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Financial development and innovation: Cross-country evidence[☆]

Po-Hsuan Hsu^a, Xuan Tian^{b,*}, Yan Xu^a^a Faculty of Business and Economics, University of Hong Kong, Hong Kong^b Kelley School of Business, Indiana University, Bloomington, IN, United States

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ABSTRACT

We examine how financial market development affects technological innovation. Using a large data set that includes 32 developed and emerging countries and a fixed effects identification strategy, we identify economic mechanisms through which the development of equity markets and credit markets affects technological innovation. We show that industries that are more dependent on external finance and that are more high-tech intensive exhibit a disproportionately higher innovation level in countries with better developed equity markets. However, the development of credit markets appears to discourage innovation in industries with these characteristics. Our paper provides new insights into the real effects of financial market development on the economy.

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1. Introduction

While innovation is vital to ensure a country's long-term economic growth and competitive advantage (Solow, 1957), motivating and nurturing innovation is very

difficult. As Holmstrom (1989) points out, the whole innovation process is not only long, idiosyncratic, and unpredictable, but also involves a very high probability of failure. Therefore, promoting innovation effectively requires well-functioning financial markets that play critical roles in reducing financing costs, allocating scarce resources, evaluating innovative projects, managing risk, and monitoring managers. Despite the Schumpeter (1911) argument that the development of financial markets is critical for a nation's innovation, rigorous empirical studies that link financial market development and technological innovation are sparse. Hence, the objective of this paper is to provide cross-country evidence for the real effects of financial market development on the economy from the perspective of technological innovation. Specifically, we examine the different impacts of equity market development and credit market development on innovation and identify economic mechanisms through which they occur.

A major challenge of our study is identifying the causal effects of financial market development on technological

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* Corresponding author.

E-mail addresses: paulhsu@hku.hk (P.-H. Hsu), tianx@indiana.edu (X. Tian), yanxuj@hku.hk (Y. Xu).

innovation, due to both reverse causality and omitted variable concerns. First, there is an old debate on the direction of causality between finance and growth. A large body of literature starting with Schumpeter (1911) argues that finance leads to economic growth, because the services that the financial sector provides allow capital and resources to be allocated to the highest value use with reduced risk of loss caused by adverse selection, moral hazard, or transaction costs. Conversely, a large body of literature follows Robinson (1952), who famously argues that “where enterprise leads, finance follows” (p. 86). This literature believes that economies with good growth opportunities develop financial markets to provide the funds necessary to support their good growth prospects. In such cases, the economy leads, and finance follows. Second, omitted variables could bias the estimation and statistical inferences that result from using traditional cross-country regressions. Unobservable industry or country characteristics related to both financial market development and innovation are left in the residual term of the regressions, which makes correct statistical inferences hard to draw.

Our identification strategy is to use a panel-based fixed effects identification approach that studies the specific economic mechanisms through which financial market development affects innovation, building on the seminal work of Rajan and Zingales (1998). Our panel-based approach captures both time series and cross-sectional dynamics between financial markets and innovation, allowing for more reliable statistical inferences.

We examine two mechanisms motivated by economic theories about the functions of financial markets and institutions. First, we consider the most important function of financial markets: overcoming moral hazard and adverse selection problems and, therefore, reducing the firm’s cost of external capital. Specifically, we examine whether industries that are more dependent on external finance innovate more in countries with more developed financial markets. Second, as high-tech industries usually undertake more innovative and risky projects that involve long and intensive research processes before final production, financial markets’ function of evaluating long-term and risky projects and diversifying risk will crucially affect the financing of innovation. Hence, we study whether high-tech industries innovate more in countries with more developed financial markets when compared with those industries in countries with less developed financial markets.

When we examine these two economic mechanisms, we differentiate the effects of equity market development and credit market development on innovation. We propose that different effects of equity and credit markets could be due to the different payoff structures to equity and credit providers. We discuss these two mechanisms and related theories in more detail in Section 2; we also develop our testable hypotheses in this section.

We collect innovation and financial development data for 32 economies from the National Bureau of Economics Research (NBER) patent database, the Worldscope (WS) database, and the World Development Indicators and Global Development Finance (WDI/GDF) database. Our

sample includes developed countries such as the US, the UK, and Japan, as well as emerging nations such as Russia, India, and Brazil. Following Rajan and Zingales (1998), we assume that US financial markets are relatively frictionless and informative, so we use US data to form the benchmark measures of industry-level economic mechanisms.

Our baseline results show that industries that are more dependent on external finance and that are more high-tech intensive exhibit disproportionately higher innovation levels in countries with better developed equity markets. However, better developed credit markets appear to discourage innovation in industries with these characteristics. We conduct a number of robustness checks to examine whether our main results are robust to alternative econometric specifications (controlling for country–industry fixed effects and clustering standard errors only at the country level), alternative proxies for financial market development, alternative proxies for high-tech intensiveness, and alternative innovation proxies defined at the technology class level. Collectively, these tests help us understand where the variation that drives our main results originates.

Our paper offers new insights into the real effects of financial development and is related to two streams of literature. First, it contributes to the literature on finance and growth. Starting with Schumpeter (1911) and Robinson (1952), a large literature has tried to understand the relation between financial systems and economic growth. Recent theoretical work indicates two likely links between finance and growth. Bencivenga and Smith (1991) and Jappelli and Pagano (1993) argue that financial markets matter by affecting the volume of savings available to financial investments, while Greenwood and Jovanovic (1990) suggest that financial markets matter by increasing investment productivity.¹ Second, our paper contributes to the emerging literature on finance and innovation that examines various strategies for promoting innovation. Manso (2011) argues that managerial contracts that tolerate failure in the short run and reward success in the long run are best suited for motivating innovation. Also, Ferreira, Manso, and Silva (2014) show that private, not public, ownership spurs innovation. Nanda and Rhodes-Kropf (2011) suggest that “hot” rather than “cold” financial markets help promote innovation.² Unlike earlier studies, we use a rich cross-country data set to examine specific

¹ Empirical evidence linking finance and growth has shown that the size, depth, and liberalization of an economy’s financial system positively affect its future growth in per capita, real income, entrepreneurship, employment, and output (e.g., King and Levine, 1993a; Jayaratne and Strahan, 1996; Rajan and Zingales, 1998; Beck and Levine, 2002; Black and Strahan, 2002; Bekaert, Harvey, and Lundblad, 2005).

² Empirical evidence shows that laws (Acharya and Subramanian, 2009; Acharya, Baghai, and Subramanian, 2014; Brown, Martinsson, and Petersen, 2013), stock liquidity (Fang, Tian, and Tice, forthcoming), investment cycles in financial markets (Nanda and Rhodes-Kropf, 2013), financial analysts (He and Tian, 2013), product market competition (Aghion, Bloom, Blundell, Griffith, and Howitt, 2005), investors’ attitudes toward failure (Tian and Wang, 2014), banking competition (Cornaggia, Mao, Tian, and Wolfe, forthcoming), corporate venture capital (Chemmanur, Loutskina, and Tian, forthcoming), and institutional ownership (Aghion, Van Reenen, and Zingales, 2013) all positively or negatively affect innovation.

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