EFFECT OF COTTON GIN PLANT COMPLIANCE WITH AIR POLLUTION REGULATIONS ON FINANCIAL STABILITY

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Abstract

Simulation analysis of representative gin plant firms in Texas was carried out to determine the effect of required investments in air pollution controls on firms financial performance. The simulation analysis facilitated the measure-ment of the representative firms financial performance *ex ante* and *ex post* the required investment in pollution controls. The research shows many of the smaller, low-volume gin plant firms in Texas are likely to fail over a ten year period before (*ex ante*) any required investment in pollution controls. For those representative firms projected to be successful before *ex ante* the required investment in control systems, failure rates were calculated as controls were introduced that increasingly lowered emission rates. Nine percent of the representative firms processing stripped cotton (with and without debt) are projected to fail when introducing best available control technology (BACT), a baseline or minimum emissions system (2.24 lbs/bale) specified for Texas gin plants, while 11 and 20 percent fail when upgrading to systems with emission rates of 1.8 and 0.9 lbs/bale, respectively. The analysis show firm failure rates are sensitive to plant volume over the repayment cycle on the required investment in controls, stringency of the controls, plant size, indebtedness of plant at time of the required investment and whether the plant processes picked or stripped cotton.

Introduction

The Clean Air Act of 1963 was the first major federal involvement in air pollution regulation in the United States. This act was subsequently amended in 1967, 1970, 1977, and 1990 and, in general, increased federal involvement in air pollution regulation. The Clean Air Act of 1970 required that minimum emission standards be established for stationary sources of air pollution. These standards were to be established on an industry-by-industry basis and were to consider the cost of air pollution control. The established standards were to represent the "best available control technology" (BACT) available to the industry. The Federal Clean Air Act (FCAA) amendments of 1990 represented a further strengthening of the Clean Air Act and ended more than a decade of Congressional stalemate over air pollution regulations in the United States. The 1990 legislation represents an important change in air pollution regulation, in particular, as it affects stationary sources such as cotton gins.

Air pollution regulations are implemented at the state level; the implementing agency in Texas is the Texas Natural Resources Conservation Commission (TNRCC), otherwise known as the Texas Air Control Board (TACB) prior to September 1, 1993. Cotton gins emit suspended particulate and are regulated under a nuisance standard; the emitted particulate is not viewed as a threat to health.

Cotton gins in isolated locations with favorable community acceptance and no past nuisance compliance violation history will be required to invest in a minimum level of control which is defined as baseline "best available control technology" (BACT). In Texas, BACT has been defined to include 2D2D or 1D3D cyclones on centrifugal fan exhausts and covered condenser drums on axial flow fan exhausts. Gin plants which require more control than BACT (the minimum level of control) must propose additional controls to the TNRCC. The complement of control equipment finally required of a particular plant is the result of negotiations between the TNRCC and gin plant management.

Objectives

The Texas Natural Resources Conservation Commission has some flexibility and discretion in administering the clean air statutes by considering the trade-offs between economic and environmental impacts. In particular, the regula-tion states that a plant will use the best available control technology with con-sideration being given to its technical practicability and economic reasonable-ness. (TACB, *General Rules* 116.3) The term "economic reasonableness" is undefined in law or regulations.

A gin plant firms investment in an air pollution control system may be substantial and in some cases may place an excessive financial burden on the firm that results in insolvency or failure. In view of this concern, the primary objective of this study is to determine the likely success/failure rates for Texas gin plant firms that would result from compliance with various levels of air pollution control. Analysis focuses on five representative gin plant sizes (firms) and three air pollution control systems that offer differing control technology and particulate emission. The results of this study may be used by the Texas regulatory agency and cotton ginners to establish air pollution control systems that consider economic implications.

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Approach

Analysis is carried out with financial models of representative gin plant firms in Texas. The models generate revenues, costs, profits/losses and other financial information that is subsequently included in profit and loss statements and balance sheets. The representative cotton ginning firms are evaluated over a multi-year period since the primary influence of the required investment in air pollution controls extends over its repayment and depreciation cycle. Further, the firm's financial well-being is closely related to its ginning output over time. Historical ginnings of Texas plants are used to develop frequency distributions of annual gin output for each representative gin plant firm. Based on these distributions, simulation analyses are carried out to generate financial statements for representative firms over a multi-year period. Information in these statements determine the success or failure of the firm. To isolate the influence of the required investment in air pollution controls, the success/failure rates are contrasted for the representative firms *ex ante* and *ex post* these investments.

Five gin plant firms are established based on bale per hour capacity (bph). These include: (1) ≤ 10 bph; (2) 11-15 bph; (3) 16-25 bph; (4) 26-34 bph; and (5) ≥ 35 bph plants. Three air pollution control systems are evaluated for each representative firm. For each representative firm, a series of simulations are carried out based on a frequency distribution of annual ginnings. The initial simulation relates the representative firms failure rate with current emission controls (4 lbs/bale) while successive simulations identify success/failure rates for control systems with emission rates that range from 2.24 to 0.90 lbs/bale. Failure rates are contrasted for each control system and associated emissions rate to identify the influence of the various control systems on each representative firm's financial success.

Several important efforts were required to accomplish study objectives. These include (1) designing five air pollution control systems for each representative firm and estimating the associated capital investment, (2) development of a financial model for each representative cotton ginning firm that includes financial statements which reflect investment in air pollution controls and variability in annual ginning output, and (3) development of a simulation process which links each representative firm model with frequency distributions of annual ginnings. The following sections relate further information about these efforts.

Air Pollution Control Systems

Three air pollution control systems (BACT, BACTD0, BACTD1) were defined for each representative gin plant firm and associated capital investments estimated. The following offers a brief description of each control system.

BACT

The Best Available Control Technology design (BACT) consists of either 2D2D or 1D3D cyclones on all the centrifugal fan exhausts and fine mesh screens on the condenser drums of all axial flow fan exhausts. This design was defined by cotton ginning industry engineers in Texas and permit engineers with the TNRCC. BACT is expected to lower emissions from the pre-control level of 4.0 lbs/bale to 2.24 lbs/bale.

BACTD0

BACTD0 includes 1D3D or 2D2D cyclones on centrifugal fan exhausts but, in contrast, to BACT includes 1D2D cyclones on axial flow fan exhausts rather than the covered drums. The 1D2D cyclones can be used for axial flow fan exhausts because they operate at low pressure (< 1.5 inches w.g.) (Simpson, *et al*, 1995). It was assumed that the emission concentration from the 1D2D cyclones would average 0.03 grains per dry standard cubic foot which would lower the emission rate for BACTD0 to 1.8 lbs/bale.

BACTD1

BACTD1 includes a pre-separator/1D3D cyclone system on all fan exhausts. The emission factor for BACTD1 is expected to be 0.9 lbs/bale.

Investment in Air Pollution Control Systems

The estimated investment in air pollution control systems was based on earlier research by Vatavuk who focused on control systems for the chemical processing industry. Based on knowledge of gin plant design, the original formulation by Vatavuk was modified. The following modified relationship was used to estimate investment in cyclones, fans, motors, supports and hoppers/drums:

$$\text{Investment } (\$) = 5500\ (A^{0.9}),$$

where, A = total inlet area of cyclones (ft^2).

The total inlet area (A) is based on an estimated relationship between cyclone dimension, airflow and inlet area. It was assumed that the standard airflow rate for gin plants processing stripped cotton was 8,000 cfm per bale per hour of capacity, respectively. Investments to upgrade air pollution control systems in plants processing stripped cotton are shown in Tables 1.

Representative Firm Models

For each of the representative gin plant firms, (≤ 10 bph, 11-15 bph, 16-25 bph, 26-34 bph, ≥ 35 bph) a financial model was developed. The model produces an annual profit and loss statement and balance sheet that reflects bales ginned and changes in fixed and operating costs that result from investment in air pollution controls. The firms financial statements are linked over a ten year period and if selected measures of financial well-being take on critical values during this period, the firm is judged to be insolvent or to have failed. By contrasting financial performance *ex ante* and *ex post* the air pollution control investment, it is possible to isolate the influence of the required investment on measures of financial well-being and calculate the likely success/failure rate for each representative gin plant firm. The following offers discussion on procedure and data to estimate entries in each representative firm's profit and loss statement and balance sheet.

Revenues

Gin plant revenues are earned by the performance of ginning services, a margin on cottonseed marketings and a compression rebate. Ginning charges in Texas were estimated from a USDA survey of Texas plants which showed the average charge to be $50/bale for plants processing stripped cotton (Glade, Johnson and Meyer). Gin plant data from 36 Texas gins showed the cottonseed margin to average $5.45/bale and the compression rebate to average $7.80/bale. The compression rebate is available to those plants with universal-density (UD) presses; in this study, all gin plants are assumed to be equipped with a UD press except those with ≤ 10 bph capacity. Plants processing stripped cotton and equipped with a UD press earn per bale revenues of $63.25/bale while the smallest plants (≤ 10 bph) generate revenues of $55.45/bale.

Costs

Each representative gin plant model includes the ability to estimate operating and fixed costs. Operating costs were estimated with GINMODEL, an economic-engineering cost estimation procedure. GINMODEL allows for the development of model plants with a particular bale/hour capacity, equipment, labor force, efficiency level and operational procedures. Prevailing manager-ial techniques and other institutional aspects common to the industry are introduced into each model plant. Once a model plant has been designed and organized into an efficient and workable organization, physical and monetary coefficients are attached to various inputs to estimate operating costs.

GINMODEL produces a per bale estimate of each operating cost at alternative ginning levels for each representative gin plant firm. Operating costs include salaries/wages of gin plant manager, superintendent, office manager, ginner(s), and seasonal gin labor as well as costs of electricity, drying fuel, repairs, bagging and ties, gin trash disposal, property taxes, and insurance on buildings and equipment.

Fixed costs include depreciation, interest and repayment of principal. Annual depreciation expense is based on investment in plant and equipment and the appropriate depreciation schedule. Cotton ginning assets are depreciated over a seven year recovery period using a 150% declining balance method (IRS, *Farmers Tax Guide*).

Interest expense is based on the amount of the loan, the payback period and interest rate. Financial institutions in Texas indicated a willingness to finance half of the investment in gin plant, equipment and land with payback over seven years. Estimated investments in gin plants ranged from $0.425 million for the smallest plant (≤ 10 bph) to $3.66 million for the ≥35 bph plant. Estimated capital investments for the 11-15, 16-25, and 26-34 bph plants were $0.725, 1.34 and 2.22 million, respectively. Based on this information and a 9.8% interest rate, principal and interest payments were calculated.

Dividends

Dividends are paid by representative firms if profits after taxes are positive; the maximum dividend payment is based on the non-financed portion of gin plant investment (50%) and an average rate of return on cotton ginning assets as found in Dun and Bradstreet's *Industry Norms and Key Business Ratios*. A review of this publication showed an average rate of return on gin plant assets of 14.7 percent.

Taxes and Other Items in Financial Statements

Corporate taxes paid by the representative gin plant firm's are based on the taxable income rate schedule found in *1994 Tax Guide for Small Business*. Cash, a current asset, was estimated for each representative gin plant firm from balance sheets presented in *Industry Norms and Key Business Ratios* and consultation with Texas financial institutions. Based on these data, beginning cash was estimated to be $51,200, $76,800, $128,000, $192,000, and $320,000 for the ≤ 10 bph, 11-15 bph, 16-25 bph, 26-34 bph, and ≥ 35 bph plants in their first year of operation, respectively. Cash in subsequent years was endogenously determined by the representative firm models. All other items and associated entries in the representative firm's balance sheet and profit and loss statement were endogenously determined by firm models.

Firm Insolvency or Failure

A cotton ginning firm was judged to be insolvent when it was unable to meet its financial obligations. When a cotton gin experiences a negative net cash flow, it becomes necessary to meet the unpaid obligation from cash. If, during the ten year period of analysis, a firm incurs a negative net cash flow and cash is inadequate to meet the financial obligation, the cotton ginning firm was judged to be insolvent or to have failed. The generated financial statements provided information to determine firm insolvency or failure.

Representative firms that become insolvent may have positive net worth and conceptually could borrow against this equity for purposes of debt repayment or to cover costs. Regardless of this possibility, financial institutions indicated an unwillingness to provide loans to firms which experience negative cash flows that result from a history of low ginning volumes. For this reason, equity was not included as part of the solvency criteria.

Costs Affected by Investments in Air Pollution Control
Additional investment in air pollution control affects the representative firm's depreciation, interest expense, electrical costs, property tax, repairs, and insurance on building and equipment. Additional controls include air-cleaning devices that require an increase in connected electrical horsepower and electrical costs.

Probability Distributions to Facilitate Simlation

To facilitate the simulation analysis, probability distributions of annual ginning volumes were estimated for each representative gin plant firm. To estimate the probability distributions, ginning volumes and associated bph capacity were obtained for 410 Texas gins for 1985-1994. The volume data were divided into the five gin plant size categories and then subdivided by gin plant utilization level. This facilitated the development of a probability distribution of ginning volumes for each plant utilization level within each plant size category. Based on portion of Texas plants in each utilization category and Monte Carlo methods, a 200 x 10 matrix of annual ginning volumes was created for each representative firm. The 200 x 10 matrix represents 200 gin plants annual ginning volumes over a ten year period. This matrix of ginning volumes is used to carry out simulations for each representative gin plant firm under pre-control, BACT, BACTD0, and BACTD1. By contrasting success/failure rates, under pre-control, BACT, BACTD0, and BACTD1, the impacts of required investments in air pollution control are estimated.

Results

Results focus on the estimated failure rates associated with upgrading the five representative gin plant firms to BACT, BACTD0, and BACTD1. Further, the analysis examines the effects of firm debt on failure rates since some existing plants are presumed to have little or no debt. Simulation results for each representative gin plant firm are segregated by historical ginning volume categories of Texas plants to isolate the influence of volume level on the ability of a firm to successfully upgrade air pollution controls.

Stripped Cotton/Without Debt
Simulation results for the five representative gin plants processing stripped cotton and without debt are presented in Table 2. Because these firms are without debt on gin building, equipment and land, they incur only operating costs until upgrading air pollution control systems. Once these firms invest in air pollution controls, they incur interest expense, depreciation and principal payments on this debt.

There are an estimated 56 Texas plants in the $\leq$ 10 bph classification and based on the simulation analysis, 28 plants are projected to be financially successful over a ten year period if not required to invest in air pollution controls (pre-control) (Table 2). That is, in selected years, revenues would not be adequate to cover operating costs for half of these firms. Simulation analysis of the 11-15 bph plant size category yield results similar to that for the $\leq$ 10 bph plant size. In particular, about half of the plants (73/148) are projected to be successful (pre-control) whereas in the 16-25 bph grouping nearly 80 percent are projected to be successful. All plants in the two large plant classifications (26-34 and $\geq$ 35 bph) are projected to be financially successful *ex ante* any required investment in air pollution controls (Table 2).
If the 28 successful firms in the $\leq$ 10 bph grouping introduce the BACT system (2.24 lbs/bale), six are projected to fail for a failure rate of 21.4 percent (Table 2). And, if the BACTD0 (1.8 lbs/bale) or BACTD1 (0.9 lbs/bale) systems were introduced, failure rates are projected to be 28.6 and 32.1 percent, respectively. In contrast, in the 26-34 and $\geq$ 35 bph classifications, virtually all plants can successfully upgrade to BACT, BACTD0 and BACTD1. These results show large plants experience lower failure rates than small plants when upgrading their control systems and failure rates increase when controls are introduced which increasingly lower particulate emission rates.

Stripped Cotton/With Debt
In this scenario, representative firms are processing stripped cotton and incurring costs associated with debt on gin plant, equipment and land. It is assumed that investment in plant, equipment, land and air pollution controls are made in the initial year of the analysis (Table 3).

Contrasting stripped cotton/without debt and stripped cotton/with debt scenarios offers perspective on the affect of debt on failure rates. First, a substantially higher portion of firms are successful over a ten year period if they are without debt and not required to invest in air pollution controls. Consider that about two-thirds (273/410) of Texas plants are projected to be successful if without debt (Table 2) and not required to invest in controls (pre-control), while about 44 percent are projected to be successful if with debt (Table 3). Second, if financially successful plants (pre-control) are with debt and are required to upgrade their air pollution controls, their failure rates are generally higher than those plants without debt. For example, in the $\leq$ 10 bph classification, plants with debt fail at rates of 27.3, 27.3 and 90.9 percent (Table 3) when upgrading to BACT, BACTD0 and BACTD1, respectively, whereas respective failure rates for plants without debt are projected to be 21.4, 28.6 and 32.1 percent (Table 2).

Effect of Volume on Failure Rate

Tables 4, 5 and 6 project number of successful plants under pre-control for stripped cotton/without debt scenarios and associated failure rates when upgrading controls for plants in the $\leq$ 10 bph, 11-15 bph and 16-25 bph classifications, respectively. The information in Table 4 shows 56 Texas gins in the ≤ 10 bph category with 34 processing an average of 1,829 bales/season. In seven out of ten years, these plants are expected to process from 1, 445 to 2,213 bales (1,829 ± 384)(Table 4). In the remaining three years, ginning output is estimated to lie outside this range. Simulation analysis projects only six of the 34 firms to be successful over a ten year period., i.e., in selected years, revenues would not be adequate to meet operating costs for 28 firms. In addition, if financially successful firms in this output category were required to invest in a BACT or BACTD0 air pollution control system, five of the six firms would fail and if required to invest in BACTD1, all six firms would fail.

Fifteen firms in the ≤ 10 bph plant size category annually process an average of 4,519 bales and based on the simulation analyses, all are successful under pre-control or without investment in an air pollution control system (Table 4). One of the plants is projected to fail if required to upgrade to BACT, two fail if upgraded to BACTD0 and three fail if upgraded to BACTD1. Seven plants are in the highest volume category (8,308 bales/season) and none are expected to fail if required to invest in any of the presented air control systems (Table 4).

Results for the ≤ 10 bph and 11-15 bph plants (Tables 5 and 6) show only a portion of the plants to be successful under pre-control if operating at less than about half of annual capacity. For example, in the 11-15 bph category 57 Texas gins process an average of 3,053 bales/season (25% of annual capa-city) with seven projected to succeed over a ten year period and in the 5,497 bales/season grouping (46% of annual capacity) 37 of the 62 firms are pro-jected to be successful. In general, plants with higher average volumes have lower fail rates under pre-control, except for 16-25 bph plants in the 15,717 and 13,636 bales/season categories (Table 6). In particular, plants in the 13,636 bales/season grouping experience no failure *ex ante* investment in air pollution controls, whereas plants with average ginnings of 15,717 bales/ season fail at an 8 percent rate. This outcome is the result of the substantially higher variability in annual ginnings (2,563) associated with plants in the 15,717 bales/season classification; the coefficient of variation for these plants is 16.3 percent (2,563/15,717 x 100 = 16.3%) whereas plants in the 13,636 bales/season classification are represented by a coefficient of 4.6 percent.

Finally, the analysis shows annual gin output has an important effect on the ability of the firm to successfully upgrade their air pollution control systems. For example, virtually all plants in the 11-15 bph classification can successfully upgrade to an emissions rate of 0.9 lbs/bale (BACTD1) if operating at three-fourths of annual capacity, however, at lower volumes, failure rates range up to 86 percent. Similarly, plants in the 16-25 bph grouping, if operated at two-thirds of annual capacity can upgrade to BACTD1 but, at lower volumes, failure rates are significant.

Conclusions

The primary findings of this study are:

1. A relatively large portion of low volume gin plants in Texas are projected to be financially unsuccessful over a ten year period even with no required investment in air pollution controls.

2. Firm indebtedness affects the projected financial success/failure of cotton ginning firms. About two-thirds of Texas plants are projected to succeed over a ten year period if without debt and not required to upgrade their pollution controls (pre-control) while less than half are projected to be financially successful if with debt. Further, failure rates tend to increase moderately when upgrading air pollution controls of firms that are with debt.

3. The smaller, lower volume gin plants (≤ 10 bph, 11-15 bph, and 16-25 bph) experience relatively high failure rates when upgrading their controls. In general, if the plants operate at less than three-fourths of their annual capacity, failure rates are significant.

4. Larger plants have greater financial ability to upgrade their air pollution control systems than their small plant counterparts. Virtually all plants in the 26-34 bph and ≥ 35 bph classifications can successfully upgrade to an emissions rate of 0.9 lbs/bale (BACTD1) if without debt. In contrast, failure rates for the ≤ 10 bph, 11-15 bph, and 16-25 bph groupings when without debt fail at rates of 32, 30, and 10 percent, respectively.

5. Failure rates for firms increase when air pollution controls are introduced which increasingly lower particulate emissions rates.

Analysis shows many of the small and mid-size gin plants in Texas operate at low volume levels and these firms are likely to experience financial difficulties without investment in air pollution controls. This suggests the need for firms to merge/consolidate to survive. The introduction of air pollution controls compounds the need for these plants to merge/consolidate since the analysis shows these firms can only survive when operating at relatively high volume levels.

References

Dun and Bradstreet, 1991-1993, *Industry Norms and Key Business Ratios*, Dun and Bradstreet Credit Services, New York, NY.

Glade, E., M. Johnson and L. Meyer, 1994, *Cotton Ginning Charges, Har-vesting Practices and Selected Marketing*

Costs, U.S. Dept. of Agriculture, Economic Research Service, Washington, D.C.

Internal Revenue Service, 1994, *Farmers Tax Guide*, Dept. of the Treasury, Washington, D.C.

Internal Revenue Service, 1994, *Tax Guide for Small Business*, Dept. of the Treasury, Washington, D.C.

Texas Natural Resources Conservation Commission (TNRCC) 1993, *General Rules 101.4*. TRCC, Austin, Texas

Vatavuk, W., 1990, *Estimating Costs of Air Pollution Controls*, Lewis Publishers, Michigan.

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Table 1. Estimated Capital Investment for Representative Plants Upgrading to BACT, BACTD0 and BACTD1, Stripped Cotton

Plant Size Category (bales/hour)	Average Capacity (bales/hour)	Dollars		
		BACT	BACTD0	BACTD1
≤ 10	10	57,600	81,600	112,800
11-15	12.5	70,000	99,000	138,000
16-25	20	105,600	148,800	211,200
26-34	30	151,200	211,200	304,800
≥ 35	35	173,600	243,600	352,800

Table 2. Estimated Failure Rates for Representative Plants Upgrading to BACT, BACTD0 and BACTD1, Stripped Cotton Without Debt

Plant Size Category (bales/hour)	Texas Plants In Category	Financially Successful Plants, Pre-Control	Number of Plant Failures (% failed)					
			BACT		BACTD0		BACTD1	
≤ 10	56	28	6	21.40%	8	28.60%	9	32.10%
11-15	148	73	8	11.00%	10	13.70%	22	30.10%
16-25	161	127	6	4.70%	6	4.70%	12	9.50%
26-34	27	27	0	0.00%	0	0.00%	1	3.70%
≥ 35	18	18	0	0.00%	0	0.00%	0	0.00%
Total	410	273	20	7.30%	24	8.80%	44	16.10%

Table 3. Estimated Failure Rates for Representative Plants Upgrading to BACT, BACTD0 and BACTD1, Stripped Cotton With Debt

Plant Size Category (bales/hour)	Texas Plants In Category	Financially Successful Plants, Pre-Control	Number of Plant Failures (% failed)					
			BACT		BACTD0		BACTD1	
≤ 10	56	11	3	27.30%	3	27.30%	10	90.90%
11-15	148	36	4	11.10%	5	13.90%	10	27.90%
16-25	161	96	11	11.50%	13	13.50%	21	21.90%
26-34	27	22	1	4.60%	1	4.60%	1	4.60%
≥ 35	18	13	1	7.70%	1	7.70%	2	15.40%
Total	410	178	20	11.24%	23	12.92%	44	24.72%

Table 4. Estimated Failure Rate for Financially Successful ≤ 10 Bale Per Hour Firms Upgrading to BACT, BACTD0 and BACTD1, Stripped Cotton Without Debt

Average volume (bales/yr)	Average variability (bales/yr)	Texas Plants in Volume Category	Financially Successful Plants, Pre-Control	Number of Plant Failures (% failed)					
				BACT		BACTD0		BACTD1	
1,829	384	34	6	5	83.33%	6	100.00%	6	100.00%
4,519	739	15	15	1	6.67%	2	13.33%	3	20.00%
8,308	605	7	7	0	0.00%	0	0.00%	0	0.00%
TOTAL		56	28	6	21.43%	8	28.57%	9	32.14%

Table 5. Estimated Failure Rate for Financially Successful 11-15 Bale Per Hour Firms Upgrading to BACT, BACTD0, BACTD1, Stripped Cotton Without Debt

Average volume (bales/yr)	Average variability (bales/yr)	Texas Plants in Volume Category	Financially Successful Plants, Pre-Control	Number of Plant Failures (% failed)					
				BACT		BACTD0		BACTD1	
3,053	470	57	7	4	57.14%	4	57.14%	6	85.71%
5,497	906	62	37	4	10.81%	6	16.22%	15	40.54%
9,408	1,870	11	11	0	0.00%	0	0.00%	1	9.09%
9,177	583	13	13	0	0.00%	0	0.00%	0	0.00%
11,189	566	4	4	0	0.00%	0	0.00%	0	0.00%
16,219	60	1	1	0	0.00%	0	0.00%	0	0.00%
TOTAL		148	73	8	10.96%	10	13.70%	22	30.14%