

LOGGING PRODUCTIVITY IN ALABAMA 1995 - 2000

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FORESTRY IN ALABAMA

- 22 million acres of land in Alabama (2/3 of the state) is covered in forest land
- \$13 billion for Alabama each year
- 10% of Alabama's total work force (Alabama Forestry Association)

However, there is little literature on technical efficiency and factors affecting on logging capacity of Alabamian loggers.

THIS STUDY

- examines effects of firm scale, machine ages and products on production of logging firms in Alabama using non-parametric statistical tests
- calculates substitution elasticity between labor and machine cost from linear production function estimated with the OLS method.
- Discuss on effects from changes in factors on output changes in cumulative logistic models.

DATA

- 200 questionnaires are mailed on December 1, 2000, 82 responses
- The loggers selected were firm owners, co-owners, or corporate officers
- 67 were currently in the logging or log hauling business
- 6 had left the logging business in the last 3.5 years
- Half the respondents' firms were started before 1983, with the average firm started in 1981.

METHODOLOGY

- Non-parametric tests: Kruskal-Wallis, Median One-Way Analysis, Van der Waerden One-Way Analysis, and Savage One-Way Analysis
 - *explore a significant difference between firm groups of sizes (employment), machine ages and products*
- Linear regression for a production function
 - *identify substitution coefficients between labor and machine cost*
- Logistic models:
 - *examine the relationship between changes in input factors on changes in production and net worth*

GROUP DESCRIPTION

	Group name	Description	Freq.	Percent
Firm size	small	1-5 employees	33	55
	medium	6-8 employees	12	20
	large	> 8 employees	15	25
Machine age	new	$\geq 30\%$ new (0-1 year)	18	30
	'normal'	$< 30\%$ new but $> 50\%$ in lifetime	30	50
	old	$\leq 50\%$ in life time	12	20
Product	1	Hardwood sawtimber	11	18.33
	2	pulp-wothout sawtimber pine	19	31.67
	3	Pine w/o hardwood sawtimber	30	50

DESCRIPTIVE STATISTICS

	Unit	Ave.	Min	Max
production in 2000'	load/week	37.77	5	110
production in 1997	load/week	43.37	7	138
production in 1995	load/week	40.34	5	150
labor efficiency	weekly load/employment	6.02	0.95	15.83
machine cost efficiency	weekly load/1000 USD	0.15	0.03	0.65

DIFFERENCE BETWEEN FIRM SIZES

Firm size (labor number)	production (load/week)			Labor efficiency	Machine efficiency	Machine efficiency (w/o truck)	
	N	1995'	1997'				2000'
1-5	33	25.60	26.13	24.71	6.17	0.15	0.16
6-8	12	55.17	60.08	44.33	6.69	0.19	0.24
>8	15	59.21	66.80	61.23	5.14	0.14	0.17
Kruskal Wallis Test	χ^2	21.16	24.89	23.53	4.50	2.00	4.50
Savage Analysis	χ^2	16.18	20.86	22.24	4.20	1.19	4.20

DIFFERENCE BETWEEN MACHINE GROUPS

Machine group	N	production (load/week)			labor efficiency	machine efficiency	Machine efficiency (w/o truck)
		1995'	1997'	2000'			
new	18	51.17	56.14	57.08	7.8170	0.1363	0.1608
'normal'	30	43.13	45.27	34.95	5.2154	0.1704	0.2073
old	12	15.77	17.32	15.83	5.3125	0.1321	0.1464
Krusal Wallis Test	χ^2	17.06	18.39	24.65	8.88	2.31	3.79
Savage Analysis	χ^2	9.58	9.86	17.67	12.64	3.99	5.81

DIFFERENCE BETWEEN PRODUCTS GROUPS

Productgroup	N	production (load/week)			Labor efficiency	Machine efficiency (with truck)	Machine efficiency (w/o truck)
		1995'	1997'	2000'			
1	11	36.35	35.50	25.32	4.8851	0.1863	0.2185
2	19	46.11	46.68	44.95	6.5948	0.1454	0.1677
3	30	38.05	43.90	37.78	6.0627	0.1446	0.1761
Kruskal-Wallis Test	χ^2	3.37	2.48	5.32	3.77	0.00	0.33
Van der Waerden	χ^2	2.94	2.37	5.27	3.9	0.01	0.25

PRODUCTION FUNCTION

	Model 1a	Model 1b	Model 2a	Model 2b
Intercept	-3.42148	-3.97471	-3.2276	-3.70157
firmsize	-0.06528	-0.10486	-0.04817	-0.07842
Magroup	-0.15943	-0.13355	-0.15973	-0.13819
Productgroup2	0.19105	0.18066	0.18435	0.17424
Productgroup3	0.10207	0.09771	0.12534	0.12256
lnempday0	0.45317	0.50748	0.49208	0.53424
lnmacostwtruck	0.45999	0.49252		
lncostwotruck			0.43676	0.46576
Retriacts		-0.416		-0.31078
Adj-R ²	0.6935	0.6979	0.6786	0.6837
Subs. Elasticity L/MC	1.01505	0.970521	0.887579	0.871818

PRODUCTION FUNCTION

	Model 3a	Model 3b	Model 4a	Model 4b
Intercept	<i>-3.8757</i>	<i>-5.2852</i>	<i>-4.0292</i>	<i>-5.3139</i>
Lnload3	<i>0.3770</i>	<i>0.3442</i>	<i>0.4022</i>	<i>0.3784</i>
firmsize	<i>-0.1614</i>	<i>-0.2520</i>	<i>-0.1596</i>	<i>-0.2342</i>
Magroup	-0.0484	0.0103	-0.0329	0.0207
Productgroup2	0.0661	0.0402	0.0483	0.0201
Productgroup3	-0.0559	-0.0635	-0.0430	-0.0487
lnempday0	<i>0.3461</i>	<i>0.4837</i>	<i>0.3758</i>	<i>0.4901</i>
lnmacostwtruck	<i>0.4242</i>	<i>0.5163</i>		
Lncostwotruck			<i>0.4247</i>	<i>0.5099</i>
Retriacts		-1.0338		-0.8285
Adj-R ²	0.78	0.77	0.77	0.77
Subs. Elas L/MC	1.23	1.07	1.13	1.04
LR elasticity of labor	0.5555	0.7375	0.6285	0.7885
LR elasticity of ma-cost	0.6810	0.7872	0.7104	0.8203

FREQUENCIES OF FIRMS

Score	Description	Production	Net worth
1	decrease by >20%	15	15
2	decrease by 0 - 20%	9	9
3	no change	4	5
4	increase by 0 -20 %	15	15
5	increase by >20 %	13	11

LOGISTIC MODELS FOR A CHANGE IN PRODUCTION AND NET WORTH

	Change in production		Change in net worth	
firmsize	1.7125	1.6531	0.9331	0.9262
magroup	0.3912	0.4097	-0.1776	-0.3306
group2	1.3803	1.2446	0.7686	0.8123
group3	0.5563	0.3676	-0.1995	-0.3627
btire	-1.1664	-1.1871	-1.5573	-1.5026
binsl	1.7324	1.7553	1.4214	1.3827
macoswtruck	-0.0073		-0.0037	
costwotruck		-0.0074		-0.0062
Re-scaled R ²	0.43	0.42	0.36	0.37
Likelihood	29.5758	28.1837	22.9040	23.8429
P >Chisq	0.0087	0.0134	0.0619	0.0479

DYNAMIC LOGISTIC MODELS FOR A CHANGE

IN PRODUCTION AND NET WORTH

	Change in production		Change in net worth	
<i>load3</i>	0.0718	0.0605	0.0498	0.0461
magroup	0.5851	0.7219	-0.0971	-0.1669
productgroup2	0.6493	0.5220	-0.1244	0.0189
productgroup3	-0.1549	-0.2193	-0.7322	-0.8336
btire	-0.7088	-0.7521	-1.0411	-1.0710
<i>binsl</i>	1.2765	1.3335	1.0475	1.0672
<i>macostwtruck</i>	-0.0116		-0.0062	
<i>costwotruck</i>		-0.0093		-0.0074
Re-scaled R ²	0.5267	0.4762	0.4422	0.4398
Likelihood	38.287	33.2261	29.5863	29.3717
P>Chisq	0.0005	0.0027	0.0087	0.0093

CONCLUSION

- More labor and newer machine, more load per week.
- Newer machines create higher labor efficiency.
- Unit substitution elasticity between labor and machine cost.
- Increases in production and net worth are associated with expense for insurance liability and previous production.
- Increases in machine cost and tire expenses between 1997 and 2000 lower an increase in production while the effect of machine ages and product kinds seem not to be significant.
- Increases in equipment price, expenses for fuel or parts, and labor wage give NOT significant effect on an increase of production or net worth.