Firm Size, Wages, and Productivity*

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Abstract

Several theoretical models predict a tight relationship between firm productivity, firm size, and wages paid to workers. Consistent with these models is the well-known firm size-wage premium; workers at larger firms generally receive higher wages. Yet many factors in the real economy drive a wedge between productivity, size, and wages. Market segmentation and firm dynamics mean that some small firms may yet be highly productive. Additionally, new empirical evidence on voluntary job changes suggests the tight relationship between firm size and wages in wage posting models may not hold empirically. In this paper, we use linked employer-employee data from the U.S. to investigate the joint distribution of firm productivity, wages, and size to shed additional light on the empirical relationship between these three and implications for theoretical models of on-the- job search and firm size.

* Any opinions and conclusions expressed herein are those of the author(s) and do not necessarily represent the views of the U.S. Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed. Republication in whole or part must be cleared with the authors.

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Overview

What is the relationship between firm productivity, size, and the wages paid to workers? Equilibrium models of the firm size distribution predict that more productive firms should be larger (Lucas (1978), Melitz (2003)). Models with search frictions predict that high productivity firms should be larger and higher paying (Burdett and Mortensen (1998), Moscarini and Postel-Vinay (2009, 2010, 2013, 2014)). That firm size and wages are linked is also suggested by the empirical literature on the firm size-wage premium. Yet seminal papers on the employer-size premium stress that many factors may cause larger firms to pay higher wages, such as efficiency wages to avoid shirking in larger organizations or differences in worker quality across firms (Brown & Medoff (1989), Oi & Idson, 1999). Similarly, factors other than productivity have been shown to account for the evolution of the size distribution across firms – for instance, market segmentation (Foster, Haltiwanger, and Syverson (2008, 2013) and firm age (Haltiwanger, Jarmin, and Miranda, 2013). Whether firm wages, size, and productivity are tightly or loosely linked remains an open question in the empirical literature on firms.

In this paper, we use longitudinal linked employer-employee data to evaluate the relationship between firm size, productivity, and wages, and the dynamic response of size and wages to productivity shocks. Part of our contribution here is the use of newly integrated firm productivity data with linked employer-employee data for the U.S. to examine the joint distribution of firm size, wages, and productivity.[1] The longitudinal

[1] As of this writing, we are working on these important data links, thus this overview does not contain any empirical results from the newly linked data.

nature of our linked data also allow us to examine the dynamics of firm productivity, size, and wages. The ability to follow workers longitudinally across jobs also allows us to examine worker reallocation across firms by all three dimensions. In particular, we will be the first to empirically examine whether worker reallocation via job-to-job flows serves to reallocate workers from less-productive firms to more-productive ones.

One reason we have chosen to investigate the relationship between firm size, wages, and productivity, is new findings on worker reallocation across firms, which raise questions about the tight relationship between firm size and wage in search and matching models. Beginning with Burdett and Mortensen (1998), models of on-the-job search generally make a natural assumption about job-to-job moves in the labor market: employers offering higher wages induce workers to leave lower paying jobs and accept their employment offers. A related prediction of these models is that, since larger businesses offer higher wages, voluntary job moves should generally reallocate workers from smaller to larger employers.[2] However, in an earlier paper (Haltiwanger, Hyatt, and McEntarfer, 2014) we use new data on worker flows across firms to show that voluntary movements of workers across jobs generally reallocate workers from lower-paying to higher-paying firms - but not from smaller to larger firms. Large employers actually lose workers, on net, through job-to-job movements from larger established firms to small young firms. Such stark differences in patterns of worker reallocation by firm size and firm wage raise questions about the predictions of wage posting models as

[2] Note that the Burdett and Mortensen (1998) framework generates firm size and wage dispersion for ex ante identical firms and workers, and so larger firms offer higher wages even in the absence of any productivity differences for employers.

well as the relationship between firm wage and size. By adding firm productivity to this analysis we hope to shed some additional light on this apparent puzzle.

We characterize and quantify the joint distribution of firm size, firm wages and firm productivity by integrating the LEHD data infrastructure on matched employer-employee data with information from the Economic Censuses, Annual Surveys of Businesses and the Census Business Register. We first quantify the cross sectional relationship between firm size, firm wages and firm productivity and also their joint evolution over time. For the latter, we investigate whether there is evidence that this joint evolution has changed over time and also the dynamics of the relationship. Past research has shown that high productivity firms are high wage firms (see Dunne et. al. (2004)) but an open question is whether there is a lag between firms experiencing a rise in productivity and firm level wages. Likewise, while firm size and productivity are positively related in the cross section, it takes time for firms with productivity shocks to adjust their size. Such dynamic relationships between firm productivity, firm wages and firm size are interesting in their own right but may also be important in helping to account for the patterns of worker reallocation on these dimensions.

II. Data

We use linked employer-employee data from the LEHD program at the U.S. Census Bureau integrated with firm-level productivity data integrated from the Census Business Register, Economic Censuses and Annual Surveys. We begin with a discussion of the the LEHD data.

The LEHD data consist of quarterly worker-level earnings submitted by employers for the administration of state unemployment insurance (UI) benefit programs, linked to establishment-level data collected for the Quarterly Census of

Employment and Wages (QCEW) program. As of this writing, all 50 states, DC, Puerto Rico, and the Virgin Islands share QCEW and UI wage data with the LEHD program as part of the Local Employment Dynamics (LED) federal-state partnership. LEHD data coverage is quite broad; state UI covers 95% of private sector employment, as well as state and local government.[3] The unit of observation in the UI wage data is the state-level employer identification number (SEIN). This unit captures the activity for a given employer within the state in specific industry categories. In this respect, workers that move across establishments within the same SEIN are not considered to be hires or separations (and therefore don't contribute to net job flows either).

The matched employer-employee data permit comprehensive measurement of net employment growth of employers decomposed into hires and separations. Moreover, the net and gross flows can be characterized in terms of employer characteristics such as firm size, firm age and firm wage (described in more detail below). Thus, we can classify hires and separations in any given quarter as being to/from large vs. small, high wage vs. low wage and young vs. mature firms. We focus on hires and separations of workers main jobs where main jobs are those with the highest earnings in the quarter.

Firm size and firm age in the LEHD data is defined at the national level using Census Bureau's Longitudinal Business Database (LBD).[4] Firm size is the national size of the firm in March of the previous year; we use three size categories: "large" firms employ 500 or more employees, "medium" firms employ 50-499 employees, and "small" firms employ 0-50 employees. In sensitivity analysis below, we also consider a

[3] For a full description of the LEHD data, see Abowd et al. (2009).
[4] Haltiwanger et al. (2013) describes the methodology for linking the LBD and LEHD data.

definition of firm size using relative measures of firm size within industries. Firm age is the age of the national firm, defined as the age of the oldest establishment in the first year of a firm's existence, and aging naturally afterwards. We use two age categories: "young" firms are those up to 10 years of age, while firms who are 11 or more years of age are "mature." For firm wage, we use quintiles of the firm earnings per worker distribution in each quarter. We classify firms as high wage if they are in the top two quintiles, medium wage if in the next two quintiles, and low wage if they are in the bottom quintile.

The ability to track hires and separations in a comprehensive manner by firm size, firm wage and firm age is a unique feature of the LEHD data infrastructure that we take advantage of this paper. But we seek to push the data even further in order to decompose hires and separations into those that reflect a job-to-job flow (what we call equivalently call a poaching flow) and those that involve hires and separations from nonemployment. To accomplish this, we longitudinally link workers' job histories across firms using the approach described in Hyatt and McEntarfer (2012b) and Haltiwanger, Hyatt, and McEntarfer (2014).

Productivity data are the most prevalent for manufacturing firms. Foster, Grim and Haltiwanger (2014) develop a database tracking TFP for all plants in the Annual Survey of Manufactures and Census of Manufactures from 1972-2010. We plan to integrate that data into our infrastructure. Revenue per worker data can be derived from the Census Business Register as shown in Haltiwanger, Jarmin, Kulick and Miranda (2014) for most U.S. private, nonfarm firms. We also plan to integrate that that data into our infrastructure.

III. Preliminary Results

To motivate our proposed analysis and to highlight the potential of our data, we reproduce Figure 6 from Haltiwanger, Hyatt and McEntarfer (2014). This figure summarizes the starkly different patterns of net poaching flows by firm size and firm wage classes. Net poaching for high wage firms is positive and large while net poaching for low wage firms is large and negative. In contrast, net poaching for large firms is negative (albeit modest in magnitude) while net poaching for small firms is positive. There is also evident procyclicality of net poaching from low wage to high wage firms while the same does not hold for net poaching across firm sizes.

From Figure 6 it is apparent that there is a job ladder that yields workers moving via job-to-job flows from low wage to high wage firms. But there is not a corresponding job ladder moving workers from small to large firms. Haltiwanger, Hyatt and McEntarfer (2014) show that while there is a strong employer size wage premium in the data, only about 5 percent of the variation in firm wages is accounted for by variation in firm size. Figure 6 highlights that the substantial variation in wages across firms not accounted for by firm size yields systematically different job-to-job flow patterns. These patterns are inconsistent with the predictions of the wage posting models discussed in the introduction that predict a tight relationship between firm size and firm wages. Haltiwanger, Hyatt and McEntarfer (2014) show that the firm size job ladder cannot be rescued by controlling for firm age effects or differences in technology across industries. The same wage posting models yield similarly strong predictions about a tight relationship between firm size, firm wage and firm productivity. These predictions help motivate integrating firm level productivity statistics into this type of analysis.

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Figure 6 (from Haltiwanger, Hyatt and McEntarfer (2014))