Economics
UNIVERSITY OF TORONTO

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Dear Selection Committee,

My name is Yao Luo, an assistant professor of economics at University of Toronto. I am writing this letter to give my highest recommendation for Mr. Zhe Yuan. I started to serve on his thesis committee in 2014. We meet regularly almost every week. I think I know him well enough to discuss his potentials.

I would recommend Zhe for all top departments in Canada, top 10-30 places in the US, top 10 departments or business schools in mainland China, and all departments or business schools in Hong Kong and Singapore. I also suggest research-oriented departments and government agencies take a close look at his profile. He is a highly motivated researcher and has a lot of creativity, which I will explain below.

First, Zhe has a very promising job market paper, which studies airline competition as a three-stage game. With suitable revisions and polishing, I think this paper is of quality at least RAND journal of economics and has a good chance in a top 5. Estimating network formation games such as airline competition is difficult, if not impossible, due to the high dimensionality of the problem. Zhe proposes an elegant framework that avoids the computation of equilibrium. His strategy is to estimate his three-stage model backward. On one hand, he uses the optimality of the observed price and quantity data to estimate the marginal costs of providing extra capacities on the routes. One the other hand, since he endogenizes the network formation, he is able to construct moment inequalities that reveal fixed costs. If an airline operates in a market, the benefit of operating is higher than the cost. Therefore, the profit loss if the airline exits this market is an upper bound of the fixed cost. Similarly, if an airline does not operate in a market, the profit loss if the airline enters is a lower bound of the fixed cost. The estimation is done in a Chernozhukov, Hong and Tamer (2007) fashion. While his counterfactual studies the consequences of JetBlue entering one market, his method opens venues for many possibilities. His method can be extended to study many other industries as well. In fact, we are considering a project applying it to the Chinese cigarette industry, which I will explain later.

Zhe is very knowledgeable of the airline industry. His knowledge of this industry and high ability of modeling make his paper a beautiful piece of structural work with the right amount of sophistication. Zhe has been working on this industry since his second year at U of Toronto. While being sophisticated in his structural model, he carefully discus every assumption he makes and algorithm he proposes in his job market paper. I am not working on the airline industry, but I found myself learning a great deal from Zhe.

Moreover, Zhe has collected a unique dataset of his own that records daily for every flight, its origin destination airports, scheduled and actual time of departure and arrival, gates for departure and arrival, aircraft used and the airline company. To my knowledge, other popular datasets do not seem to have the departing and arriving gate numbers and the actual time of departure and arrival. He is very dedicated to what he is doing. To collect the data, he visit the website every day, run his python script and double check everything. He has accumulated records of about a year. This dataset will become a quite valuable one as it accumulates.

Second, Zhe is also a great coauthor that everyone would love to have. He has the right combination of intuition, modeling, programming and enthusiasm. We have several joint projects together. Rongwei Chu (Fudan U, China), Zhe Yuan and I are working on a project studying the Chinese cigarette industry. Zhe was definitely the core of this team.

China being the largest consumer and producer of tobacco in the world, affordability is an important contributing factor. Moreover, consumers' purchasing power increases overtime because the nominal prices of products are fixed upon introduction. On the other hand, the government launched the low tar campaign, among other legislations, to reduce consumption and health consequences of smoking. The maximum limit on ISO tar ratings decreases from 17 mg in 2001 to 12 mg in 2011. Using a novel data on product-prefecture level cigarette sales, we evaluate the impact of administered price and the low tar campaign in the Chinese cigarette industry. Zhe did most of the work: worked out the estimation and counterfactuals, and has written a draft of about 20 pages. Our estimation shows that administered prices contribute to 12.5% of the consumption growth between 2007 and 2013. Our counterfactuals show that per unit tax outperforms Ad valorem tax as it reduces total tar intake while maintaining tax collected and sales. It is still work in progress only because I have not found the time to revise the draft Zhe wrote. This paper will be a very interesting empirical paper. After his job market, I expect to continue working with him on this data. We plan to study product entry and exit of multiproduct tobacco firms, which requires significant development in methodology due to again the high dimensionality of the problem. He will be a great addition to this study given his expertise in network formation games.

Third, being an empirical IO researcher, Zhe shows some interests in econometrics as well. His job market paper is a showcase of him using recent methods in econometrics. As a matter of fact, Victor (Zhe's main advisor), Zhe and I are also working on estimation of discrete choice models based on moment inequalities. I will leave it to Victor to comment on that. Besides attending the

IO seminars, I see him coming to the econometrics seminars quite often. We sometimes have short discussions afterward. He had many quite interesting insights.

Finally, I will try to demonstrate a few other things. In terms of personality, Zhe is smart, modest, industrious, reliable and easy to get along. We started interacting research wise starting from the summer when he was my summer RA. He prepared a timber auction data I needed for revising the empirical application in my paper with Nianqing Liu, "A Nonparametric Test of Exogenous Participation in First-Price Auctions". This has been a crucial point for our revision. Both my coauthor and I are grateful for his contribution to our project. The raw data have 31 large pieces. Zhe did an excellent job manipulating them and gave me a directly useable data. He carefully documented every step he did, which I rely heavily on for a couple of other projects on auctions.

Zhe has also demonstrated his ability to communicate his knowledge through teaching. He is teaching the same course as me (ECO380: Market, Competition and Strategies). Mine is in the fall and his in the spring. Some of Zhe's students took my ECO418 (Empirical Applications of Economic Theory). I have heard a lot of good words about Zhe's classes.

In summary, I am confident that Zhe Yuan would be an outstanding asset to your department and will become very accomplished in academic. He possesses the right combination of drive and intelligence to excel. If you should need any additional information you can feel free to contact me at +1 (416)-946-5288 or by email at yao.luo@utoronto.ca anytime.

Best Regards,

Yao Luo