

Research Statement – Jaromir Nosal

My research focuses on two broad areas of economics. The first area is international macroeconomics and finance, where I study questions of international pricing, risk sharing, shock transmission and international capital flows. The second area studies the functioning of credit and asset markets, with focus on household finance and the efficiency of asset market allocations.

1. International Macroeconomics and Finance.

International Pricing

One of the central questions in international macroeconomics is what drives deviations from the law of one price (or, equivalently, pricing to market behavior). A vast empirical literature identifies large and persistent international deviations from the law of one price, a finding that can be expressed as incomplete cost or exchange rate pass-through to international prices. Providing a mechanism for the observed pricing behavior has been at the forefront of research in international macroeconomics.

The empirical evidence and theoretical results in the field point to a crucial role of the so-called *real rigidities* in driving pricing behavior—in short, deviations from the law of one price are just too persistent to be explained by nominal frictions alone. One of the sources of real rigidities overlooked in the literature is that expanding sales in any market is a costly and time-consuming process. Evidence suggests that it usually involves establishing contact with suppliers and ensuring the quality and reliability of the product (especially in intermediate goods markets), or capturing and sustaining a customer base (in both intermediate and final product markets). This suggests that factors other than the price may be a significant determinant of sales,

which in the data may look like failure of arbitrage. In *“Understanding International Prices: Customers as Capital”* (*American Economic Review*, 2012), Lukasz Drozd and I propose an equilibrium theory in which micro-founded search and matching frictions lead to endogenous market segmentation and deviations from the law of one price resulting in incomplete pass-through. The key mechanism is that producers need to explicitly build up market share in each market in which they sell, and that this process is costly and time consuming. Our proposed friction is fully operational in the short run and dynamically weakens at long horizons. We use this fact in tandem with data on the dynamic response of trade to tariff liberalizations, or in other words, the difference between the short-run and the long-run estimated trade elasticity, to parameterize the key parameter of the friction in the model. Quantitatively, due to persistent pricing to market implied by the theory, the model successfully accounts for key pricing to market data facts. We show that a unique feature of our friction—that it is dynamic—also implies that the model is consistent with different estimates of the exchange rate pass-through coefficients depending on the horizon of the analysis.

Several other micro-founded real frictions have been put forward in quantitative international business cycle literature. In various contexts, they have been demonstrated to be capable of improving upon their respective frictionless benchmarks. However, since the definition of the frictionless benchmark as well as the set of analyzed data moments typically vary across papers, it is hard to compare the performance of these mechanisms against each other, and thus evaluate their potential for future applications. In *“Pricing-to-Market in Business Cycle Models”* (*Reject and Resubmit, Review of Economic Dynamics*, 2022), Lukasz Drozd and I fill this gap by performing a consistent comparison of leading frictions in the literature. We embed each friction in a common frictionless business cycle model, and evaluate them against the same set of robust data moments. In particular, we characterize whether the mechanism generating pricing to market: (i) depends on the type of shocks driving the fluctuations, (ii) generates the dynamic behavior of quantities that is consistent with the data and (iii) generates the dynamics of the deviations from the

law of one price that are in line with the data. We consider four state-of-the-art frictions, provide a way to parameterize each model in a mutually consistent way and then characterize the quantitative performance of each friction against these benchmarks.

Another major aspect of the behavior international prices and the deviations from the law of one price is what they imply for the behavior of the real exchange rate. The real exchange rate can move for two broad reasons: movements in the relative price of tradables to non-tradables (with the law of one price holding), or deviations of the domestic and foreign price of tradables—usually interpreted as deviations from the law of one price. The assessment of the relative contribution of these two forces in the data is that the dominant determinant of real exchange rates are deviations of domestic and foreign tradables from parity, as opposed to the relative price of non-tradables. In *“The Nontradable Goods’ Real Exchange Rate Puzzle” (NBER ISOM 2009)*, Lukasz Drozd and I evaluate, from the perspective of a standard international business cycle model, whether this finding per se implies the necessity of deviations from the law of one price in business cycle models. In principle, the typical models usually feature tradables that are differentiated by country of origin and home-bias, and hence the tradable baskets consumed in each country are different—and therefore may have different aggregate prices. We ask whether a parameterized model with a tradable and non-tradable sector and goods differentiated by country of origin can account for the small contribution of the relative price of non-tradables to real exchange rate movements. The model we put to the test is a backbone of a vast literature in international macroeconomics, and therefore we view this as an important step in guiding further research on the topic. We find that while the tradable component can be volatile in the model even under law of one price, its contribution to the fluctuations of the real exchange rate are far too small relative to the data. We show that the source of this failure is that the shock to the tradable sector implies a counterfactually strong negative correlation between the tradable and non-tradable components of the real exchange rate, and that given the estimated productivity processes, that shock is the main driver of the cycle. Hence, we conclude

that deviations from the law of one price are quantitatively necessary to account for the behavior of the real exchange rate.

International Risk Sharing and Capital Flows

Another major question in international macroeconomics is: What role does trade play in the transmission of business cycle shocks across borders? In “*The Trade-Comovement Puzzle*” (*AEJ: Macroeconomics*, 2021), Lukasz Drozd, Sergey Kolbin and I provide a theoretical and quantitative analysis of this question. Analytically, we show that in a broad class of open economy macroeconomic models, shock transmission through trade depends on the values of the short-run and long-run elasticities in the model. We illustrate the importance of this fact by focusing on the *trade-comovement* relationship between average trade and correlations of real GDPs—a relationship which has been found significantly positive in numerous empirical studies. We show analytically, in a prototypical business cycle model, that the standard transmission mechanism that is embedded in most international macroeconomics models implies a counterfactual negative relationship between trade and GDP comovement. We then provide a theoretical analysis of the source of this failure, which points us to three potential resolutions: (i) financial market imperfections, which we model in the extreme version of financial autarky to gauge the potential of this resolution (ii) shutting down income elasticity of labor in the form of Greenwood-Hercowitz-Huffman preferences and (iii) modeling dynamic trade elasticity, specifically low short-run and high long-run elasticity, consistent with the data. We quantify the potential of each of the resolutions in a quantitative general equilibrium multi-country model and conclude that the dynamic elasticity resolution performs best quantitatively in accounting for the trade-comovement relationship. Our model is at its core the basis of virtually all international macroeconomic models, and hence this sheds light on the failure of the literature to provide a mechanism that accounts for the positive trade comovement link using models with a single elasticity, usually parameterized to match the short-run estimates.

International capital flows across countries are typically large and associated with vast gross flows. These global portfolio flows, especially for equity holdings, have important consequences for stability of financial markets and potential for regulating capital flows. A large theoretical and empirical literature on *sudden stops* and *fickle capital*, for example, studies the issue of foreign investors withdrawing most their funds in a short period of time (sudden stop), or sudden retrenchment of foreign investors towards their country of origin (fickleness), leading to large price drops and potential negative externalities on the local economy. Most of the empirical literature on this topic uses aggregate data, which is useful in pinning down common factors determining the flows, but not rich enough to pin down the precise economic mechanism driving the behavior of international investors. In “*Global Volatility and Firm-Level Capital Flows*” (submitted, 2022), joint with Marcin Kacperczyk and Tianyu Wang, I try to shed more light on this issue by providing firm-investor-level panel evidence on global equity holdings, which allows us to study the response of foreign investors to global volatility shocks. The richness of the data allows us to control for a variety of local and firm- and investor-specific factors, and also isolate systematic differences in foreign investor responses in the cross-section of assets. This allows us to address the fundamental questions: Does foreign investment destabilize markets? Does the stability of the response to global shocks depend on individual responses or cross-section? What is the mechanism behind the responses of institutional investors? We find that foreign investors do exhibit increased responses to global shocks relative to domestic investors on average, and provide evidence that such retrenchment can de-stabilize firm stability by adversely affecting volatility and liquidity. However, we also find that in the cross-section of assets, the foreign investor response is much more muted for large stocks, leading to a reallocation of foreign portfolios towards large stocks after an increase in global volatility. This finding implies that foreign investment flows can actually play a stabilizing role for some assets (large) and destabilizing role for other assets (small) in times of global financial stress. We shed light on the mechanism behind the estimated responses by exploring the predictions of an equilibrium model of portfolio choice and endogenous learning, in which foreign investors are more sophisticated – consistent with empirical findings

in the literature. We show that the model is consistent with the empirical patterns we estimated, and that the theory points to the crucial role of endogenous learning in explaining the relocation of portfolios across assets.

2. Credit and Asset Markets.

I am interested in the determinants of asset, debt and default choices of individuals which is reflected in my household finance research. I am also interested in the functioning of asset markets in the presence of information frictions, which resulted in my asset markets research papers.

Household Finance: Quantitative Theory

A fundamental question in household finance is what determines the asset allocation choices of households, which in turn affects their financial outcomes, in particular financial wealth and capital income. In *“Investor Sophistication and Capital Income Inequality” (Journal of Monetary Economics, 2019)*, Marcin Kacperczyk, Luminita Stevens and I investigate the forces behind the growing capital income inequality in the US. We propose an economic mechanism by which differences in investor sophistication—modeled as access to informationally superior investment technology—contributes to growth in capital income inequality. We use a portfolio choice model with endogenous information acquisition and quantify the effects of heterogeneity in information capacity on the portfolio choices of investors (households). We show that in a parameterized model, capacity heterogeneity can generate differences in portfolio returns that are quantitatively close to the data. We also provide external validity of the mechanism by showing that the time evolution of portfolio composition of different investor classes in the data is consistent with progress in overall information technology in the model. Finally, we show that given initial capacity differences, aggregate progress in information technology can

generate an increase in capital income inequality that is quantitatively consistent with data from the Survey of Consumer Finances.

There is a fundamental market incompleteness in households' debt instruments, in that credit repayments are not contingent on individual characteristics and present state of an individual. As a result, some individuals may find themselves in situations in which they are unable to pay back their debt obligations. This typically results in distortions to other economic choices that these individuals make: in labor supply decisions, housing location decisions, the set of potential job opportunities, etc. The institution of personal bankruptcy and foreclosure is designed to minimize these distortions and provide individuals in financial distress an orderly way to liquidate their assets and discharge their debt. Personal bankruptcy is a relatively new option (effectively established in the US in 1978), and the consumer credit market has exhibited unprecedented growth over the recent decades. These make it a very exciting topic to study.

I study the determinants debt and borrowing in unsecured credit markets, and their relation to the competitiveness of credit markets in "*Imperfect Competition in Credit Markets*" (submitted, 2022), joint with Tzuo Law and Manolis Galenianos. In the paper, we show that a departure from perfect competition or constant markup assumption in the credit market fundamentally changes the distribution of borrower profitability: from safe borrowers being highly profitable in the competitive framework towards risky borrowers being highly profitable in a model in which the lenders have more market power. The second prediction-of risky borrowers being highly profitable-is more consistent with empirical evidence, and hence we view this finding as the data pointing to departures from perfect competition in credit markets. We provide a theoretical analysis of the determinants of profitability, and then build a quantitative equilibrium model with a search friction which gives rise to endogenous market power of the lenders. We show that the parameterized quantitative model matches the prediction of high profitability of the risky consumers, and then analyze the effects of regulating market power in the credit market. We show that interest rates caps in

the imperfectly competitive model imply greater access to credit on the intensive and extensive margin, together with lower bankruptcy due to cheaper rollover options for borrowers, implying large welfare gains of such policy. This is in stark contrast to the predictions of the competitive model, which implies that credit access declines in response to the policy, and welfare is reduced. Our analysis implies that it is crucial to capture the details of the competition in the credit markets when evaluating the effects of regulation of financial contracts, such as interest rate regulation that is widely discussed in policy and academic circles.

I further study the interplay between market structure, debt and default in "*Competing for Customers: A Search Model of the Market for Unsecured Credit*" (*working paper*), Lukasz Drozd and I study theoretically the role of a new credit instrument on household debt and bankruptcy decision: the credit card. The credit card emerged as the only form of unsecured borrowing in the US over the last 30 years, and the growth of this market was concurrent with rapid growth of both unsecured borrowing and personal bankruptcies. We build a theory of credit card borrowing in which we explicitly model two crucial elements of credit cards: (i) that they are an option to borrow up to the limit, and (ii) that the terms are set once for a prolonged time, with effective commitment to the limit by the banks. We show that such contracts induce much more borrowing and default behavior in equilibrium relative to an economy with standard lending contracts, which are pre-set amounts that are re-priced every time a household needs additional credit. At the same time, credit card contracts still allow banks to break even on the (riskier) credit lines, which suggests credit cards are a superior credit instrument for both sides of the market.

Household Finance: Empirical Analysis

In addition to my theoretical work described above, I also think that careful data analysis is of crucial importance, especially when evaluating potential policy interventions in credit markets. This is strongly exemplified by my analysis of the evolution of mortgage debt and default during the Great Recession in "*Credit Growth*

and the Financial Crisis: A New Narrative” (Accepted, *Journal of Monetary Economics*), joint with Stefania Albanesi and Giacomo De Giorgi. In the paper, we use a proprietary panel dataset on the credit files of 1% of US population to study the evolution of mortgage debt and defaults between 2001 and 2013. We document that both the rise in mortgage borrowing in the run-up to the crisis, as well as the subsequent spike in delinquencies and foreclosures is concentrated among mid- to high-credit score borrowers. Additionally, among those borrowers, we find that real estate investors played a critical role in the rise of mortgage defaults. Our analysis is contrary to the popular view that the mortgage crisis during the Great Recession was a sub-prime phenomenon, and has dramatically different implications in terms of the potential regulatory tools that should be used to avoid future crises of this kind. Specifically, our findings suggest that borrower characteristics such as credit score may be less important than behavior, such as real estate investment activity, in driving mortgage defaults.

Another crucial aspect of credit markets and personal bankruptcy is pinning down the amount of optimal social insurance provided by the bankruptcy option. There is a long-standing debate both in academic and policy circles on how restrictive the bankruptcy law should be. On the one hand, there is the need to provide a safety net to unlucky individuals who fall into financial dire straits. On the other hand, the law has to discourage irresponsible behavior that leads to abuse of this insurance provision—a classic moral hazard problem. In *“Insolvency after the 2005 Bankruptcy Reform”* (Revise and Resubmit, *Journal of Law, Economics and Organization*, 2022), Stefania Albanesi and I contribute to this discussion by using the same proprietary panel dataset on the credit files of 1% of US population to study the effects of the 2005 Bankruptcy Abuse Prevention and Consumer Protection Act on individual behavior. The 2005 Act is the most important piece of bankruptcy legislation since the original bankruptcy act of 1978, and it significantly increased the filing burden on households, with the intent of preventing the abusers from using the option. Using our dataset, we show that the law, through increased lawyer fees, is responsible for a significant drop in the bankruptcy rate. However, we show that the new non-bankrupts also don’t pay

off their debts, but instead a large fraction of them become severely and persistently delinquent. These effects are significantly larger for lower income (low credit score) groups. We additionally shed light on the potential mechanism behind the estimated response, by showing that the impact of the law only happened for Chapter 7 bankruptcy filings and not Chapter 13 bankruptcy filings—even though filing cost for both chapters increased as a result of the reform. The crucial difference between filing costs for the two chapters is that Chapter 13 cost can be paid by the filer in installments after bankruptcy, but Chapter 7 costs must be paid up-front, because they are considered junior debt in bankruptcy proceedings. This suggests that liquidity constraints bind for a large fraction of potential filers, suggesting a large number of households needing financial relief through bankruptcy, but post-reform unable to obtain it. Our findings indicate a thus-far undocumented and perhaps unintended consequence of the law in that it reduced access to bankruptcy for the lowest income group through higher lawyer fees, suggesting a welfare cost of the reform. Finally, our results imply that the full measure of financial distress of households includes not only bankruptcy filings but a measure of households that are severely delinquent.

In ongoing work on a project *“Born to be (sub)Prime” (work in progress, 2022)*, joint with Helena Bach, Pietro Campa, Giacomo De Giorgi and Davide Pietrobon, use panel data on consumer credit from the credit bureau Experian to study mobility in credit markets. Our focus is on the evolution of individual credit scores and credit outcomes such as debt and delinquency. Credit scores are an important summary statistic of an individual that is widely used in evaluating credit applications, job applications, housing rentals and can have profound impact on an individual’s ability to smooth expense shock, move to a new location or get a new job. In this context, we investigate the determinants of individual credit scores, and in particular ask what determines which score an individual enters the credit market at age 18, and what determines the future evolution of the credit score. Specifically, focusing on individuals entering the credit market with low scores (i.e. are ‘born subprime’), we ask whether their initial ranking depends on their parents’ credit scores and also whether they are able

to improve their scores by 'good behavior', i.e. being current on all their accounts. We document three robust patterns. First, the initial rankings depend in large part on the (synthetic) parent credit scores. In particular, young entrants' low scores are not due to any observed past behavior, but rather may be due to the length their records inherited from their parents. Second, we show that low credit scores at entry matter in terms of future access to credit in the forms of credit cards, auto loans, mortgages and student loans. Finally, using machine learning methods, we ask which behaviors are most salient for improving the credit score over the individual's life cycle? Specifically, we are interested in whether in order to improve one's credit score, one needs to first improve credit access—which in turn requires higher credit scores, making the situation a self-fulfilling low credit score trap.

Asset Markets

My interest in the workings of asset markets in the presence of market incompleteness led me to study the topic in the context of banking and government bailouts, as well as the efficiency of asset markets in the context of institutional investors producing information about asset payoffs.

In "*Uncertainty as Commitment*" (*Journal of Monetary Economics*, 2016), Guillermo Ordoñez and I study the problem of a government facing a banking sector that is subject to a classic moral hazard problem of taking excessive leverage and creating a crisis ex-post. In such cases, classic theories imply that if the government lacks commitment, banks will choose to take on excessive leverage and crises with subsequent bailouts will happen on the equilibrium path. In this context, we show that when the government faces uncertainty at the onset of the crisis as to whether the problem is systemic or specific to a particular bank, it creates incentives to delay bailouts and learn from market reaction. If delay generates a market takeover of a troubled bank, the problem is idiosyncratic, if not, then there is an aggregate liquidity shortage, and a bailout will be necessary in the future. Such delay carries risks that some banks will fail before the government intervenes, but also generate benefits of

not having to provide inefficient social transfers (from households to banks). We show that this natural extension of the theory dramatically changes equilibrium outcomes. In particular, if delayed bailout is optimal, this creates a disciplining effect on the banks' leverage choices ex-ante—no bank wants to be the first to show distress in case of a crisis. In equilibrium, this disciplining force, through a Bertrand-type competition for not having the highest leverage, brings leverage all the way to the first best outcome. This means that the equilibrium allocation coincides with the one that obtains if the government had commitment power, but in this case no commitment power is assumed. Our result points to the fact that the classic moral hazard outcome of equilibrium over-leverage, crises and bailouts is not robust to imperfect information on the government side, and points to alternative explanations for banking crises, such as bank runs.

In “*Market Power and Price Informativeness*” (*Revise and Resubmit, Review of Economic Studies, 2022*), Marcin Kacperczyk, Savitar Sundaresan and I study the incentives of large investors to learn and produce information about asset payoffs, which is then revealed in prices. Equity markets in the US and worldwide have been rapidly evolving in terms of the overall institutional ownership and its concentration, bringing to the forefront issues related to the regulation of size and ownership structure of equity markets by large institutional investors. In order to inform this policy discussion, we provide a framework which is able to address questions related to the distributional effects of asset ownership on the amount of information revealed in prices. We show that the crucial elements needed to study this question are (i) modeling large investors with price impact, (ii) allowing for endogenous information choices and (iii) having a rich multi-asset environment. The three elements have not been analyzed in a single equilibrium model up to this point. In our framework, we find that information contained in asset prices responds to the size of the institutional sector in a *non-monotonic* fashion, driven by a race between a *positive* effect of having the more sophisticated institutional investors being larger versus *negative* effect of increased size due to the fact that larger investors have bigger price impact and in response endogenously choose to *act less on the signals* they receive, a channel which

we term the *information pass-through*. We also study the effects of increased concentration and a growing size of passive large investors – both trends in US data. For each of the experiments, we can isolate the information pass-through channel and show that quantitatively it is the primary source of variation of information revealed in the price.