total number of months worked by the firm's employees in a given year, divided by 12.

¹⁹See, for example, the review in Guiso & Pistaferri (2020).

Table 7: Semi-elasticity of Earnings to Unemployment by Firm Size

Dep. Var: log of real monthly wage	Firm Size (employees)			
	1-9	10-49	50-199	200+
Regression A				
All workers	-1.74 (0.02)	-1.95 (0.02)	-1.92 (0.02)	-1.33 (0.01)
Regression B				
Keepers (12+m)	-1.36 (0.03)	-1.78 (0.02)	-1.63 (0.02)	-0.73 (0.01)
Keepers (6-11m)	-1.21 (0.08)	-1.67 (0.06)	-1.91 (0.07)	-1.97 (0.06)
Keepers (1-5m)	-1.44 (0.08)	-1.63 (0.06)	-1.93 (0.06)	-1.93 (0.05)
Direct Changers	-1.99 (0.07)	-2.08 (0.05)	-2.23 (0.04)	-2.43 (0.03)
Changers (1-2m)	-2.05 (0.09)	-2.29 (0.06)	-2.44 (0.06)	-2.59 (0.04)
Changers (3-6m)	-2.03 (0.12)	-2.19 (0.09)	-2.36 (0.09)	-2.24 (0.07)
Changers (7-11m)	-1.42 (0.13)	-1.99 (0.09)	-2.12 (0.09)	-1.90 (0.07)
Entrants & Changers 12+m	-1.32 (0.07)	-1.45 (0.05)	-1.45 (0.06)	-1.49 (0.04)

Notes: Robust standard errors in parenthesis. Fixed effect regressions. See notes in Table 2 for details about the sample and the sets of fixed effects included in each regression. Each regression includes, additionally, fixed effects and time trends for each group defined by the combination of ER type (rows) and firm size (columns).

5 Concluding Remarks

This paper provides evidence of the effect of aggregate macro conditions on individual wages, using administrative data for the universe of wage earners and firms in Chile between 2005 and 2016. Our data allows us to precisely measure the length of job transitions, as well as the tenure of job keepers. Our results show that this finer characterization of the worker's employment status is important to understand the cyclical behavior of earnings, especially in the light of the recent debate on the difference between job-to-job transitions and new hires out of unemployment.

Our results support the general result that the earnings of newly created jobs are significantly more sensitive to aggregate unemployment than those of continuing jobs. However, the larger sensitivity of new jobs does not only come from direct transitions, but also from transitions through non-employment that take place within a semester. There is also a relevant degree of heterogeneity among job keepers, with the earnings of workers with at least a year of tenure being the less cyclical. These results are robust to controlling for changes in the worker's relative earnings position, both for workers that stay in the same firm and those to move to a new job.

These general patterns do not appear to be driven by the behavior of a particular group of workers and firms, although there is a significant degree of heterogeneity in the level of earnings procyclicality among workers and firms.

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