

# Mail Processing Productivity and Local Labor Market Conditions

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## Abstract

The United States Postal Service (USPS) pays wages that are unresponsive to local labor market conditions or the local cost of living. Mail processing facilities requiring USPS employees to perform identical tasks exist outside most major cities. This implies that USPS employees are likely to come from different parts of local distribution of worker productivity in different parts of the United States. In regions with low average wages relative to the USPS wage, the USPS is likely to attract workers from higher percentiles of the local distribution of worker productivity than in regions with high average wages relative to the USPS wage. We find empirical evidence consistent with this hypothesis using data on monthly mail processing productivity for both mail sorting and flats sorting for 364 mail processing facilities from 2016 to 2019 and wages for mail processing facility employees and wages for competing jobs in that locality. These results argue in favor of the USPS consolidating mail sorting activities into the facilities with high productivity workers as a way to achieve operating cost savings.

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# 1 Introduction

A large body of empirical research in labor economics is built on the assumption that the wage paid reflects a worker's productivity. An implication of this assumption is that if the same task is performed in different locations but the relative wage paid in some locations is higher than it is in other locations, more productive workers are likely to be hired in the high relative wage locations. The United States Postal Service (USPS) provides an ideal environment to test this implication of wage reflecting a worker's productivity.

Mail processing facilities where USPS employees perform identical tasks exist outside most major cities. The USPS does not adjust the wages it pays for these tasks to reflect local pay rates or cost-of-living differences.<sup>1</sup> This implies that USPS employees are likely to come from different percentiles of the local distribution of worker productivity in different parts of the United States. In regions where relatively low wages are paid for performing similar tasks to mail processing, the USPS is likely to attract workers from the higher percentiles of the local distribution of worker productivity. In regions where relatively high wages are paid for performing similar tasks to mail processing, the USPS is likely to attract workers from the lower percentiles of the local distribution of worker productivity.

The organization of mail processing by the USPS provides an ideal environment to examine the extent to which the above logic holds and to quantify the cost to the USPS of its uniform wage policy. These football-field-sized indoor facilities are configured in virtually the same manner at all locations and USPS employees process both incoming and outgoing mail using the same delivery bar code sorter (DBCS) machines and automated flats sorting machines (AFSM).<sup>2</sup> Differences in the amount of mail processed using a DBCS machine or AFSM machine per hour of labor applied to these machines across mail processing facilities is most likely due to differences in the productivity of the workers operating these machines across mail processing facilities.

The above logic implies that localities with higher average wages for jobs that compete with USPS mail processing jobs should have lower mail processing labor productivities because workers from higher percentiles in the local distribution of labor productivity take these jobs rather USPS mail processing jobs. Conversely, localities with lower average wages for jobs that compete with USPS mail processing jobs should have higher mail

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<sup>1</sup>See Office of Inspector General (2014).

<sup>2</sup>DBCS machines scan the address on a letter and sort it into one of up to 286 pockets for delivery by a letter carrier. See Figure 1 for a picture of a DBCS machine. AFSMs sort flats (larger mail pieces) in a similar manner. See Figure 2 for a picture of AFSM.

processing labor productivities because higher productivity workers take USPS jobs rather than the competing lower wage jobs.

Data on the monthly number of pieces entering each mail processing operation, the monthly hours of USPS employee time applied to that mail processing machine from 2016 to 2019 for all mail processing facilities combined with annual average wage data for USPS mail processing jobs and comparative jobs to USPS jobs in the locality nearest to the mail processing facility compiled by the United States Bureau of Labor Statistics are used to examine the extent to which this hypothesis holds.

We find evidence consistent with our hypothesis even after accounting for year-of-sample, month-of-year, and facility-level fixed effects for both AFSM and DBCS operations. For AFSM, a 10 percent increase in mean postal wage relative to the mean wage for competing jobs predicts a 5 percent increase in monthly mail processing productivity. For DBCS, a this 10 percent increase in the mean postal wage relative to the mean wage for competing jobs predicts a 4 percent increase in monthly mail processing productivity. We also find that given the level of this relative wage, a higher level of local unemployment predicts a higher level of monthly productivity for that mail processing operation. This result is consistent with the logic that a higher local unemployment rate allows the USPS to be more selective in the hiring workers at the local mail processing facility, thereby obtaining even higher productivity workers.

Our empirical results have implications for reform of the USPS. Specifically, consolidating mail processing activities in the localities with higher labor productivity offers the opportunity for the USPS to realize significant cost savings. Recently the USPS has been attempting to reduce the number of mail processing facilities as a cost cutting measure.<sup>3</sup> We present a simple counterfactual calculation demonstrating that such a consolidation based the relative postal wage could reduce annual mail processing labor costs associated with the DBCS and AFSM machines by more than 10 percent.

The remainder the paper proceeds as follows. The next section discusses the data sets used for this analysis and summary statistics. Section 3 presents the econometric models we estimate to examine our hypothesis. Section 4 presents our empirical results. Section 5 presents our counterfactual calculation. Section 6 discusses the policy implications of our empirical results.

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<sup>3</sup>See "USPS Begins New Round of Facility Consolidations While Procuring Dozens More," available at <https://www.govexec.com/management/2021/04/usps-begins-new-round-facility-closures-while-also-procuring-dozens-more/173640/>

## 2 Summary of Empirical Analysis and Data Employed

The analysis proceeds in three steps. First, the facility-level monthly labor productivity for each mail processing operation is computed for the period 2016 to 2019 using data from the USPS Management Operating Data System (MODS). Each day, MODS collects facility-level data on total mail pieces fed (TPF), total pieces handled (TPH), and first handled pieces (FHP) by sort scheme at the three-digit MODS operations level.<sup>4</sup> MODS also collects data on the duration of each sort scheme and the total hours of labor worked by USPS employees on each sort scheme. This information is used to construct the facility-level and operations-level monthly average measures of mail processing productivity.

The second step links each mail processing facility to information obtained from the Bureau of Labor Statistics on mean wage for workers in a USPS mail processing facility and the mean wage for comparable jobs to working in a USPS mail processing facility. The third step regresses the logarithm of the monthly average measure of mail processing productivity for these two MODS operations on the logarithm of ratio of the mean postal mail processing wage to the mean wage for comparable jobs in the locality nearest to the mail processing facility. This model is estimated with and without facility-level fixed effects and annual and month-of-year fixed effects.

To measure facility-level mail processing productivity, we leverage nonpublic USPS data on the monthly quantity of mail processed at each postal facility and the total hours worked by USPS employees, recorded by the USPS Management Operating Data System (MODS) on two equipment types: Automated Flat Sorting Machines (AFSM), and Delivery Bar Code Scanners (DBCS) for letters. Mail volume is measured using total pieces fed (TPF) into the machine, which includes all mail pieces inserted into automation equipment, including rejects, reworks, and refeeds. Productivity is calculated individually for each of the equipment types on a monthly basis as TPF per hour of labor recorded.

The hours measure for the AFSM and DBCS MODS operations that enters the denominator of our monthly average productivity measure is the total number of hours USPS employees worked that machine during that month. Workers in USPS mail processing facilities move from MODS operation to operation throughout their workday. When they begin working an AFSM or DBCS machine this is noted in the MODS system and when they stop working this machine this is also noted in the MODS system. Consequently, our

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<sup>4</sup>Appendix B of the Management Operating Data System (MODS) Handbook M-32, available at <https://www.nalco.org/workplace-issues/resources/manuals/other/m32.pdf>, contains a complete listing of the three-digit MODS operations.

hours measure contains only the total hours worked by USPS employees on that machine during that month.

The Bureau of Labor Statistics is the source for our USPS mail processing wage data, competing jobs wage data and unemployment rate data at the Metropolitan Statistical Area (MSA) level. Using the BLS Occupational Employment and Wage statistics database, we compile the mean wage for each MSA-year pair for both USPS Mail Sorters, Processors, and Processing Machine Operators and General Office and Administrative Service Occupations. Note that USPS Mail Sorters, Processor and Processing Machine Operators omits USPS mail carriers; it only considers individuals working at facilities processing mail. General Office and Administrative Service Occupations is a broad category that is meant to represent the average wage of similar professions to mail processing. We also record the unemployment rate for each MSA-year pair from the BLS. Henceforth, we refer to the former mean wage as the Postal Wage and latter as the Clerical Wage and the ratio of these two mean wages,  $(\text{Postal Wage})/(\text{Clerical Wage})$ , as the Relative Postal Wage.

From these sources, we construct a monthly panel from 2016-2019 with all USPS facilities; productivity for AFSM and DBCS; and local postal wage, office and administrative wage, and unemployment rate for the MSA in which the facility is located. Monthly productivity for facility  $i$  during month  $t$  is defined as  $P_{it} = \frac{TPF_{it}}{Hours_{it}}$ , where  $TPF_{it}$  is the total pieces fed into that operation at facility  $i$  during month  $t$  and  $Hours_{it}$  is the total number labor hours worked at that operation at facility  $i$  during month  $t$ . The Relative Postal Wage,  $W_{it} = \frac{MPW_{it}}{MOW_{it}}$ , where  $MPW_{it}$  is the Postal Wage for facility  $i$  during month  $t$  and  $MOW_{it}$  is the Clerical Wage for facility  $i$  during month  $t$ . Because of mail processing facility openings and closings this panel is unbalanced.

### 3 Econometric Model

To explore the relationship between  $\ln(P_{it})$  and  $\ln(W_{it})$  we plot the binscatter of the relationship between these two variables first accounting for year-of-sample and month-of-year fixed effects (one-way) and then accounting for both facility-level and year-of-sample and month-of-year fixed effects (two-way) using the procedure described in Cattaneo et al. (2019). In its most basic form that binscatter process defines approximately equal size bins of values of the variable on the horizontal axis, in our case  $\ln(W_{it})$ , and computes the mean of the values of the variable on the vertical axis, in our case  $\ln(P_{it})$ , for each bin. Then the bin-level means of the  $\ln(P_{it})$  are plotted as a function of the mid-point of each

$\ln(W_{it})$  bin. As noted by Cattaneo et al. (2019), accounting for the inclusion of fixed-effects complicates the process of computing the binscatter, but its interpretation remains as a non-parametric estimate of the relationship between facility-level productivity and the facility-level relative wage after controlling for the impact of these additional controls.

Figures 3 and 4 present the one-way (time) fixed effects binscatter for the AFSM and DBCS operations. Both cases the binscatter shows an increasing relationship between  $\ln(P_{it})$  and  $\ln(W_{it})$ . Figures 5 and 6, which includes two-way (time and facility) fixed effects confirms this same increasing relationship for both AFSM and DBCS.

We fit the following two-way fixed-effect models to estimate the relationship between  $\ln(P_{it})$  and  $\ln(W_{it})$  and  $\ln(U_{it})$ , where  $U_{it}$  is the unemployment rate in the metropolitan area nearest to facility  $i$  during month  $t$ .

$$\log(P_{it}) = \beta_W \log(W_{it}) + \beta_U \log(U_{it}) + \gamma_i + \lambda_m + \delta_y + \epsilon_{it} \quad (1)$$

$$\log(P_{it}) = \beta_W \log(W_{it}) + \beta_U \log(U_{it}) + \beta_{WU} [\log(W_{it}) \cdot \log(U_{it})] + \gamma_i + \lambda_m + \delta_y + \epsilon_{it} \quad (2)$$

Equations (1) and (2) assume the  $\gamma_i$  are facility-level fixed effects, the  $\lambda_m$  are month-of-year fixed effects, and the  $\delta_y$  are year-of-sample fixed effects. Summary statistics of these variables are given in Table 1:

Variable	Mean	Std. Dev.
$P_{it}$	5151	23492
$W_{it}$	1.4	0.15
$U$	6.25	2.51

## 4 Empirical Results

Table 2 presents our estimates of Models (1) and (2) for AFSM. Table 3 present our estimates of Models (1) and (2) for DBCS. The standard errors account for possible heteroscedasticity and autocorrelation in the  $\epsilon_{it}$  using the procedure presented in Arellano (1987).

For both AFSM and DBCS a higher Relative Postal Wage at a processing facility predicts a higher monthly mail processing productivity, even after controlling for the unemployment rate in the nearest metropolitan area. For both models, a higher local unemployment

rate predicts a higher monthly mail processing productivity. This result is consistent with the logic that a higher local unemployment rate allows the USPS to be more selective in its hiring decisions, in order to employ more productive workers. We also included an interaction term between  $\ln(W_{it})$  and  $\ln(U_{it})$ , but for both models this coefficient was not statistically different from zero.

Table 2: AFSM Results		
	Model 1	Model 3
Log(Wage)	0.526 (0.180)	0.801 (0.430)
Log(Unemployment Rate)	0.1889 (0.015)	0.241 (0.031)
Log(Wage)*Log(Unemployment Rate)		-0.139 (0.209)

Table 3 DBCS Results		
	Model 1	Model 3
Log(Wage)	0.386 (0.041)	0.338 (0.234)
Log(Unemployment Rate)	0.033 (0.003)	0.023 (0.013)
Log(Wage)*Log(Unemployment Rate)		0.033 (0.078)

## 5 Counterfactual Calculation

This section presents a counterfactual calculation of the potential labor cost savings to the Postal Service from transferring mail volume from facilities with the smallest values of the Relative Postal Wage to facilities with the largest values of the Relative Postal Wage.

To classify facilities in terms of their values of the Relative Postal Wage, we first compute the sample mean over time of the Relative Postal Wage for each processing and distribution center (PDC) facility. We restrict our analysis for this counterfactual to 162 PDC facilities, rather than the full sample of mail processing facilities to ensure comparability of the activities carried out at these facilities. Because of the similarity of the MODS operations carried out at PDC facilities throughout the United States, it is likely to be the case that mail volume formerly processed at one PDC facility could be processed at another PDC facility.

Let  $\bar{W}_i$  equal the time mean of the Postal Relative Wage for facility  $i$ . Figure 7 plots a histogram on the values of  $\bar{W}_i$  across the 162 facilities. We then divide this distribution into quartiles. Let Q1 equal the set of facilities for all time periods that are in the lowest



quartile of the distribution of  $\bar{W}_i$  and Q4 equal to the set of facilities for all time periods that are in the highest quartile of the distribution of  $\bar{W}_i$ .

Compute an estimate of the actual cost of processing mail in MODS operation  $k$  at all facilities in Q1 for all years as:

$$Actual\_Cost\_Q1_k = \sum_{(i,t) \in Q1} Postal\ Wage_{it} \times Hours_{itk}, \quad (3)$$

where  $Hours_{itk}$  is equal to the hours worked on the MODS operation  $k$  at location  $i$  during year  $t$  and  $Postal\ Wage_{it}$  is the mean Postal Wage at facility  $i$  in year  $t$ . The share of mail volume for MODS operation  $k$  across all facilities in Q4 and all years in our sample that is processed at facility  $i$  during year  $t$  is equal to:

$$s_{itk} = \frac{TPF_{itk}}{\sum_{(i,t) \in Q4} TPF_{itk}} \quad (4)$$

where  $TPF_{itk}$  is the total pieces fed in MODS operation  $k$  at facility  $i$  in period  $t$ . The total amount of mail volume for MODS operation  $k$  across all facilities and years in Q1 is equal to:

$$TOTTPF_k = \sum_{(i,t) \in Q1} TPF_{itk} \quad (5)$$

The counterfactual number of hours needed to process the mail volume re-allocated to facility  $i$  in Q4 and year  $t$  is equal to the additional mail volume processed,  $s_{itk} \times TOTTPF$ , divided by the annual average productivity of MODS operation  $k$  at facility  $i$  in year  $t$ ,  $\frac{TPF_{itk}}{Hours_{itk}}$ :

$$Hours\_Counter_{itk} = s_{itk} \times TOTTPF \times \frac{Hours_{itk}}{TPF_{itk}} \quad (6)$$

The counterfactual cost of processing the volume of mail formerly served by facilities in Q1 by facilities in Q4 is equal to:

$$Counterfactual\_Cost_k = \sum_{(i,t) \in Q4} Postal\ Wage_{it} \times Hours\_Counter_{itk} \quad (7)$$

For each MODS operation we compute the percent cost reduction from processing the mail volume at facilities in the first quartile of the distribution of  $\bar{W}_i$  at facilities in the fourth

quartile of the distribution of  $\bar{W}_i$  as:

$$Percent\_Cost\_Reduction_k = 100 \times \frac{Actual\_Cost_k - Counterfactual\_Cost_k}{Actual\_Cost_k} \quad (8)$$

We also compute overall percent cost reduction for both AFSM and DBCS as:

$$Total\_Percent\_Cost\_Reduction_k = 100 \times \frac{Total\_Actual\_Cost - Total\_Counterfactual\_Cost}{Total\_Actual\_Cost} \quad (9)$$

where

$$Total\_Actual\_Cost = Actual\_Cost_{AFSM} + Actual\_Cost_{DBCS}$$

and

$$Total\_Counterfactual\_Cost = Counterfactual\_Cost_{AFSM} + Counterfactual\_Cost_{DBCS}.$$

Table 4 reports the values of the percent cost reductions for each MODS operation and the overall percent cost reduction. For the AFSM MODS operation, shifting mail volume from facilities in the first quartile of the distribution of  $\bar{W}_i$  to facilities in the fourth quartile of this distribution is estimated to reduce total labor costs for this MODS operation by 8.3 percent. For the DBCS MODS operation shifting the volume processed at facilities in the first quartile of the distribution of  $\bar{W}_i$  to facilities in the fourth quartile of this distribution is estimated to reduce total labor costs for this MODS operation by 13 percent. The overall mail processing labor reduction from shifting mail volume for these two operations is 11.7 percent, which implies annual average labor cost savings of more than 100 million dollars.

Table 4: Cost Reductions from Shifting Volume from Q1 to Q4 Facilities	
MODS Operation	Percent Cost Reduction
AFSM	8.3
DBCS	13.0
Overall	11.7

## 6 Policy Implications

Our empirical results support recent actions by the USPS to consolidate mail processing facilities. Facilities in regions where the mail processing wage is low relative to wage for competing jobs and the local unemployment rate is low are likely to be the best candidates

for closure. Facilities in regions where the mail processing wage is high relative to the wage for competing job and the local unemployment rate is high are likely to be best candidates to accept the resulting increase in volume.

## References

**Arellano, Manuel**, “Computing Robust Standard Errors for Within-Groups Estimators,” *Oxford Bulletin of Economics and Statistics*, 1987, 49 (4), 431–34.

**Cattaneo, Matias D, Richard K Crump, Max H Farrell, and Yingjie Feng**, “On binscatter,” *arXiv preprint arXiv:1902.09608*, 2019.

**Office of Inspector General**, “Locality Pay,” Report Number RARC-WP-14-008, United States Postal Service February 2014.

**Figure 1:** DBCS Machine



**Figure 2: AFSM Machine**



**Figure 3: AFSM Binscatter, one-way**

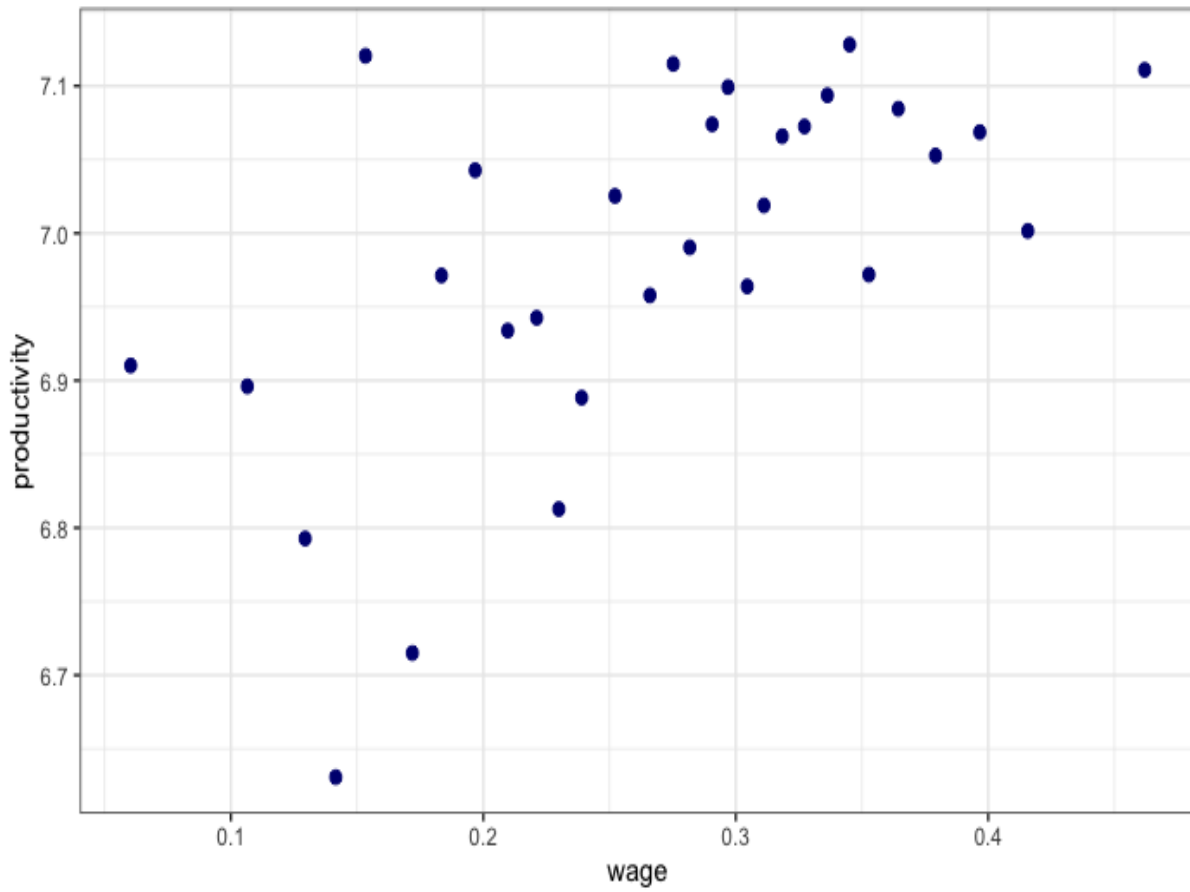
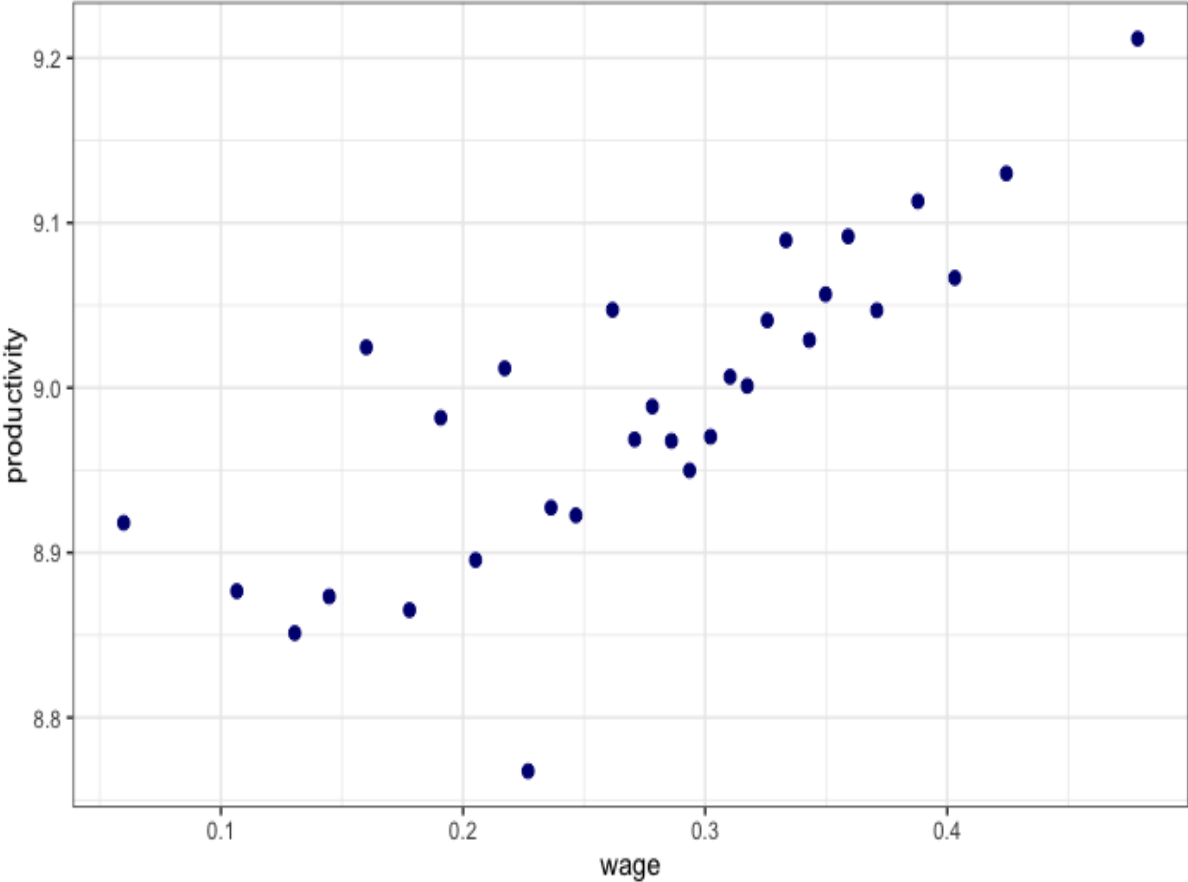
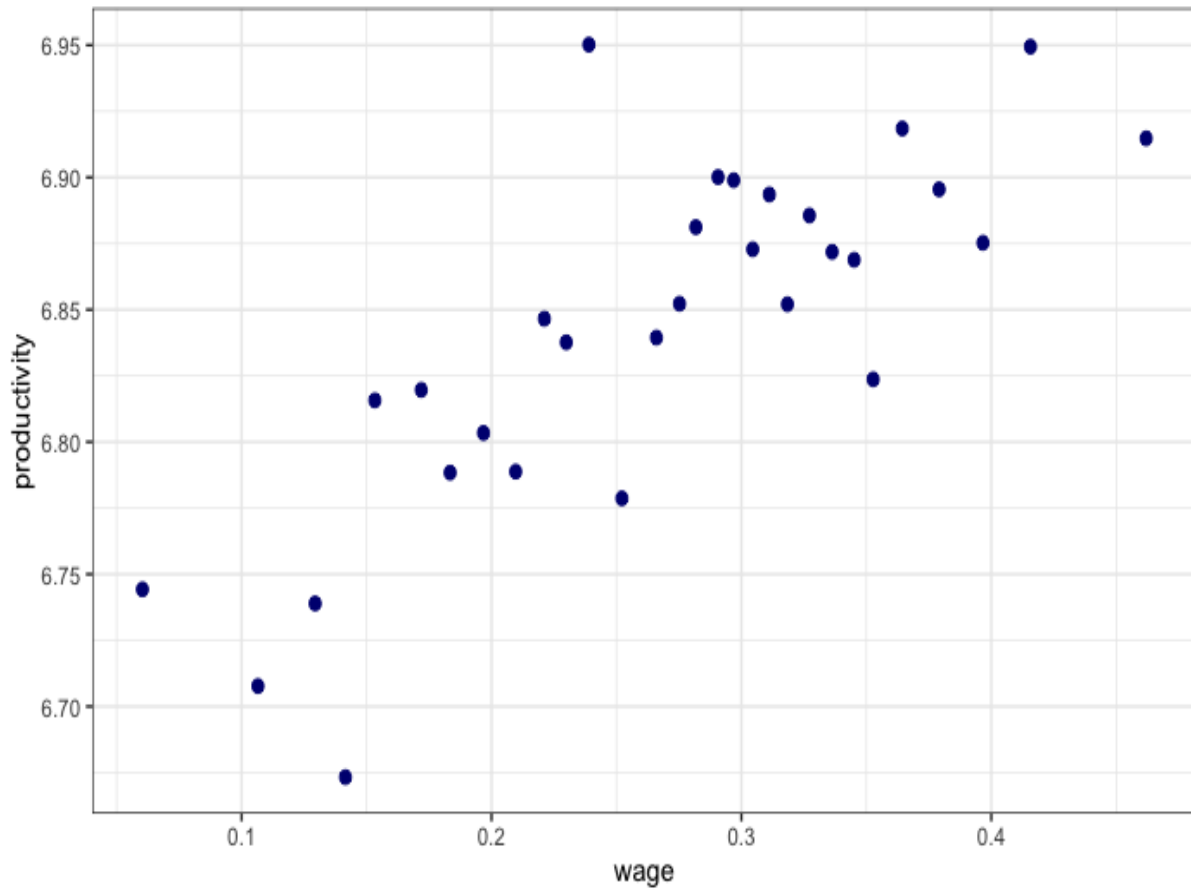


Figure 4: DBCS Binscatter, one-way

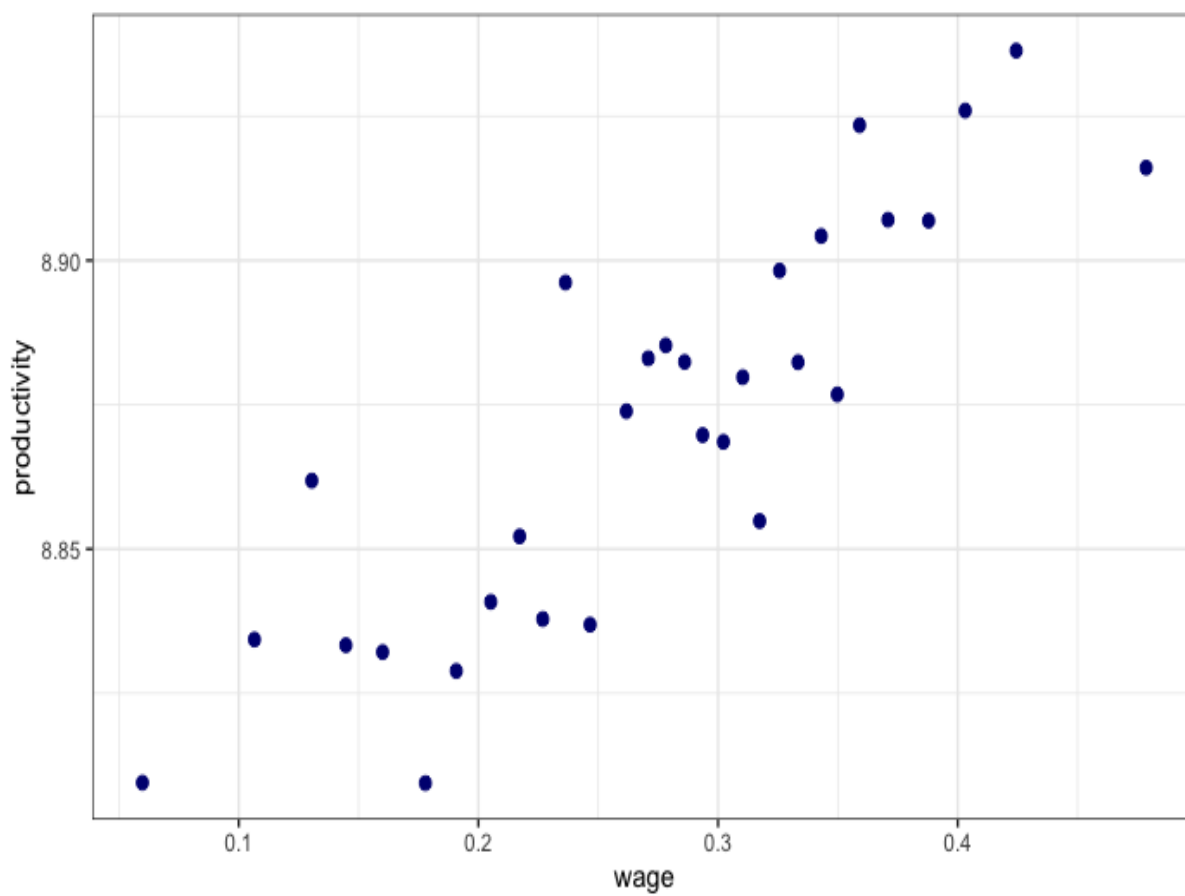




**Figure 5: AFSM Binscatter, two-way**



**Figure 6:** DBCS Binscatter, two-way



**Figure 7:** Mean Relative Wage ( $\bar{W}_i$ ) Distribution

