Prize Citation for 8th Stephen A. Ross Prize in Financial Economics Awarded by Foundation for Advancement of Research in Financial Economics (FARFE)

The 8th Ross Prize has been awarded to "Leverage Cycles and the Anxious Economy," written by Ana Fostel from the University of Virginia and John Geanakoplos from Yale University. The award-winning paper, which was published in the *American Economic Review* in 2008, develops an innovative analysis of financial booms and busts based on changes in leverage. The leverage channel that Fostel and Geanakoplos model has been recognized as one of the main drivers of the financial cycle, and has informed a large body of theoretical, empirical, and policy work in finance and macroeconomics.

Previous models of the financial cycle emphasize two main channels: the balance-sheet channel, whereby borrowers' ability to access external capital increases in their internal funds, and the collateral channel, whereby borrowers' ability to access capital increases in the value of the assets that they can pledge as collateral. Bernanke and Gertler (1989) and Holmstrom and Tirole (1997) model the balance-sheet channel for firms and banks, respectively. Kiyotaki and Moore (1997) model the collateral channel.

Under the balance sheet and the collateral channel, credit varies over the financial cycle because of variation in internal funds and collateral values, respectively. The leverage channel emphasizes a different type of variation, in the ability to borrow against a given amount of collateral. The ability to borrow against collateral declines when uncertainty in the economy increases because it becomes more likely that collateral will be insufficient to repay the debt. Thus, during uncertain times, assets' margin requirements increase sharply, leverage decreases, and lending to the real economy can shut down.

The idea that margin requirements are endogenous and increase with uncertainty first appears in book chapters by Geanakoplos (1997, 2003). Geanakoplos (1997) proposes the concept of collateral equilibrium, whereby margin requirements are determined from the demand and supply for different types of contracts. Geanakoplos (2003) shows that margin requirements in collateral equilibrium increase when uncertainty or disagreement are high.

Fostel and Geanakoplos (2008) integrate the leverage channel into a simple and empirically relevant asset market model, and derive a rich set of results. Agents in the model can trade three risky assets. Trade occurs over two periods, and the assets pay off in a third period. The first asset is interpreted as a risky domestic bond. The second and third assets are interpreted as emerging market bonds. Their cash flows are independent from those of the first asset, and the recovery value in the event of default is smaller for the third than for the second asset. News in the second period concerns the cash flows of the first asset only. When the news is good, the asset pays its face value with certainty in the third period. When the news is bad, the asset may default and the uncertainty about its payoff increases. Agents differ in their beliefs, and optimists can borrow from pessimists using assets as collateral.

Three main results are derived. A first result is contagion: bad news about the first asset causes the prices of the second and third asset to drop, even though their cash flows are independent. This is because disagreement about the first asset increases following bad news. Therefore, optimists want to increase their holdings of the first asset, and this

increases the opportunity cost of holding the second and third assets. A second result is that contagion is stronger towards the third asset, which has the smaller recovery value. This is because that asset is less valuable collateral, and thus the opportunity cost of holding it following bad news is larger. A third and related result is that the price of an asset exceeds the present value of the asset's future cash flows because of the asset's collateral value. An asset with higher collateral value has a higher price, all else equal.

In addition to deriving the above results, Fostel and Geanakoplos clarify the role of the leverage channel in driving them. They do so through a series of benchmark cases. When there is a representative agent, price volatility for the first asset is low and there is no contagion to the second and third assets. When agents are heterogeneous in terms of their beliefs but markets are complete, volatility increases but there is still no contagion. When markets are incomplete, and borrowing is prohibited, contagion arises but is identical across the second and third assets. Collateralized borrowing and the endogenous variation in margins are thus critical for the second and third results.

The leverage channel has informed work in finance and macroeconomics. In Gromb and Vayanos (2002), arbitrageurs supply liquidity across segmented markets. Their ability to do so and enforce the law of one price is limited by endogenous margin constraints, which tighten when volatility increases as in the award-winning paper. In Kyle and Xiong (2001), contagion across markets occurs due to wealth shocks to risk-averse agents. In Brunnermeier and Pedersen (2009), arbitrageurs intermediate trades arriving in different periods and across multiple risky assets. Following adverse price movements, margin constraints tighten because margin lenders infer that volatility has increased. In Gârleanu and Pedersen (2011), exogenous margin constraints give rise to violations of the law of one price because assets with weaker margin constraints are more valuable collateral. In Simsek (2013), agents with different beliefs can trade one risky asset. Margin contracts are derived in collateral equilibrium and depend on the nature of disagreement. Capponi, Cheng, Giglio, and Haynes (2022) show empirically that margin requirements in the CDS market depend on tail events rather than overall volatility, consistent the extension of collateral equilibrium in Fostel and Geanakoplos (2015).

Bruno and Shin (2015) incorporate the leverage cycle into an international macroeconomics model with a global banking sector that borrows in dollars and lends in foreign currency. They show that a foreign currency appreciation is associated with an increase in the banking sector's leverage. In Coimbra and Rey (2021), banks differ in leverage and can engage in risk-shifting. A looser monetary policy can stimulate investment. When, however, interest rates are low enough, risk-shifting increases financial instability. In Fostel, Geanakoplos, and Phelan (2019) countries differ in the extent to which local assets can be collateralized. This leads to cross-country capital flows, which amplify asset volatility.

In Fostel and Geanakoplos, the increase in margin requirements during uncertain times derives from the debt-like nature of the securities. Gorton and Pennacchi (1990) emphasize the advantages of debt in resolving asymmetric-information problems. Gorton and Metrick (2012) show that an increase in uncertainty during the global financial crisis of 2007-8 caused a sharp increase in margins and a run in the repo market. Geanakoplos (2010) exposits this research agenda and its future potential.

The leverage cycle model of Fostel and Geanakoplos has given rise to an important body of work on margin requirements and how these vary across assets and over time. Their work paved the way for further study of the determinants of endogenous leverage and margin requirements, which are consequential in practice.

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