I have been an Assistant Professor at UC Davis since completing my Ph.D. in Economics at the University of Pennsylvania in 2009. My research mainly focuses on answering three questions: (i) Under what conditions do assets (other than money) possess liquidity properties, and how do these properties affect the assets’ equilibrium prices; (ii) How do search frictions in certain markets affect the competition among sellers in these markets and, consequently, welfare; (iii) How do frictions that hinder unsecured credit in international transactions affect trade, and can such frictions explain some long-standing puzzles in international macroeconomics?

**Asset Liquidity, Asset Prices, and a new way of rationalizing Long-Standing Puzzles.**

One of the main lessons of the traditional asset pricing model is that, in equilibrium, an asset’s price should reflect the discounted value of its stream of dividends, sometimes referred to as the “fundamental value”. This powerful result assumes that agents would hold the asset to maturity and receive all the payments/dividends. But, in reality, agents do not always hold assets to maturity. Sometimes, they may use assets as means of payment in order to purchase consumption goods or services. Other times, they may use assets as collateral to fund consumption opportunities. And, more often, agents may visit secondary asset markets in order to sell assets before maturity for money, which then they can use to purchase consumption. In these examples, either directly (in the first two cases), or indirectly (in the third case) assets help agents facilitate transactions. In turn, when agents purchase assets in the first place, they expect that these assets may provide liquidity services “down the road”, and they will typically be willing to buy them at a price that includes a liquidity premium on top of the fundamental value. This idea is important as it suggests that the baseline asset pricing model may be missing an important ingredient of asset price determination. Indeed, recent literature suggests that adopting models where assets are priced both for their (traditional) role as stores of value and for their liquidity services, may be the key to rationalizing some long-standing asset pricing related puzzles.

My joint work with J. Licari and J.S. Lledo, titled “Asset Prices and Monetary Policy” (Review of Economic Dynamics, 2007), is one of the first to formalize these ideas. We build a model where an asset in fixed supply competes with money as means of payment, and we show that, if the asset supply is relatively scarce, the marginal unit of the asset is valued by the agents both as a store of value and as a facilitator of trade, hence, its price includes a liquidity premium. This finding is verified in recent work in empirical finance, which shows that investors are willing to pay significant liquidity premia for treasury bonds. Moreover, in our model, money and assets are substitutes, so that an increase in inflation (the cost of holding money) leads agents to increase their demand for assets, which, in turn, increases their prices and lowers their rate of return. This finding is also well-documented in the empirical finance literature.
In joint work with my student Lucas Herrenbrueck (now a professor at Simon Fraser University), titled “Monetary Policy, Asset Prices, and Liquidity in Over-the-Counter Markets” (Journal of Money, Credit, and Banking, 2016), we take asset liquidity a step further. We incorporate over-the-counter (OTC) asset trade within a monetary model, thus formalizing the idea that one of the main motives for trade in these markets is the need for liquidity. We show that assets can carry liquidity premia even if they do not serve directly as means of payment, simply because agents can sell them in the OTC market for money. Our paper suggests that asset liquidity depends crucially on the structure of the secondary markets where these assets trade. Hence, our concept of asset liquidity is empirically relevant and can be measured in the data.\footnote{The empirical relevance of our concept of asset liquidity is best reflected in the words of Brian Roseboro (Assistant Secretary of the US Treasury, 2001-04), who states that “secondary market liquidity is important because it encourages more aggressive bidding in the primary market”, indicating that the Treasury benefits from having its assets trade in liquid secondary markets, not because it obtains a direct benefit from secondary trade, but because agents who expect to be able sell assets easily in the secondary market are more willing to pay higher prices in the primary market.}

A direct, empirically testable prediction of our model is that the yield on assets that trade in (relatively) illiquid secondary markets will be higher than that on assets that trade in more liquid secondary markets (and have identical maturity and risk structure). Recent work in empirical finance confirms our finding.

In a recent paper with my former student Lucas Herrenbrueck and Kevin Salyer, titled “A Search-Theoretic Model of the Term-Premium” (forthcoming in Theoretical Economics), we show that the concept of asset liquidity developed in the JMCB paper can help us understand the term premium of long-term bonds (i.e., the upward sloping yield curve), and other empirical regularities that have been characterized as “puzzling”. In our paper, short term assets mature in time to take advantage of random consumption opportunities. Long-term assets (that mature in the future) cannot be used to purchase consumption, but agents may liquidate them in a secondary OTC market, characterized by search and bargaining frictions. Our model delivers three results that are consistent with empirical facts. First, long-term assets have higher rates of return in steady state to compensate agents for their relative lack of liquidity. Second, since the difference in the yield of short and long term assets reflects asset market frictions, our model predicts a steeper yield curve for assets that trade in less liquid secondary markets. Third, our model predicts that freshly issued (on-the-run) assets will sell at higher prices than previously issued (off-the-run) assets that mature in nearby dates, because sellers of the latter have a more urgent need for liquidity.

In joint work with my student Kuk Mo Jung (now a professor at Henan University), titled “Monetary Policy and Efficiency in Over-the-Counter Financial Trade”, we show that inflation can affect welfare not only through the traditional channel identified in monetary theory, i.e., through affecting equilibrium real balances, but also through affecting the very composition of the agents who demand and supply assets in the financial market. Interestingly, we show...
that for a certain range of parameter values a higher inflation can increase welfare through mitigating a congestion externality in the asset market. In a recent paper with my students J. Lee, S. Lee, and K. Oikawa, “OTC Trade and the Value of Assets as Collateral” (Economic Theory, 2016), we also study the equilibrium prices of liquid assets, but we focus on the case where assets help agents obtain collateralized loans.

Many studies that predict the existence of liquidity premia assume that asset supply is exogenous and relatively scarce, so that the marginal unit of the asset can help agents facilitate transactions in a frictional goods market. In recent work with L. Herrenbrueck, titled “The Strategic Determination of the Supply of Liquid Assets”, we study the joint determination of asset supply and asset liquidity in a model where financial assets can be liquidated for money in OTC secondary markets. Key to our model is the fact that an asset’s liquidity does not only depend on the (exogenous) characteristics of the market it trades in, but also on the (endogenous) behavior of agents in these markets. More precisely, secondary asset markets are segmented and customers will be drawn to the market where they expect to find the best terms. Understanding this, asset suppliers play a differentiated Cournot game, where product differentiation here stems from differences in OTC microstructure. We find that small (exogenous) differences in OTC microstructure can induce very large (endogenous) differences in the relative liquidity of the two assets. And, if one supplier has an exogenous advantage over another, the favored agent may want to strategically increase asset supply for the purpose of driving competitors out of the secondary market altogether. Our model has a number of fruitful applications, including the superior liquidity of US Treasury debt over (equally safe) municipal and corporate debt.

**Competition in Markets Characterized by Search Frictions.**

Search theory has gained tremendous popularity in the last 30 years because it helps us understand phenomena about which traditional theory (i.e., the Walrasian paradigm) has little to say: unemployment, price dispersion (especially when these prices refer to identical goods), trading delays, intermediation, etc. The baseline search model assumes that buyers and sellers match at random, and (typically) split the available surplus through bargaining. A more modern approach, dubbed “Directed Search” (DS), assumes that agents on one side of the market (typically sellers) post prices/wages in order to attract the agents on the other side of the market. This approach, not only provides micro-foundations for the matching process and the determination of the terms of trade, but also allows the study of competition within markets characterized by search frictions. In my paper, titled “Directed Search and Optimal Production” (Journal of Economic Theory, 2012), I extend the baseline DS model by allowing sellers to post general trading mechanisms, where a “mechanism” determines the number of buyers that will get served and the side payments, as functions of ex post realized demand. I show that all symmetric equilibria of the model are constrained efficient, even in the case of a few strategic
sellers. Small markets are characterized by multiple equilibria that are not payoff equivalent, but this indeterminacy vanishes as the size of the market grows. I provide closed form solutions for the matching function, and I show that the production decisions of sellers have a substantial effect on the efficiency of the matching technology.

A crucial feature of the DS approach is that it models buyers (and not just sellers) as strategic agents who choose to visit the seller who offers them the best expected terms of trade. In my work, titled “Directed Search and the Bertrand Paradox” (International Economic Review, 2014), I exploit this feature to revisit the famous Bertrand Paradox. I argue that, despite the emphasis that has been placed by the IO literature on sellers’ capacity constraints as a resolution to the paradox, the existence of such constraints is only a subcase of a more general class of environments where the paradox fails. More precisely, Bertrand’s paradox will not arise whenever the buyers’ expected utility from visiting a specific seller is decreasing in that seller’s realized demand. This will be true if sellers face capacity constraints (as identified in the literature), but it will also be true if there are congestion effects, or if sellers are allowed to price based on ex-post realized demand. These ingredients cannot be added in a standard oligopolistic model, where sellers face an exogenous demand for their good. Hence, the choice of a DS model is imperative for clarifying this important point. Although any of the three aforementioned ingredients can resolve the paradox, they lead to equilibria with very different welfare properties, hence, the model has some important policy implications.

In a recent paper published in the Review of Economic Dynamics, I use a DS model to study the important topic of unemployment insurance (UI). Most papers that have researched this question focus on the moral hazard problem that UI can generate. In contrast, my paper, titled “UI and Optimal Taxation in a Search Model of the Labor Market”, focuses on the optimal way of raising taxes to fund UI. Since firms direct workers to apply to them by posting wages, raising UI funds in a lump-sum manner distorts the efficient allocation, as it gives firms an incentive to be excessively aggressive in their attempt to maximize the probability of filing up their vacancies. I discuss two ways through which this externality can be internalized and efficiency can be re-established.

Asset Liquidity and its Effect on International Macroeconomics Outcomes.
One of the most famous puzzles in International Macroeconomics is the fact that agents’ asset portfolios exhibit high degrees of home bias. But, also, the turnover rates of foreign assets are higher than those of domestic assets, which generates an additional puzzle: All the explanations that have been offered to rationalize the “Asset Home Bias” puzzle, boil down to some friction that discourages agents from holding foreign assets. But it is precisely because of these frictions, that the existing models predict a low turnover rate of foreign assets (agents do not want to trade these assets due to frictions). In joint work with Ina Simonovska, titled “Asset Liquidity and International Portfolio Choice” (Journal of Economic Theory, 2014), we of-
fer an explanation for both of these observations. We employ a model of asset liquidity, similar to the ones described in the first section of this document, extended to a two-country environment. We assume that the net dividend from foreign assets is lower (e.g., due to a higher cross-border relative to domestic dividend income tax), and we show that, for a large set of parameters, assets circulate as media of exchange locally, i.e., domestic assets facilitate trade at home and foreign assets facilitate trade abroad. Since domestic assets yield a higher dividend, agents hold more domestic over foreign assets, and portfolios exhibit home bias. Moreover, agents hold foreign assets in order to acquire consumption abroad, but they offload them at the first given opportunity. Hence, foreign assets turn over faster than domestic assets. The calibrated model predicts a home equity share of 72% and a turnover rate for foreign equities that is 1.44 times higher than the rate for domestic equities, which favor well with the data.

In another venture into the field of International Macroeconomics, my former student Kukmo Jung and I study the importance of the structure of the FOREX market for macroeconomic outcomes. As is well-known, the FOREX is the largest OTC market in the world, characterized by bilateral trade, intermediation, and significant bid-ask spreads for agents who need to acquire foreign currency. The vast majority of the existing International Macro literature cannot account for these stylized facts, because it models the FOREX as a standard Walrasian market. Our paper, titled “An Over-the-Counter Approach to the FOREX Market” (Revise and Resubmit at International Economic Review), is the first to model the FOREX market explicitly as a decentralized OTC market, within a dynamic general equilibrium framework. Modeling the FOREX market in an empirically relevant way is not an end in itself. We show that the FOREX market microstructure critically affects the volume of international trade and, consequently, welfare. Hence, our paper highlights that modeling the FOREX as a frictionless Walrasian market is not without loss of generality. Ongoing revisions suggest that our model’s theoretical results are empirically supported.