

# Identification of Technical Analysis Patterns with Smoothing Splines for Bitcoin Prices

Nikolay Miller, Yiming Yang, Bruce Sun, and Guoyi Zhang  
University of New Mexico

This research studies automatic price pattern search procedure for Bitcoin cryptocurrency based on one-minute price data. To achieve this, search algorithm is proposed based on nonparametric regression method of smoothing splines. We investigate some well-known technical analysis patterns and construct algorithmic trading strategy to evaluate the effectiveness of the patterns. We found that the use of method of smoothing splines for identifying the technical analysis patterns and strategies based on certain technical analysis patterns yield returns that significantly exceed results of unconditional trading strategies. By using one month of BTCUSD data from Coinbase Pro, we have identified several potentially very profitable technical analysis patterns, among them Head-And-Shoulders, Inverted Head-And-Shoulders and Triangle Bottoms. We have also proposed a method to evaluate the effectiveness of the technical analysis patterns by market returns. Our results are promising and could be used as a reference to develop a successful algorithmic trading strategy.

*Keywords: Algorithmic Trading, Technical Analysis, Pattern Recognition, Statistics, Trading, Finance, Bitcoin, Cryptocurrency*

### **100% Renewable-Electricity Demand: A Dream or Dreaming a Dream**

Jamal Mamkhezri

New Mexico State University

Leonard A. Malczynski and Janie M. Chermak

University of New Mexico

State-mandated renewable portfolio standards (RPS) contribute to a substantial fraction of total electricity supply in the U.S. (Barbose, 2018). RPS is an environmentally motivated policy, yet it has the potential to greatly impact economy. There is not a concise agreement in the literature surrounding the impact of RPS policies on regional economies, especially on job creation. Integrating various methodologies such as econometrics, geographic information system, and input-output into a unique system dynamics model, this paper estimates the impact of RPS on an economy and the environment under four scenarios: 10%, 20%, 50%, and 100% RPS by 2050. We carry out our analysis in New Mexico, a southwestern state in the U.S. with an RPS of 20% by 2020 (reference case scenario) and abundant potential for fossil fuel and renewable energy sources. Under the latter two scenarios, our findings suggest supporting jobs in rural counties that are most suitable for future renewable energy installation, the former two scenarios support jobs primarily in the fossil fuel sector in urban counties. Further, our results indicate that the fossil fuel intensive scenarios will be the most beneficial scenarios, with the highest employment and economic output impacts, without considering their consequential environmental impacts. However, considering environmental impacts such as water usage, greenhouse-gases, air pollution, and human and avian mortalities and morbidities will reverse the results: the higher the RPS level, the higher the overall benefits to the state. Although the employment values appear to have minimal impacts, the disparity in job and economic output distribution across counties and energy sources suggest that counties with different energy potential and population density will experience a variation in impacts. Given the rural nature of New Mexico and variable economic outlook across its

counties, higher renewable energy diffusion may become an economic tool to stimulate growth in economically depressed areas.

*Keywords: Renewable Portfolio Standard, Employment, Economic Output, Water Use, Greenhouse-Gas, Air Pollution, Avian Mortality, Social Benefit*

# Adjusted Design Effect Model and Longitudinal Generalized Variance Functions for Survey Data

Mohammed Quazi and Yan Lu  
University of New Mexico

Many large-scale surveys such as the Current Population Survey (CPS) collect data over multiple years. Each year, thousands of estimates and standard error for each published estimator need to be reported, which involves a large amount of work. The longitudinal generalized variance functions (LGVF) proposed by Zhang, Cheng, and Lu (2019) provides convenient variance estimates by using longitudinal data. This research extends the LGVF by incorporating the design effects into modeling for use in a longitudinal survey data. The March CPS data from 2003 to 2017 is used in simulation studies and the March 2018 data is used for the purpose of model validation. Simulation results show that the proposed methods are effective and promising when compared with other methods in literature.

*Keywords: LGVF, CPS, Adjusted Design Effect, Cluster, Variance*

## Session E

### **Does the Solemn Oath Lower WTP Responses in a Discrete Choice Experiment Application to Solar Energy?**

Jamal Mamkhezri

New Mexico State University

Jennifer A. Thacher, Janie M. Chermak and Robert P. Berrens

University of New Mexico

One way to eliminate or mitigate hypothetical bias associated with stated preference surveys is the solemn oath script. While the efficacy of solemn oath script is still debatable, the key objective of this paper is to provide an initial field setting test of the solemn oath script to a particular discrete choice experiment survey application to solar energy. We conducted a discrete choice experiment survey with two treatment groups: with and without having respondents sign the solemn oath prior to taking the survey. Utilizing random parameter logit models in both preference-space and WTP-space, our results provide no evidence that the solemn oath script lowers respondents' willingness-to-pay for the good in question. Either there is no hypothetical bias in the current study, which we are unable to test as there is no real expenditure at issue, or the solemn oath script may have limited application outside of the experimental lab and is not effective under every condition. Lastly, this calls for more research on the efficacy of solemn oath script.

*Keywords: Solemn Oath Script; Hypothetical Bias; Choice Experiment Survey; Solar Energy; Marginal Willingness-To-Pay*