The Impact of Government Regulation on Business Startup Costs

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I. INTRODUCTION

The interplay between government regulation and economic performance has long been a topic of scholarly and policy interest. Theories regarding the optimal level of regulatory intervention vary widely, with some advocating for minimal interference to foster free-market growth, while others emphasize regulation's role in ensuring equity, protecting public interests, and fostering sustainable development. This paper aims to empirically investigate the extent to which government regulations influence the cost of business formation, examining both direct and indirect effects on broader economic health metrics.

The study focuses on specific regulatory indicators, such as "Enforcing Contracts," "Resolving Insolvency," and "Starting a Business," to determine their impacts on both microeconomic (firm-level) and macroeconomic (national) outcomes. By systematically analyzing these relationships, we seek to contribute to a deeper understanding of how different regulatory frameworks can either facilitate or hinder economic growth and efficiency.

II. EXPERIMENTAL SETUP

The experimental analysis was conducted using data sourced from the World Bank's Business Indicators and Economic Indicators databases. The study covers 170 countries for the period from 2004 to 2014. The primary objective is to investigate the predictability of various economic and business indicators based on a set of relevant features. The following subsections outline the key components of the experimental process, including data prepossessing, analysis methodology, statistical testing, and visualization of the results.

A. Data Description

The dataset includes indicators such as "Enforcing Contracts," "Resolving Insolvency," "Starting a Business," and "Registering Property." Each indicator represents a significant aspect of business activity and economic regulation. For each country, data spanning 2004 to 2014 is compiled and used to examine trends, changes, and relationships between different economic indicators.

A few of the features being used to predict our target variables are all related to government regulation or protection. These features specifically capture the influence of government policies and frameworks on the ease of starting a business.

- **Example Features:**
  - Enforcing contracts (DB04-15 methodology) - Score: Measures the efficiency and effectiveness of judicial systems in enforcing contracts, reflecting how government systems affect business reliability.
  - Resolving insolvency - Score: Indicates how government policies manage the resolution of insolvency, impacting business recovery options.
  - Starting a business: Procedures required - Men (number) - Score: Reflects the number of bureaucratic steps imposed by government to start a business, isolating administrative burdens.
  - Registering property: Procedures (number) - Score: Highlights the government's regulatory framework in property registration, affecting business asset acquisition.
  - Dealing with construction permits: Time (days) - Score: Shows the delays caused by governmental processes in acquiring construction permits, impacting business setup time.
  - Resolving insolvency: Strength of insolvency framework index (0-16) - Score: Assesses the robustness of the legal framework that regulates insolvency, which affects how businesses handle financial distress.
  - Registering property: Cost (% of property value): Captures the cost, as regulated by the government, associated with property registration, which is essential for business operations.

- **Target Variables:**
  - Starting a business: Cost - Men (% of income per capita): Shows the government-imposed cost of starting a business relative to income, isolating the regulatory financial burden.
  - Starting a business - Score: Measures the overall regulatory environment's impact on starting a business, based on government policy.
  - Starting a business: Paid-in Minimum capital (% of income per capita) - Score: Reflects government-mandated minimum capital requirements for business incorporation, influencing financial barriers to entry.

Here it is important to note, that we focused in on businesses impact on men, the key reason for this is that sadly many countries still have customs' and business cultures', that negatively impact women within the entrepreneurial space. While this is an important topic, it strays from our topic of discovering the influence of government regulations, as such only looked at the male sub-set, as to not remove social stigma and sexism, from possible influences on our experiment.

B. Experimental Procedure

III. INTRODUCTION

Over the past two centuries, the role of government regulation in economic activity has been a central subject of debate in both economics and political science. Numerous theoretical frameworks have been developed to quantify and qualify the impact of government interventions on market dynamics, innovation, and macroeconomic health. In this paper, we perform a mathematical analysis of the impact of regulatory burdens on the cost of starting a business and its subsequent effect on key economic metrics, such as GDP growth and overall economic efficiency.

IV. MATHEMATICAL FRAMEWORK AND EXPERIMENTAL SETUP

The study utilizes a dataset derived from the World Bank's Business Indicators and Economic Indicators databases, spanning 170 countries over the period 2004-2014. We denote the set of countries as $C = \{c_1, c_2, \ldots, c_{170}\}$ and the set of years as $T = \{2004, 2005, \ldots, 2014\}$. Let $X_i^c(t)$ represent the feature vector for country c in year t, where $X_i^c(t)$ is composed of regulatory and economic indicators such as "Enforcing Contracts," "Resolving Insolvency," and "Starting a Business."

A. Data Processing

To account for scale differences across countries, we define a normalization operator $N : \mathbb{R}^n \to \mathbb{R}^n$ such that for each feature $x_i^c(t)$,

$$\tilde{x}_i^c(t) = \frac{x_i^c(t) - x_i(t-1)}{x_i^c(t)} \tag{1}$$

This way we can isolated the effect of the change of buiness practices, from the general outlook of the economy in each county.

B. Statistical Hypothesis Testing

Hypothesis testing is conducted to determine the statistical significance of the relationships between regulatory features and economic outcomes. The null hypotheses tested are as follows:

- H_0^1: Government regulations have no statistically significant effect on the cost of starting a business (as a percentage of income per capita).
- H_0^2: Government regulations have no statistically significant effect on the ease of starting a business (measured by a composite score).

- H_0^3: Government-mandated minimum capital requirements do not significantly impact the financial barriers to business entry.

To control for multiple comparisons, we apply both the Bonferroni and Holm-Bonferroni corrections, ensuring that the family-wise error rate is appropriately managed.

1. Paired T-Test

In our analysis, we perform a paired t-test to compare the rate of change in regulation with the selected features under examination. This allows us to determine whether there is a statistically significant difference in the rate of change between the two sets of paired observations.

V. RESULTS

A. Initial P-Values

For each of our three hypotheses, we present the histograms across both countries and features.

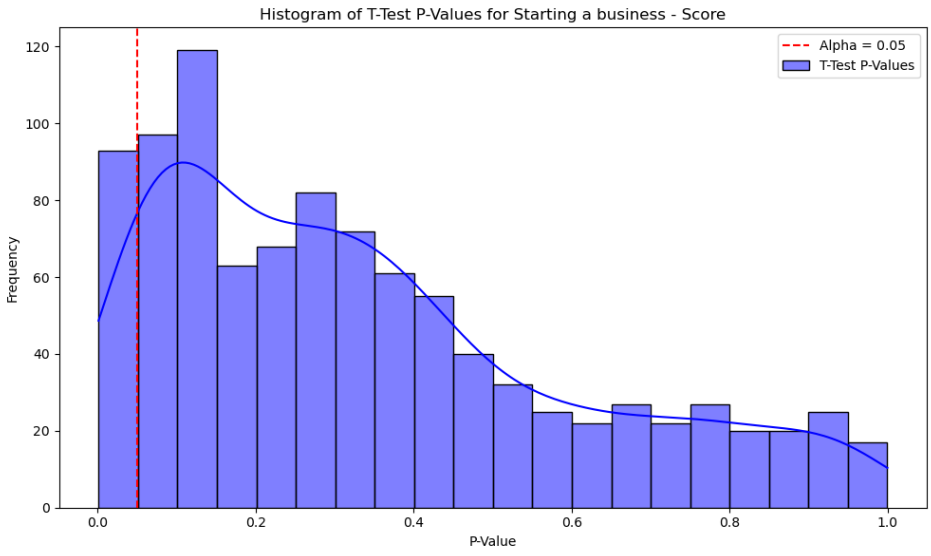

FIG. 1. P-Values for Starting a Business (Score)

Figure 1 shows the P-Values for Starting a Business (Score) H_0^3. The majority of these P-Values are above an initial alpha level of 0.05, indicating that we fail to reject the null hypothesis in most cases.

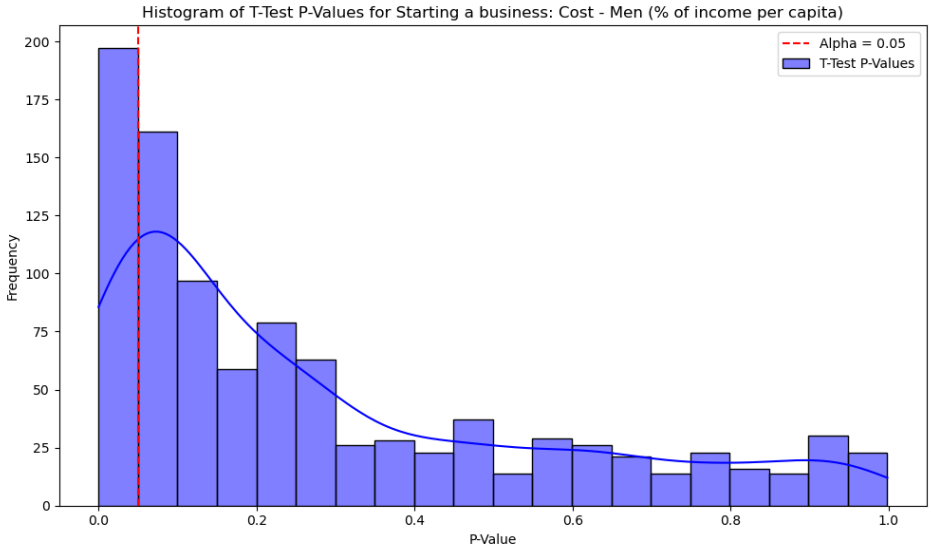

FIG. 2. P-Values for Starting a Business (Cost)

Figure 2 presents the P-Values for H_0^2 Starting a Business (Cost). It is evident that the majority of the P-Values are below or near an alpha level of 0.05, suggesting that we have sufficient evidence to reject the null hypothesis for many of the features related to cost.

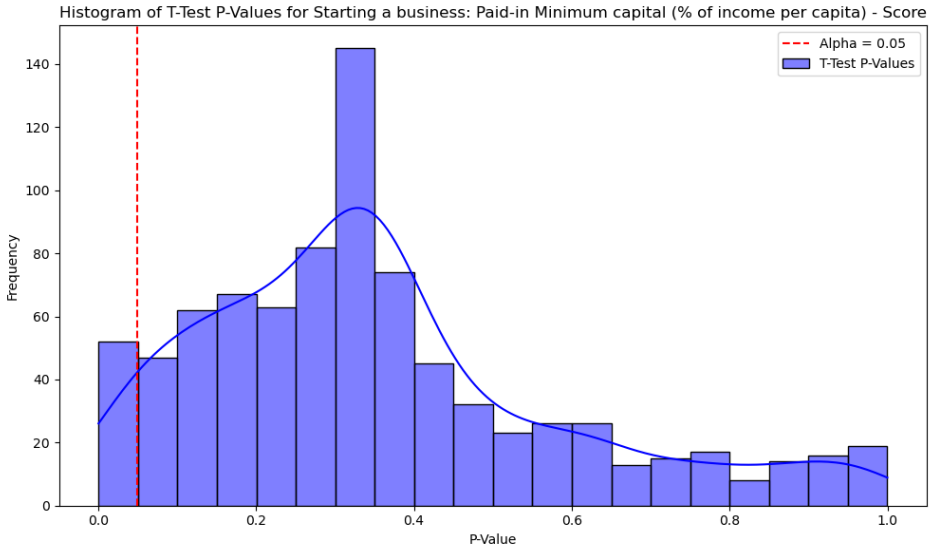

FIG. 3. P-Values for Starting a Business: Paid-in Minimum Capital

Figure 3 shows the P-Values for H_0^3 Starting a Business (Paid-in Minimum Capital). The results do not suggest a compelling story, as the majority of P-Values are above 0.05, meaning we would likely fail to reject the null hypothesis for these features.

1. Independence

To potentially improve our results, we can perform regression analysis to create a classifier θ, and then assess the p-values of the classifier.

By using this method, we uncover stronger evidence of relationships between the variables, as shown in Figure **??**. The key insight here is that, although no individual feature may exhibit a statistically significant relationship with

the target variable, when we apply a regression classifier and evaluate its p-values, we find that a combination of these non-significant values reveals a clearer understanding of the factors influencing the ease of starting a business. This aligns with the problem's context: while a few government regulations may not significantly increase difficulty, the cumulative effect of many regulations could have a much greater impact.

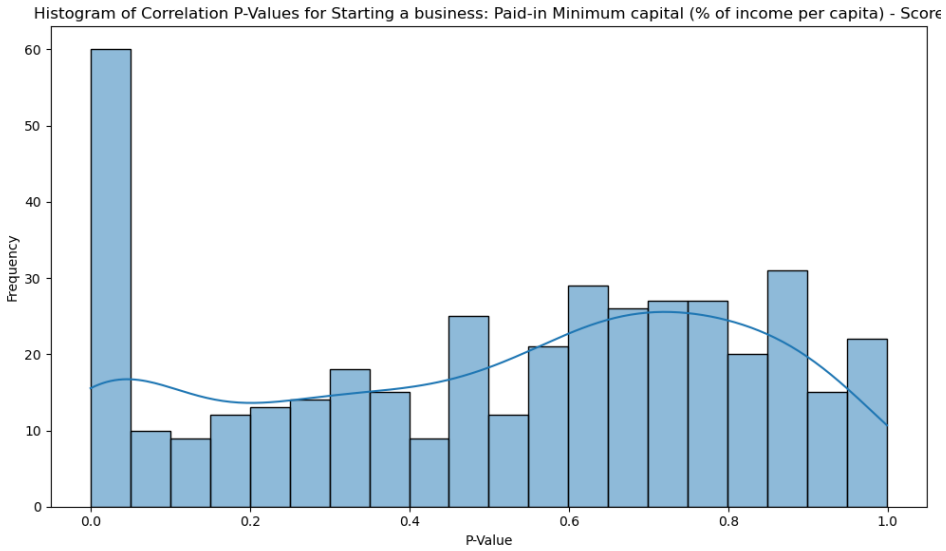

FIG. 4. Piecewise Correlation for P-Values

2. *Acceptance*

Given the initial p-values, we would reject both H_0^1 and H_0^2. If there were no effect on the null hypothesis, we would expect to see uniform or near-uniform distributions. This indicates that there is some effect on starting a business and the cost to start a business based on the amount and strength of government regulations and protections.

B. Multiple Testing Corrections

Given the large number of p-values derived from our analysis, the risk of Type I errors (false positives) is heightened. To mitigate this risk, we applied several multiple testing correction methods, including Family-Wise Error Rate (FWER) control and False Discovery Rate (FDR) control.

1. *FWER-Controlling Corrections*

To control the FWER, we employed the Bonferroni and Sidak corrections, both of which assume independence among the tests. These methods reduce the likelihood of making at least one Type I error across all comparisons.

a. Bonferroni Correction The Bonferroni correction adjusted the significance level (α) by dividing it by the number of comparisons. The resulting adjusted p-values were much more conservative, leading to fewer rejections of the null hypotheses. After applying the Bonferroni correction, only one feature remained statistically significant: Starting a business: Procedures required – Men (number).

2. *Holm-Adjusted Corrections*

We also applied the Holm-Bonferroni correction, a step-down procedure that provides a more powerful alternative to the Bonferroni correction. The Holm adjustment confirmed the findings of the FWER methods, suggesting that, after accounting for multiple comparisons, the majority of the initially significant features were no longer significant. Thus, we failed to reject the null hypotheses for most features.

3. False Discovery Rate (FDR) Control

To control the FDR, we applied the Benjamini-Hochberg (BH) procedure. Given the potential dependencies observed between features, we also considered the Benjamini-Yekutieli (BY) procedure, which is appropriate under arbitrary dependence structures.

a. Benjamini-Hochberg Correction The BH correction identified several features as significant, even after controlling for FDR. This suggests that while FWER methods may be overly conservative, a proportion of the features still display statistically significant effects when controlling the expected proportion of false positives.

b. Benjamini-Yekutieli Correction The BY correction, which is more stringent and accounts for dependency among tests, yielded fewer significant features compared to BH. This indicates that some of the significant findings from the BH procedure could be attributable to dependencies among the features, and caution should be exercised in interpreting these results.

C. Interpretation of Results

The multiple testing corrections applied to our data yielded varying conclusions about the significance of the features under consideration:

- The FWER-controlling methods (Bonferroni and Sidak) were highly conservative, resulting in very few rejections of the null hypotheses. This suggests that the majority of initial findings were likely false positives.

- The Holm adjustment, being slightly less conservative, provided similar results, emphasizing the limited evidence for rejecting the null hypotheses across most features.

- The FDR-controlling methods (BH and BY) indicated that several features could be significant, particularly under the BH procedure. However, the more stringent BY correction reduced the number of significant findings, highlighting the influence of potential dependencies among features.

Overall, these results suggest that while some features may have significant effects, the evidence is not robust across all correction methods. The dependence among features likely plays a role in inflating the number of false positives when less conservative methods are used. Therefore, from a substantive perspective, while there may be some effects of government regulations on the ease and cost of starting a business, the evidence is not unequivocal, and for all but "Starting a business: Procedures required – Men (number)" for H_0^1 we would reject the null hypothesis. In terms of the experiment, this make sense due to the fact that the more procedures required there are the more costly and difficult it would be for one to start a business.

VI. REGRESSION IMPROVEMENTS

To potentially improve our results, To potentially improve our results, we can perform regression analysis to create a classifier θ, and then assess the p-values of the classifier.

By using this method, we uncover stronger evidence of relationships between the variables, as shown in Figure **??**. The key insight here is that, although no individual feature may exhibit a statistically significant relationship with the target variable, when we apply a regression classifier and evaluate its p-values, we find that a combination of these non-significant values reveals a clearer understanding of the factors influencing the ease of starting a business. This aligns with the problem's context: while a few government regulations may not significantly increase difficulty, the cumulative effect of many regulations could have a much greater impact.

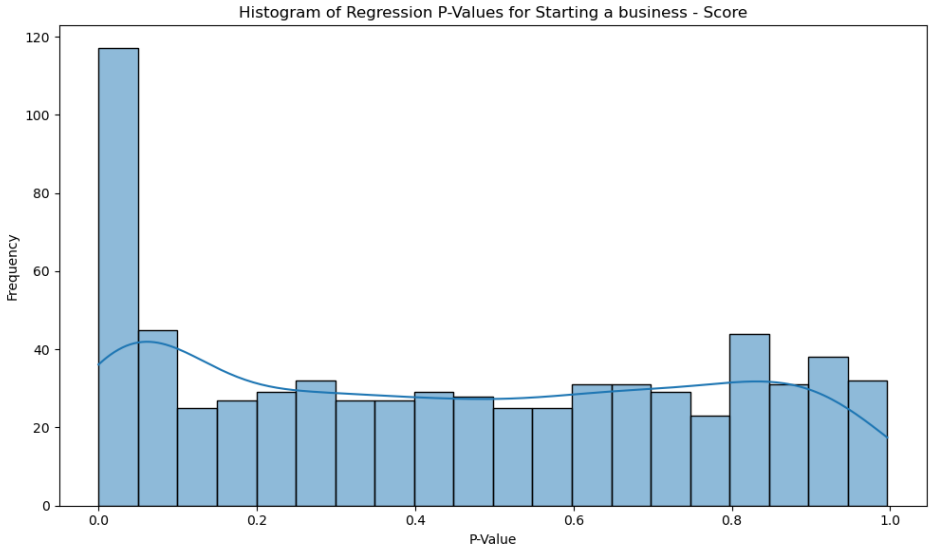

FIG. 5. Regression-Based P-Values for Starting a Business (Score)

What is most interesting about FIG 5, is that our linear classifiers, which in implementation had a PCA like effect, separating the most important components. This is important because when looking at out P-Values, one can clearly see, that there seems to be some uniform P-values, with many non 0 p-values, and I fact, when analyzing the data, this set of classifiers finds, that there is a small set of orthogonal classifiers formed over the entire feature set, whos P-Values that suggest a statistically significant role in effecting business, while the reset of the classifiers provide near uniform distribution, of P-values suggesting no significant statistically importance.

This suggest, that there are certain types and levels of government interventions and regulations that when put together play an important role in effecting the starting a business's. Such as it is important for governments to enforce contracts and have strong well-defined legal channels in place for business disputes, but also not to many businesses set up procures. While neither of these alone results in a significant effect, when combined into a classifier we see an important balance for the role of government.

VII. CONCLUSION

This study analyzed the effect of government regulations on the cost and overall ease of starting a business across 170 countries from 2004 to 2014. Our initial results suggested significant relationships between various features and the ease of starting a business. However, after applying multiple testing corrections, most of these findings were attenuated, indicating that the initial results may have been driven by Type I errors.

The only consistently significant feature across all correction methods was extitStarting a business: Procedures required – Men (number), suggesting that the procedural requirements have a tangible impact on the cost of starting a business. Regression-based analysis further highlighted the cumulative effect of regulations, suggesting that while individual features may not exhibit strong effects, their combination could substantially impact business startup costs.

Future research should explore more sophisticated modeling approaches that account for feature dependencies and use larger datasets to confirm these findings. Additionally, qualitative studies on the specific types of government regulations that most significantly impact business formation could provide further insights into the causal mechanisms underlying our findings.