UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

UNITED STATES OF AMERICA	)	
	)	
	)	No. 18 Cr. 35 (Tharp, J.)
v.	)	
	)	
JAMES VORLEY and CEDRIC CHANU,	)	
	)	
Defendants.	)	
	)	

AFFIDAVIT OF DAPHNE CHEN, PH.D.

I, Daphne Chen, hereby certify under penalty of perjury that the following is true and correct:

I. QUALIFICATIONS

1.   I am a Managing Director at Vega Economics, a company that provides consulting services on various economic issues. I have over ten years of experience in economic research and data analysis, including experience working with CME Group futures and options market data. My curriculum vitae, which sets forth my full credentials and contains a list of my publications and other professional activities, is attached as Exhibit A.

2.   I hold a Ph.D. and M.S. in Economics from the University of Texas at Austin, a M.A. in Applied Statistics from the University of Michigan, Ann Arbor, and a B.B.A. in Business Administration from National Taiwan University.

3.   Prior to consulting, I was an Assistant Professor in Economics at Florida State University, where I taught economic courses to students in undergraduate, Masters, and Ph.D. programs. I received the First Year Assistant Professor Award for my research on consumer finance. In 2012, I was invited as a CSWEP Summer Fellow to visit the

Federal Reserve Bank of Atlanta. In 2013, I was invited as a Visiting Scholar to visit the Federal Reserve Bank of St. Louis. I have participated as an invited speaker in numerous seminars and conferences, including ones hosted by Federal Reserve Board, the American Economic Association, and the Econometric Society.

4.   As set forth in my curriculum vitae, I have also published a number of articles concerning consumer finance and corporate finance in peer-reviewed journals, including *Review of Economic Dynamics*, *American Economic Journal: Macroeconomics*, *Journal of Macroeconomics*, and *Economic Inquiry*. I have also served as a referee for several economic journals, such as *Journal of Economic Dynamics and Control*, *Economic Inquiry*, and *Economic Letters* and as an external grant reviewer for Research Grants Council of Hong Kong.

5.   As a consultant, I have worked on more than fifty matters involving a wide variety of securities and markets, including the precious metals futures market. My engagements have included analyzing large datasets of trading and order book data, including CME Rapid and Armada data.

II.   SCOPE OF THE ASSIGNMENT

6.   James Vorley retained Vega Economics in connection with sentencing in the above referenced action, and through this engagement I have become familiar with the economic issues and trading records in this case.

7.   As relevant here, I have also reviewed the declaration of Professor Kumar Venkataraman, dated November 13, 2020, prepared at the request of the DOJ for purposes of sentencing.

8.   In reviewing Professor Venkataraman's declaration, I made a number of observations about the trading activity relied upon, the loss calculation, the adjustments to the loss calculation, and the gain calculation.

9.   The following are my opinions based on my expertise and experience studying principles of economics and working with trading and order book data.

III.   RELEVANT CONDUCT

10.   Professor Venkataraman's stated justification for attempting to estimate losses based on thousands of "Spoofing Sequences" is his own trial testimony that (a) the trading in the 61 trading episodes relied upon by the DOJ at trial was "not consistent with" a rational strategy aimed at executing the large visible orders and was instead "consistent with" the visible orders being used to facilitate execution of the opposite-side iceberg orders; and that (b) the defendants' broader trading activity between 2008 and 2013 was "consistent with" the patterns observed in the 61 trading episodes in that "visible orders of certain types and sizes exhibited different order submission patterns and execution outcomes when compared with Defendants' iceberg orders." Venkataraman Decl. ¶ 8.

11.   However, the DOJ's definition of "Spoofing Sequences" for purposes of his loss calculation is notably broader than the initial selection criteria used to identify potential spoofing sequences prior to trial. *See* Professor Venkataraman Decl. ¶ 13. First, the definition of "Spoofing Sequences" does not require an execution on the opposite-side iceberg order. Second, it does not impose any time limitation on the alleged spoof order. The latter is particularly significant to the loss calculation because the longer the alleged spoof is on the market, the greater will be the estimated loss during that period.

IV. LOSS CALCULATION

12. Professor Venkataraman's basic premise is that spoofing can induce market participants to raise/lower their bid/ask price quotes or cross the spread when they otherwise would not have. He reasons that "[t]herefore, market participants who trade on the same side as a spoof order while the spoof order is active, and at a price that is worse than the prevailing price immediately before the spoof order was placed, are harmed to the extent they were induced to trade by the spoofing pressure." Venkataraman Decl. ¶ 11; *see also id.* ¶ 18.

13. To estimate the extent of the harm, Professor Venkataraman attempts to compare "the observed cost of trading while the Defendants' spoof orders were active to the observed 'but for' cost of trading during a period of equal length immediately before the spoof orders were placed." Venkataraman Decl. ¶ 11. Alternatively, he attempts to compare "the rate at which market participants on the same side as the Defendants' spoof orders crossed the bid-ask spread while the spoof orders were active to the rate immediately before the spoof orders were placed." *Id.*

14. However, this method of comparing transactions while an alleged spoof order was on the market with the best bid or offer immediately before the alleged spoof orders were placed assumes that the alleged victims, regardless of whether they actually crossed the spread, would have executed trades for the same quantities at the "But For Trade Prices" if the alleged spoof orders had not been placed. *See* Venkataraman Decl. ¶ 20 n.26. There is no basis for this assumption. Rather, the alleged victims might have traded at the same price, a worse price, or a better price, or they may not have traded at all absent the alleged spoof order.

15. In addition, Professor Venkataraman does not account for the fact that the alleged victims or other market participants may also have *benefitted* from the purported

price impact of the alleged spoofs. For example, in Episode 17, the counterparties to X and Z (who did not execute on Chanu's iceberg) would have benefitted. Venkataraman Decl. p.13.

16.   A standard way to measure trading gains and losses (supported by academic literature) is to compare the price at which a trade is executed to an estimate of the underlying security value. This is akin to the "quoted spread" or the "effective spread" that Professor Venkataraman himself considers reliable measures of trading cost. *See* Bessembinder & Venkataraman, *Bid-Ask Spreads: Measuring Trade Execution Costs in Financial Markets*, Encycl. of Quantitative Finance 184-90 (2010).

V.   LOSS CALCULATION ADJUSTMENT

17.   Professor Venkataraman recognizes that his loss calculation requires adjustment to account for trades that may have taken place at the same prices regardless of the alleged spoof orders. He attempts to do this by comparing trades while the alleged spoof orders are on the market with a "control period" of the same length immediately prior to the alleged spoofs. Venkataraman Decl. ¶ 27.

18.   Professor Venkataraman first attempts to compare the "normal" "cost of trading" (the price paid by crossing the spread) during a period just before the alleged spoof orders to the "cost of trading" while the alleged spoof orders are on the market. Venkataraman Decl. ¶¶ 25, 29. However, this adjustment will lead to overestimation of losses for two reasons.

19.   First, by construction, the presence of the alleged spoof order effectively means that all transactions during the period when the order is resting on the market will be at inferior prices (they cannot be at better prices because the alleged spoof order

would have to be executed in full before transactions could occur at better prices), whereas during the control period transactions could occur at better or worse prices. This means the average trading cost during the alleged spoof period will likely be greater than during the control period as a result of this construction.

20.　　Second, Professor Venkataraman does not control for differences in quantity. Taking the example of Episode 17 again, the trades considered during the alleged spoof period involved victims who allegedly sold 18 lots. Venkataraman Decl. p.13. But Professor Venkataraman then adjusts based on the cost of trading during the control period based on transactions totaling only 13 lots. Venkataraman Decl. ¶ 30. Comparing the cost of trading 18 lots during the alleged spoof period and 13 lots during the control period will result in overstating losses.

21.　　Professor Venkataraman's alternative adjustment method attempts to compare the "rate of spread-crossing" during the alleged spoof period with the control period, and then to discount by the normal spread-crossing rate. Venkataraman Decl. ¶ 34. This calculation also reflects a selection bias because the transactions on the same side as the alleged spoof order both during the measurement period and during the control period will include both spread crossing transactions and transactions at the BBO. Discounting by the normal rate of spread crossing will therefore again result in inflated loss calculation because it only adjusts for the normal rate of spread crossing and not for the normal rate of transactions that would have occurred at the best bid or offer.

22.　　Additionally, this alternative adjustment method rests on an arbitrary selection of a five second control period immediately prior to the spoof period, despite the fact that a majority of the alleged spoof periods last less than five seconds. Further, Professor

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Venkataraman applies a uniform rate adjustment for all the alleged spoof episodes, regardless of the actual rate of spread-crossing for each alleged spoof episode. The alternative adjustment method accordingly fails to produce a reliable estimate of loss.

23. Professor Venkataraman also refers to his adjustment methods as an "event study methodology." Venkataraman Decl. ¶ 26. But this is not correct. An event study isolates the impact of an event on price – *e.g.*, how did the announcement of a dividend affect a stock price. Presumably, one could look at how prices changed after placement of a spoof order and attempt to control for other factors that may have affected the price, but that is not what Professor Venkataraman did. He was trying to calculate losses by comparing transactions during an alleged spoof period with transactions during a control period.

VI.   GAIN CALCULATION

24. Professor Venkataraman treats gain as the opposite of loss. The difference is that the gain is calculated only on transactions with the defendants' iceberg orders (as opposed to market wide). Venkataraman Decl. ¶ 42. However, this assumes that the defendants would have executed trades for the same quantities at inferior prices if the alleged spoof orders had not been placed. There is no basis for this assumption. Rather, the defendants might have traded at the same price, a worse price, or a better price, or they may not have traded at all absent the alleged spoof order.

25. Moreover, because Professor Venkataraman looks at the best bid or offer immediately prior to the alleged spoof, his method assigns all of the gain or loss from spread-crossing to one side of the transaction. As I described in connection with the loss

calculation, standard methods for calculating trading profits should include the quoted spread

or effective spread, as described by Professor Venkataraman in his book.

Executed on this 5th day of April, 2021.

Daphne Chen, Ph.D.

Exhibit A

Curriculum Vitae

Daphne Chen, Ph.D.

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Daphne Chen, Ph.D. is the Managing Director at Vega Economics with over ten years of experience advising clients in a wide range of economic issues. Dr. Chen has led case teams to support expert analysis through all phases of litigation involving structured finance, market microstructure, capital markets, financial markets, consumer credit, and econometric methods.

Prior to consulting, she was an assistant professor in Economics at Florida State University, and she received the First Year Assistant Professor Award for her research on consumer credit and labor market behavior. Dr. Chen has also taught advanced macroeconomics and computational economics in Masters and Ph.D. programs and macroeconomics, game theory, and statistics to undergraduate level students.

Dr. Chen has received several awards for her research on consumer finance. She has published in economics journals including *Journal of Macroeconomics*, *American Economic Journal: Macroeconomics*, *Review of Economic Dynamics*, and *Economic Inquiry* for topics related to consumer finance and corporate finance. She has also served as a referee for academic journals, including *Academia Economic Papers*, *Economic Inquiry*, *Economics Letters*, and *Journal of Economic Dynamics and Control*.

In addition, she was invited as a CSWEP summer fellow to visit the Federal Reserve Bank of Atlanta in 2012 and was also invited as a visiting scholar to the Federal Reserve Bank of Saint Louis in 2013. She also has participated as an invited speaker at both professional and academic seminars and conferences. Sponsors of these programs include the Federal Reserve System, University of Toronto, University of Connecticut, Stony Brook University, American Economic Association, the Econometric Society, and the Society of Economic Dynamics.

Education

Ph.D., Economics, University of Texas at Austin

M.S., Economics, University of Texas at Austin

M.A., Applied Statistics, University of Michigan – Ann Arbor

B.B.A., Business Administration, National Taiwan University

Professional Experience

Vega Economics, Principal, 2017-2019; Managing Director, 2019-present

Econ One Research, Principal, Financial Services, 2015-2017

Department of Economics, Florida State University, Assistant Professor, 2011-2015

Federal Reserve Bank of Saint Louis, Visiting Scholar, Research Department, 2013

Federal Reserve Bank of Atlanta, CSWEP Summer Fellow, Research Department, 2012

Publications

Chen, Daphne and Dean Corbae. "On Welfare Implications of Restricted Bankruptcy Information." *Journal of Macroeconomics*, 33 (2011): 4-13.

Chen, Daphne and Shi Qi. "The Importance of Legal Form of Organization on Small Corporation External Financing." *Economic Inquiry*, 54 (2016): 1607-1620.

Chen, Daphne and Jake Zhao. "The Impact of Personal Bankruptcy on Labor Supply Decisions." *Review of Economic Dynamics*, 26 (2017): 40-61.

Chen, Daphne, Shi Qi, and Don Schlagenhauf. "Corporate Income Tax, Legal Form of Organization, and Employment." *American Economic Journal: Macroeconomics*, 10 (2018): 270-304.

Fatih Guvenen, Gueorgui Kambourov, and Burhan Kuruscu, Sergio Ocampo, and Daphne Chen. "Use it or Lose it: Efficiency Gains from Wealth Taxation." No. w26284. National Bureau of Economic Research, 2019.

Honors and Grants

Joan Haworth Mentoring Fund, American Economic Association, CSWEP

Provost's Faculty Travel Grant, Florida State University

First Year Assistant Professor Award, Florida State University

University Continuing Fellowship, University of Texas at Austin

Hale Fellowship, University of Texas at Austin

Professional Development Award, University of Texas at Austin

Special Mention in Teaching, Department of Statistics, University of Michigan

Presidential Award, National Taiwan University

Professional Activities

Fellow of Institute on Computational Economics (ICE), University of Chicago, 2007

Reviewer of Council on Research and Creativity, Florida State University, 2011-12

External Reviewer of Research Grants Council (RGC) of Hong Kong, 2018

Referee for *Academia Economic Papers*, *Economic Inquiry*, *Economics Letters, Journal of Economic Dynamics and Control*.

Invited Presentations

Seminars:

University of Toronto, University of Connecticut, Federal Reserve Bank of Saint Louis, Federal Reserve Bank of Richmond, Stony Brook University, Academia Sinica (Taiwan), Federal Reserve Bank of Atlanta, Federal Reserve Bank of Cleveland, Federal Reserve Board, Florida State University, Hunter College, Kansas State University, University of Alabama, University of Scranton, Wake Forest University, Federal Reserve Bank of Dallas, University of Texas at Austin.

Conferences:

Allied Social Science Association Meeting, Computing in Economics and Finance (CEF), Eastern Economic Association Annual Conference, Housing-Urban-Labor-Macro (HULM) Conference (discussant), Midwest Macroeconomics Meeting, Midwest Economic Association Annual Meeting, Missouri Economics Conference, North American Summer Meeting of the Econometric Society, Society of Economic Dynamics Annual Meeting, Society of Labor Economists (SOLE) Meeting, Summer Workshop on Money, Banking, Payments, and Finance (Chicago Fed), Quantitative Society of Pensions and Savings Summer Workshop.

Selected Consulting Projects

Market Microstructure
- Assisted attorneys to perform data analysis regarding various trading patterns in the precious metals futures market, using CME Rapid and Armada data.
- Assisted attorneys to perform data investigation of possible collusion among bond traders and to evaluate the associated price impact using FINRA's enhanced historical TRACE data.
- Assisted attorneys to perform an event study analyzing the price impact of plea agreement announcements on stock market returns in response to a foreign government investigation for insider trading.

Complex Securities
- Assisted attorneys in analyzing economic issues involving LIBOR transition for certain structured finance products.
- Assisted attorneys representing RMBS trustees to analyze whether certificateholders were harmed due to trustees' alleged failure to enforce repurchase of R&W breaching loans and to address servicers' breaches.
- Assisted attorneys in a government investigation regarding RMBS due diligence process, including the assignment of EV ratings, disclosure of silent-second mortgages, and sampling procedures.
- Assisted attorneys representing a CDO issuer to analyze the risk disclosed to investors and the CDO's allegedly fraudulent credit ratings.
- Assisted attorneys in several repurchase cases to compare the value of mortgage loans with and without alleged misrepresentations.

- Assisted attorneys representing RMBS servicer and master servicer in more than a half a dozen cases to analyze the economic issues arising from the alleged failure of proper servicing and failure to notify regarding R&W breaches.
- Assisted attorneys representing RMBS issuers in several securities fraud cases to analyze (1) whether investors would have found the alleged misrepresentations material, and (2) whether the poor collateral performance was the result of the alleged misrepresentations.

Healthcare
- Assisted attorneys to provide a data analysis of millions of health insurance claim records to determine the sufficiency of data production and to replicate the analysis in the complaint for a case involving overbilling disputes.
- Assisted attorneys on a class action alleging a conspiracy to allocate health insurance markets to prepare a presentation to the court that contained an overview of the insurance market, market share of the parties, and financial statistics.
- Assisted attorneys in several cases involving potential price fixing for certain drugs in the generic drug market.