THE WAGE EFFECTS OF SEASONALITY IN AGRICULTURE

E. Frazao
North Carolina State University
Department of Economics and Business
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The author is a graduate student in the Dept. of Economics and Business.

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E. Frazao

North Carolina State University

Abstract

The wage effects of seasonal demand for labor in agriculture are analyzed for male heads of households in five rural villages in Guatemala. Controlling for human capital characteristics, seasonal jobs pay 57 percent more than non-seasonal jobs. Controlling for job characteristics reduces this wage differential.

THE WAGE EFFECTS OF SEASONALITY IN AGRICULTURE

Seasonality is inherent in agriculture. Different stages of plant growth generate a cyclical pattern of agricultural labor requirements, which usually reach a peak at harvest time. This peak season is a period of relatively short duration but extremely high intensity. Seasonal wage employment represents an important source of agricultural employment in developing countries which are highly dependent on agricultural cash crops[1]. Not only are more workers demanded and wages higher, more workers also seem to be available, with women and children often joining the labor force at this time and the weekly hours of work increasing as well.

With rare exceptions, studies of rural wages and labor supply implicitly assume that wages remain constant throughout the year, and that time-allocation decisions made in each period are independent of each other. However, where agriculture is an important industry, seasonal movements in the wage rate and in the quantity of labor might be expected. An income-maximizing individual will take into account the potential seasonal and non-seasonal earnings in formulating his year-long time-allocation plans (Huffman, 1984). In some instances, then, this might lead an individual to specifically look for seasonal work, perhaps to supplement other sources of income (for example, self-employed farming).

In spite of the importance of seasonal work in agriculture, little attention has been focused on the seasonal patterns of wages. This paper addresses the question for a specific sample by describing the wage-increasing effect of the seasonal demand for labor among male heads of households in five rural villages in Guatemala.

The next section describes the sample used in the analysis. Section 3 analyzes the wage returns of seasonality, taking into account human capital differences and job characteristics such as part-time or full-time work, location of the job, and urban/rural residence. The final section is a summary and conclusion.

SECTION 2. THE SAMPLE

The analysis presented in this paper is based on data from a 1976 retrospective life history of 431 male heads of households from five non-Indian villages in Southeastern Guatemala. These households participated in a nutrition and fertility study by INCAP (Institute of Nutrition for Central America and Panama) and the Rand Corporation (Butz et al, 1975; Corona, 1978; Piveral, 1972). Inclusion in the sample required that the households contain at least one woman of fertile age (25-55 years of age). Four of the villages were small and rural. The fifth village was larger, less rural, and within easy commuting distance to Guatemala City. Farming was the major industry in the more rural villages, and an important source of employment even in the less rural village. Land holdings tended to be fragmented.

characterized by multiple parcel ownership, small amounts of land owned, and poor quality of land.

Beginning with the individual's first adult employment (defined as age eighteen), information was obtained on the starting date, duration, daily hours worked, days worked per week, occupation, location, rate of pay, and other characteristics of any occupation lasting more than one month (including self-employment). A continuous record was thus available on each individual's employment history beginning at the age of eighteen, with every month accounted for.

Due to the high serial correlation between the monthly observations, and the inability of the monthly records to capture the patterns of seasonal work, a "job event" structure was created, defined to cover the entire period during which all occupation-related characteristics remained constant. In the month any of the occupation-related characteristics changed (for example, the rate of pay, the hours of work, or the occupation category itself), a new job event was defined. Multiple job--holding, in which a worker engaged in more than one job event over the same period of time, was common.

Another common pattern of employment in these data was that of seasonal work: a worker split his work year, devoting all the time in each week to one occupation or another. In the most prevalent situation, the worker was a self-employed farmer for most of the year, and a hired agricultural worker during the seasonal months. The questionnaire itself did not provide a

definition of seasonal work. An empirical definition was developed, based on accounts that the peak season for the large cash crops in Guatemala (cotton, coffee) occurred from December to March. Therefore, a job event was classified as seasonal if it took place entirely within the period between December and March, whether or not it was performed the subsequent years. It should be stressed that the definition of seasonality was based entirely on the seasonal cycle of the large cash crops such as cotton and coffee, which are grown in large scale on plantations and have a high seasonal demand for hired labor.

To minimize recall errors the sample was limited to only the last three years of the retrospective. After data cleaning there were a total of 612 labor market job events, which include both agricultural and non-agricultural work.

SECTION 3. THE WAGE EFFECTS OF SEASONALITY

Wages in agriculture tend to be higher during the peak season than during the slack season. It remains to be seen, however, the extent to which that difference can be attributed to the shift in the demand for labor (the seasonality factor itself), and how much can be explained by differences in the composition of the labor force.

We follow the now standard practice in labor economics of relating the natural log of the hourly wage rate to schooling, experience, and other personal characteristics[2]. We also control for job characteristics such as industry and part-time work.

Using the job event structure, the basic model used to represent the differences in observed wage rates across job events may be written as

$$\ln W_{ij} = f(X_i , Z_{ij}) + e_{ij} \qquad (1)$$

where W_{ij} represents the wage for person i in job event j, X_i represents observed personal characteristics that are common across all the job events of an individual, Z_{ij} represents job or personal characteristics that vary across job events, and e_{ij} represents unobserved factors that vary across individuals or job events. Job event numbering is specific to the individual. Some people have only one job event; others have as many as six job events. This is not a panel or cross-section/time series data and there is no particular commonality between, say, job event 2 for two different people.

Seasonality Issues

Before proceeding with the analysis, a number of issues should be addressed. The first relates to the frequent practice of setting wage rates for seasonal field workers on a piece-rate basis. In such cases, the daily (or hourly) rate of pay is determined by the speed at which the individual works and the total number of hours worked per day (that is, how many tasks are finished in a working day). Formal schooling seems unlikely to be important in determining a worker's hourly wage in a piecerate

system, while experience, physical endurance, and strength are more likely to be important (Huffman, 1984). Martin (1985) indicates that daily earnings of piece-rate workers tend to peak when they are relatively young. Huffman (1985) states that this is common when little formal training is required, and physical strength and endurance peak at a relatively young age, which is about when earnings peak. Unfortunately no data are available on whether work was done on a piece-rate basis or on the exact nature (or physical demands) of the job.

A second issue is tied to the relatively high proportion of temporary migration which is often associated with seasonal jobs. Thus, seasonal wage rates might be higher to compensate for the costs of migrating, of leaving family members behind, or of having to set up temporary living quarters. In some instances, in-kind payment is available, such as housing, which partially offsets some of the costs involved. Unfortunately, no reliable data on migration, migration costs, or the value of in-kind payments are available.

A third issue relates to the multiple job holding characteristics of seasonal jobs, and the intertemporal dependence of time allocation decisions. That is, once an individual decides to take a full-time job during the slack agricultural season, the likelihood of that individual doing any seasonal work decreases. What is really needed is a dynamic model which takes into account the intertemporal dependence of job-related decisions.

Keeping these problems in mind, it is still of interest to investigate how seasonality influences wage rates.

Empirical Results

The effects of human capital variables such as education and experience on wage rates have been addressed in another paper (Sumner and Frazao, 1986). The focus here is on the effects of the seasonal aspects of employment on the wage rate, using the job event structure. Variable means and definitions are presented in Table 1.

It should be noted here that in a semilogarithmic specification of the wage equation the coefficients of the dummy variables should not be interpreted as a direct measure of the relative effect of those independent variables. As detailed in Halvorsen and Palmquist (1980), the coefficients of the dummy variable measures the discontinuous effect on the dependent variable of the presence of that particular factor, and the appropriate interpretation of that coefficient requires a transformation of the regression equation. For small values of the regression coefficient the relative effect is approximately equal to the regression coefficient; for coefficient values larger in magnitude than 0.25, however, there may be substantial differences. In this paper, the discussion of the relative wage effects of specific factors uses such a transformation (Appendix 1), and may therefore be different from the estimated regression coefficient in question.

Table 2, column (1), shows that, after accounting for human capital variables, seasonal job events pay nearly 57 percent more than non-seasonal job events. Because seasonal job events are mainly full-time agricultural job events, this wage differential reflects the wage differentials which exist between agricultural and non-agricultural job events and between part-time and full-time agricultural job events. Controlling for these two factors (column 2), the seasonal wage differential is reduced by nearly half, to approximately 30 percent, which still represents an appreciable difference. Furthermore, controlling for part-time work and agricultural work reduces the coefficients for literacy and experience, an indication that such human capital factors may be involved in the selection of this type of work.

Inclusion of variables controlling for rural residence, firm size, and payment in kind (column 3) further reduces the seasonal wage differential to 16 percent, which suggests that seasonal job events are associated with those variables.

SECTION 4. CONCLUSION

This paper analyses the effects of seasonality on wage rates. Using regression analysis to isolate the wage-increasing effect of seasonality, we find that seasonal wages are nearly 57 percent higher than non-seasonal wages after controlling for human capital characteristics. This differential is reduced to 16 percent after controlling for job characteristics such as industry of work

(agricultural or non-agricultural), part-time work, firm size, rural residence, and availability of payment in kind.

This finding that wages are not uniform throughout the year is of importance to studies of labor supply in agricultural areas. It suggests the possibility that individuals might make their time allocation decisions based on the perception of two periods (seasonal, non-seasonal) and two different wage rates. As such, time allocation decisions may differ throughout the year, with time allocated in one period being dependent on time allocation decisions for another period.

The parameter estimates provided herein were obtained from a very specific sample, of male heads of households that include females of child-bearing age in rural Guatemala. It would be of interest to compare these results from those of different samples. Of further interest, also, would be an analysis of the wage effects of seasonality in conjunction with the seasonality of prices of staple foods, since Chaudhury (1981) found evidence that, in Bangladesh, the rise in seasonal wages was cancelled out by the high price of rice prevailing at that time.

TABLE 1

VARIABLE DEFINITIONS AND MEANS

Variable	Definition	Mean (std. error)
AGESTART	Age of individual at start of job event	31.09 (9.34)
AGESTARTSQ	Above variable, squared	
STARTDATE	Starting date of job event, in months, as of January 1900	848.89 (43.78)
DLITERATE	Dummy=1 if literate	0.61 (0.48)
SCHOOL	Years of schooling completed	2.75 (2.55)
DSCHLE3	Dummy=1 if completed three years or less of schooling	0.65 (0.48)
SCHLE3	Years of schooling completed if less than or equal to 3	0.83 (1.17)
AGREXPER	000's hours of experience in hired agricultural work	12.77 (13.51)
AGREXPSQ	Above variable, squared	
NONAGREXPER	000's hours of experience in non-agricultural work	14.11 (19.67)
NONAGREXPSQ	Above variable, squared	
DRURAL	Dummy=1 if residence in one of the four rural villages	0.75 (0.44)
DAGRICJOB	Dummy=1 if job event is hired agricultural work	0.65 (0.48)
DPARTTIME	Dummy=1 if part-time work (less than 5 days/week)	0.36 (0.48)
EMPLOYEES	Number of employees at place of work	80.95 (194.94)
DPAYKIND	Dummy=1 if payment in kind	0.24 (0.43)
DSEASONAL	Dummy=1 if job event is seasonal	0.12 (0.33)

TABLE 2

WAGE REGRESSIONS (N=612)
(standard errors in parenthesis)

	(1)	(2)	(3)
Intercept	-3.98 (.48)	-2.61 (.43)	-2.71 (.43)
AGESTART	.030 (.013)	.026 (.012)	.027 (.011)
AGESTARTSQ	-.00034 (.00019)	-.00022 (.00016)	-.00024 (.00016)
STARTDATE	.0017 (.00052)	.00071 (.00046)	.00068 (.00045)
DLITERATE	.11 (.061)	.057 (.054)	.055 (.054)
SCHOOL	.083 (.019)	.068 (.016)	.073 (.016)
DSCHLE3	.31 (.12)	.33 (.10)	.34 (.10)
SCHLE3	-.11 (.031)	-.066 (.028)	-.078 (.028)
AGREXPER	-.026 (.0044)	-.016 (.0039)	-.016 (.0039)
AGREXPSQ	.00029 (.000076)	.00012 (.000067)	.00013 (.00061)
NONAGREXPER	.016 (.0029)	.0035 (.0027)	.0054 (.0027)
NONAGREXPSQ	-.00020 (.000042)	-.000079(.000038)	-.000090(.000037)
DRURAL			.053 (.069)
DAGRICJOB		-.35 (.060)	-.41 (.066)
DPARTTIME		-.46 (.052)	-.37 (.056)
EMPLOYEES			.00042 (.00012)
DPAYKIND			.11 (.054)
DSEASONAL	.46 (.070)	.27 (.069)	.16 (.072)
R^2	.31	.47	.49

NOTES

1. Miro and Rodriguez (1982) have estimated that, in Central America, seasonal migrants alone constitute nearly 70 percent of the labor force employed in agriculture. More specifically, they estimated that in Guatemala, over 40 percent of the country's estimated agricultural labor force move to coffee and cotton plantations at harvest time, while in El Salvador, over 50 percent of the active agricultural population is employed for less than six months of the year. In the data presented below, nearly 20 percent of all wage-earning agricultural work by male heads of households was performed on a seasonal basis, defined here as the harvest period of the cash crops, from December through March. This figure is lower than the figures cited by Miro and Rodriguez (1982), possibly because their data reflect all seasonal workers (including women and children, who tend to participate heavily in seasonal work), whereas the data used in the analysis below relates only to male heads of specific households.

2. The classic reference is Mincer, 1974.

APPENDIX 1

Relationship Between Dummy Variable Coefficients and Relative Effects in Semilogarithmic Equations (adapted from Halvorsen and Palmquist, 1980).

Coefficient of Dummy Variable	Relative Effect
1.00	1.72
0.75	1.12
0.50	0.65
0.45	0.57
0.40	0.49
0.35	0.42
0.30	0.35
0.25	0.28
0.20	0.22
0.00	0.00
-0.20	-0.18
-0.25	-0.22
-0.30	-0.26
-0.35	-0.30
-0.40	-0.33
-0.45	-0.36
-0.50	-0.39
-0.75	-0.53
-1.00	-0.63

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