Research Statement

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Addressing endogeneity in nonlinear regression models, such as the threshold regression model, presents a challenge that the conventional instrument variable approach struggles to surmount. To overcome this limitation, researchers must adopt a more sophisticated approach, leveraging existing information more intelligently. This concept forms the core premise of my current working paper. In the context of the threshold regression model, my contributions encompass the following: (1) addressing misspecification concerns when utilizing linear instrument variables (IVs), and (2) devising IVs that leverage the heteroskedasticity of the error term, especially in situations where valid IVs are lacking. In the following sections, I will provide an overview of my current working papers, followed by insights into my ongoing research and the potential contributions it holds.

1 Working paper

(1) ***"Linear Control Function Approach in Endogenous Kink Threshold Regression Models"***
(*Jianhan Zhang, Chaoyi Chen, Yiguo Sun, Thanasis Stengos*)
My first working paper considers the endogeneity in a kink threshold regression model. The continuity property of the kink threshold regression model makes it sufficiently different from the threshold regression model, with and without the existence of the endogeneity. Based on the work of Hansen (2017), we apply the linear control function approach to extend the kink threshold regression model by allowing the endogenous.

(2) ***"Endogeneity Kink Threshold Regression"***(JMP)
(*Jianhan Zhang, Chaoyi Chen, Yiguo Sun, Thanasis Stengos*)
In my job market paper, I extend the existing control function approach to a Kink threshold regression model by proposing a two-step non-parametric estimate via using the sieve method. The contributions of the paper are twofold. First, the two-step non-parametric control function approach is first considered in a threshold regression model, which solves the possible misspecification problem in a linear setup. Second, in the kink threshold regression model, our paper is different from Hansen (2017), via introducing the nonparametric estimate with possible infinite dimension. Aside from the theoretical contribution, we also investigate the threshold effect of COVID-19 on the labor market in North America and find the negative effect is only severe while the number of people infected by COVID-19 is above a certain value. The paper is *resubmitted* to the *Journal of Business Economic Statistics*.

(3) ***"Threshold Regression Model with Mismeasured Variables"***
(*Jianhan Zhang, Yiguo Sun*)
My second working paper considers a threshold regression model with possible mismeasured regressors. Following Lewbel (2012), we employ error heteroskedasticity to construct valid moment conditions. This method proves especially useful when instrumental variables or other side information are missing or unreliable. We propose a two-step GMM estimator as well as a robust estimator based on the median

of means method to overcome possible heavy-tailed problems. We apply our approach to investigate the potential threshold relationship among investment, Tobin's q, and cash flow. Our method fills this gap nicely, both empirically and theoretically. The working paper is targeted at the *Journal of Econometrics*.

2 Working in progress

All my papers working in process can be viewed as extensions of the current working papers.

(1) ***"Robust Generalized Method of Moments (GMM) Estimation in Error-in-Variables Models"***

(Jianhan Zhang, Yiguo Sun)

While we investigate the existing method in solving the measurement error of Tobin's q theory, we find the methods are debated by their bad Monte Carlo results. Now researchers attribute that to the effect of the small number of extreme values and that is part of the side effect of using the higher-order moment conditions. Though will not affect the consistency, it is hard to make inferences in constructing the confidence interval. To solve that problem, we propose a robustness GMM estimator will a Median of Means gradient. The method does not affect the objective function and thus maintains the property of the function. That is meaningful as the cooperate finance data are heavily tailed and are useful in identification.

(2) ***"Threshold Regression Model with Non-Classical Measurement Errors"***

(Jianhan Zhang, Yiguo Sun)

During our examination of Tobin's q theory through the application of a threshold regression model, we have identified dynamic fluctuations in the degree of mismeasurement affecting Tobin's q over time. These fluctuations appear to be responsive to certain external factors, such as alterations in interest rates, which challenge the assumption of classical measurement error. Consequently, this paper aims to contribute to the current methodology by introducing a threshold regression model with nonclassical measurement errors.

(3) ***"Latent Group Structure in the Kink Threshold Regression Model"*** (Invited paper by Econometrics)

(Chaoyi Chen, Jianhan Zhang, Thanasis Stengos)

(4) ***"Analyzing the Nexus Between Natural Disasters and Economic Growth: Insights from a Threshold Regression Model"***

(Jianhan Zhang, Hong Li, Thanasis Stengos)

References

Hansen, B. E. (2017). Regression kink with an unknown threshold. *Journal of Business & Economic Statistics 35*(2), 228–240. 1

Lewbel, A. (2012). Using heteroscedasticity to identify and estimate mismeasured and endogenous regressor models. *Journal of Business & Economic Statistics 30*(1), 67–80. 1