Regional Institutional Quality and Start up Activities in the US

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Abstract

With innovative mindsets, entrepreneurs organize and manage various factors of production and seize un-grasped profit opportunities. Along with mindset, willingness, and ability, they also require freedom to act on their vision. The freedom to act on their vision can largely depend upon the institutional settings in which they belong. Ample of studies find a positive association between economic freedom and entrepreneurship at the international level. However, limited studies venture on the regional level analysis. This paper provides newer insights into economic freedom and entrepreneurship in the US from 2004 to 2015 using high dimensional panel data and machine learning method designed for causal inference. In this paper, the startup density, available from Kauffman Index of Startup Activities, proxies the entrepreneurship, while, the Economic Freedom of North America (EFNA) index represents economic freedom. The employer firms less than one-year-old that employ at least one person represents the startup density, which measures the number of newly established employer businesses to the total employer business population (in 1,000s). To select on observable confounders, I implement the double-selection post-LASSO method on big-data of nearly 200 variables related to socio, economic, demographic, housing, political features. I find an increase in labor market freedom affects startups density positively but overall business adversely. Furthermore, less restrictive government, tax, and economic freedom adversely affects startups density but affects overall business efficiency.

***Keywords**:*

JEL codes:

1. Introduction

The association between entrepreneurship, economic freedom and growth are mixed at best in the literature. This paper investigates such ambiguous relationship and tries to offer some explanations. Entrepreneurship is a crucial ingredient of economic development (Kibly, 1971; Kirzner, 1997; North, 1990; J. Schumpeter, 1934), economic growth (Carree & Thurik, 2003; Romer, 1986; Wennekers & Thurik, 1999) and the miracles of capitalism (Baumol, 1996;

Bjørnskov & Foss, 2008). Entrepreneurs discover opportunities to employ resources in more productive ways and help the economy to achieve allocative and adaptive efficiency (DiLorenzo, 2005; North, 2010; Schumpeter, 1942). Entrepreneurs have the mindset to seize un-grasped profit opportunities, and in the pursuit of profits, they ponder and take calculative risks to organize and manage various factors of production. These entrepreneurial ability and willingness are the characteristics of entrepreneurs and appear as anthropological constants within all the cultural variations (Kirzner, 1997; Mises, 1949; Rath, 2002).

The decisions to become an entrepreneur comprise the flux between motivation and uncertainty (McMullen, Bagby, & Palich, 2008; North, 2010) while several factors play a different role in such a decision-making process. For example, a matrix of institutional setting like economic freedom within a nation (Ali & Crain, 2002; Cole, 2003) can play a vital role for aspiring entrepreneurs. Gwartney & Lawson (2002) define economic freedom as "the degree to which a market economy is in place, where the central components are the voluntary exchange, free competition, and protection of persons and property.". For entrepreneurs, economic freedom relates to "the freedom to act on their vision" (Powell & Weber, 2013). Economic freedom gives "individuals the opportunity and incentive to arbitrage, take ideas to market, and create value for others, has a positive impact on measures of entrepreneurship across countries" (Hall & Lawson, 2014).

This paper intends to study the effect of economic freedom on the startup entrepreneurial activities in the US. However, any association between economic freedom and startup entrepreneurial activities is likely to be spurious for three reasons. First, the fundamental problem to estimate the impact of economic freedom on entrepreneurial activities is that the state-level economic freedom is not randomly assigned[1], and it is likely that there will be factors that confound to both economic freedom and entrepreneurial activities. Second, a set of confounding factors persist among state-to-state differences in policies, socio-economic profiles, and demographics that are likely related to the overall state-level economic freedom and entrepreneurial activities. For example, it could be the case that entrepreneurial activities are rising over period while economic freedom is also rising but could be due to completely different factors. Without controlling for these confounding

[1] Since the economic freedom is a variable that is not or cannot be randomly assigned therefore the gold standard technique for causal inference like the randomized control trail method is not viable. The researcher cannot randomly select half of the United States and treat it with economic freedom and rest with the dictatorship and then measure whether the outcome like entrepreneurial activities is significantly different among states treated with economic freedom versus states treated with dictatorship.

unobservable, one can mistakenly associate the rise in economic freedom with entrepreneurial activities. Third, there can be other observable time-varying characteristics such as state-level socio, economic and demographic characteristics along with other policies and political attributes that explain the rise in economic freedom with entrepreneurial activities.

This paper's estimation strategy also differs from various conventional economic papers or at least within the subdomain which studies economic freedom and entrepreneurial activities. Most accepted papers regress the entrepreneur activities with economic freedom indicators and various other control variables. Researcher, based on the economic intuitions, select regressors from a potentially vast set of control variables as well as interactions and the other transformation of these regressors. Then, on an ad hoc approach, researcher shows several estimates that are insensitive to a different set of controls selected. These sensitivity analyses are useful but suffer a lack of rigorous justifications. Furthermore, none of any previous research handles the situations when the numbers of regressors are higher than the numbers of observations. This paper contributes to use high dimensional panel data to model impact of economic freedom on the startup activities. In addition to that, most of the study use policy variable or treatment variable as binary for the causal inference, while, evidently the economic freedom is not binary. This paper implements the double-selection post lasso selection method proposed by Belloni, Chernozhukov, & Hansen (2013). Their method is theory grounded machine learning approach to select confounders and instruments from the big data. The findings of this paper contribute to the debate about the impact of institutional quality in entrepreneurship at the regional level.

2. Literature Reviews

Several studies validate the positive link between economic freedom, growth and development (Ali & Crain, 2002; Berggren, 2002; Cole, 2003; de Haan & Sturm, 2000; Gohmann, Hobbs, & McCrickard, 2008; J. Hall, Lacombe, & Shaughnessy, 2018; Heckelman, 2000; Powell, 2003). While, several other studies relate the economic freedom and entrepreneurial activities only (Bjørnskov & Foss, 2008; N. D. Campbell & Rogers, 2007; Díaz-Casero, Díaz-Aunión, Sánchez-Escobedo, Coduras, & Hernández-Mogollón, 2012; J. C. Hall, Nikolaev, Pulito, & Vanmetre, 2012; McMullen et al., 2008; Powell & Weber, 2013). For example, Sobel (2008) tests the institutional quality proxied by Economic Freedom North American (ENFA) index on productive, unproductive and net state entrepreneurial activity and concludes good institutional quality

experiences higher venture capital investment, patents, sole proprietorship growth rate, substantial and total firm establishment birthrate, and lower rate of unproductive political and legal entrepreneurship. Sobel & Hall (2008) provide evidence that the differences of regional entrepreneurship across US states can be explained by the difference of the regional economic freedom, in which they measure entrepreneurial activities by the Kauffman Index of Entrepreneurial Activity. Similarly, Wiseman & Young (2011) also find a positive relationship between US state-level net entrepreneurial activity. Cumming & Li (2013) analyze the effect of the state public policy (proxied with disaggregated EFNA) on new firm births, net births, venture capital and patents with 18 different empirical models and finds that the smaller government size promotes firm creation and that labor market freedom is positively associated with firm creation, net births, and venture capital, but is unrelated to patents. These results are robust to different controls; state fixed effects and model specifications.

However, in a recent study of Campbell, Mitchell, & Rogers (2013) checks the robustness of the effects of economic freedom by using five different spatial measures of entrepreneurial activity. They find that economic freedom is not a consistently significant predictor of entrepreneurship in US states. About this, the general relationship between unemployment and entrepreneurship provides mixed results with many studies showing positive relationships, negative relationships, and zero relationships Parker (2009).

Another set of literature relates economic freedom to: migration (Ashby, 2007; Ashby, Bueno, & Villarreal, 2013; Hall & Lawson, 2014; Mulholland & Hernández-Julian, 2013; Shumway, 2018); inequality (Apergis, Dincer, & Payne, 2014; Ashby & Sobel, 2008; Bennett & Nikolaev, 2017; Bjørnskov, 2017; Pérez-Moreno & Angulo-Guerrero, 2016; Webster, 2013); cultural diversity (Sobel, Dutta, & Roy, 2010); political economy (for more detail survey see J. Hall, Stansel, Tarabar, & Hall (2015)), demographic features like race (Deskins & Ross, 2016; J. C. Hall, Humphreys, & Ruseski, 2018; Hoover, Compton, & Giedeman, 2018).

Controlling for these variables along with the various socio-economic-demography profile of US states, this paper investigates how the index of economic freedom explains the entrepreneurial startup activities in the United States from 2004 to 2015. This paper implements the recently developed double-selection post-lasso method which is a causal inference method based on machine learning.

3. Data

3.1 The startup density

Previous literature uses the sole proprietorship rate and new business starts as a proxy for entrepreneurial activity. However, I use "startup density" as the proxy to measure the startup entrepreneurial activities in the US. This variable is available from the Startup Activity Indices of the Kauffman Index of Entrepreneurship. The Kauffman Index of Entrepreneurship measures the US entrepreneurship across the national, state, and metro levels based on three in-depth studies known as the Kauffman Index of Startup Activity, the Kauffman Index of Main Street Entrepreneurship, and the Kauffman Index of Growth Entrepreneurship (Tareque, Fairlie, & Morelix, 2017). This index has been referenced in "multiple testimonies to the U.S. Senate and House of Representative, by U.S. Embassies and Consulates across various countries—including nations like Spain, Ukraine, and United Kingdom—by multiple federal agencies, by state governments and governors from fifteen states— from Arizona to New York—and by the White House's office of the President of the United States" (Morelix, Fairlie, Russell-Fritch, & Reedy, 2015). The KIEA data exist for each state from 1996, but due to the limitation concerning the covariate data, I use the data from 2005 to 2015.

Figure-1: Startup Density Index [about here]

Figure 1 exhibits the startup density– the employer firms less than one-year-old that employs at least one person. The startup density is the number of newly established employer businesses to the total employer business population (in 1,000s). Both numbers come from the Bureau of Labor Statistics Business Dynamics Statistics (BDS) and are taken from the universe of businesses with payroll tax records in the United States, as recorded by the Internal Revenue Service. The startup density is a measure of the rate of creation of businesses with employees. These employer businesses are generally larger and have higher growth potential than non-employer businesses do because companies captured by this indicator have employees, they tend to be at a more advanced stage than are the companies in the rate of new entrepreneurs' measure. Although new businesses with employees represent only a small share of all new businesses, they represent an important group for job creation and economic growth (Morelix et al., 2015; Tareque et al., 2017).

3.2 The Economic Freedom of North America index

As the proxy of the institution, I use the subnational index of the Economic Freedom of North America which the Fraser Institute annually publishes. It measures the extent to which the policies were supportive of economic freedom and the ability of individuals to act in the economic sphere free of undue restrictions. The all-government index compares the jurisdictions in different countries while the subnational index compares the individual jurisdictions within the same country. In this research, I use the subnational index called the Economic Freedom of North America for the United States (see panel A1 of figure-2) which comprises of ten components of the subnational index fall into three areas: Area 1 known as Government Spending (government freedom index henceforth), Area 2 Taxes (tax freedom index henceforth), and Area 3 Labor Market Freedom on a relative ranking scale from 0 to 10 for each US states (Stansel, Torra, & McMahon, 2017). A higher score on each of the index represents higher economic freedom.

Figure-2: The Economic Freedom of North America index and Sub-indices [about here]

The government freedom index (plotted in panel A.2 in figure-2) of the subnational EFNA is the composite of three other indices: General Consumption Expenditures by Government as a Percentage of Income (1A); Transfers and Subsidies as a Percentage of Income (1B) and Insurance and Retirement Payments as a Percentage of Income (1C). Higher government freedom index shows larger government size and potentially less freedom for private choices. The tax freedom index (plotted in panel A.3 in figure-2) of the subnational EFNA comprises of income and payroll tax revenue as a percentage of income; top marginal income tax rate and the income threshold at which it applies; property tax and other taxes as a percentage of income; and sales tax revenue as a percentage of income (Gwartney et al., 1996). All these components server to quantify the tax burdens. The labor market freedom index (plotted in panel A.4 in figure-2) of the subnational EFNA comprises an index of minimum wage legislation; government employment as a percentage of total state/provincial employment and union density (Stansel et al., 2017).

Control variables

In this study, first, we review several studies that relate the economic freedom, entrepreneurship, and growth with the various control variable. As stated earlier, several studies have related economic freedom and growth with migration, inequality, cultural diversity, political economy and demographic features like race. Based on these studies, we gather various control variable from the US Census Bureau data profile of each US states from 2004 to 2016. These control variables

comprise of culture proxied by born place, race; quality of lives; poverty and inequality; economic variables; demographic features; socio-economic-demographics and migration. The fraction of state and senate house that's is democrats along with unemployment rate, population, gross state product, percent of low-income uninsured children, personal income, workers compensation, poverty rate are retrieved from the National Welfare data provided from the University of Kentucky Center for Poverty Research (UKCPR).

In aggregate the data comprises 58 different variables (see Appendix A.1). Then we consider a square polynomial of all these variables and all the possible interaction among 58 variables. Therefore, the covariate matrix comprises of total 58 + 58 + 58*57/2 = 1769 variables for 50 US states for 11 years (from 2005 to 2015). The dataset we observe is the unbalanced (Nebraska does not have state and senate house) panel dataset with 1769 control variables with 550 observation running a general panel estimation, therefore, is not feasible. In the estimation strategy section, we lay out a detail explanation on how to perform a causal estimation while controlling for the big data which may have proper explanation power and nuances as well.

4. Estimation Strategy

Consider the following basic model set up:

$$y_{it} = \alpha a_{it} + z'_{it}\beta + \delta_i + \gamma_t + \varepsilon_{it}$$

Where i indexes states, t indexes times, δ_i are state-specific effects that control for any time-invariant state-specific characteristics, γ_t are time-specific effects that control flexibly for any aggregated trends, z_{it} are a set of control variables to control for time-varying confounding state-level factors, a_{it} is a measure of the economic freedom relevant for the entrepreneurial activities and y_{it} is the entrepreneurial activities in each state in each time. For the analysis, we argue that economic freedom is defined as exogenous relative to the entrepreneurial activities once the observables have been conditioned.

The main point of departure of this paper from the standard literature is that z_{it} allows a much richer set of control variables. Such addition of controls allows for the possibility that there may be some feature of a state that is associated with both economic freedom and entrepreneurial

activities. For example, different socio-economic, political and demographic features of the state could lead to having an initially high-levels of economic freedom which could be associated with having higher economic freedom and entrepreneurial activities. Failure to control for these factors could then lead to misattributing the effect of this initial factor, perhaps driven by policy or state-level socio-economic and demographics, to the effect of entrepreneurial activities. Other than including many socio, economic, political and demographic features, the paper also allows higher-order terms of the control variables and interaction terms. Technically, allowing richer set z_{it} has an important step mainly to avoid type–I error and type–II error. Type-I represents the situation when the null hypothesis is rejected when it is true. This situation arises when an irrelevant variable is included in the model. Type-II error, on the other hand, represents the situation when the null hypothesis is accepted when it is false. This situation arises when a relevant variable is omitted from the model. Type–I error leads to loss of efficiency whereas type–II error leads to specification error. The cost of type–II error is much more significant than the cost of type–I error.

The richer set z_{it} leads to a high-dimensional setting and an estimation based on the least-squares estimation in such high-dimensional setting is at worst infeasible and at best prone to overfit the data. Traditionally, there exist at least two methods: dimension reduction in the linear model with principal component analysis (PCA) and regression subsetting. PCA is commonly used to reduce dimension when the likelihood function is normal. PCA creates principal components using linear combinations of a much larger set of variables from a multivariate dataset. Interpreting the coefficients on the principal components requires the researcher first to interpret the principal components, which can prove a challenge as all variables have non-zero loadings. While the regression subsetting in an alternative approach to dimension reduction is to assume that the right model is well approximated by a subset of few explanatory variables. In the context of linear regression, this implies the coefficient vector has some elements equal to 0. In this situation, the coefficient vector is said to be sparse. In this paper, the numbers of observations n is smaller than the numbers of variables p i.e. $n \ll p$ therefore the traditional approaches to select variable based on the regressing subsetting like selection method based on minimizing the Akaike information criterion (AIC) or Bayesian information criterion (BIC) or maximizing the adjusted R^2 are infeasible because to use any of these methods requires calculating 2^p models (all the possible combination of p variables). Given a large number of variables in the set of the control variable

z_{it} and the combinatorial nature of this approach, these approaches are computationally prohibitive. Furthermore, regression subsetting model with the p^* selected variables, if the $p^* \geq n$ the least square estimation will not generate the standard error and if the $n \geq p^*$ the regression subsetting based on AIC, BIC or R^2 usually overfits the data.

The least absolute shrinkage and selection operator (LASSO) described in Tibshirani, (1996) provides a feasible alternative. LASSO simultaneously performs model selection and coefficient estimation. Owing to a penalty function, coefficients are biased towards 0 but can still be consistent. In short, LASSO (i) screens for essential variables, (ii) provides easily interpreted coefficients, and (iii) performs well in out-of-sample testing. However, LASSO estimation generates biased but consistent coefficients. Given a large number of observations in the dataset, biased but consistent coefficients can improve out-of-sample performance, but for causal inference, coefficient needs to be unbiased and consistent.

Note that interpreting estimates of the effect of economic freedom on the entrepreneurial activities from the model of the equation as causal relies on the belief that there are no higher-order terms of the control variables, no interaction terms, and no additional excluded variables that are associated both to economic freedom and entrepreneurial activities. Thus, controlling for a large set of variables as described above is desirable from the standpoint of making this belief more plausible. At the same time, naively controlling lessens our ability to identify the effect of interest and thus tends to make estimates far less precise.

In this paper we juggle the tradeoff between controlling for very few variables (which may leave us wondering whether we have included sufficient controls for the exogeneity of the treatment) and controlling for so many variables (that we are essentially mechanically unable to learn about the effect of the treatment) with an efficient, data-driven way to search for a small set of influential confounds (that one could potentially learn about the treatment) from among a sensibly chosen broad set of potential confounding variables known as the double-post-Lasso procedure proposed

by Belloni, Chernozhukov, & Hansen (2013). The double-post-Lasso procedure proposed by Belloni, Chernozhukov, & Hansen (2013) comprises of the following steps[2]:

1. In the first step, a set of control variables that are useful for predicting the treatment of economic freedom are selected using the LASSO procedure. This step helps to ensure robustness by finding control variables that are strongly related to the treatment and thus potentially important confounding factors.
2. In the second step, additional variables are selected from the control variables that predict entrepreneurial startup activities to ensure important variables to exits in the equation of interest, ideally helping keep the residual variance small as well as intuitively providing an additional chance to find essential confounds.
3. In the final step, we estimate the treatment effect α by the linear regression of y_{it} on the treatment a_{it} and the union of the set of variables selected in the two variable selection steps.

In short, I first run Lasso of y on z to select a set of predictors for y and run Lasso of a on z to select a set of predictors for a. The α is then estimated by running OLS regression of y on a, and the union of the sets of regressors selected in the two Lasso runs, and inference is corrected merely with usual heteroscedasticity robust OLS standard error from this regression.

4. Results and Discussions

The random assignment of treatment is the gold standard for claiming the causal effect. In our case "economic freedom" is not feasible to assign randomly; therefore, we must rely on the observational studies. To disentangle the effect of treatment (economic freedom) on the outcome variable (startup entrepreneurial activities) at least all the confounding factors should be controlled. Based on the literature review, I gather the potential variable list of the confounders. The data of these confounders then are collected from various database. The results presented in this section are based on the double post lasso selection method, which tweaks a machine learning method

[2] For the theoretical arguments see (Belloni et al., 2013; Belloni, Chernozhukov, & Hansen, 2014; Nowak & Smith, 2017).

called lasso and provides data-driven theory grounded approach for the variable selection for the model. The outcome variable is the "start-up density," and treatment variable is the various indicators for economic freedom namely: government freedom, taxes freedom index and labor market freedom index.

4.1 Impact of government freedom index on startup density.

The table-1 shows the impact of the government freedom index on the startup density using six different models. Note that higher government freedom represents less total government spending. The coefficient of interest is the impact of government freedom on the startup density is given in the first row. The coefficients presented in model 5 and model 6 are the primary coefficient of interests. Other than naïve OLS (NOLS) and naïve fixed effects (NFE), rest of the model presents the estimates of regression of startup density on the government freedom index using the confounding variable selected based on the double post lasso selection method. The standard errors are corrected with HAC. The table-1 presents few significant covariates only. Net-migration is given in terms of the percentage of the total population. PCGSP and PCWC represent the per capita gross state product and per capita wage compensation. The construction and industry represent the sectorial composition or share of the respective industry to the total industry. Foreign-born represents the percentage of the foreign-born population. The native-born SSR represents the percentage of the population who are native born in the US who are resident in the same state where they were born. The SHR 1-year ago represent the percentage of the population who are in the same house resident for at least a year. The value 300k-500k shows the percentage of Owner-occupied units whose values are within 300,000 dollars to 500,000 dollars.

Table-1: Impact of government freedom index on startup density. [about here]

The first model given as NOLS (1) is a naïve OLS model that gives the estimates of regression of startup density on the government freedom index. It suggests that one unit increase in government freedom affects startup density by 3.884 units or increases by about four units of newly established employer businesses to the total employer business population (in 1,000s). This estimation can be contaminated by observed and unobserved confounding factors.

The second model, given as NFE is naïve fixed effect model uses year and state fixed effects of soaking up the unobserved heterogeneity related with time and states. The estimates of regression

of startup density on the government freedom index are about 0.5 units suggesting a unit increase in government freedom index increases about 0.5 units of newly established employer businesses to the total employer business population (in 1,000s). The NFE estimate is smaller than that of NOLS estimates suggesting, state and year fixed effect accounted for the unobserved heterogeneity. It is clearer that state and year fixed effect accounts for the unobserved heterogeneity when we compare the estimates of NOLS 3.884 and the pooling regression (without any fixed effects) in the model (3) 3.022 with the NFE to estimates 0.588. The positive coefficients suggest the crowding in of the startups with increased government freedom.

The model (4) is a random-effects regression model. The estimates of the impact of government freedom on the startup density are 2.734 shows the estimates of regression of startup density on the government freedom index as 3.022. Since the data is in state-level random estimates are not appropriate. The model (5) is the fixed effect model with covariates selected using the double selection from a list of 38 different variables and model (6) is also the fixed effect model with covariates selected using the double selection from a list of 119 different variables. Both models show the effect of government freedom index on the startup density to be around -2 suggesting a decline of about two newly established employer businesses to the total employer business population (in 1,000s) for a unit rise in the government freedom index. This result is interesting suggesting increased government freedom or reduction of government spending is associated with a decline in the startup activities. In another term, the negative coefficients suggest crowding out of the startups with increased government freedom.

The government freedom index is composite of three other subcomponents: general consumption expenditures by the government as a percentage of income; insurance and retirement payments as a percentage of income and transfers and subsidies as a percentage of income. The rise of general consumption expenditure (1A) serves two broad government functions: protection of individuals against invasions by domestic and foreign intruders (productive function) and the provision of the public goods (productive function) (James Gwartney et al., 1996). Beyond these two functions, the government provision of private goods can restrict the consumer choices thus suppress economic freedom. In other words, government spending, independent of taxation, once exceeds the necessary minimum level of protective and productive function can reduce economic freedom. An increase in government consumption lowers the score of government spending index.

Similarly, an increase in transfer and subsidies is the government redistribution strategy and is associated with the rise of taxation. The taxation restricts an individual to harvest the full benefits of their labor and reduces the real returns of such activity (Gwartney et al., 1996). Therefore, a higher level of transfers and subsidies lowers the government freedom index. When the private and voluntary arrangement of retirement and insurance are replaced by the insurance and retirement payments due to mandatory government programs of insurance and retirement, it infringes and lowers the scores of the government freedom.

Intuitively, higher government freedom should incentivize to startup. However, our findings on this paper suggest otherwise that the increased government freedom or reduction of government spending is linked with a decline in the startup activities. In other words, people tend to start up in a more restricted environment. One potential interpretation would be lower government freedom suggesting necessity driven entrepreneurial startup activities. Since the startup is recorded as the newly established employer businesses to the total employer business population (in 1,000s) therefore; higher government freedom is linked with better opportunities for the business other than the startups, therefore does not defy the economic logic.

4.2 Impact of tax freedom on startup density

The table-2 shows the impact of tax freedom on the startup density. The structure of table-2 is same as the table-1. Therefore, we will only focus on the estimates given in the model (5) and model (6). The covariates PCPI is the log of per capita personal income, Native-born DS represent the percentage of the population who are born in the US but resides in the different states while rest of the covariates are similar as presented in the table-1.

Table-2: Impact of tax freedom on startup density [about here]

Since the structure of table-2 is same as the table-1, we will only focus on the estimates given in the model (5) and model (6). Indeed, these estimates of the impact of tax freedom on the startup density are roughly -4 and statistically significant. These estimates show that the per unit increase in tax freedom leads to about four new establishments per 1000's new establishment. Intuitively, higher tax burdens restrict the private choices; thus the tax freedom declines; therefore, the index of tax freedom score goes down and adversely affects the entrepreneurial activities. However, the estimates seem to be counter-intuitive that the higher tax freedom adversely affects the startup

activities. However, the startup is recorded as the newly established employer businesses to the total employer business population (in 1,000s); therefore; higher tax freedom is linked with better opportunities for the business other than the startups.

4.3 Impacts of labor market freedom on the startup density

The table-3 shows the impact of the labor market freedom index on the startup density. Again, the structure of this table is the same as previous and selected covariates are about the same. The standard errors are HAC corrected. The coefficients of the interests are in the model (5) and model (6). The estimated coefficient of the impact of labor market freedom on the startup density is positive and about 5. This suggests a unit increase in the labor market freedom is associated with the about 5 unit increase in the new startup establishment in 1000's establishments.

Table-3: Impacts of labor market freedom on the startup density [about here]

The labor market freedom index is a composite of other indices like government employment as a percentage of total state employment; minimum wage legislation and; union density. The government employment as a percentage of total state employment, if increase beyond the protective and productive functions, shows government's attempt: to supply the goods and services which otherwise could be provided by private sectors or individuals would not care to obtain if provided by the private sectors. Higher government employment as a percentage of total state employment, therefore, restricts individuals and organization to freely contract the labor services (Stansel et al., 2017).

The minimum wage legislation is measured as the percentage of annual income of full-time workers as of per-capita income. High minimum wages restrict the ability of employees and employers to negotiate contracts to their liking (Stansel et al., 2017). In particular, minimum wage legislation restricts the ability of low-skilled workers and new entrants to the workforce to negotiate for employment they might otherwise accept and, thus, restricts the economic freedom of these workers and the employers who might have hired them (Stansel et al., 2017). This component measures the annual income earned by someone working full time at the minimum wage as a percentage of per-capita income.

As the minimum wage grows relative to productivity, thus narrowing the range of employment contracts that can be freely negotiated, there are further reductions in economic freedom, resulting

in a lower score for the jurisdiction. For example, minimum wage legislation set at 0.1% of average productivity is likely to have little impact on economic freedom; set at 50% of average productivity, the legislation would limit the freedom of workers and firms to negotiate employment to a much greater extent. For instance, a minimum wage requirement of $2 an hour for New York will have little impact but, for a developing nation, it might remove most potential workers from the effective workforce. The same idea holds, though in a narrower range, for jurisdictions within Canada and the United States.

4.4 Impacts of economic freedom index on startup density

The table-4 shows the impact of economic freedom on the startup density. The estimates are given in model (5) and model (6) suggest a decline of about 7 startups in 1000 new establishment for per unit increase in economic freedom. Economic freedom is an equally weighted average of the government, tax, and labor market freedom.

Table-4: Impacts of economic freedom index on startup density [about here]

4.7 Robustness Checks

In the previous selection, 58 different variables were used to select the model. Now, to check the robustness, we include 58 variables, their square terms, and the interactions. This leads us to 58 + 58 + 58*57/2 = 1769 variables as potential confounder. We perform double post lasso selection on these 1769 variables. The primary reason to do so is to allow any potential quadratic relationship and interaction relationship. The impact of government, tax, labor market and economic freedom were found to about the same when we allow an even much richer set of potential confounders. This helps to conclude that with 58 variables we are properly selecting the confounders.

Table-5 [about here]

The estimates in the robustness check are very similar to what we have found in the results section. These estimates suggest that startups occurs in less government, tax and economic freedom regimes alternatively business other than startup thrive better in higher government, tax, and economic freedom regimes. While the labor market freedom is associated with higher startups, this represents that higher labor freedom is not good for the business other than startup.

Conclusions

The relation of economic freedom to the entrepreneurial activities seems intuitive and obvious; however, to estimate such relation can be tough due to an inability of proper selection on the observables. Our study identifies the causal impact of economic freedom on startup entrepreneurial actives based on the proper selection on the big data of observable features. Meanwhile, proper selection on the unobservable is also essential however we assume and seems plausible that year and state fixed effect along with the proper selection on the big dataset of observables potentially nullify the endogenous effect. Furthermore, there may be some indirect channel of the entrepreneurship affecting other variables (like state growth) which might affect the economic freedom which might feedback endogeneity due to reverse causality, but we only estimate the effect of economic freedom to the entrepreneurship. Therefore, our estimates are probably not contaminated by reverse causality. Also, we study the startup entrepreneurial activities. Therefore, economic freedom might affect startup entrepreneurial activities and not the other way around.

In this study, first, we review several studies that relate the economic freedom, entrepreneurship, and growth with the various control variable. Based on these studies, we gather various control variable from the US Census Bureau data profile of each US states from 2005 to 2015. The data profile comprises 58 different variables. Then we consider a square polynomial of all these variables and all the possible interaction among 58 variables. Therefore, our covariate matrix comprises of total 58 + 58 + 58*57/2 = 1769 variables for 50 US states for 11 years (from 2005 to 2015). Then we use the startup density with entrepreneurial startup activities. Then we use the treatment variable as the Economic Freedom of North America for the United States which comprises of ten components of the subnational index fall into three areas: Government freedom, Taxes, and Labor Market. These variables are available for the 50 US states for 11 years (from 2005 to 2015). Therefore, our analysis comprises of balanced panel dataset; however, then we have more variables than observation which is known as thick data or big dataset. Hence the usual method of estimation is not feasible. Therefore use the double-post-Lasso procedure proposed by Belloni, Chernozhukov, & Hansen (2013). First, we make variable selection regressing the treatment variables (various variables related to economic freedom) with big data of covariates, secondly, we perform variable selection regressing the outcome variables (various variable related with startup entrepreneurship) with big data of covariates and lastly, we regress outcome variable with the treatment variable and union of selected variables performed in above two steps. Then we provide the results of the impact of the treatment variables on the outcome variables. Such double

selection, in general, disentangle the nuances, and proper selection on the observables is performed.

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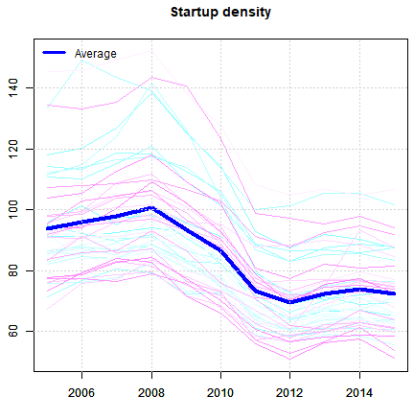
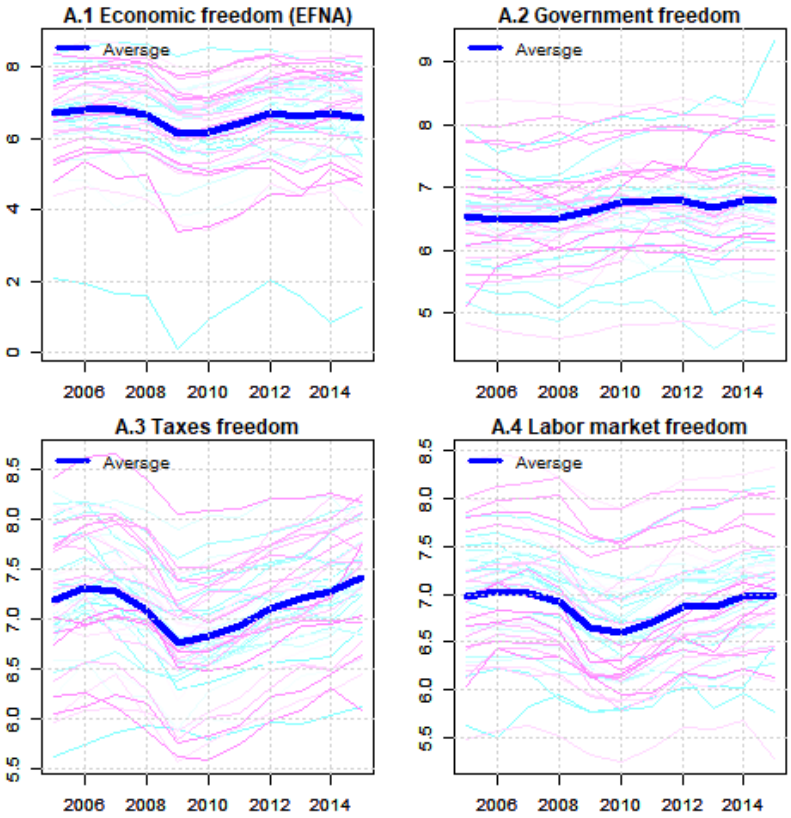
Appendix

Figure-1: Startup Density Index



Note: Each line represents time series of each US state and the solid think line represents the average of US states.

Figure-2: The Economic Freedom of North America index and Sub-indices



Note: Each line represents time series of each US state and the solid think line represents the average of US states.

Table 1: Impact of government freedom index on start–up density

	Start–up density (in 1,000s)					
	NOLS	NFE	Pool	Random	FE	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Govt. freedom index	3.884***	0.558	3.022**	2.734**	−2.025	−2.277**
	(0.864)	(1.555)	(1.190)	(1.109)	(1.258)	(1.157)
Net migration			−0.080	0.815	0.519**	0.795***
			(0.635)	(0.550)	(0.231)	(0.288)
PCGSP (Ln)			17.861**	25.393***	34.309***	33.172***
			(7.494)	(8.910)	(8.744)	(10.225)
PCWC (Ln)			0.031***	0.053***	0.071**	0.071**
			(0.012)	(0.018)	(0.029)	(0.032)
Construction (%)			3.859***	5.527***	2.357***	1.894***
			(0.805)	(0.595)	(0.582)	(0.449)
Information (%)			10.403***	7.979***	−0.866	−1.962**
			(2.797)	(1.757)	(0.950)	(0.982)
Foreignborn (%)			1.153***	1.529***	1.500**	
			(0.283)	(0.252)	(0.671)	
Nativeborn SSR (%)						−0.786***
						(0.272)
SHR 1-year ago (%)						1.332**
						(0.650)
Value 300k-500k (%)						0.214*
						(0.113)
Year fixed effects	-	Yes	-	Yes	Yes	Yes
State fixed effects	-	Yes	-	Yes	Yes	Yes
Selected covariates	-	-	Yes	Yes	Yes	Yes
Observations	550	550	550	550	550	550
R^2	0.041	0.001	0.774	0.740	0.364	0.385
Adjusted R^2	0.039	−0.122	0.767	0.732	0.261	0.271
F Statistic	23.551***	0.411	107.123***	89.276***	15.892***	10.752***

Note: *p<0.1; **p<0.05; ***p<0.01

Table 2: Impact of tax freedom index on start–up density

	Start–up density (in 1,000s)					
	NOLS	NFE	Pool	Random	FE	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Taxes freedom index	1.086	−5.044***	3.561**	0.922	−4.662***	−4.175**
	(0.927)	(1.921)	(1.636)	(1.882)	(1.808)	(1.663)
PCPI (Ln)			−68.975***	−78.631***	31.737***	28.985***
			(10.129)	(8.662)	(9.575)	(11.238)
Construction (%)			5.272***	6.388***	1.737***	1.270***
			(0.843)	(0.641)	(0.647)	(0.473)
Information (%)			7.625***	7.000***	−1.569*	−1.703**
			(2.457)	(1.821)	(0.929)	(0.841)
Foreignborn (%)			1.029***	1.101***	2.435***	
			(0.327)	(0.354)	(0.745)	
Nativeborn DS (%)						−2.340***
						(0.906)
Nativeborn SSR (%)						−2.979***
						(0.817)
Value 300k-500k (%)						0.421***
						(0.162)
Year fixed effects	-	Yes	-	Yes	Yes	Yes
State fixed effects	-	Yes	-	Yes	Yes	Yes
Selected covariates	-	-	Yes	Yes	Yes	Yes
Observations	550	550	550	550	550	539
R^2	0.002	0.038	0.783	0.731	0.342	0.359
Adjusted R^2	0.0002	−0.080	0.776	0.722	0.235	0.243
F Statistic	1.104	19.121***	106.442***	80.346***	13.645***	10.214***

Note: *p<0.1; **p<0.05; ***p<0.01

Table 3: Impact of labor market freedom index on start–up density

	Start–up density (in 1,000s)					
	NOLS	NFE	Pool	Random	FE	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Labor market freedom	3.680***	9.299***	4.929***	5.529***	4.965***	4.841***
	(1.366)	(3.142)	(1.848)	(1.851)	(1.828)	(1.772)
Net migration (%)			−0.552	0.326	0.184	0.566**
			(0.644)	(0.711)	(0.230)	(0.282)
PCPI (Ln)			−56.518***	−66.102***	45.585***	44.934***
			(7.010)	(7.950)	(12.966)	(14.798)
Bedrooms 5+ (%)			0.367*	0.337	−1.955*	−2.700**
			(0.197)	(0.239)	(1.022)	(1.120)
No bedrooms (%)			2.035***	2.006***	−1.066	−1.078*
			(0.335)	(0.329)	(0.657)	(0.638)
Construction (%)			4.495***	5.011***	2.237***	1.837***
			(0.607)	(0.529)	(0.629)	(0.446)
Information (%)			11.114***	8.823***	−1.544*	−2.253**
			(1.866)	(1.686)	(0.856)	(0.955)
Foreignborn (%)			1.195***	1.430***	2.242***	
			(0.266)	(0.285)	(0.765)	
Native born SSR						−1.344***
						(0.313)
Year fixed effects	-	Yes	-	Yes	Yes	Yes
State fixed effects	-	Yes	-	Yes	Yes	Yes
Selected covariates	-	-	Yes	Yes	Yes	Yes
Observations	550	550	550	550	550	550
R^2	0.014	0.096	0.815	0.759	0.312	0.336
Adjusted R^2	0.013	−0.015	0.809	0.750	0.196	0.211
F Statistic	7.956***	52.022***	116.900***	83.442***	10.645***	8.341***

Note: *p<0.1; **p<0.05; ***p<0.01

Table 4: Impact of economic freedom index on start–up density

	Start–up density (in 1,000s)					
	NOLS	NFE	Pool	Random	FE	FE
	(1)	(2)	(3)	(4)	(5)	(6)
Economic freedom index	5.176***	1.757	3.898**	3.392*	−6.732**	−6.781**
	(1.376)	(3.206)	(1.707)	(1.826)	(2.678)	(2.660)
Net migration (%)			−0.253	0.842	0.564**	0.726**
			(0.719)	(0.815)	(0.243)	(0.327)
PCPI (Ln)			−56.149***	−65.481***	67.765***	66.403***
			(8.113)	(9.167)	(12.639)	(15.282)
No bedrooms (%)			2.062***	1.912***	−1.148*	−1.008*
			(0.377)	(0.338)	(0.661)	(0.570)
Walked (%)			2.128**	1.638**	1.818**	1.926*
			(0.943)	(0.773)	(0.790)	(1.049)
Construction (%)			3.792***	5.004***	2.499***	2.039***
			(0.685)	(0.519)	(0.588)	(0.475)
Information (%)			9.046***	7.001***	−1.381	−2.091**
			(1.942)	(1.614)	(0.938)	(0.925)
Foreignborn (%)			1.573***	1.638***	1.654**	
			(0.215)	(0.243)	(0.721)	
Nativeborn SSR						−1.239***
						(0.292)
Year fixed effects	-	Yes	-	Yes	Yes	Yes
State fixed effects	-	Yes	-	Yes	Yes	Yes
Selected covariates	-	-	Yes	Yes	Yes	Yes
Observations	550	550	550	550	550	539
R^2	0.028	0.003	0.794	0.741	0.308	0.332
Adjusted R^2	0.026	−0.120	0.787	0.732	0.195	0.201
F Statistic	15.906***	1.259	113.714***	84.483***	11.688***	7.446***

Note: *p<0.1; **p<0.05; ***p<0.01

Table 5: Robustness check

	Start–up density (in 1,000s)			
	FE	FE	FE	FE
	(1)	(2)	(3)	(4)
Goverment freedom	−3.147**			
	(1.477)			
Tax freedom		−4.937***		
		(1.595)		
Labor market freedom			3.306*	
			(1.904)	
Economic freedom				−5.263**
				(2.566)
Year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
Selected covariates	Yes	Yes	Yes	Yes
Observations	550	550	550	550
R^2	0.354	0.394	0.419	0.383
Adjusted R^2	0.218	0.269	0.281	0.250
F Statistic	6.900***	8.451***	6.947***	7.372***
Note:				*p<0.1; **p<0.05; ***p<0.01

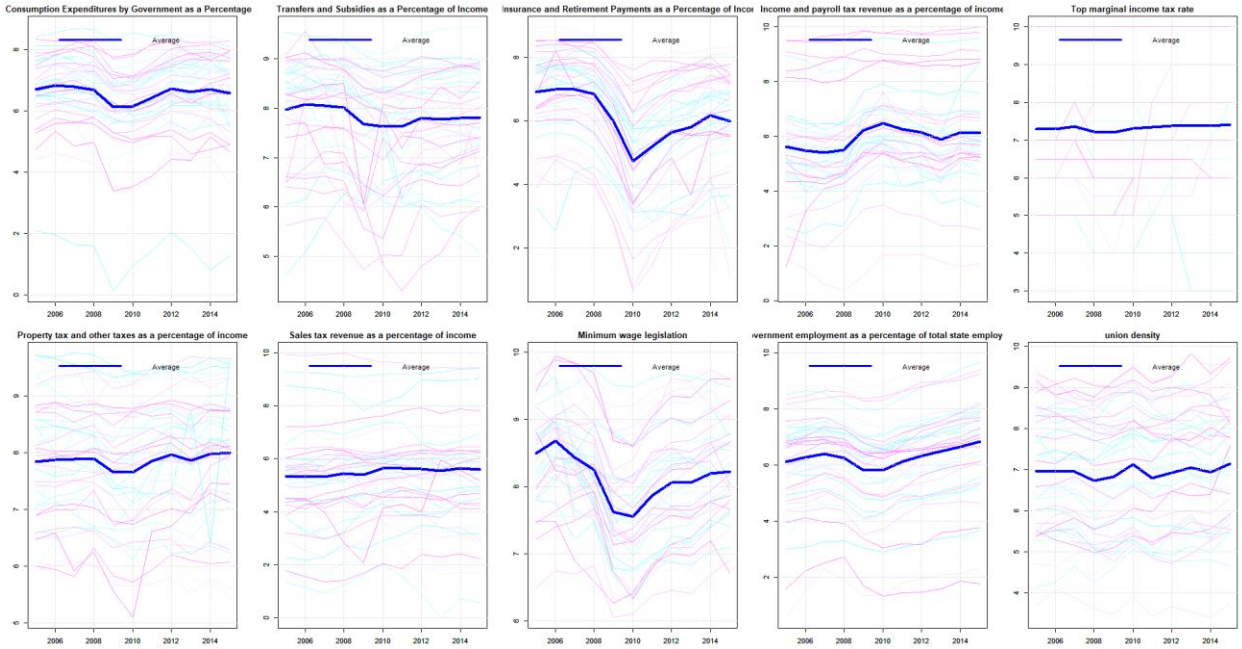
A1. Lists of variables under considerations

SN	Variables	Sources
1	outflow	US CB
2	inflow	US CB
3	net	US CB
4	Population	UKCPR
5	Unemployment rate	UKCPR
6	Gross State Product	UKCPR
7	Percent Low Income Unisured Children	UKCPR
8	Personal income	UKCPR
9	Workers compensation	UKCPR
10	Poverty Rate	UKCPR
11	Fraction of State House that is Democrat	UKCPR
12	Fraction of State Senate that is Democrat	UKCPR
13	PCGSP	UKCPR
14	PCPI	UKCPR
15	PCWC	UKCPR
16	Percent_BEDROOMS_Nobedroom	US CB DP
17	Percent_CLASSOFWORKER_Governmentworkers	US CB DP
18	Percent_CLASSOFWORKER_Privatewageandsalaryworkers	US CB DP
19	Percent_CLASSOFWORKER_Selfemployedworkersinownnotincorporatedbusiness	US CB DP
20	Percent_CLASSOFWORKER_Unpaidfamilyworkers	US CB DP
21	Percent_COMMUTINGTOWORK_Cartruckorvancarpooled	US CB DP
22	Percent_COMMUTINGTOWORK_Cartruckorvandrovealone	US CB DP
23	Percent_COMMUTINGTOWORK_Othermeans	US CB DP
24	Percent_COMMUTINGTOWORK_Publictransportationexcludingtaxicab	US CB DP
25	Percent_COMMUTINGTOWORK_Walked	US CB DP
26	Percent_COMMUTINGTOWORK_Workedathome	US CB DP
27	Percent_EDUCATIONALATTAINMENT_9thto12thgradenodiploma	US CB DP
28	Percent_EDUCATIONALATTAINMENT_Associatesdegree	US CB DP
29	Percent_EDUCATIONALATTAINMENT_Bachelorsdegree	US CB DP
30	Percent_EDUCATIONALATTAINMENT_Graduateorprofessionaldegree	US CB DP
31	Percent_EDUCATIONALATTAINMENT_Highschoolgraduateincludesequivalency	US CB DP
32	Percent_EDUCATIONALATTAINMENT_Lessthan9thgrade	US CB DP
33	Percent_EDUCATIONALATTAINMENT_Somecollegenodegree	US CB DP
34	Percent_INDUSTRY_Agricultureforestryfishingandhuntingandmining	US CB DP
35	Percent_INDUSTRY_Artsentertainmentandrecreationandaccommodationandfoodservices	US CB DP
36	Percent_INDUSTRY_Construction	US CB DP
37	Percent_INDUSTRY_Educationalservicesandhealthcareandsocialassistance	US CB DP
38	Percent_INDUSTRY_Financeandinsuranceandrealestateandrentalandleasing	US CB DP
39	Percent_INDUSTRY_Information	US CB DP
40	Percent_INDUSTRY_Manufacturing	US CB DP
41	Percent_INDUSTRY_Otherservicesexceptpublicadministration	US CB DP
42	Percent_INDUSTRY_Professionalscientificandmanagementandadministrativeandwastemanagementservices	US CB DP

43	Percent_INDUSTRY_Publicadministration	US CB DP
44	Percent_INDUSTRY_Retailtrade	US CB DP
45	Percent_INDUSTRY_Transportationandwarehousingandutilities	US CB DP
46	Percent_INDUSTRY_Wholesaletrade	US CB DP
47	Percent_OCCUPATION_Managementprofessionalandrelatedoccupations	US CB DP
48	Percent_OCCUPATION_Naturalresourcesconstructionandmaintenanceoccupations	US CB DP
49	Percent_OCCUPATION_Productiontransportationandmaterialmovingoccupations	US CB DP
50	Percent_OCCUPATION_Salesandofficeoccupations	US CB DP
51	Percent_OCCUPATION_Serviceoccupations	US CB DP
52	Percent_PLACEOFBIRTH_Native	US CB DP
53	Percent_WORLDREGIONOFBIRTHOFFOREIGNBORN_Africa	US CB DP
54	Percent_WORLDREGIONOFBIRTHOFFOREIGNBORN_Asia	US CB DP
55	Percent_WORLDREGIONOFBIRTHOFFOREIGNBORN_Europe	US CB DP
56	Percent_WORLDREGIONOFBIRTHOFFOREIGNBORN_LatinAmerica	US CB DP
57	Percent_WORLDREGIONOFBIRTHOFFOREIGNBORN_NorthernAmerica	US CB DP
58	Percent_WORLDREGIONOFBIRTHOFFOREIGNBORN_Oceania	US CB DP

Note: US CB represents US Census Bureau; UKCPR represents data from University of Kentucky Center for Poverty Research and US CB DP represents data from US Census Bureau data profiles.

A2. Plots of various variable related with economic freedom



A3. BCH estimates without the polynomials and interaction terms.

Impact of	on	Estimate.	Std. Error	Pr(>|t|)
EFNA	KIEA	-0.492*	0.27	0.07
	New entrepreneurs	-5.356	14.84	0.72
	Opportunity share	-0.159	0.17	0.36
	Startup density	-5.271***	1.62	0.00
General Consumption Expenditures by Government as a Percentage of Income	KIEA	-0.045	0.14	0.75
	New entrepreneurs	-9.683	6.93	0.16
	Opportunity share	0.095	0.07	0.17
	Startup density	0.602	0.88	0.49
Government employment as a percentage of total state employment	KIEA	0.388**	0.15	0.01
	New entrepreneurs	0.303	7.56	0.97
	Opportunity share	0.095	0.07	0.15
	Startup density	4.735***	1.05	0.00
Government freedom	KIEA	-0.298*	0.16	0.06
	New entrepreneurs	-5.129	8.08	0.53
	Opportunity share	-0.141	0.09	0.12
	Startup density	-1.088	0.89	0.22
Income and payroll tax revenue as a percentage of income	KIEA	-0.059	0.08	0.44
	New entrepreneurs	2.12	4.92	0.67
	Opportunity share	-0.112*	0.06	0.05
	Startup density	-1.039	0.6	0.08
Insurance and Retirement Payments as a Percentage of Income	KIEA	-0.142*	0.08	0.07
	New entrepreneurs	-3.676	4.35	0.40
	Opportunity share	-0.047	0.05	0.36
	Startup density	-0.797	0.53	0.13
Labor Market Freedom	KIEA	0.437	0.28	0.12
	New entrepreneurs	9.977	13.58	0.46
	Opportunity share	0.221	0.14	0.12
	Startup density	4.089***	1.37	0.00
Minimum wage legislation	KIEA	0.181	0.13	0.18
	New entrepreneurs	0.06	6.79	0.99
	Opportunity share	0.107	0.07	0.12
	Startup density	0.058	0.65	0.93
Property tax and other taxes as a percentage of income	KIEA	0.064	0.13	0.62
	New entrepreneurs	5.497	7.13	0.44
	Opportunity share	0.019	0.08	0.81
	Startup density	1.116	0.91	0.22
Sales tax revenue as a percentage of income	KIEA	-0.251**	0.1	0.01
	New entrepreneurs	-1.547	5.17	0.76
	Opportunity share	-0.092	0.05	0.09
	Startup density	-2.606***	0.81	0.00
Taxes freedom	KIEA	-0.303*	0.16	0.07
	New entrepreneurs	-4.422	9.54	0.64
	Opportunity share	-0.068	0.12	0.56
	Startup density	-4.558***	1.08	0.00
Top marginal income tax rate	KIEA	-0.068	0.08	0.39
	New entrepreneurs	-9.648**	3.8	0.01
	Opportunity share	0.144**	0.06	0.01
	Startup density	-0.754*	0.46	0.10
Transfers and Subsidies as a Percentage of Income	KIEA	-0.114	0.08	0.17
	New entrepreneurs	2.582	4.25	0.54
	Opportunity share	-0.094**	0.05	0.04
	Startup density	-0.338	0.48	0.48
union density	KIEA	-0.142	0.16	0.36
	New entrepreneurs	-1.911	7.84	0.81
	Opportunity share	0.068	0.08	0.40
	Startup density	-1.3	0.82	0.11

Note: *, ** and *** shows level of significance in 10%, 5% and 1% level. The estimates for covariates, year fixed effects and state fixed effect to save space and available in supplementary materials.