Contracting out Labor Market Dynamism*

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Abstract

This paper investigates how domestic outsourcing affects plant-level labor responses to revenue productivity shocks and biases the measurement of aggregate job reallocations. I develop a methodology to transform reported expenses on temporary and leased workers into plant-level outsourced employment using comprehensive administrative data on the U.S. manufacturing sector. I show that plant-level outsourced employment is twice as responsive as payroll employment to revenue productivity growth deviations and adjusts more quickly. The evidence indicates that domestic outsourcing is an important margin of adjustment that plants use to modify their workforce while they learn about the permanency of the shock. These micro implications have significant macroeconomic measurement consequences. I show that the measured pace at which jobs reallocate across workplaces is underestimated. On average, every year, we omit the equivalent to 15% of payroll reallocations. The extent of mismeasurement varies with the business cycle, falling in downturns and increasing in upturns. My findings suggest that the increasing use of labor market intermediaries accounts for a substantial portion of the measured decline in labor market dynamism, and further reflects structural adjustments in the choice set of firms when facing shocks.

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1 Introduction

Since at least the 1990s, U.S. firms have met their labor needs by hiring directly or contracting other firms in the U.S. to "rent" workers —domestic outsourcing. The U.S. manufacturing sector increased the number of outsourced jobs per payroll job by at least 40% between 2006 and 2017, yet previously data limitations have prevented this growing phenomenon from being incorporated into analyses of establishment-level and aggregate labor adjustment. This paper shows that (i) outsourced workers are an important margin of adjustment at the micro and aggregate level, and (ii) not accounting for the creation and destruction of jobs filled by outsourced workers biases the measurement of indicators at the center of our understanding of labor markets and the design of public policies targeting firms —job creation, job destruction, hires, separations, vacancies and employment.

A large literature documents a downward trend in the pace at which jobs and workers move across workplaces in the U.S. in recent decades (R. A. Decker, Haltiwanger, Jarmin, & Miranda, 2016a; Molloy, Trezzi, Smith, & Wozniak, 2016; Bjelland, Fallick, Haltiwanger, & McEntarfer, 2011; Akcigit & Ates, 2021)[1]. The decline in labor market fluidity has received considerable attention because less fluid labor markets results in lower productivity growth through the misallocation of resources: fewer jobs and workers flowing to their more productive uses (Jovanovic & Moffitt, 1990; Haltiwanger, Foster, & Krizan, 2001). R. A. Decker, Haltiwanger, Jarmin, and Miranda (2020) finds that reduced plant-level payroll employment responsiveness to revenue productivity underlies the aggregate decline in payroll job reallocations and has been a drag on aggregate productivity. These results added allocative efficiency to the productivity slowdown debate and settled the discussion about the underlying causes of payroll job reallocations beyond changes in the firms' demographic distribution[2]. However, the factors behind declining plant payroll employment responsiveness are still an open question and an important one given its implications for allocative efficiency.

This paper argues that the increasing use of domestic outsourcing is one of the factors behind the decline in plant-level payroll employment responsiveness and accounts for a significant share of the aggregate decline in payroll job reallocations. The growing availability of labor market intermediaries has broadened the choice set for employers seeking to ad-

[1] Although the level of the decline largely depends on the data source and the indicator used to measure it, there is a strong agreement about the downward trend (Hyatt & Spletzer, 2013).

[2] The discussion about the documented slowdown in the U.S. productivity growth rate focused on technological and measurement explanations (Byrne, Fernald, & Reinsdorf, 2016; Gordon, 2016; Syverson, 2017).

just employment. In particular, these intermediaries specialize in flexible labor sourcing, which is particularly attractive for plants responding to productivity fluctuations.

Domestic outsourcing happens when firms (clients) contract with other firms or individuals in the U.S. to provide goods and services previously performed in-house. Thus, outsourced staff effectively work for client firms but are legally employed by a staffing agency; therefore, these workers may change jobs, tasks, and workplaces —but not the employer of record as in traditional employment relationships. In the U.S., the data used to track labor markets' activity accounts for the labor market transitions of outsourced workers in their agency's sector (services), and omits their reallocations across client establishments altogether. This omission gives rise to (i) a systematic undercount of the aggregate job and worker reallocations (and the vacancies they fill), and (ii) a misrepresentation of the reallocations composition across sectors —this is the *omitted reallocations* problem. I conclude the omitted reallocations problem is a measurement issue, pervasive across labor market fluidity indicators and sectors, with non-trivial implications for our understanding of labor markets.

The biggest challenge to empirically investigate the implications of the omitted reallocations problem lies on the very nature of the problem at hand: *omitted* reallocations. The client firm-outsourced employee relationship is not observable, and thus linking outsourcing and productivity at the micro level has not been possible until now[3]. I overcome this challenge by combining multiple datasets administered by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics, and developing a procedure to transform plant-level information on expenses on staffing services into plant-level outsourced employment. The Census and Annual Survey of Manufacturers collect plant-level information on expenses on different types of outsourced staff since 2006[4]. I focus on temporary and leased employees because this type of outsourced workers perform tasks on the client's worksite, typically in occupations at the core of the manufacturing business (S. Houseman, Dey, & Polivka, 2010). From now on, I use temporary and leased employment and outsourced employment interchangeably for simplification.

I begin my empirical analysis by characterizing the type of manufacturing plants using domestic outsourcing while documenting novel facts on the prevalence and growth of this phenomenon. First, I find that the share of revenue spent on outsourced workers (outsourced labor share) is decreasing in the plant's age and payroll employment size.

[3]See Bernhardt, Batt, Houseman, and Appelbaum (2016) and (S. Houseman & Bernhardt, 2017) for a discussion on the data limitations to study outsourcing and an overview of the existing data.

[4]Outsourced workers include temporary help workers, leased employees, independent contractors and contracted out workers through business service firms

These patterns are in line with the drop in the share of payroll jobs created by smaller and younger firms partly accounting for the long-term decline in labor market fluidity (Davis & Haltiwanger, 2014; R. Decker, Haltiwanger, Jarmin, & Miranda, 2014; R. A. Decker, Haltiwanger, Jarmin, & Miranda, 2016b). Second, between 2006 and 2017, the outsourced labor share exhibits steeper and more volatile growth compared with the payroll labor share. The average manufacturing plant increased its outsourced labor share by 85%, compared to a 10% increase in the payroll labor share. Third, the decision to use staffing arrangements as well as the intensity in which they use them vary systematically with revenue growth. The share of manufacturing plants using outsourced labor decreases when revenue growth is shrinking and increases when it is expanding. These three facts suggest plants using domestic outsourcing strategically and domestic outsourcing being one of the phenomena underlying the decline in aggregate job reallocations.

Business dynamics models' result that plants adjust their employment in response to their own ever-changing productivity (Hopenhayn, 1992; Bergin & Bernhardt, 2004) motivate my empirical strategy to assess outsourced labor responsiveness; strategy that, in turn, builds on (R. A. Decker et al., 2020)'s empirical design to study payroll employment responsiveness to revenue productivity. I then define shocks as revenue productivity growth deviations from own or detailed industry-year average productivity growth.

Outsourced employment is an important margin of adjustment. I find that plant-level outsourced employment is twice as responsive as payroll employment to shocks and adjusts more quickly. Plants respond to shocks by adjusting outsourced employment growth within the same year of the shock, while payroll employment reacts in the following year. The "immediate" response of outsourced employment reflects the flexible nature of this type of workers and is micro evidence for the use of temporary help employment as a leading recession indicator (Peck & Theodore, 2007; S. N. Houseman & Heinrich, 2015; Luo, Mann, & Holden, 2021).

I interpret the subsequent and smaller response of payroll employment as plants using outsourced workers to adjust their workforce while they learn about the permanency of the shock which, in turn, is consistent with outsourced jobs temporarily substituting payroll jobs. That is, the evidence suggests that (i) following negative shocks, plants shed outsourced jobs first to retain permanent workers in whom they have invested and who have acquired firm specific skills, and (ii) following positive shocks plants outsource new hires, waiting to see whether the shock is long-lasting enough to merit costly investments in new permanent employees. This pattern is consistent with the hypothesis that payroll employment adjustment costs are an important mechanism behind the use of staffing services

(Abraham & Taylor, 1996; Segal & Sullivan, 1997; S. Houseman, 2001; S. N. Houseman, Kalleberg, & Erickcek, 2003; Autor, 2003). Consistent with domestic outsourcing as one of the factors behind the drop in job reallocations, payroll employment adjustment costs have also been shown to be a relevant mechanism for the decline in labor market flows (Autor, Kerr, & Kugler, 2007; Davis & Haltiwanger, 2014; Cairo & Cajner, 2017; Fujita, 2018).

Domestic outsourcing micro implications have significant macroeconomic measurement consequences. On average, every year, we omit the equivalent to 14% of payroll job reallocations. Moreover, the creation or destruction of outsourced jobs can account to as much as one-fifth of the corresponding payroll job flow in a given year. Outsourced job creation did in 2010, the first year after the Great Recession. In contrast, the omitted job destruction was at its minimum in the same year. This contrast means that, in the first year after the Great Recession, relative to payroll jobs, the manufacturing sector not only was creating jobs to be filled by outsourced workers at a higher pace but it was not destroying the existing ones as quickly. It then follows that the omitted reallocations problem qualitatively affects our understanding of labor markets adjustment along the cycle.

More generally, the widespread use of gross job flows to investigate U.S. labor markets, test theories about their behavior, understand cyclical fluctuations in employment and inform public policy decisions underscores the importance of considering the first-order effects documented in this paper in labor market analyses. A salient example are search models' calibrations —a workhorse model for the empirical research of labor markets, for most of which gross labor flows are key parameters (Pissarides, 1985; Mortensen & Pissarides, 1994, 1999).

Additional contributions to the literature. My findings contribute to two strands of literature: labor market dynamism and domestic outsourcing. In the literature on the decline in labor market dynamism, the omitted reallocations hypothesis is novel. In the domestic outsourcing body of work, this paper highlights the importance of domestic outsourcing *dynamics* and contributes with administrative client plant-level evidence for the biggest client sector of staffing services, manufacturing.

Domestic outsourcing is increasingly receiving attention by the economic literature mostly because of its consequences on wages, wage discrimination within the firm and wage inequality (S. N. Houseman et al., 2003; Autor & Houseman, 2010; Dube & Kaplan, 2010; Goldschmidt & Schmieder, 2017; Bloom, Guvenen, Smith, Song, & von Wachter, 2018;

Dorn, Schmieder, & Spletzer, 2018; Bilal & Lhuillier, 2021; Bergeaud, Mazet-Sonilhac, Malgouyres, & Signorelli, 2021; Weber Handwerker, 2022). Not surprisingly, then, this literature is mostly focused on the worker side. Two notable exceptions to this practice are S. Houseman (2001) and Anderson and McKenzie (2022). My contribution to this body of work is twofold. First, the descriptive evidence of this paper complements our knowledge about domestic outsourcing from the client business side. The facts on the type of businesses using staffing services more intensively, as measured by the outsourced labor share, are novel in the literature; and those on the prevalence of this phenomenon across plants characteristics are consistent with S. Houseman (2001)'s results. Second, my results show that the dynamics in the use of domestic outsourcing also have significant consequences on our understanding of labor markets' functioning. The existing empirical evidence concentrates on the effects of transitioning from not outsourcing to outsourcing. This paper also adds the magnitude of the decline in gross job flows to the list of measurement issues in which we can incur for not accounting for outsourced workers. Previous work has focused on employment and labor productivity patterns or worker flows (Dey, Houseman, & Polivka, 2012, 2017; S. N. Houseman & Heinrich, 2015; Atencio De Leon, 2022).

Accounting for domestic outsourcing complements our knowledge on the decline of labor market dynamism and on labor adjustment at the aggregate and micro level (Shimer, 2012; Hyatt & Spletzer, 2013; Davis & Haltiwanger, 2014; R. A. Decker et al., 2016a; Molloy et al., 2016; Peters & Walsh, 2019; R. A. Decker et al., 2020; Akcigit & Ates, 2021). My results suggest that at least part of the decline reflects a transformation of the labor market towards the use of intermediaries in the employment process rather than a decline in underlying dynamism and that allowing a broader definition of employers' responsiveness to include domestic outsourcing enriches our understanding of micro-level adjustments to shocks.

Overview of this paper. Section 2 documents the prevalence and growth of domestic outsourcing in the U.S. manufacturing sector. Section 3 presents the methodology to estimate plant-level outsourced employment from expenses and assesses the consequences of omitting outsourced workers on plant-level labor responsiveness of plants to changes in revenue productivity. Section 4 quantifies the omitted reallocation problem in manufacturing job reallocations. Section 5 discusses the results. Section 6 concludes.

2 Domestic outsourcing in U.S. manufacturing: growth and prevalence

This section describes domestic outsourcing in the U.S. manufacturing sector using administrative micro data on expenses on temporary and leased staff for the period between 2006 and 2017 (see Section 2.1). I describe the prevalence of domestic outsourcing by plant employment size, high/low-industry, three-digit industry and revenue growth. I also characterize the types of plants that use outsourced staff more intensively, as measured by the share of revenue spent on this type of workers. Finally, I investigate the use of outsourced employment over time. The results in this section show that domestic outsourcing is increasing over time and exhibits substantial cross-sectional variation along plant-level characteristics and revenue growth.

2.1 Data

Large data gaps have impeded accurately accounting for outsourced workers in economic analyses. I overcome this challenge by combining multiple administrative datasets from the U.S. Census Bureau. Specifically, I use the Annual Survey of Manufacturers (ASM), the Census of Manufacturers (CM), the Longitudinal Business Database (LBD) and the Revenue Longitudinal Business Database (RE-LBD).

The Annual Survey of Manufacturers contains a sample representative of the manufacturing sector that rotates every five years (in years ending in "4" and "9"). The Census of Manufacturers, on the other hand, contains the universe of manufacturing plants and is conducted in years ending in "2" and "7". For such years, I keep only the plants that are in the corresponding rotating sample of the ASM. The rotating sample feature of the ASM is essential for my empirical analysis since I rely on year-to-year changes.

The ASM-CM has establishment-level information on revenue and revenue productivity and since 2006, on expenses on outsourced services[5]. I focus on expenses on temporary and leased staff since, in manufacturing, this type of outsourced workers typically work side-by-side payroll employees and are in production occupations (Dey et al., 2017)[6]. These

[5]Revenue is defined as the sum of total value of shipments and variations in inventory.

[6]Domestic outsourcing includes independent contractors, on-call workers, contract company workers, temporary workers and leased staff. Temporary help agencies assign their workers to client plants, while professional employment organizations (the legal employer of leased employees) completely takes over client plants' human resources tasks.

characteristics of temporary and leased workers are important for my analysis because they suggest that the jobs filled by these type of outsourced workers are comparable to those filled by payroll employees. This implies that the omission of the creation and destruction of jobs filled by temporary and leased workers reflects a structural change in the employment processs (the use of intermediaries) rather than in the task composition of the production process. From now on, I will use temporary and leased workers and outsourced workers interchangeably.

I link the ASM-CM sample with the LBD to retrieve information on plant location, plant age, firm age and firm payroll employment. The LBD is a census of establishments and firms in the U.S. with paid employees. I use the plant location to link each plant with the average labor share (payroll over revenue) of temporary help firms and professional employment organizations in a given state. This information is in the RE-LBD and is an important component of the estimation of outsourced staff from expenses on temporary and leased staff.

I restrict the ASM-CM sample to establishments with no missing or imputed information on expenses on temporary and leased staff. Therefore, to ensure that my empirical analysis is still representative of the manufacturing sector, I construct propensity score weights based on a logit model of industry, firm size and firm age to adjust the restricted sample to represent the LBD (Section A.3 provides details). The baseline sample for the analysis of this paper is a non-balanced panel of manufacturing plants between 2006 and 2017.

2.2 Domestic outsourcing in the cross-section

Table 1 describes the use of temporary and leased staff in the manufacturing sector by establishment age, size and high-tech status. Column (1) displays the percentage of client plants: establishments reporting having spent on outsourced employment in a given year. Column (2) shows expenditures on outsourced employment as a percentage of revenue for client plants. In this way, the outsourced labor share of revenue captures use intensity without confounding the participation decision.

The use of domestic outsourcing is common in the manufacturing sector. 70% of the plants reported having spent on outsourced employment between 2007 and 2017 and 47% of the manufacturing plant-year observations in the sample are client plants. The difference indicates that using outsourced staff is not an absorbing state. Manufacturing plants use outsourced staff intermittently. The average client business spent 1.7% of its revenue on

professional employment organizations and temporary help agencies.

Table 1: Outsourced staff in the manufacturing sector: participation in staffing arrangements is more prevalent in older, bigger and high-tech establishments, but younger, smaller and low-tech establishments use them more intensively.

	Pct. of establishments *(1)*	Pct. of revenue (clients) *(2)*
Total	47.14	1.70
Establishment age class		
0-4	41.51	2.23
5-9	44.29	1.81
10-29	47.63	1.60
30+	51.97	1.45
Establishment size class		
0-9	27.60	2.54
10-49	39.88	1.99
50-249	67.51	1.31
250+	81.19	1.01
High-tech status		
High-tech	63.62	1.46
Low-tech	46.11	1.72

Notes: Yearly averages by the given establishment characteristic. Column 1 displays the percentage of establishments reporting having spent on temporary workers and leased employees. Column 2 reports the percentage of revenue spent on temporary and leased employees by the average client establishment in each category. High-tech is defined using four-digit NAICS industries as in (Hecker, 2005). Source: Author's calculations from ASM-CM-LBD data in 2006-2017.

Outsourcing arrangements are more prevalent in bigger and older establishments, but among clients, smaller and younger establishments use these arrangements more intensively. Panel A of Table 1 shows that the percentage of establishments with fewer than 10 payroll employees using staffing arrangements is one third of that of establishments with more than 250 payroll employees. Conversely, among client establishments, small plants temporary and leased staff share of revenue more than double that of big establishments.

Haltiwanger, Hathaway, and Miranda (2014) have found that the decline in payroll job

reallocation between 2003 and 2011 was largest among high-tech manufacturing plants, so I investigate how outsourcing varies between high-tech and other manufacturing plants. High-tech is defined using four-digit NAICS industries as in Hecker (2005). Table 1 shows the results. Consistent with the omitted reallocations hypothesis, high-tech establishments are more likely to spend on staffing arrangements than other manufacturing plants. According to Table 1, 63.6% of this type of manufacturing plants used staffing arrangements compared to 46.1% of low-tech establishments and 47.14% overall.

I next consider the cross-sectional relationship between use of domestic outsourcing and average plant-level revenue growth. This exercise will provide insights on the strategic use of outsourced employment by plants. My hypothesis is that the use of intermediaries allows for lower cost adjustments of labor needs and faster adjustment.

I restrict the sample to establishments observed for at least two consecutive years and compute the symmetric revenue growth rate for each of them.[7] Then, I split the sample into twenty equally-sized groups and compute domestic outsourcing use statistics for each group. Figures 1 displays the average share of client establishments for each revenue growth ventile. Similarly, Figure 2 depicts average plant-level expenses on outsourced staff as a share of revenue for each revenue growth ventile.

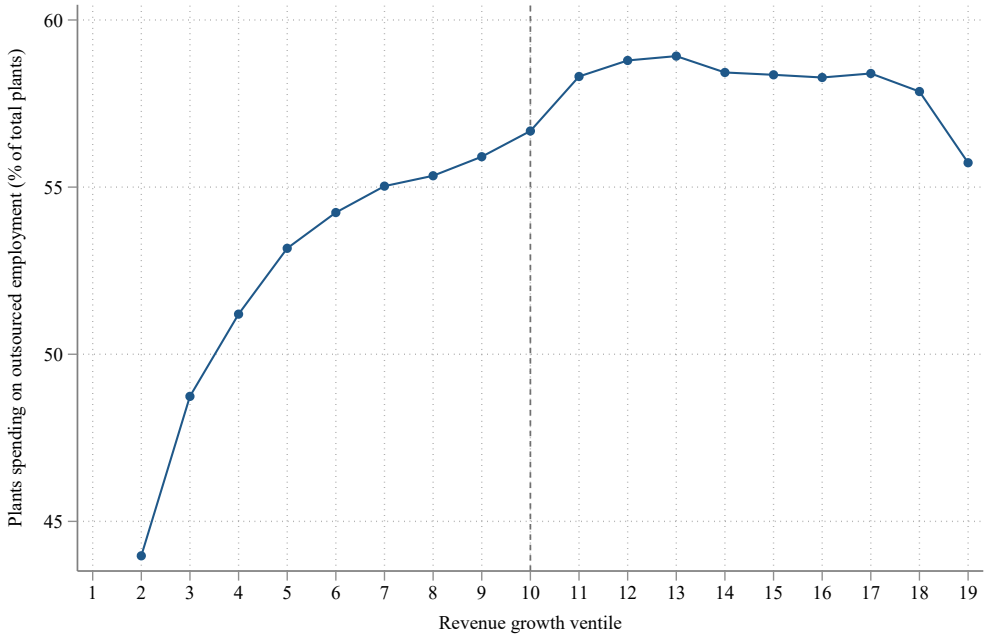
Figure 1 shows an increasing, nonlinear relationship between revenue growth and the use of domestic outsourcing. The share of client plants declines sharply when revenue growth is shrinking. Above the median revenue growth, the participation margin rises until it reaches its maximum at 59.5%; then it flattens to finally decline for establishments at the top of the revenue growth distribution. Figure 1 indicates that the revenue growth and the decision of using outsourced workers are tightly linked at the business level. The "hook" shape of the relationship supports the hypothesis that plants use domestic outsourcing strategically and potentially as a margin of adjustment to variations in revenue growth. The pattern exhibited by the relationship between the intensive margin and revenue growth is consistent with this interpretation (Figure 2).

2.3 Domestic outsourcing over time

The use of domestic outsourcing is increasing over time. The share of revenue spent on this type of staffing arrangement almost doubled for the studied period, going from 0.65% to

[7] DHS or arc-elasticity widely used in the literature. This measure is inclusive of establishments exiting or entering the market; however; I do not report them in figures 1 and 2.

Figure 1: The share of client plants increases with revenue growth. The increase flattens after the median.



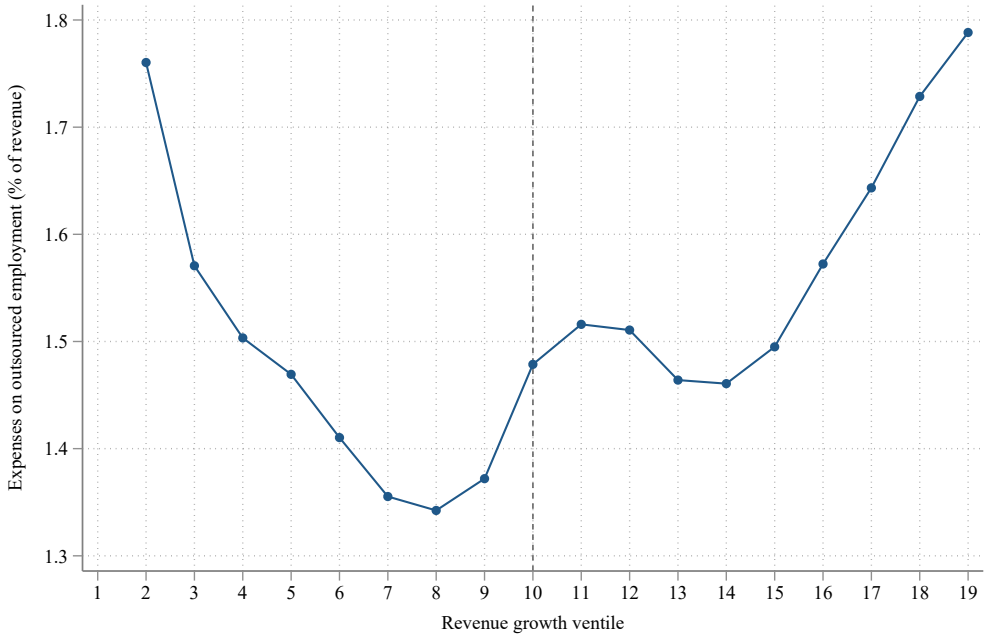
Note: The figure displays the share of client establishment by revenue growth ventile. Each point is the three-point moving average. Source: Author's calculation from ASM-SM-LBD data in 2006-2017.

1.21%. This growth is conditional on business age, industry and payroll employment size, i.e., it is not accounted for changes in the composition of plants along these characteristics. The average client business exhibits the same pattern. Figure 3 depicts the temporary and leased staff share of revenue for the average client business over time. Every year, on average, plants that reported having spent a non-zero amount on temporary and leased staff increased the share of revenue spent on this service by approximately 7%, going from 1.49% in 2006 to 2.70% in 2017.

Despite the average positive yearly growth rate, between 2007 and 2009, the outsourced labor share of revenue dropped by 23%. During these years, the U.S. economy was undergoing the Great Recession; thus, the drop is expected but its magnitude is remarkable considering that revenue was also declining. It follows that client plants cut expenses on temporary and leased employment at a higher pace than they saw their revenue decline. Figure 4 suggests the same does not hold for payroll employment.

Figure 4 displays the labor share of outsourced and payroll employment for the average manufacturing business over time. It shows that, between 2007 and 2009, the average

Figure 2: There is a U-shaped relationship between the share of revenue spent on outsourced staff and revenue growth.

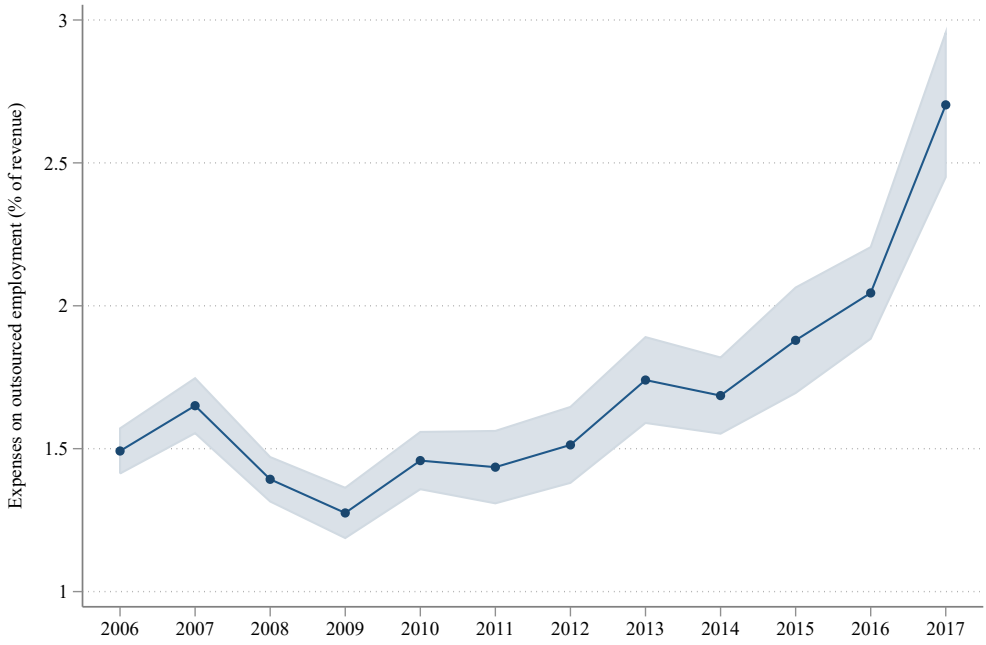


Note: The figure displays the average share of revenue spent on temporary and leased staff by revenue growth ventile. Each point is the three-point moving average. Source: Author's calculation from ASM-SM-LBD data in 2006-2017.

payroll employment share saw a small increase, presumably due to the decline in revenue, whereas the outsourced employment share dropped by 35%. Not surprisingly, the decline for the average manufacturing plants exceeds that of the average client business since the former confounds the fact that plants may decide not to use outsourced workers altogether in response to the adverse economic environment (the participation margin). This evidence is in line with the relationship between domestic outsourcing and revenue growth documented in the previous section. It also points to outsourced workers being an important margin of adjustment for plants. I investigate the role of outsourced workers as a margin of adjustment in Section 3.

Figure 4 is also consistent with manufacturing plants increasingly sourcing labor from temporary help agencies and professional employment organizations even relative to direct hires. The figure additionally shows that outsourced labor share variance is significantly higher than that of payroll employment. The evidence suggests that the creation of jobs filled by outsourced workers has increased over time and supports the interpretation of outsourced workers as being an unobserved margin of adjustment. Sections 3 and 4 confirm

Figure 3: The average manufacturing plant increased the outsourced labor share by 85% between 2006 and 2017.



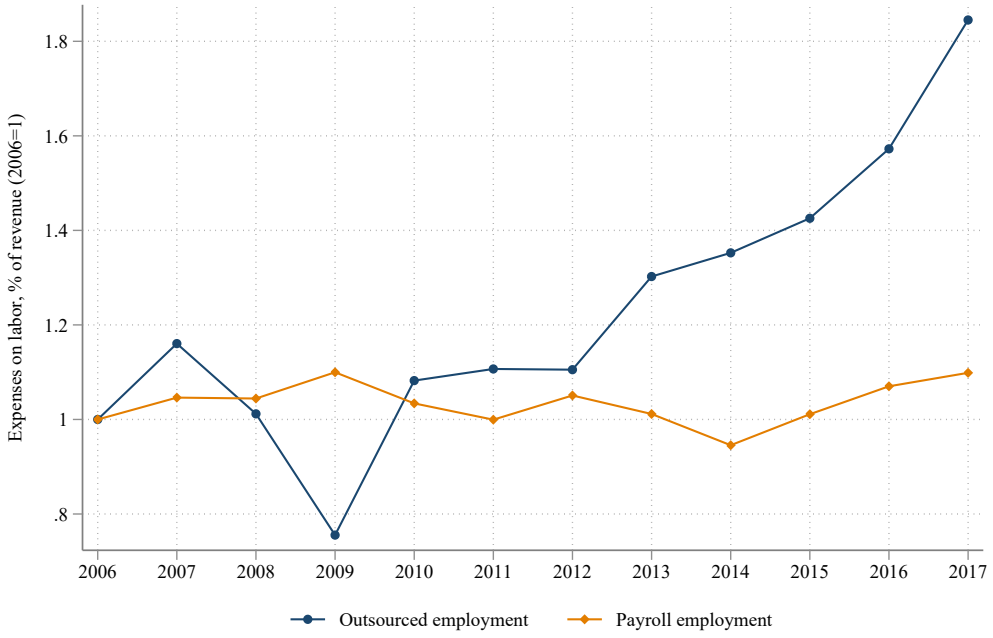
Note: Point estimates and robust standard errors of plant-specific expenditures on outsourced staff as a share of revenue, controlling for employment size, age, and three-digit industry. Source: Author's calculations from ASM-CM-LBD data in 2006-2017.

these statements.

3 Domestic outsourcing and plant-level labor responsiveness

The omitted reallocations problem goes beyond measurement. The failure to account for outsourced workers translates into misconceptions of the labor market and how it works. I illustrate this point with the labor adjustment of plants to changes in revenue productivity growth (responsiveness). I show that by not considering outsourced workers in the labor responsiveness of plants we omit a margin of adjustment whose dynamics differ from that of the observed margin (payroll employment), limiting in turn our understanding of employers' strategic behavior. The increasing share of revenue spent on temporary and leased employment (see Section 2) suggests that such an omitted margin of adjustment may be one of the underlying causes of the decline in payroll labor responsiveness documented by the literature.

Figure 4: Outsourced employment share of revenue is increasing, whereas payroll employment share of revenue remained roughly constant.



Note: Point estimates of plant-specific expenditures on outsourced and payroll employment as a share of revenue, controlling for employment size, age, and three-digit industry. Point estimates normalized to the value in 2006. Source: Author's calculations from ASM-CM-LBD data in 2006-2017.

3.1 Plant-level outsourced employment from reported expenses

Total expenditures on outsourced staff, exp^o, is a function of the wage bill of outsourced workers, o^o, and the fixed costs related to outsourcing, F:

$$exp^o_{jst} = o_{jst} w^o_{jst} + F_{jst},$$

where a plant is indexed by j, state by s, and year by t.

Suppose that fixed costs are proportional to wages paid for outsourced employees, then

$$exp^o_{jst} = (1 + \alpha) o_{jst} w^o_{jst}, \tag{1}$$

where α is the overhead per outsourced employee charged by the staffing agency associated with plant j.

To estimate plant-level outsourced employment o_{jst}, I begin by making two conservative assumptions. First, average earnings per payroll job w^p_{jst} are equal to that of outsourced jobs w^o_{jst}. Second, the agency's overhead per outsourced employee is equal to the inverse labor share of the average staffing agency ℓ in state s[8]. I then estimate plant-level outsourced employment as follows:

$$\hat{o}_{jst} = \underbrace{exp^o_{jst} \times \frac{payroll_{\ell st}}{revenue_{\ell st}}}_{\text{Outsourced wage bill}} \times \frac{1}{w^p_{jst}}. \tag{2}$$

Equation (2) underestimates plant-level outsourced employment as long as

$$\frac{payroll_{\ell st}}{revenue_{\ell st}} < \frac{1}{1+\alpha}, \tag{3}$$

α is small, otherwise the client plant would hire all employees directly instead of outsourcing. Moreover, besides competing with clients' direct-hiring, staffing agencies also compete aggressively with each other on price. Consequently, $\frac{1}{1+\alpha} \approx 1$ and whenever outsourcing agencies have profits or expenses other than labor, $\frac{payroll_{\ell st}}{revenue_{\ell st}} << 1$. Thus, condition (3) holds and my baseline estimate of plant-level outsourced employment is a lower bound.

Let me elaborate on the wage assumption. The average wage of outsourced workers is a fraction of that of payroll employees in the same occupation:

$$w^p_t = (1+\gamma_t) w^o_t$$

Dube and Kaplan (2010) show that for low-wage service occupations γ_t ranges from 4% to 24%. Using German data, (Goldschmidt & Schmieder, 2017) show there is an outsourcing wage penalty (ranging between 10% and 15%) even for jobs that are moved outside the boundary of the firm to contracting firms. Using data from the Occupation and Employment Wage Statistics (OEWS), I find that in my setting, γ_t varies from 10% to 15%. Equation 2 effectively assumes that γ_t is constant and equal to zero. Once again, my baseline results are a lower bound. I relax the wage assumption in Section 4.

[8] I leverage location information on both staffing agencies and client plants to approximate an agency's labor share with the labor share of the average staffing agency in the state s in which the client plant is located β_{st}. I do so because, although I observe the labor share of staffing agencies, the staffing agency-client plant link is not observed.

3.2 Outsourced employment and revenue productivity changes

I investigate outsourced workers as a margin of adjustment estimating a fixed-effects panel equation of outsourced employment growth on revenue productivity change ($log(a_t) - log(a_{t-1})$). My empirical strategy is motivated by business dynamics models' result that plants adjust their employment in response to their own ever-changing productivity (Hopenhayn, 1992; Bergin & Bernhardt, 2004) and builds on the empirical design of R. A. Decker et al. (2020)[9]. Specifically, I estimate the following equation:

$$\Delta_\tau y_j = \alpha_{it} + \beta_1 \Delta_t a_{jt} + controls + \varepsilon_{j\tau} \qquad \tau \in \{t-1, t \quad t, t+1 \quad t+1, t+2\} \tag{4}$$

where α_{it} are six-digit industry-year fixed effects, j denotes establishments and t denotes year. The outcome $\Delta_\tau y$ is the symmetric (or DHS) growth rate of outsourced employment between any pair of years in τ.[10] The variable of interest is $\Delta_t a_{jt}$, the change in log revenue productivity between t and $t-1$. I estimate equation 4 for plants that stayed in the sample for at least five years.

Outsourced employment DHS growth rates, $\Delta_\tau y$, are inclusive of plants that stopped using this type of workers at any time during the studied period. This feature is important in my empirical design because plants may respond to revenue productivity changes by adjusting the intensity in which they use outsourced workers or they may stop using them altogether. DHS growth rates capture both responses computing outsourced employment annual changes relative to average outsourced employment for the two periods involved. However, this measure is not defined whenever such average is zero, i.e., non-client plants that decided to stay as such for the subsequent period. I define the outcome as zero in these cases. In particular, for $\tau = t-1, t$

$$\Delta_t y_j = \begin{cases} 2 \times \frac{\hat{o}_{jt} - \hat{o}_{jt-1}}{\hat{o}_{jt} + \hat{o}_{jt-1}}, & \text{if } \hat{o}_{jt} + \hat{o}_{jt-1} > 0 \\ 0, & \text{otherwise} \end{cases}$$

where $\hat{o}_{jt}$ is the plant-level outsourced employment estimated using equation (2). Setting to zero the growth rate of plants that "dropped out" from using temporary and leased

[9] These authors study plant-level labor responsiveness as a cause for the decline in job reallocation.

[10] This growth rate concept is commonly used in the literature on firm dynamics. DHS refers to Davis, Haltiwanger, and Schuh (1996).

staff but did not exit the market allows me to capture, for example, situations in which the plant "hired" outsourced workers to fulfill a big order with a short deadline (less than one year) and then "laid them off": a common situation for the use of outsourced workers in manufacturing. The outcome would also capture the opposite case: plants that "opted in" from using the studied margin after the productivity change. It also permits me to follow the same set of establishments from $t-1$ to $t+2$, the periods involved in the estimation of equation 4.

The parameter of interest, β_1, estimates outsourced labor responsiveness shocks. The average plant-level response of outsourced staff growth to *deviations* from industry-year average revenue productivity growth. The difference specification already nets out estimated responsiveness of time-invariant factors at the establishment level; therefore, the inclusion of industry-year fixed effects makes β_1 the responsiveness to changes on plant-level deviations from the average revenue productivity growth in their detailed industry in a given year. I control for factors, common to all plants, inducing a linear trend in revenue productivity growth by including change in log productivity interacted with a linear trend in *controls*.

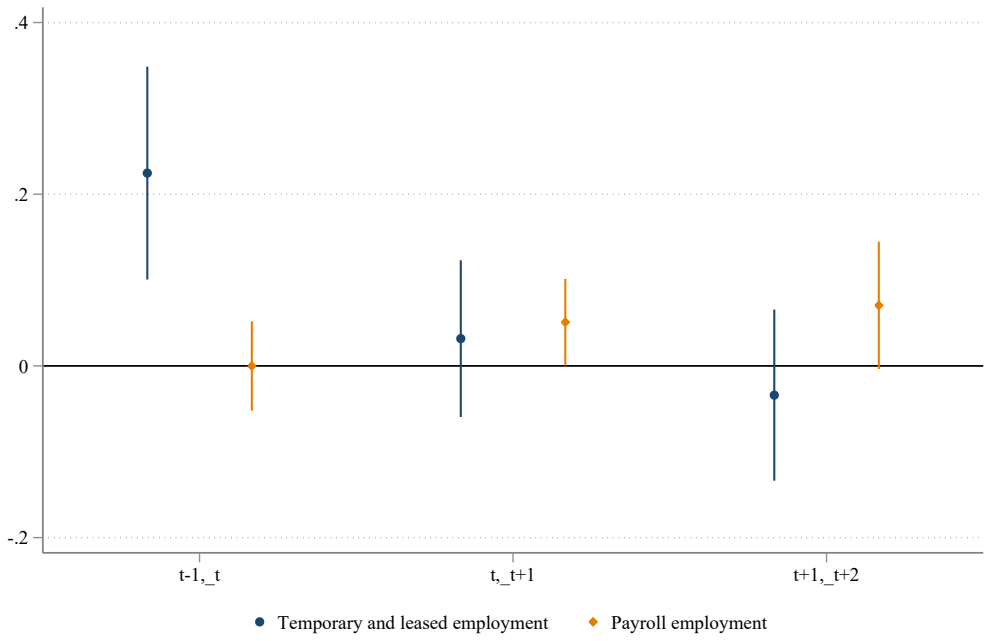
In addition to the interaction between log revenue productivity change and a linear trend, *controls* includes a variety of covariates informed by the results in Sections 2 and 4. These include initial establishment log employment size, initial firm log employment size, firm age and establishment age; in line with heterogeneity in the use of outsourced workers documented in Section 2. The control set also includes a third-degree polynomial of log revenue productivity change, recognizing that the relationship between outsourced staff growth and revenue productivity growth is not linear as shown by Figure A.6. Other covariates in the control set are state fixed effects, ASM rotating sample fixed effects, and cyclical indicators: change in state unemployment rates, and change in state unemployment rates interacted with log revenue productivity change. I include cyclical indicators to avoid $\hat{\beta}_1$ being driven by the pro-cyclical feature of temporary and leased employment, since the Great Recession is in the period of analysis.

I also estimate payroll labor responsiveness to deviations from average revenue productivity growth. Specifically, I estimate equation (4) with payroll employment DHS growth rate as the outcome.[11] Figure 5 displays the estimated responsiveness of outsourced employment (blue) and payroll employment (red) to revenue productivity changes ($\hat{\beta}_1$), as well as 95%

[11] In contrast with outsourced employment, the average payroll employment between two periods (denominator of the DHS growth rate) is only zero if the business exited the market in a preceding year. This case is ruled out by the five-year sample restriction mentioned above.

confidence intervals. Standard errors are clustered at the establishment level. The first column of Table 2 displays the results as well.

Figure 5: Plant-level outsourced employment growth is twice as responsive as payroll employment growth to revenue productivity shocks and adjusts more quickly.



Note: The figure shows point estimates and 95-percent confidence intervals of plant-level payroll, and outsourced employment growth rate on revenue productivity change (see Equation 4). Source: Author's calculations based on ASM-CM-LBD and RELBD from 2006-2017.

Plants use outsourced employment as a margin of adjustment. The response of outsourced employment DHS growth rate is sizable, statistically significant and "immediate". For the average manufacturing business in the sample, a 1% deviation on its revenue productivity growth from the industry-year average is associated with a 0.22% increase in the outsourced employment growth rate in the same year of the productivity change. This is 4% of the average outsourced employment growth. The comparable payroll employment responsiveness is half of that of outsourced employment (2% of the average).

Plants accelerate the use of outsourced workers only in the period of the shock (t), whereas their response through payroll employment occurs in the following period ($t+1$). The correlation between the outsourced employment growth rate for the two periods following the productivity change and the productivity change is small and not statistically different from zero. Conversely, the average business increases its payroll employment growth rate by 0.05% in $t+1$, when presumably it has more information on the persistence of the

productivity change. Similarly to outsourced employment, the payroll employment growth rate in $t+2$ is not statistically different from zero, but positive. Table 2 shows that the qualitative result holds for a different definition of the shock: deviations from own average productivity growth.

Table 2: Plant-level outsourced employment growth is twice as responsive as payroll employment growth to revenue productivity shocks and adjusts more quickly.

Dependent variable	Prod. Change $\Delta_t a_{jt}$		Dep. Var Mean
	(1)	(2)	(3)
Payroll employment growth			
t-1, t	-0.0001	-0.0521	2.66
	(0.0266)	(0.0111)	
t, t+1	0.05095	0.0286	2.57
	(0.0257)	(0.0145)	
t+1, t+2	0.07052	0.0072	3.79
	(0.0379)	(0.0173)	
Outsourced employment growth			
t-1, t	0.2246	0.2557	6.04
	(0.0633)	(0.0563)	
t, t+1	0.0318	0.0211	4.66
	(0.0466)	(0.0474)	
t+1, t+2	-0.0341	-0.0229	5.09
	(0.0509)	(0.0528)	
Observations	102,000	102,000	102,000
Industry-year fixed effects	Yes		
Establishment fixed effects		Yes	

Notes: Plant-level labor responsiveness estimates to revenue productivity shocks. Standard errors clustered at the establishment level in parenthesis. Column (1) displays results for the baseline specification: shocks defined as plant's revenue productivity growth deviations from NAICS six-digit industry-year average. Column (2) displays results when the shock is defined as plant's productivity growth deviations from own productivity growth average. Source: Author's calculations based on ASM-CM-LBD.

Table 3 shows that the responsiveness result is robust to different specifications and not restricting the sample to five-period continuers.

Table 3: Outsourced employment growth is more responsive than payroll employment growth.

Dependent variable	Revenue Productivity			
	Level a_{jt}	Change $\Delta_t a_{jt}$		
	(1)	(2)	(3)	(4)
Payroll employment growth	0.1782	0.1742	0.1061	0.1164
$t, t+1$	(0.0110)	(0.0203)	(0.0395)	(0.0410)
Dependent variable mean			-14.22	
Outsourced employment growth			0.1374	0.1703
$t, t-1$			(0.0467)	(0.0526)
Dependent variable mean			2.87	
Observations	1,630,000	1,181,000	150,000	150,000
1981-2013	Yes	Yes		
2006-2017			Yes	Yes
Third-degree polynomial				Yes
Total initial employment				Yes
Industry-year fixed effects	Yes	Yes	Yes	Yes

Notes: Plant-level labor responsiveness estimates to revenue productivity shocks for 1981-2013 and 2006-2017 and different specifications. Standard errors clustered at the establishment level in parenthesis. Columns (1) and (2) display results for 1981-2013, the period of analysis of (R. A. Decker et al., 2020). Columns (3) and (4) display results for 2006-2017, the period for which outsourced employment estimates are available. Column (1) reports payroll employment growth responsiveness to productivity level following (R. A. Decker et al., 2020)'s specification. Column (2) reports payroll employment growth responsiveness to productivity change following a specification otherwise identical to that of Column (1). Column (3) additionally reports outsourced employment growth responsiveness. Column (4) adds a productivity third-degree polynomial and initial outsourced employment to the control set. All coefficients are statistically significant with $p < 0.01$. Source: Author's calculations based on ASM-CM-LBD.

The (apparently) immediate response of outsourced staff reflects the flexible nature of this type of employment. Client plants can renegotiate staffing agreements within weeks. In fact, it is standard for staffing agencies to bill depending on the workers provided, allowing the client business to adjust temporary and leased workers at a moments' notice, so that a renegotiation may not be even needed. I study yearly changes due to the frequency of the data available. The lagged plant-level response of outsourced staff relative to payroll staff

is also in line with the pattern exhibited by the share of employment of outsourced workers at the aggregate level. This series drops sharply the year preceding a recession as shown in Figure A.1. Therefore, this result provides micro-level evidence supporting the use of employment in the temporary help sector as a predictor of aggregate economic conditions. It also suggests that plants use outsourced and payroll employment as substitutes.

4 Domestic outsourcing and the measurement of aggregate job reallocations

The previous section showed that plants use outsourced employment as a first line margin of adjustment to shocks, and the increasing outsourced labor share documented in Section 2 suggests this has been occurring at an increasing rate; thus, supporting the hypothesis that the increasing use of domestic outsourcing is one of the underlying causes of manufacturing payroll employment becoming increasingly stable —payroll declining dynamism. In particular, the mismeasurement of labor market flows, as the dynamism is increasingly concentrated in the unmeasured mobility of outsourced workers. In this section, I show that, in fact, manufacturing outsourced jobs reallocate at a higher pace than payroll jobs. For job reallocations in the U.S. manufacturing sector between 2006 and 2017, I will show that the omitted reallocations problem is sizeable, exhibits considerable variation over time and across average plant-level revenue growth, and is tightly linked to the cycle.

I begin by defining job reallocations. Job reallocations capture the reshuffling of job opportunities across workplaces. Formally, they are the sum of plant-level employment gains and losses that occur between two years. Therefore, plant-level outsourced employment is the main ingredient to quantify how the creation and destruction of jobs filled by outsourced workers bias the measurement of the aggregate job reallocation. I calculate gross outsourced job reallocations OJR_t using plant-level outsourced employment $\hat{o}_{jt}$ estimated in Section 3.1 as per Equation (2),

$$OJR_t = \sum_j |\hat{o}_{jt} - \hat{o}_{jt-1}| \tag{5}$$
$$OJR_t = OJC_t + OJD_t$$

OJR_t captures the reallocation of outsourced jobs across manufacturing plants and it also

equals the sum of the total number of outsourced jobs created OJC_t and destroyed OJD_t in a given year. Analogously, payroll job reallocations are the sum of payroll jobs created and destroyed in a given year.

Table 4: The omitted reallocations problem is sizeable and varies significantly over time.

	Job Creation JC (1)	Job Destruction JD (2)	Job Reallocations JC+JD (3)
Panel A: Yearly outsourced job flow (% payroll job flow)			
Average	16.20	13.66	**14.61**
Std. Dev.	2.47	3.68	2.66
2017 - 2007	4.19	8.57	6.48
Panel B: Yearly job flow rate (%)			
Payroll			
Average	7.52	7.98	15.49
Std. Dev.	1.29	2.86	2.07
2017 - 2007	12.31	-12.35	**-0.46**
Outsourced			
Average	30.38	25.99	56.36
Std. Dev.	6.12	6.70	10.01
2017 - 2007	-1.42	6.21	**1.90**
Total			
Average	8.39	8.66	17.05
Std. Dev.	1.38	2.88	2.11
2017 - 2007	14.81	-6.87	3.80
Panel C: Job flow percentage change (2017 - 2007)			
Payroll	-2.14	-23.62	-13.27
Outsourced	22.99	32.50	27.12
Total	1.39	-17.76	-8.33
Obs	259,500	259,500	259,500

Notes: Job creation is the employment change sum of expanding plants. Job destruction is the employment change sum of shrinking plants. Job reallocations is the sum of jobs created and jobs destroyed (see Equation (5)). A job flow rate is the job flow expressed as a share of employment. Source: Author's calculations from ASM-CM-LBD data in 2006-2017.

Table 4 summarizes the results. Panel A presents summary statistics for yearly outsourced jobs created, outsourced jobs destroyed and outsourced gross job reallocations as a percentage of the corresponding payroll job flow between 2007 and 2017. They paint a clear picture: aggregate job flows are underestimated and the extent of mismeasurement varies significantly over time.

On average, every year, we omit the equivalent to 16% of the payroll jobs created and 13% of the payroll jobs destroyed. Both indicators display significant variation over time accounting to as much as one-fifth of the payroll job flow in a given year. Moreover, for the studied period, the share of outsourced jobs destroyed more than doubled, ranging from 8 to 20 outsourced jobs destroyed per every 100 payroll jobs destroyed. The reported variation is tightly linked to aggregate economic conditions, a point that I explore later in this section and that have non-trivial consequences on our understanding of labor market adjustment along the cycle.

Outsourced jobs reallocate at a higher pace than payroll jobs across plants. Panel B of Table 4 displays summary statistics for yearly outsourced and payroll job reallocation rates. That is, the corresponding job flow as a share of payroll or outsourced employment. For every job flow, the outsourced rate is at least two times higher than the corresponding payroll rate. The measurement of aggregate job flows not only omit the reallocations of a certain type of jobs, these jobs reallocate at a higher pace —a necessary condition for the omission of outsourced jobs reallocations to account for part of the documented decline in the payroll job reallocation rate. If the manufacturing sector were outsourcing longer-tenure jobs (relative to payroll jobs), the omitted reallocations problem would imply an overestimation of the payroll job reallocation rate.

For the studied period, the payroll job reallocation rate dropped by 0.46%. In contrast, the outsourced job reallocation rate increased by 1.90% (Table 4, Panel B). Panel C of Table 4 presents the percentage change in outsourced and payroll job reallocations.

I find that the documented increase in the outsourced job reallocation rate is driven by outsourced job reallocations increasing at a higher pace than outsourced employment (27.1% vs. 23.3%). Similarly, the drop in the pace at which payroll jobs reallocate across worksites is driven by payroll job reallocations decreasing at a higher pace than payroll manufacturing employment (13.3% vs. 11.9%). The positive long-difference in the reallocation of jobs filled by outsourced workers represents 28% of the long-difference decline in payroll job reallocations. If the reallocation of outsourced jobs were considered in manufacturing job reallocations, the 13.27% decline would be 4.9 percentage points smaller. This is 37%

of the drop.

These findings support the hypothesis that a significant part of the decline in payroll job reallocations is reflecting a transformation of the labor market towards the use of intermediaries in the employment process, rather than a decline in underlying dynamism. This conjecture follows the fact that I find evidence supporting domestic outsourcing as one of the causes behind the drop in payroll job reallocations even while focusing on the period between 2007 and 2017 and the manufacturing sector. Publicly available indicators point to domestic outsourcing having its steepest increase in the 1990s (see Figure A.1) and abundant anecdotal evidence suggests the use of staffing arrangements becoming increasingly popular in other sectors such as health.

According to evidence from the Contingent Worker Supplement of the Current Population Survey (CPS-CWS), manufacturing has been the biggest client industry since we collect this information, 1995. Every year in which the CPS-CWS was conducted, around one-third of temporary help employees reported performing tasks in a manufacturing business (Appendix Table A.2). Interpreting domestic outsourcing as an innovation of the labor market, this evidence is consistent with manufacturing plants having learnt how to incorporate the new technology in their production process faster than businesses in other industries, thus, leaving less room for growth in the sector. Given the flexible nature of outsourced employment, I conclude that the magnitude of the omitted reallocations problem in the measurement of job reallocations may be even greater in sectors that started adopting this technology more recently.

The fact that outsourced employment increased by 23.3% while payroll employment dropped by 11.9% is yet another manifestation of the importance of outsourced workers for our understanding of labor markets[12]. One that has received more attention for its implications on measured labor productivity, and the influence of factors such as technological change in the decline in manufacturing payroll employment and labor demand in general. While confirming the increasing use of domestic outsourcing using client plant information, the results in this section also suggest a relevant role of domestic outsourcing *dynamics* for our

[12]The employment trends documented in this section are not at odds with those in previous literature. In line with the representativeness of my analysis sample, the drop in manufacturing employment is comparable to that published by the Census Bureau for the manufacturing sector (11.5%). Moreover, reaffirming the validity of the methodology developed in this paper to estimate outsourced employment, the increase in outsourced employment in manufacturing between 2007 and 2017 is remarkably close to that found by Dey et al. (2017) between 2007 and 2015 (23.1%). The authors follow a different methodology to estimate outsourced employment assigned to manufacturing combining employment-occupation information provided by staffing agencies (from the OEWS) with average occupation-industry of assignment distribution derived from worker-level data (CPS-CWS).

understanding of labor markets' adjustment given the considerable variation exhibited by outsourced job flows.

The variation on the extent of aggregate job flows mismeasurement is tightly linked to aggregate economic conditions. Figure 6 displays omitted jobs created (green line) and destroyed (red line) as a share of the corresponding payroll job flow over time. The omitted job creation reached its maximum in 2010, implying that the total number of jobs created in manufacturing that year was 1.2 times the measured figure. In contrast, the omitted job destruction was at its minimum in the same year. This contrast means that, in the first year after the Great Recession, relative to payroll jobs, the manufacturing sector not only was creating jobs to be filled by outsourced workers at a higher pace but it was not destroying the existing ones as quickly. It can be inferred that the omitted reallocations problem qualitatively affects our understanding of recoveries.

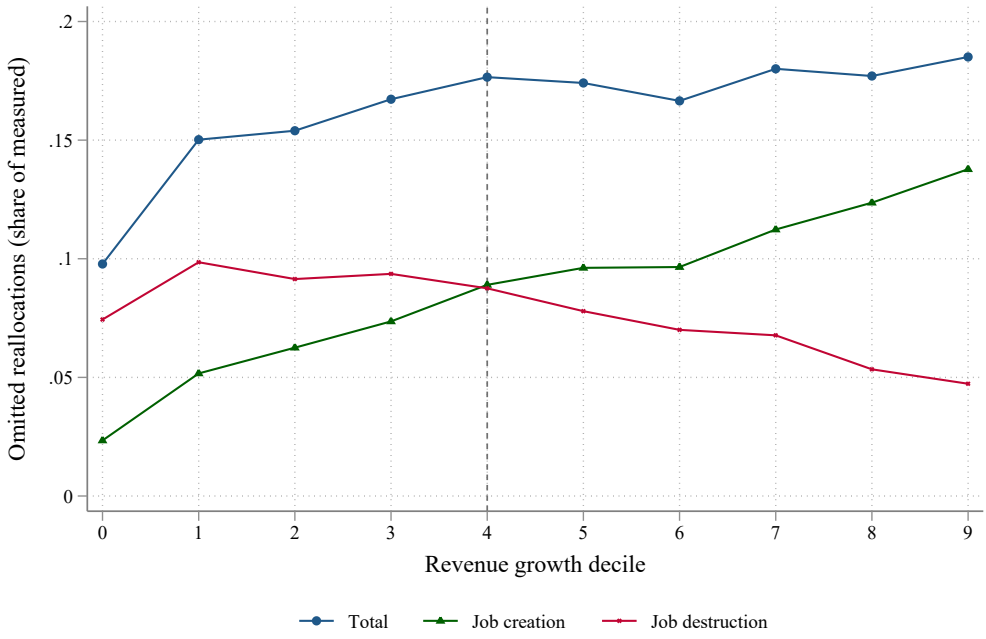
Figure 6: Aggregate job flows mismeasurement varies with the cycle. The share of omitted jobs created dropped entering the Great Recession and started increasing just before the recovery, reaching its maximum in 2010. The share of omitted jobs destroyed increased entering the recession and dropped just before the recovery, reaching its minimum in 2010.

Note: Job reallocations of outsourced employees as a share of the job reallocations of payroll employees over time. Source: Author's calculations based on ASM-CM-LBD and RELBD from 2006-2017.

Since 2010, manufacturing plants destroyed payroll jobs at a lower pace than outsourced jobs, so that the omitted share of jobs destroyed more than doubled between 2010 and 2017

(from 8.4% to 20%). The same pattern does not hold for omitted job creation. Between 2011 and 2013, manufacturing plants created outsourced jobs at a higher pace than payroll jobs but the opposite is true between 2014 and 2017. This evidence is consistent with manufacturing plants handling the uncertainty in the aftermath of the Great Recession creating outsourced employment and then subsequently substituting with increased payroll employment.

Figure 7: The destruction of jobs filled by outsourced workers accounts for most of the omitted reallocations in plants with negative revenue growth, while the creation of jobs filled by temporary and leased workers accounts for the omitted reallocations in plants with positive revenue growth.



Note: The figure displays the average job reallocations of temporary and leased employees relative to measured job reallocations by revenue growth ventile. Each point is the three-point moving average. Source: Author's calculations based on ASM-CM-LBD and RELBD from 2006-2017.

Figure 7 shows the average share of total outsourced reallocations by plant-level revenue growth decile. In general, the share of outsourced reallocations is increasing in revenue growth. However, the qualitative relationship between the share of outsourced jobs created and revenue growth is in stark contrast to that between the share of outsourced jobs destroyed and revenue growth: relative to the corresponding payroll job flow, outsourced job creation increases with revenue growth while outsourced job destruction decreases with revenue growth. On average, for plants experiencing negative (positive) revenue growth the share of omitted reallocations is mostly accounted for the destruction (creation) of jobs

filled by temporary and leased workers. This evidence further supports the interpretation that employers use outsourced workers strategically and shows that at the plant-level, the sign of labor growth mismeasurement is not evident. At the aggregate level, gross job flows are undercounted; however, average plant-level employment growth might be under or overestimated depending on revenue growth.

One threat to the results presented in this section is the composition of the jobs filled by outsourced workers over time. Plants may be outsourcing more expensive jobs over time. In this case, expenses on staffing services would exhibit the increasing trend documented in section 2 without translating into an increase in the number of temporary and leased workers employed in manufacturing. I address this concern in two ways. First, I show that the occupation distribution of temporary workers assigned to manufacturing in 2005 is comparable to that in 2017 (Table A.2). Second, the average earnings of temporary workers relative to that of payroll workers did not increased between 2007 and 2017, the period of my analysis.

The results presented in this section support domestic outsourcing as one of the factors behind the decline in payroll job reallocations. Moreover, the significant variation in the extent of mismeasurement of job flows along the cycle highlights the importance of not only accounting for the use of outsourced workers but for its dynamics. They enrich our understanding of labor market adjustment to aggregate economic conditions.

5 Discussion

Labor flows and vacancies are key parameters in most search models —a workhorse model for the empirical research of labor markets— and thus central to their calibration. The omitted reallocations problem leads to an underestimation of labor flows and the number of vacancies in the economy or in the client sector; thus, the measurement dimension of the omitted reallocations problem will translate into misconceptions about the labor market. The results in this paper illustrated this statement showing that the omitted reallocations problem hinders our understanding of plants' behavior when facing unexpected conditions and even of the margins of adjustment available to them —the labor responsiveness of plants to productivity.

The use of intermediaries, such as staffing agencies, in the search process for job candidates destroys the equivalency between a job change and an employer change in the data, masking both the behavior of firms and the behavior of a certain type of job seeker in the

search process. Omitting the reallocations of outsourced workers across client plants masks labor market frictions in the hiring process. The omitted reallocations problem renders invisible in the data the rungs filled by outsourced workers, hindering our understanding of job ladders.

Therefore, the results on the size, growth and cyclical variation of the omitted reallocations problem provide insights into macroeconomic puzzles such as the break of the standard matching function and of the job ladder after the Great Recession (Davis, Faberman, & Haltiwanger, 2013; Moscarini & Postel-Vinay, 2016). Similarly, the fact that outsourced employment increased between 2007 and 2017, while payroll employment dropped during the same period provides insights into the magnitude of what the literature has called "jobless recoveries" in the manufacturing sector in line with what previous work on domestic outsourcing has found (Shimer, 2007; S. Houseman & Bernhardt, 2017).

6 Conclusion

This paper shows that domestic outsourcing affects plant-level labor responses to revenue productivity shocks and biases the measurement of aggregate job reallocations. To do so, I define the *omitted reallocations problem*. The omitted reallocations problem are the errors in which we incur for not accurately accounting for the hires and separations of outsourced workers, the creation and destruction of outsourced jobs and the vacancies these workers fill. Outsourced staff effectively work for client plants but are legally employed by a staffing agency; therefore, the data used to track labor markets' activity accounts for the labor market transitions of outsourced workers in the services sector, and omits their reallocations across client plants altogether. This omission has two implications (i) a systematic undercount of the aggregate job and worker reallocations (and the vacancies they fill), and (ii) a misrepresentation of the reallocations composition across sectors.

I assess the omitted reallocations problem on job reallocations in the U.S. manufacturing sector between 2006 and 2017. The importance of the omitted reallocations problem hinges on the growth and prevalence of domestic outsourcing. Consequently, I describe the use of temporary and leased staff in the cross-section and over time. I document that the participation and intensity in the use of staffing services exhibits significant variation across size, industry and revenue growth category. Over time, the average manufacturing establishment increased the share of revenue spent on temporary and leased staff by 85% for the studied period. The growth of the outsourced labor share of revenue is eight times

that of payroll and exhibits more variation.

At the sector level, the omitted reallocations problem undoubtedly leads to a systematic undercount of job reallocations, suggesting that part of the measured decline in job reallocations is a sign of a structural change in the way plants source labor instead of an actual decline in underlying dynamism. At the business level, however, the direction of the employment growth bias is not evident. I find that while the share of omitted jobs destroyed is declining along average plant-level revenue growth, the share of omitted jobs created is increasing. This evidence suggests that plant-level employment growth is overestimated whenever revenue is shrinking but underestimated when is growing. I investigate the omitted reallocations problem at the plant-level (employment growth) studying the relationship between deviations from average revenue productivity growth and outsourced staff growth. I find that outsourced workers are a margin of adjustment that reacts more quickly than the measured margin (adjustment of payroll employment). This provides plant-level micro-evidence for the use of temporary help employment as a leading indicator and calls for a more comprehensive measure to study the labor responsiveness of plants. Policies targeting firms commonly define elegibility and compliance conditions on payroll jobs destroyed or created and this paper showed plants may adjust destroying or creating jobs filled by outsourced workers, who work side-by-side payroll typically performing the same jobs.

The micro implications have significant aggregate consequences. The reallocation of jobs filled by temporary and leased workers across manufacturing plants accounts for 37% of the decline in payroll employment job reallocations. The omitted reallocations problem is sizeable, exhibits significant variation over time and is tightly linked to aggregate economic conditions. The share of omitted jobs created peeked in 2010, the first year after the Great Recession. In contrast, the share of omitted jobs destroyed was at its minimum in the same year. Relative to payroll jobs, the manufacturing sector was not only creating jobs to be filled by outsourced staff a at a higher pace, it was not destroying the existing ones. This evidence shows that the omitted reallocations problem hinders our understanding of recoveries and thus limits the effectiveness of recovery policies.

Further research is required on the implications of the omitted reallocations problem. This paper documented that the omitted reallocations problem is pervasive across labor market fluidity flows, vacancies and economic sectors. Therefore, it has potential implications for our understanding of the search process and firm behavior. Thus, a contribution of this paper is the estimation of plant-level temporary and leased employment from expenses data that opens the door to deepen our knowledge on the interaction of domestic outsourcing

and current developments of the labor market.

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A Appendix

A.1 Tables

Table A.1: The use of domestic outsourcing varies greatly across three-digit manufacturing industries.

	Pct. of establishments *(1)*	Pct. of revenue (clients) *(2)*
Food Manufacturing	47.33	1.81
Beverage and Tobacco	48.06	1.92
Textile Mills	51.03	1.60
Textile Product Mills	34.37	1.73
Apparel	26.98	1.81
Leather and Allied Product	33.03	1.27
Wood Product	37.17	2.11
Paper	70.78	1.14
Printing	44.14	1.93
Petroleum and Coal Products	25.36	1.27
Chemical	59.63	1.32
Plastics and Rubber	67.48	2.07
Nonmetallic Mineral	26.29	1.52
Primary Metal	59.24	1.05
Fabricated Metal	47.22	1.81
Machinery	52.69	1.46
Computer and Electronic	61.83	1.58
Electrical Equipment	62.44	1.44
Transportation Equipment	60.64	1.55
Furniture and Related	40.35	1.86
Miscellaneous	41.17	1.97
Total	47.14	1.70

Notes: Yearly averages by the given establishment characteristic. Column 1 displays the percentage of establishments reporting having spent on temporary workers and leased employees. Column 2 reports the percentage of revenue spent on temporary and leased employees by the average client establishment in each category. Industry groups correspond to the 3-digit NAICS classification. Source: Author's calculations from ASM-CM-LBD data in 2006-2017.

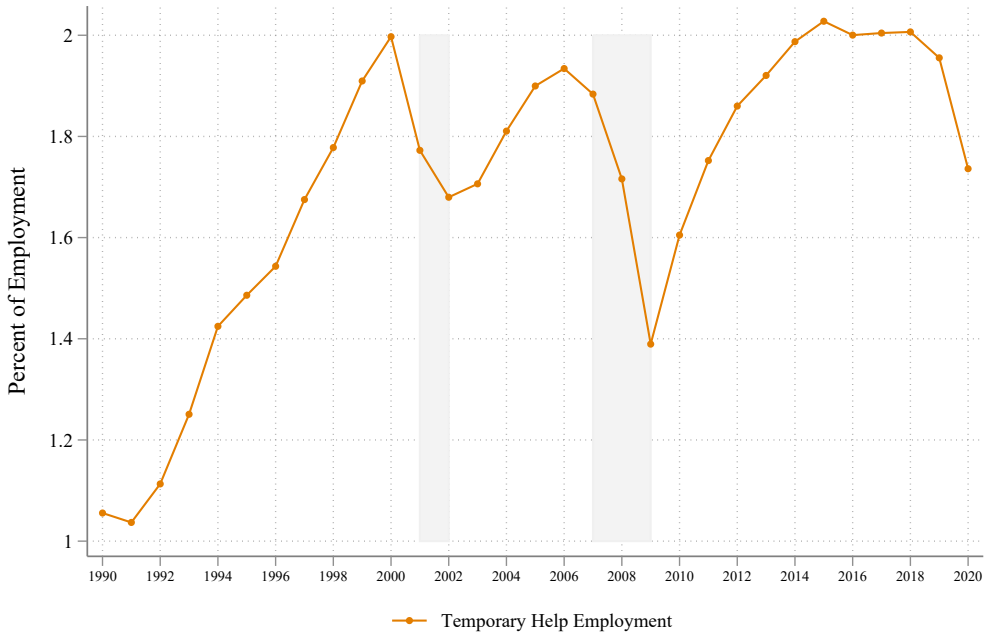
Table A.2: Industry of Assignment Distribution of Temporary Help Workers

	1995	1997	1999	2001	2005	2017
Agriculture, forestry, fishing	0.30	0.00	0.40	0.90	0.80	0.80
Mining	0.20	0.70	0.10	0.90	0.50	0.70
Construction	2.90	2.60	2.70	3.50	3.50	3.40
Manufacturing	34.10	32.10	31.20	22.70	29.50	34.90
Transportation, Communications	7.40	6.40	6.30	8.00	3.80	5.30
Wholesale trade	2.90	4.40	4.10	3.10	5.70	4.00
Retail trade	5.30	3.30	4.10	4.10	3.30	2.90
Finance, Insurance, and Real Estate	6.90	8.40	7.10	7.00	3.80	4.30
Business and repair services	22.60	25.90	25.60	30.30	29.20	23.20
Personal services	2.70	1.90	3.40	1.00	3.30	0.90
Entertainment and recreation services	0.70	0.90	0.50	1.90	0.00	0.60
Professional and related services	12.60	13.20	13.20	14.10	13.80	18.10
Public administration	1.30	0.00	1.20	2.40	2.90	1.00

Note: Calculations based on major industry of assignment (1990 codification) reported by those in the CWS who indicate being paid by a temporary help agency. CWS weights used. Source: Author's calculations based on the CP-CWS.

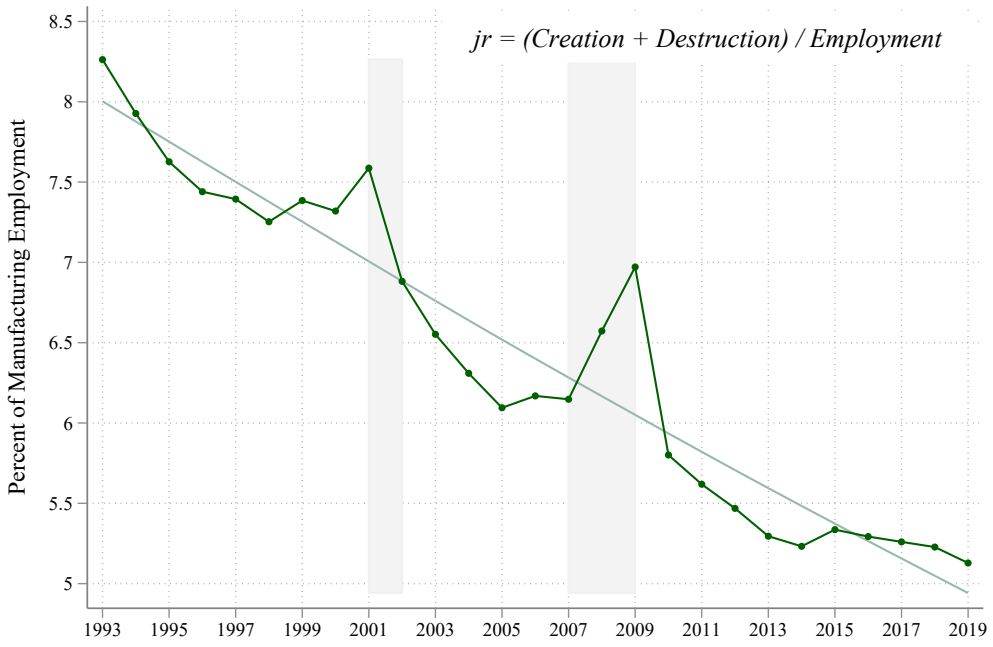
A.2 Figures

Figure A.1: The use of domestic outsourcing dramatically increased in the 1990s



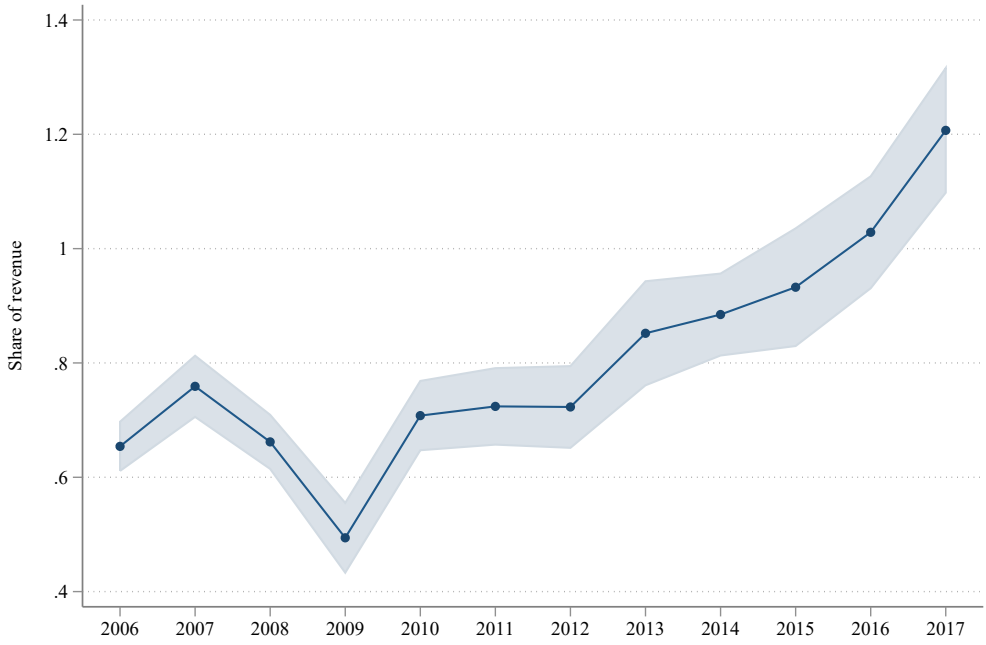
Note: The figure displays the average monthly employment in temporary help agencies relative to non-farm employment over time. Temporary help services is a six-digit NAICS industry comprised of establishments whose main activity is supplying workers to clients' plants. Source: Author's calculations based on Current Employment Statistics series, seasonally adjusted.

Figure A.2: The job reallocation rate in manufacturing has declined 40% since 1993.



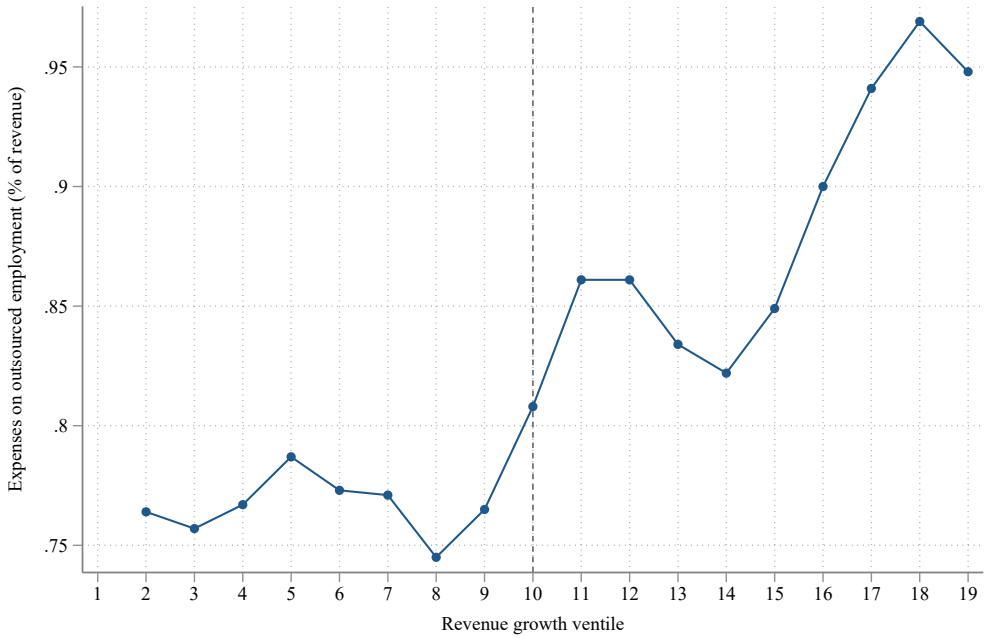
Note: The figure displays yearly averages of the quarterly job reallocation rate in the manufacturing sector and its HP trend. Source: Author's calculations based on Quarterly Workforce Indicators, seasonally adjusted.

Figure A.3: The share of revenue spent on temporary and leased staff by the average establishment increased by 86% between 2006 and 2017.



Note: Table shows point estimates and robust standard errors of business-specific expenditures on temporary and leased staff as a share of revenue, controlling for employment size, age, and three-digit industry. Source: Author's calculations from ASM-CM-LBD data in 2006-2017.

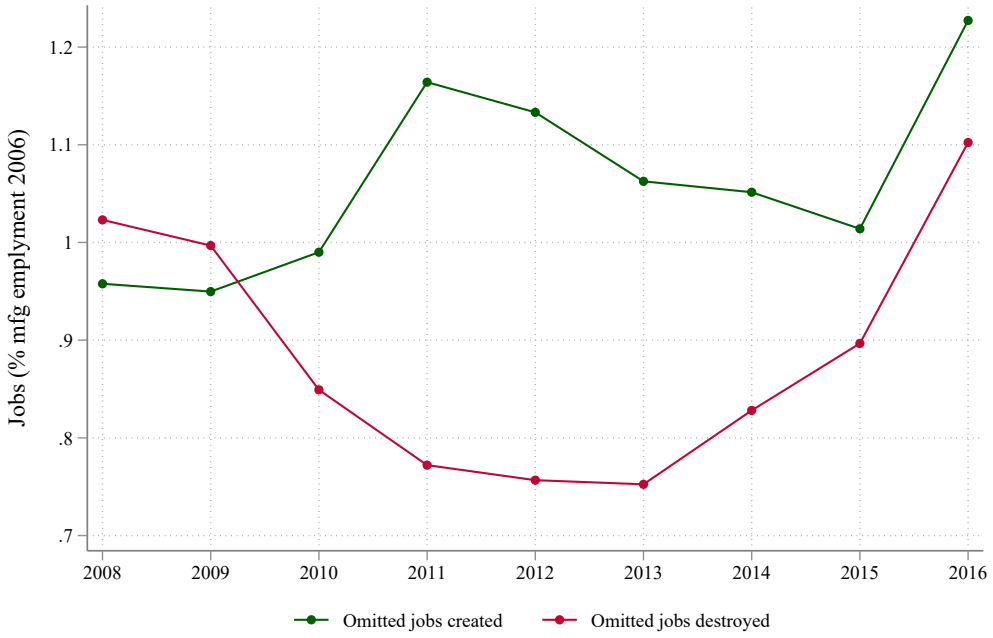
Figure A.4: Outsourced labor share along plant-level revenue growth for all establishments.



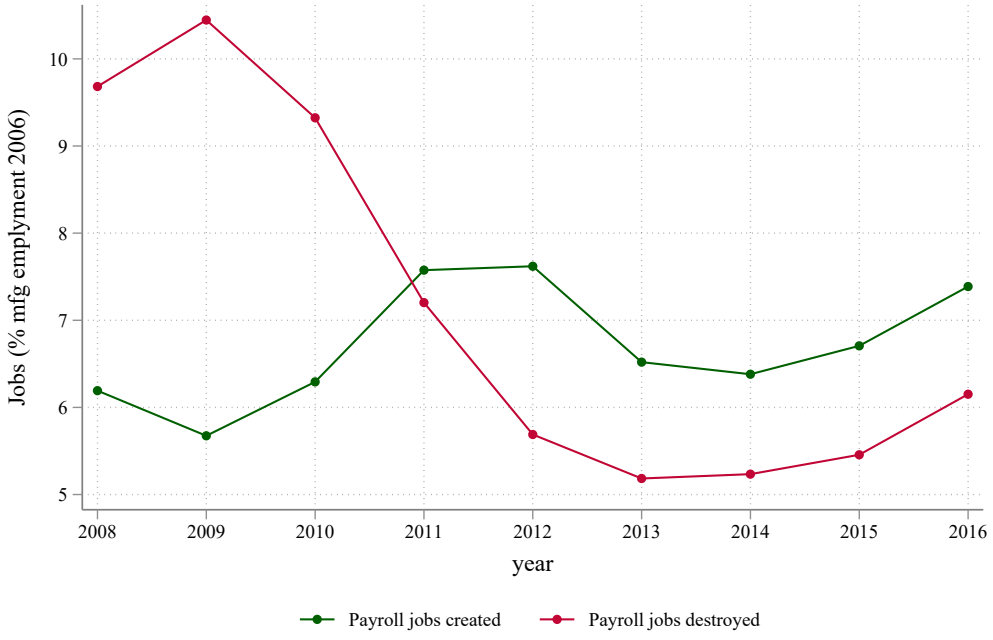
Note: The figure displays the average share of revenue spent on temporary and leased staff by revenue growth ventile. Each point is the three-point moving average. Source: Author's calculation from ASM-SM-LBD data in 2006-2017.

Figure A.5: The manufacturing sector created more outsourced jobs than it destroyed

Panel A: Omitted job reallocations

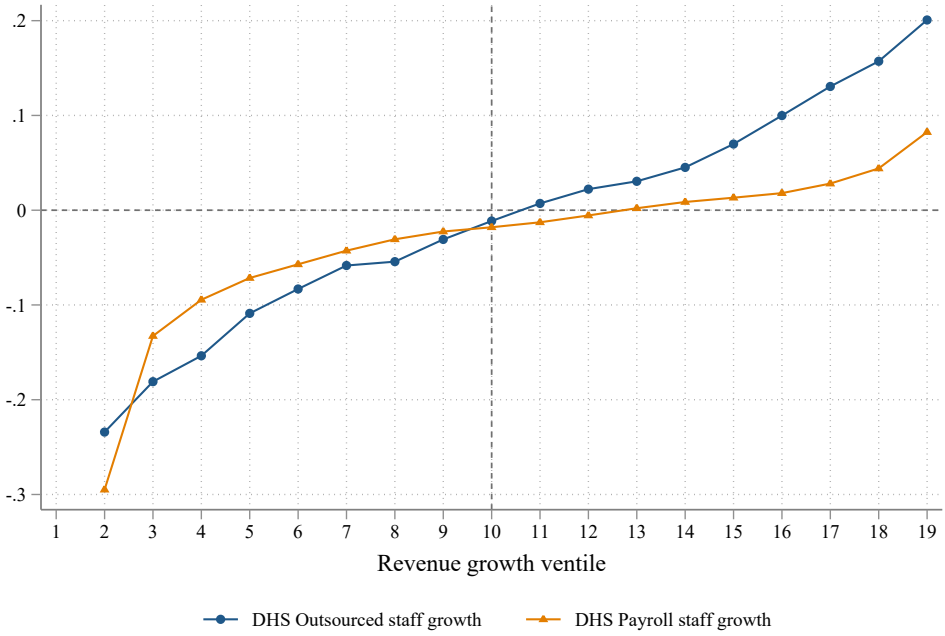


Panel B: Payroll job reallocations



Note: Each point is a three-year average. Omitted job reallocations computed following equation (5). Payroll job creation (destruction) is the sum of employment changes in expanding (shrinking) establishments. Source: Author's calculation based on ASM-CM-LBD and RELBD data from 2006-2017.

Figure A.6: The qualitative relationship between outsourced employment growth and revenue growth exhibits more variation than that of payroll employment.



Note: The figure displays average DHS growth rate of temporary and leased employment and payroll employment by revenue growth ventile. Each point is the three-point moving average. Source: Author's calculations based on ASM-CM-LBD and RELBD from 2006-2017.

A.3 Data Appendix

Sample restrictions

I limit the analysis to "ASM establishments" in Census years (years ending in 2 and 7) to ensure longitudinal consistency.

I drop observations that seem imputed using the industry average ratios of the value of shipments and cost of materials to payroll.

Exclusion criteria (Dunne, 1998; Roberts and Supina, 1996)

- Compute the ratio of total value of shipments and cost of materials to payroll for each establishment with a payroll greater than zero.

- Drop establishments in which either of the ratios is zero or missing.

- For each year in the sample, I drop establishments whose ratios equal the six-digit industry modal ratio.

For each year, I trim the industry-year TFP distribution by dropping establishments whose TFP deviate from the six-digit industry average by more than 2 in absolute value.

I delete establishments with zero or negative values in either of the TFP components: revenue, capital, total hours, materials and energy.

Winsorize capital to the 99.5 percentile.

Weights

I use an ASM-CM-LBD sample for the analysis. The ASM-CM provides the main variable of interest —expenses in outsourcing services, and the information to construct revenue productivity —main dependent variable. The LBD, on the other hand, has accurate establishment-level data on location, age and firm characteristics.

I restrict the sample to establishment with information on outsourcing expenses. Therefore, to ensure that the analysis sample is representative of the manufacturing universe, I compute weights based on the probability of being sampled in the ASM and having reported outsourced expenses given presence in the LBD (propensity score). I run a logistic regression in which the dependent variable is a dummy equal to one if the establishment is in both the ASM-CM and the LBD for that year and equal to zero if the establishment is only in the LBD. The independent variables are a multi-unit firm dummy, establish-

ment size class dummies (measured by employment), payroll category dummies, and LBD detailed industry codes. The weight is the inverse of the predicted probability.

Weight = 1/predicted probability.

B The origin of the omitted reallocations problem: the measurement dimension

The origin of the omitted reallocations problem is the data. Labor market flows are directly computed from three data sources: the Job Openings and Labor Turnover Survey (JOLTS), the Longitudinal Employer-Household Dynamics (LEHD), and the Business Employment Dynamics (BED). Yet, none of these datasets account for the reallocation of outsourced workers across client plants or record the outsourced worker-client business pair as a job.

The JOLTS definition of employment, vacancies, and labor flows explicitly excludes outsourced workers from the count.[13] Thus, JOLTS' labor fluidity measure (worker reallocations) is likely underestimated. To illustrate this point, consider, for example, a janitor that worked consecutively for two different companies in a year but was legally employed by the same staffing agency during the entire period. Although the reallocation of this janitor across two client plants entails two hires and two separations, these flows are not observed in JOLTS data.

The LEHD and the BED only record employer-employee relationships. Outsourced workers can reallocate across client plants while remaining on the contracting firms' payroll throughout. That is, workers change jobs, tasks, and workplaces—but not the employer of record as in traditional employment relationships. In consequence, the reallocations of outsourced workers between client plants are omitted in labor flows derived from the LEHD and the BED. This situation arises because the LEHD and the BED are primarily derived from state-submitted unemployment insurance (UI) wage records, and the outsourced worker-client business relationship is not captured by UI records: when a business outsources tasks that were previously performed in-house, the employer of record of the employees performing these tasks changes to the contracting firm, i.e., the staffing agency. Staffing agencies are, in consequence, the employers subject to submitting wage informa-

[13]The JOLTS is conducted by the Bureau of Labor Statistics of the U.S. Department of Labor since December 2000. It is a monthly, establishment-level survey that collects information on employment, vacancies, hires, quits, layoffs, and other separations

tion on their outsourced workers even if they are performing tasks on-site for a different establishment —the client business. The LEHD is the source of information for the Quarterly Workforce Indicators (QWI), which publishes aggregated information on worker and job flows quarterly.

Similar to the QWI, the BED statistics are derived from a quarterly census of all establishments under state UI programs, the Quarterly Census of Employment and Wages. Different from the QWI, however, the BED only tracks job flows; it does so by longitudinally linking UI records aggregated at the establishment level since the third quarter of 1992. To the extent that the outsourced worker-client business relationship is not captured in UI records, BED job flows omit client plants' creation and destruction of jobs filled by outsourced workers, hence underestimating the labor dynamism of these establishments industries. Moreover, if the client business' creation (destruction) of jobs filled by outsourced workers did not map into the creation (destruction) of jobs in the contracted staffing agencies, the omission results in the underestimation of the *aggregate* BED job reallocation measure of labor fluidity and not only of the client business' industry —the omitted-reallocation problem arises in BED data.

As shown in this section, the omitted reallocations problem is pervasive across labor market fluidity indicators and economic sectors. However, administrative establishment-level data is only available for the manufacturing sector. Consequently, this paper focuses on manufacturing to estimate the magnitude of the omitted reallocations problem on job reallocations. Therefore, this empirical exercise will capture both the fact that outsourced workers may move across client

plants while officially employed by the staffing agency and that the services sector is "stealing away" the dynamism from client sectors (composition). I show that our empirical understanding of the manufacturing labor market are based on analyses that inadvertently omit 15% of the yearly measured action in the labor market (Section 4).

C Aggregate worker flows are underestimated

I implement a three-step empirical strategy whose cornerstone is the decomposition of the worker reallocation rate. The decomposition illustrates that a declining worker reallocation rate is compatible with increasing omitted reallocations and that, such increase, can be caused by either a growing share of leased workers in aggregate employment (prevalence) or by leased workers staying longer in staffing agencies' payrolls (duration). In the second

step, I test the decomposition predictions in the data and obtain both the share of leased workers over time and the predicted tenure of leased workers in their contracting staffing agencies. I combine the duration estimates with statistics about the average length of an individual assignment in a client firm (the job to which leased workers are assigned) to return to the decomposition, and obtain a worker reallocation rate series that considers the reallocation of leased workers across client firms. Each step of the empirical strategy is detailed in the subsections below.

C.1 Decomposing the Worker Reallocation Rate

For any given point in time, the worker reallocation rate (wr_t) is the sum of total hires (H_t) and separations (S_t), i.e., the aggregate worker reallocation (WR_t), as a proportion of total employment (E_t). Total hires and separations are, in turn, the sum of all industries' hires (H_{jt}) and separations (S_{jt}). After some manipulation, this identity shows that the aggregate worker reallocation rate can be expressed as the average of the industries' worker reallocation rates, each weighted by their corresponding employment share (e_{jt}). To visualize better where omitted reallocations fit in this framework, in Equation 6, I take the worker reallocation rate of the staffing industry ($j = l$) out of the sum[14].

$$wr_t = \frac{WR_t}{E_t} = \frac{H_t + S_t}{E_t} = \sum_j \frac{(H_{jt} + S_{jt})}{E_t}$$

$$\begin{aligned} wr_t &= \sum_j \frac{E_{jt}}{E_{jt}} \frac{(H_{jt} + S_{jt})}{E_t} \\ wr_t &= \sum_j \frac{E_{jt}}{E_t} \frac{(H_{jt} + S_{jt})}{E_{jt}} \\ wr_t &= \underbrace{\sum_{j \neq l} (e_{jt} \times wr_{jt})}_{f(e_{jt}, wr_{jt})} + \underbrace{(e_{lt} \times wr_{lt})}_{l(e_{lt}, wr_{lt})} \end{aligned} \tag{6}$$

Movements of workers across employers that, in a world without staffing agencies, would have increased $f(e_{jt}, wr_{jt})$ in Equation 6, are now unobserved transactions between client firms and staffing agencies: the omitted-reallocation problem. I assume that, if observed,

[14]This assumes that all firms whose economic activity is to meet the demand for workers of their client firms are classified under the same industry. Section 2.1 discusses the veracity of this assumption in the data.

omitted reallocations would be counted in the staffing industry, i.e., $l(e_{lt}, wr_{lt})$ would be higher in the absence of the omitted-reallocation problem[15]. Equation 6 hence illustrates that the omitted-reallocation problem depends on both the share of leased employees and the measured worker reallocation rate in the staffing industry.

As an example, consider a guard that worked in three different companies during 2019, all classified under an industry different than the staffing industry ($j \neq l$). If this guard was hired directly by the firms for which he provided his services, his reallocations would have added three hires and three separations to $wr_{j,2019}$. In contrast, this guard was a leased worker, legally employed by a staffing agency during 2019. Therefore, the six gross reallocations of the guard in the example were either (i) completely omitted in the computation of wr_t if he has been working for the staffing agency longer than one year, i.e, he was hired by the staffing agency before 2019; (ii) counted as only one hire in $wr_{l,2019}$ if the guard was hired by or separated from the staffing agency in the same year in which the six reallocations took place: 2019; or (iii) counted as two gross reallocations, one hire and one separation, in $wr_{l,2019}$ if the guard was both hired by and separated from the staffing agency in 2019.

Notice that in the guard example, the number of omitted reallocations ranges from four to six depending on the guard's tenure in the staffing agency. In general, the more a leased worker stays employed by a staffing agency, the more reallocations are omitted over time, holding everything else constant. This is the *duration* channel, one of the two mechanisms through which the omitted reallocation problem could be worsening over time, hence causing an artificial decline in the observed worker reallocation rate. The second mechanism is *prevalence*. In the guard example, the prevalence channel captures the fact that if a economy had more and more leased guards instead of regular ones, the number of omitted reallocations would no longer range from 4 to 6 but from 400 to 600, say, if this economy had 100 leased guards instead of 1 leased and 99 regulars. This example stresses the point that each channel can cause an increase in total omitted reallocations over time, even if the other stays constant.

As mentioned before, I assume that all omitted reallocations would be counted in the staffing industry if observed. Formally, the corrected staffing worker reallocation is the sum of the observed (WR_{lt}) and the omitted (OWR_{lt}) worker reallocations. The corrected worker reallocation rate (cwr_t) is, in consequence, a function of the observed (wr_t) and omitted (owr_t) worker reallocation rates:

[15]This assumption shuts down the composition effect of domestic outsourcing on labor fluidity to focus on the aggregate level effect.

$$
\begin{aligned}
cwr_t &= wr_t + owr_t \\
cwr_t &= \sum_{j \neq l} (e_{jt} \times wr_{jt}) + \left[e_{lt} \times \frac{WR_{lt} + OWR_t}{E_{lt}} \right] \\
cwr_t &= \sum_{j \neq l} (e_{jt} \times wr_{jt}) + (e_{lt} \times wr_{lt}) + owr_t \qquad (7)
\end{aligned}
$$

where $owr_t = \frac{OWR_t}{E_t}$

To quantify how much of the decline in the observed worker reallocation rate (wr_t) is rationalized by the omitted reallocation hypothesis, I estimate a corrected worker reallocation rate series (wr_t^*) and compare it to the observed one. To perform such estimation, I take the two predictions of the decomposition depicted in Equation 7 to the data, and obtain estimates for both the employment share of the staffing industry for every year between 1993 and 2018 (e_{lt}) and the omitted reallocations for the same period (OWR_t). But before proceeding to detail such estimations, it is necessary to define how to identify leased workers in the data. Previous literature have used industry-occupation combinations, solely occupation, or solely industry for the identification of a subset of leased workers (S. Houseman et al., 2010; Dube & Kaplan, 2010; Goldschmidt & Schmieder, 2017; S. Houseman, 2001). The first two routes are often used by studies assessing the impact of outsourcing on individual-level outcomes as wages, such that they can draw inference for a small subset of well-identified leased workers. The industry alternative, on the other hand, has been more suitable for studies assessing economy-wide implications of domestic outsourcing on employment and occupational structures. Hence, this is most suitable approach for the purpose of this paper. Accordingly, I define the staffing industry as the Temporary Help Services industry; the facts supporting this choice as well as details on the identification of leased employees are discussed in Section 2.1.

The main component of the prevalence channel (e_{lt}), i.e., the employment share of the Temp-Help Services industry is readily available in the data since 1990. The estimation of the duration channel, on the other hand, merits more discussion.

C.2 Estimating the Duration Channel

Tenure Estimation As illustrated in the previous section, the longer a leased worker stays employed by a staffing agency, the more reallocations across client firms are omitted in

official data sources; therefore, the omitted reallocation hypothesis is consistent with an increasing tenure of leased workers in staffing agencies. One simple way of testing the longer tenure prediction is computing the yearly unconditional average of leased workers' tenures. This approach is, however, overly sensible to extreme values or variation that could be related to, for example, the type of jobs leased workers are assigned to, their demographic characteristics, or the features of the labor market in which they compete. To obtain tenure predicted values that control for characteristics potentially related to leased workers' spells, I estimate Equation 8.

$$y_{ist} = \alpha_{occ} + \alpha_{edu} + \alpha_s + \alpha_t + \sum_t \beta_t (l_{ist} \times d_t) + \gamma X_{ist} + \varepsilon_{ist} \tag{8}$$

where y_{ist} is the natural logarithm of tenure measured in years for worker i in state s and year t, l_{ist} is a dummy variable for leased employee status constructed as described in Section 2.1, d_t is a dummy variable for year, and X_{ist} is the vector of control variables which includes age, sex, marital status and race. Equation 8 also includes fixed effects such that its parameters of interest, β_t, capture variation within narrow job characteristics defined by two-digit occupation categories, education level, state, and year[16].

Each coefficient β_t is the year-specific log-tenure difference between leased and in-house employees[17]. Thus, after estimating Equation 8, I observe the trend in the tenure gap between comparable leased and in-house employees in terms of individual characteristics and type of job performed. This output allows to determine if the tenure of leased workers is increasing *relative* to in-house workers. Such analysis is important because, even in the absence of omitted reallocations, there is a mechanical negative relationship between worker reallocations and job tenure. Intuitively, the longer a worker stays in a job, the less reallocations he makes. This negative association arises naturally in a search-and-matching framework in which job matches are experience goods, and hence, gradual learning about match quality leads to a separation rate that declines with job tenure (Jovanovic, 1979). The theoretical prediction has been documented empirically by several papers since at least 1965 (Stoikov & Raimon, 1968; Burton Jr & Parker, 1969; Parsons, 1972; Freeman, 1980). The estimation of the tenure gap, between comparable leased and in-house workers, is yet another advantage of the followed approach; that is, over just computing the average

[16]Four education levels: less than high school, high school, some college and college.

[17]In the original scale of the outcome, years, the exponentiated parameters of interest are the ratio of the mean tenure of leased employees over that of in-house employees for the respective year and within a state-education-occupation cell.

tenure of leased workers within the same narrow cells implied by Equation 8.

The identification of tenure gaps, $\widehat{\beta}_t$, requires that, conditional on demographic characteristics, tenure within occupation-education-state-year-cells be uncorrelated with factors not included in Equation 8, which are associated with leased employee status. The standard errors of the estimated model are clustered at the state, occupation and year level[18].

C.3 From Predicted Tenure to Omitted Reallocations

In the previous section, I described the process to test the longer tenure prediction derived from the worker reallocation rate decomposition (explained in Section 6). During that process, I obtain estimates for all coefficients in Equation 8. I proceed to use these estimates to compute predicted tenure, and then estimate the implied number of omitted reallocations; in this section, I describe how to achieve the latter step.

The extent to which longer spells of leased workers in staffing agencies translate into more omitted reallocations depends on the length of individual assignments over time. If leased workers had indeed stayed longer in staffing agencies but the tenure of the jobs to which they were assigned (individual assignments) had increased proportionally, the omitted reallocation problem would have not worsened over time. For example, consider a janitor that stayed employed by a staffing agency for one year, and during that year he was assigned to two different jobs so that two gross reallocations (out of four) were omitted. If the same janitor had stayed employed by the staffing agency for three years (longer tenure) but during that period he worked the same two jobs, the total number of omitted reallocations would have been the same.

Given the importance of individual assignments' length for the analysis, to estimate the reallocations omitted by leased-worker term in the staffing agency, I first compute the reallocations omitted in each year for the typical leased worker, using the average individual assignments' length for the corresponding year. Specifically, I divide the weeks in a year by the length of the typical individual assignment ($length$). Then, for each leased worker in the sample, I multiply this result (average assigned jobs in a given year) by twice the pre-

[18] Occupation-education-state-year cells with no leased employees are excluded from the analysis. Workers in occupation-industry combinations outside the Temp-Help industry, that have been clearly identified by previous studies as contracted-out workers, are also excluded from the analysis. In particular, I exclude janitors/cleaners (CPS occupation code 453) working in the Services to Buildings and Dwellings industry (CPS industry code 722), and guards (CPS occupation code 426) working in the Protective Services industry (CPS industry code 740) from the analysis (Dube & Kaplan, 2010)

dicted tenure (in years) to obtain the gross omitted reallocations by leased-worker term[19]. Next, I compute the average gross worker reallocations omitted in a given quarter-year to obtain the corrected worker reallocation indicator quarterly CWR [20]. This aggregation takes into account the average placement rate of staffing agencies.

$$CWR_{t:q} = \frac{1}{4\,\widehat{y_t}} \left[\frac{52\ weeks}{length_t}\, 2\,\widehat{y_t} - 1 \right] \times [Leased\ workers_{t:q}(\ 1 - Placement\ rate)\ ] \quad (9)$$

The omission of the time subscript in the placement rate is intentional, I assume the matching efficiency in pairing leased workers (active jobseekers) with permanent jobs in client firms did not changed in the studied period, and therefore, the placement or permanent job-finding rate is in steady state[21].

With the employment share of the staffing industry and its corrected worker reallocation rate, I return to the decomposition in Equation 6 to compute the aggregate corrected worker reallocation rate.

$$cwr_{t:q} = \frac{WR_{t:q} + OWR_{t:q}}{Employment_{t:q}}$$

where $Employment_{t:q}$ is the average between End-of-Quarter and Beginning-of-Quarter Employment, as defined by the QWI.

[19]Each assigned job represents one omitted hire and one omitted separation. The initial hire of the term, however, is counted in the staffing agencies' hires.

[20]In the intersecting quarters, I take the average. For example, take the fourth quarter of 1998, according to 2000 tenure information there were 1.9 omitted reallocations per leased employee in 1998:4, while according to 1998 tenure information, there were 1.8.

[21]I am in the process of verifying the veracity of this assumption with the administrator of the staffing agency statistics used in this paper.