

# WHAT PRODUCES JOBS: A STATISTICAL ANALYSIS

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### Introduction

This note statistically explores the reasoning behind the tepid job growth recovery seen in the US economy. Standard economic theory says that firms maximize profits given a neo-classical production function, with or without perfect competition. This reasoning implies that a firm's hiring decision is based on the principle of profit maximization. Thus, a firm calculates the employment level where the marginal cost of hiring (wage rate) is equal to the marginal revenue from that increased hire (marginal productivity of labor). Our hypothesis is that it not profit maximization that determines job growth but growth in the sales or revenues of a corporation. This reasoning implies that marginal cost and benefit of hiring are *conditional* given a level of profits. Thus, maximizing profits becomes a secondary criterion.

The motivation for this hypothesis is the fact that by December 2003, some 25 months after the recession ended in November of 2001, an additional 624 thousand jobs had been lost instead of job gains that were expected. This occurred despite a stellar rebound in profits in 2002 and 2003. Even when measured by the broader NIPA accounting standards, profits were still stellar. Additionally, by December 2003, the economy grew by 7.2% in real GDP terms, and 11.2% by the nominal GDP metric. This

makes for a compounded 5.0% nominal or 3.3% real growth rate for the 2002-2003 period. However, this recovery pales in comparison to the 2 years after the end of 1980-82 recession. At that time, the economy had grown by 21.8% in nominal GDP terms.

Corporations cite all sorts of excuses but emphasize stagnant revenues to justify lack of hiring. Notwithstanding the penchant of economists to convert everything into real terms, a CEO or a firm, has to deal with payroll, balance-sheets and income statements, including the skeptical eye of the Wall Street investor, in current or nominal dollar terms. A firm is constrained by the amount of cash on hand, plus what they can borrow from the capital market where contracts are written in nominal terms. Also, the majority of labor contracts are not written explicitly for payments in real terms, although there may exist some provisions for inflation indexation over the length of the contract. Therefore, borrowing and hiring decisions are based on nominal, rather than real values, unlike the requirements of standard economic theory.

### Data Description

Annual sales or revenue figures, net profit margins, industry type and employee count was collected for 133 publicly traded firms that are headquartered in the state of Geor-

Chart 1

Revenues of Georgia-based companies

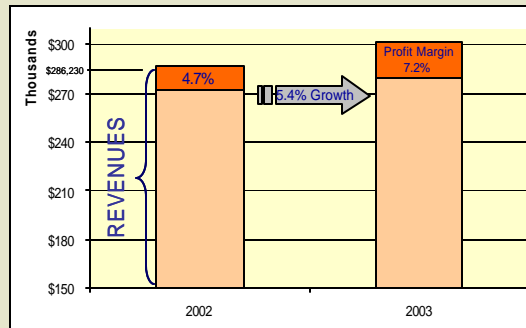
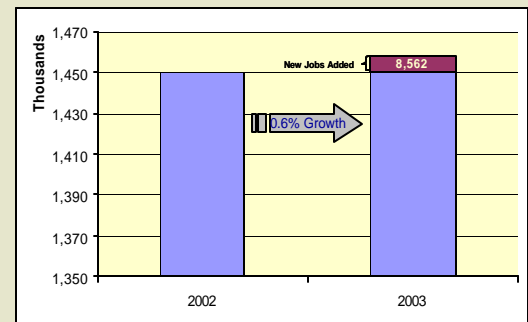


Chart 2

Employment at Georgia-based companies



gia. The information was collected for years 2002 and 2003 from public data sources such as Yahoo and Hoover. The aim was to analyze hiring (or firing) behavior for 2003. The following charts give us a back-of-the-envelope support to proceed with a statistical check of our hypothesis. As shown in the charts above revenue growth was 5.4% and net profit margin improved from 4.7% to 7.2% in 2003. However, job growth was a very anemic 0.6% in 2003!

Numerous studies (see Dhawan (2001a) for a full list) have shown that in accessing capital markets, a company's size can be of crucial importance. Small firms may have limited access to credit, but they are able to overcome this handicap by generally being more productive than their large counterparts (Dhawan 2001b). Table 1 shows the importance of small firms in the US economy. On average small firms produce 53% of Income as measured by GPO (*Gross Product Originating*) and employ 53% of civilian work-force. We defined a small firm as one having less than 500 employees, medium firms employed between 500 and 1000 employees with large firms having more than 1000 employees.

Table 2 shows the characteristics of the sample. Employment growth at small firms was twice that of medium-sized firms, with large firms displaying virtually no employee growth. Revenue growth, on the other hand, was much larger at medium and large firms. Profit growth, surprisingly, was negatively

correlated with size. Table 3 has size and industry characteristics of our sample data and shows a fair representation of firms from every major industry.

**Results**

Simple OLS was used at the regression estimation stage as we only have a cross-sectional sample for one period when variables are measured as changes from previous year. Equation 1 regresses employment change ( $\Delta Emp_i$ ) on the level of profits in 2002 ( $Profits'02_i$ ). The coefficient on profit levels is positive in the regression, which seems to support the traditional hypothesis that profits matter for hiring. However, given an  $R^2$  of only 0.093, the explanatory power of the equation is abysmal. This means that we may have not have specified the regression equation properly, most likely omitting variables of interest. For example, this regression lacks any control for revenue changes at the firm level.

Equation 2 adds the change in revenues ( $\Delta Rev_i$ ) as an additional explanatory variable. Now we find that the profit levels have a negative coefficient value that is significant. This proves that profit growth comes at the expense of hiring when revenues are controlled for. This implies that revenue growth is a critical prerequisite for growth in hiring. Most importantly, the revenue change coefficient is positive and highly significant. The  $R^2$  of this equation is also much higher (0.444), signifying that the explanatory power of this regression specification is relatively good. *This proves our hypothesis that job*

growth requires revenue growth as a precondition. Equation 3 adds the size and industry dummy variables. The size dummy takes the value 0 when firms are small, and is positive when they are medium or large. The industry variable simply takes on the

value 1 to 8 for the eight industry groups in the sample. The basic results of equation 2 are still valid. However, both the size and industry dummy coefficients seem to be insignificant. Equation 4 attempts to control for the heterogeneity of firm types

**Table 1. Importance of Small Firms in the U.S. Economy**

| Year           | Total Employment | Numbers (Million.) | Total #. Of firms | Gross Product Originating |
|----------------|------------------|--------------------|-------------------|---------------------------|
| 1958           | 55.2 %           | 3.303              | 99.76 %           | 58.0 %                    |
| 1963           | 53.0 %           | 3.457              | 99.74 %           | 55.0 %                    |
| 1967           | 53.2 %           | 3.510              | 99.69 %           | 54.0 %                    |
| 1972           | 53.0 %           | 3.541              | 99.67 %           | 53.0 %                    |
| 1977           | 52.5 %           | 4.352              | 99.73 %           | 53.0 %                    |
| 1982           | 55.8 %           | 4.633              | 99.72 %           | 51.0 %                    |
| 1987           | 54.5 %           | 5.937              | 99.77 %           | 52.0 %                    |
| 1992           | 53.0 %           | 6.296              | 99.76 %           | 51.0 %                    |
| 1997           | 51.8 %           | 6.874              | 99.70 %           | 50.0 %                    |
| 2001           | 49.9 %           | 7.073              | 99.69 %           | 47.0 %                    |
| Avg. 1958—2001 | 53.2 %           | 5.335              | 99.72 %           | 52.4 %                    |

Source: Dhawan (2001a) and EFC calculations

**Table 2. Sample Statistics**

|                        | Small  | Medium  | Large     | Overall   |
|------------------------|--------|---------|-----------|-----------|
| # of Companies         | 46     | 69      | 18        | 133       |
| Total Revenues '03     | 2,447  | 50,372  | 248,072   | 300,891   |
| Revenue Growth         | 1.16%  | 7.72%   | 4.65%     | 5.12%     |
| Total Net Profits '03  | 155    | 1,899   | 19,473    | 21,527    |
| Net Profits Margin '03 | -6.3 % | 3.8 %   | 7.8 %     | 7.2 %     |
| Total Employment '03   | 10,062 | 222,185 | 1,226,443 | 1,458,690 |
| Employment Growth      | 6.5%   | 3.1%    | 0.1%      | 0.6%      |

**Table 3. Size and Industry Characteristics**

| Category                     | Small | Medium | Large | Overall |
|------------------------------|-------|--------|-------|---------|
| Manufacturing & Construction | 1     | 15     | 7     | 23      |
| Trade                        |       | 5      | 3     | 8       |
| Transportation               |       | 2      | 2     | 4       |
| Utility                      |       | 2      | 1     | 3       |
| Banking, Finance & Insurance | 18    | 15     | 2     | 35      |
| Real Estate                  | 3     | 2      |       | 5       |
| Information & Technology     | 10    | 11     |       | 21      |
| Telecommunication            | 5     | 6      | 2     | 13      |
| Healthcare                   | 8     | 8      |       | 16      |
| Leisure & Hospitality        |       | 2      | 1     | 3       |
| Others                       | 1     | 1      |       | 2       |

## Regression Results of the Model

### Equation 1: Regress Employment Change on Profit Level

$$\Delta Emp_i = a + b_1 * Profits'02_i + e_i$$

Where i = 1, 2, 3...133

$$\Delta Emp_i = -115.698 + 1.119 * Profits'02_i$$

(0.66)      (3.64)<sup>†</sup>

**R<sup>2</sup> = 0.093**

### Equation 2: Regress Employment Change on Profit Level and Revenue Change

$$\Delta Emp_i = a + b_1 * Profits'02_i + b_2 * \Delta Rev_i + e_i$$

$$\Delta Emp_i = -138.297 - 1.379 * Profits'02_i + 2.661 * \Delta Rev_i$$

(1.00)      (3.68)<sup>†</sup>                      (8.79)<sup>†</sup>

**R<sup>2</sup> = 0.444**

### Equation 3: (Equation 2) + Industry and Size Dummies

$$\Delta Emp_i = a + b_1 * Profits'02_i + b_2 * Size_i + b_3 * \Delta Rev_i + b_4 * Industry_i + e_i$$

$$\Delta Emp_i = 180475 - 1.27019 * Profits'02_i - 283199 * Size_i + 2.67094 * \Delta Rev_i - 268389 * Industry_i$$

(0.66)      (3.30)<sup>†</sup>                      (1.31)                      (8.78)<sup>†</sup>

(0.60)

**R<sup>2</sup> = 0.4437**

### Equation 4: (Equation 2) + Industry \* Size Interaction

$$\Delta Emp_i = a + b_1 * Profits'02_i + b_2 * (Size * Industry)_i + b_3 * \Delta Rev_i + e_i$$

$$\Delta Emp_i = 79.029 - 1.302 * Profits'02_i - 71.1608 * Size_i * Industry_i + 2.753 * \Delta Rev_i$$

(0.46)      (3.50)<sup>†</sup>                      (2.07)<sup>†</sup>                      (9.10)<sup>†</sup>

**R<sup>2</sup> = 0.453**

<sup>†</sup> - Denotes statistically significant values

by using an interaction dummy between the firm size and industry variables. The interaction coefficient is significant and negative, implying that large firms seem to hire less than their larger counterparts in a given industry, when revenues and profit motives are controlled for.

### Conclusions

The regression exercise has proven that job growth is inversely related to profitability motive in the sense that profitability comes at the expense of hiring, and more so for larger firms. Revenue growth appears to be the key to hiring. Hence, this statistical analysis proves the conjecture that the desire to improve profits is to be blamed for lack of job growth in the latest recovery. There are a few caveats to the above analysis. The sample size was very small and should be extended at a minimum to include firms in the S&P500 stock index so as to be considered a better representative of the corporate sector. Additionally, the dataset should be made panel in type by adding data from the late 90's to test for the changing nature of corporate environment. Other financial variables such as net-worth to asset ratio, bond rating, sales to asset ratio etc. should be included to measure a firm's access to capital markets in a broader sense. These extensions are a subject matter for future research.

### References

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"Declining Share of Small Firms in U.S. Output: Causes and Consequences," *Economic Inquiry*, 39(3): 651-662.
- Dhawan, R.(2001b) "Productivity Differential among Large and Small Firms: Evidence from U.S. Panel Data," *Journal of Economic Behavior and Organization*, 44(3):269-263.