



**ADB Working Paper Series**

**IMPLICATIONS OF PLATFORM  
FINANCE ON MONETARY  
POLICY TRANSMISSION**

---

Chin-Yoong Wong  
and Yoke-Kee Eng

No. 970  
June 2019

**Asian Development Bank Institute**

Chin-Yoong Wong is an associate professor in economics at the Department of Economics, Faculty of Business and Finance of the Universiti Tunku Abdul Rahman in Malaysia. Yoke-Kee Eng is a professor in econometrics, also at Universiti Tunku Abdul Rahman.

The views expressed in this paper are the views of the author and do not necessarily reflect the views or policies of ADBI, ADB, its Board of Directors, or the governments they represent. ADBI does not guarantee the accuracy of the data included in this paper and accepts no responsibility for any consequences of their use. Terminology used may not necessarily be consistent with ADB official terms.

Working papers are subject to formal revision and correction before they are finalized and considered published.

The Working Paper series is a continuation of the formerly named Discussion Paper series; the numbering of the papers continued without interruption or change. ADBI's working papers reflect initial ideas on a topic and are posted online for discussion. Some working papers may develop into other forms of publication.

Suggested citation:

Wong, C-Y. and Y-K. Eng. 2019. Implications of Platform Finance on Monetary Policy Transmission. ADBI Working Paper 970. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/implications-platform-finance-monetary-policy-transmission>

Please contact the authors for information about this paper.

Email: [wongcy@utar.edu.my](mailto:wongcy@utar.edu.my)

We are grateful to ADBI for warm hospitality and financial support for the paper. We especially thank Peter Morgan and participants in the ADBI Conference on Fintech and Financial Stability 2018 for interesting discussions. The earlier version of this paper also benefited from presentation at the 5th BNM Economics Research Workshop 2017. All errors remain ours.

Asian Development Bank Institute  
Kasumigaseki Building, 8th Floor  
3-2-5 Kasumigaseki, Chiyoda-ku  
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500  
Fax: +81-3-3593-5571  
URL: [www.adbi.org](http://www.adbi.org)  
E-mail: [info@adbi.org](mailto:info@adbi.org)

© 2019 Asian Development Bank Institute

**Abstract**

The emergence of a decentralized peer-to-peer platform that matches lending and borrowing without collateral requirements has called the bank lending and balance-sheet channels for monetary transmission into question. Via a standard New Keynesian macroeconomic model expanded with two-sided platform and group identity, we put forward a novel *platform density channel* of monetary transmission, which could overshadow the conventional channels. An increase in policy rate, for instance, would instigate a shift toward platform borrowing. Increasing borrowers' density attracts participation in platform deposits, which in turn further enhances borrowers' benefit of joining the platform, making liquidity available at decreasing platform loan rates. Business investment and hence the inflation rate gets lifted despite monetary tightening. The implication of a platform density channel diminishes, however, when platform borrowings pose nontrivial risk of default.

**Keywords:** P2P lending, digital finance, two-sided platform, group identity, monetary transmission

**JEL Classification:** E43, E44, E52

## Contents

1.	INTRODUCTION .....	1
2.	PLATFORM FINANCE IN A NEW KEYNESIAN MODEL .....	2
2.1	Modeling Platform Finance.....	3
2.2	Public Reviews as a Solution to Asymmetric Information.....	5
3.	PARAMETERIZATION .....	6
4.	PLATFORM DENSITY CHANNEL OF MONETARY POLICY .....	8
5.	CONCLUDING REMARKS.....	13
	REFERENCES .....	14
	APPENDIX.....	16

# 1. INTRODUCTION

Although today's payment system is already by and large electronic, it is still centralized and bank-based. The private nonfinancial sector can only gain access to the liquidity by holding claims against or by the financial institutions. Against this backdrop, the recent development of financial technology seems capable of unprecedentedly reshaping our conventional understanding about money. With the use of a ledger distributed across agents with no central entity, for instance, a decentralized digital currency can be created to facilitate transactions. This type of decentralization defies the role of monetary authority in monetary control. This explains why the profession has paid primary attention to the question of whether decentralized digital currency compromises the ability of central banks to control the money supply and hence the economy (see, for instance, Bordo and Levin 2017; Heller 2017; Camera 2017; Raskin and Yermack 2016; Fernandez-Villarverde and Sanches 2016). A proposal that the central bank should seriously contemplate issuing its own digital currency has even started to gain momentum (Barrdear and Kumhof 2016; Fung and Halaburda 2016).

Nonetheless, financial technology has disrupted not only the payment system and currency issuance but also access to credit. Private nonfinancial companies already participate in internet finance based on data gleaned from an electronic transaction platform or a user's social network history (see, for instance, Atz and Bholat 2016). Platform lending is a decentralized market for debt finance through which lenders and borrowers match and trade directly. Borrowers submit a loan request with information about their current financial situation. Based on this information, along with credit scores and peer reviews, lenders can offer a loan with an appropriate interest rate. In this sense, every successful platform transaction generates a pair of loan and deposit.

What makes platform finance fascinating is the absence of intermediation and collateral guarantees. Without a bank-based intermediation, according to Bernanke and Blinder (1988), the bank lending channel becomes obsolete. As an individual lender has no claims against the central bank, the policy rate would have no leverage on the interest rate the individual is willing to offer via the platform. Hence, monetary policy will be unable to influence the deposit rate and hence the aggregate supply of loans. Likewise, without a collateral requirement, the agency cost of lending is decoupled from monetary policy. The net worth of borrowers becomes an irrelevant factor in loan formation. The balance sheet channel of monetary policy in the fashion of Bernanke et al. (1996) becomes trivial. Of main concern is this question: if financial frictions underlie the transmission of monetary policy, does it follow that frictionless financial transactions imply the irrelevance of monetary transmission?

The focus of our paper is precisely the assessment of the impact of platform finance on monetary policy transmission. We form our arguments via a standard New Keynesian model by incorporating a two-sided platform in the manner of Armstrong (2006) and Rochet and Tirole (2003) that matches lenders and borrowers. Unlike a bank loan, collateral is not required in platform borrowing. Rather, trust in peer reviews pertaining to the borrowers' past records plays the critical role in the platform lending decision (see Thakor and Merton 2018). By decoupling collateral-oriented creditworthiness from the platform lending–deposit interest rate spread, monetary policy has no leverage of influence in the platform interest rate determination and loans–deposits formation, but can only shape the rates indirectly through density of participation driven by what is going on in the bank loan market and the real economy. We model this “trust to be part of them” element via identity in utility function in the spirit of Benjamin et al. (2010) and Akerlof and Kranton (2000).

In the platform, the participation density of borrowers and depositors is mutually advancing. On the one hand, greater borrowers' density enhances depositors' benefits of joining the platform, thereby increasing depositors' participation that would in turn draw in further demand for platform loans. On the other hand, increasing borrowers' density reduces the per-unit processing fee for depositors' participation. This allows platform deposit rates to fall, which then can feed into falling platform loan rates.

Against this mechanism, we argue that participation density of the platform is the key factor that gives rise to what we dub the *platform density channel* that disrupts the bank lending and balance-sheet channels of monetary policy. An increase in policy rate, for instance, would instigate a shift toward platform borrowing. Increasing borrowers' density attracts participation in platform deposits that make liquidity available at decreasing loan rates. Business investment and hence the inflation rate gets lifted despite monetary tightening.

That platform interest rates move against the policy rate is indeed an interesting observation that is consistent with Bertsch et al.'s (2016) empirical finding, though for different reasons, in which a lift-off in the federal funds rate has driven average loan interest rates in the peer-to-peer lending market downward. This finding is also in line with Faia and Paiella (2019), despite a different modeling approach, which demonstrates a drop in peer-to-peer platform interest rates alongside an increase in platform participation driven by the risk of a bank run in the traditional banking sector. Meanwhile, the mechanism we lay out, in which monetary policy can only indirectly influence the dynamics of platform finance via its association with the real economy and conventional banking sector, interestingly corroborates the internet finance development in the People's Republic of China that hosts the fastest growing decentralized finance platform in the world (Guo et al. 2016).

There is a growing literature on this kind of decentralized platform finance, with particular attention paid to the role of signals and the extent of asymmetric information in the formation of platform loans (see, for instance, Freedman and Jin 2011, 2017; Bertsch et al. 2016; Iyer et al. 2016; Duarte et al. 2012). Closer to us is Faia and Paiella (2019), who work out a dynamic general-equilibrium model with borrowers and lenders who can turn either to conventional or platform finance to study the link between information and platform interest rates. In this respect, our paper is among the first that explores the macroeconomic impact of decentralized platform finance via a standard general-equilibrium dynamic model enriched with bells and whistles loaned from industrial economics and identity economics. By doing so, our paper not only contributes to broadening the literature on decentralized platform finance but is also related to the literature examining two-sided markets (see, for instance, the classic paper by Rochet and Tirole 2006) and the application of identity economics (Epstein and Heizler 2015; Georgiadis and Manning 2013; Akerlof and Kranton 2010).

The remaining discussion is organized in the following layout. We discuss how platform finance can be added to a dynamic macroeconomic model in Section 2 by looking at how interest rates and loans are formed via the two-sided platform, and how platform deposits are possible even without collateral via public review. The model is then parameterized in Section 3, from which we draw insights on the implications of platform finance on monetary transmissions in Section 4. The last section offers conclusions.

## **2. PLATFORM FINANCE IN A NEW KEYNESIAN MODEL**

To address the question whether the presence of decentralized platform lending and borrowing meaningfully reshapes the monetary spillovers, we make use of a canonical

New Keynesian model as expounded for instance in Gali (2015). We expand the model to incorporate a dynamic investment function with Tobin's  $q$ , which takes into account a priori financing need for carrying out an investment project,  $I_t \leq L_{t-1}/P_t$ . Firms are given the choice to resort to either conventional bank loans  $L_t^B$  or platform loans  $L_t^P$ , where  $L_t \equiv L_t^B + L_t^P$ .

Two characteristics in the model distinguish platform loans from conventional bank loans. Unlike conventional bank loans that require collateral to mitigate the asymmetric information problem, platform loans are moderated via credit scoring and publicly available reviews on the past records. A larger pool of transactions with more reviews makes borrowers' creditworthiness more transparent to facilitate loan formation without the upper-bound constraint of a collateral requirement. This could make the debt-to-collateral ratio irrelevant as a signaling device for overborrowing due to pecuniary externalities (see, for instance, Korinek and Mendoza 2014).

The second characteristic is the disconnection between the platform lending and deposit rates and policy rate. In a canonical monetary model with banks, the policy rate sets the tune for the bank deposit rate, which in turn transmits to the bank lending rate, subject to overall borrowers' creditworthiness and the bank leverage ratio, to shape the business investment and hence the economy. The platform lending and deposit rates, however, are determined by the cost and benefit of participating in the platform, and its market thickness.

## 2.1 Modeling Platform Finance

Here is how we think about the decentralized decision via the platform. It is a platform operated by a financial-technology company through which anyone can lend and get a loan. Whether an individual is willing to spend time searching potential borrowers online via the platform depends on the thickness of the availability of borrowers,  $\mathbb{m}_{l,t}$ . The denser the pool of borrowers, the more benefits a depositor can extract from the interactions with borrowers, and the greater the appeal of the platform. By the same token, the willingness of potential borrowers to identify a financing opportunity via the platform depends on the density of depositors available,  $\mathbb{m}_{d,t}$ . Borrowers' utility in joining the platform is stronger when interaction with a denser pool of depositors yields larger benefits.

Put formally, we start with a monopoly platform in the spirit of Armstrong (2006). There is a  $\mathbb{m}_{d,t}$  continuum of depositors who join the platform in search of yield  $r_{d,t}^P$ . Unlike the conventional banking system, where banks bear the risk of loan default  $\Psi$ , in the platform depositors are solely responsible for the risk. The net yield on platform deposits after taking into account the probability of a run with 100 percent loss is  $r_{d,t}^P(1 - \Psi)$ . At the same time, there is a  $\mathbb{m}_{l,t}$  continuum of depositors who search credit opportunities via the platform who promise to pay  $r_{l,t}^P$ . Individuals who participate as depositors are required to pay a processing fee,  $f_d$ , whereas borrowers are subject to a credit scoring fee,  $f_l$ . An individual's utility in joining the platform as depositor and borrower, respectively, can be written as

$$u_{d,t} = \alpha_d \mathbb{m}_{l,t} - f_d; u_{l,t} = \alpha_l \mathbb{m}_{d,t} - f_l \quad (1)$$

where  $\alpha_d$  and  $\alpha_l$ , respectively, refer to the benefits enjoyed when depositors (borrowers) interact with borrowers (depositors). We let the thickness of the platform be determined by the willingness of each individual to participate, which depends on the utility of participation. Greater utility prompts an individual to join, contributing to market thickness

that enhances the benefits of interaction and hence the utility of participating for the other side. In this sense,  $\mathbb{m}_{l,t} = \phi(u_{l,t})$  and  $\mathbb{m}_{d,t} = \phi(u_{d,t})$ , where  $\phi' > 0$ .

The platform operator's profit is given by

$$\pi_t = f_d \mathbb{m}_{d,t} + f_l \mathbb{m}_{l,t} + \eta \left( r_{l,t}^P - r_{d,t}^P (1 - \Psi) \right) \mathbb{m}_{d,t} \mathbb{m}_{l,t} \quad (2)$$

where  $\eta$  is a transaction fee charged on a pair of deposits and loans successfully created, based on the interest rate differential. Suppose the platform operator concerns about the participants' utility instead of the processing and credit scoring fee charged. Eq. (1) can then be rearranged to get  $f_d = \alpha_d \mathbb{m}_{l,t} - u_{d,t}$  and  $f_l = \alpha_l \mathbb{m}_{d,t} - u_{l,t}$ , respectively, which, in turn, enables Eq. (2) to be reformulated as

$$\begin{aligned} \pi = & \phi(u_{d,t})(\alpha_d \phi(u_{l,t}) - u_{d,t}) + \phi(u_{l,t})(\alpha_l \phi(u_{d,t}) - u_{l,t}) \\ & + \eta \left( r_{l,t}^P - r_{d,t}^P (1 - \Psi) \right) \phi(u_{d,t}) \phi(u_{l,t}) \end{aligned}$$

By differentiating the profit function against  $u_{d,t}$  and  $u_{l,t}$  and rearranging the first-order conditions, we can obtain  $r_{d,t}^P$  and  $r_{l,t}^P$ .

$$\begin{aligned} r_{d,t}^P &= \frac{1}{1 - \Psi} \left\{ r_{l,t}^P + \frac{\alpha_l}{\eta} + \frac{f_d}{\eta \mathbb{m}_{l,t}} \left( 1 - \frac{1}{\varepsilon_d} \right) \right\} \\ r_{l,t}^P &= r_{d,t}^P (1 - \Psi) - \frac{\alpha_d}{\eta} - \frac{f_l}{\eta \mathbb{m}_{d,t}} \left( 1 - \frac{1}{\varepsilon_l} \right) \end{aligned} \quad (3)$$

where  $\varepsilon_{d,t} \equiv -\phi'(u_{d,t})f_d/\phi(u_{d,t})$  and  $\varepsilon_{l,t} \equiv -\phi'(u_{l,t})f_l/\phi(u_{l,t})$ , respectively, refer to the fee elasticity of depositors' and borrowers' participation.

Several points are noteworthy on platform interest rate determination. First, when depositors exert a large positive benefit for lenders (higher  $\alpha_l$ ), then the depositors group will be targeted aggressively by the platform. In our context, the offered deposit rate will be higher. Likewise, if lenders bring about a large positive benefit to depositors (higher  $\alpha_d$ ), the cost of borrowing will be lower. The role of "cross-group externalities," however, is weakened by the imposition of per-transaction charges  $\eta$ .

Second, a higher fixed processing fee will cause the deposit rate to go up, whereas a higher fee paid on credit scoring is compensated by a lower borrowing rate. The link is stronger when platform participants are less elastic to the fixed fee charged. Last but not least, the link is also shaped by the density of the other side. When there is a large pool of borrowers, which implies more options and greater odds for successful transaction, depositors are more tolerant of a higher fixed fee. Similarly, when there is a large pool of depositors, borrowers would have greater access to credit and therefore would be willing to go along with a higher credit scoring fee without being compensated by a lower borrowing rate.

In the appendix we provide a short description of the optimal decisions made by households, firms, and banks for consumption, hours worked, business investment, pricing, and conventional loans, respectively. Readers can refer to Wong and Eng (2019) for detail. Putting everything together, we can make sense of how a monetary policy decision is transmitted into and through decentralized finance. Take an expansionary monetary stance, for example. A reduction in the policy rate is expected to raise the value of investment and directly reduce the bank deposit rate. As a result, the bank lending



rate falls to stimulate business investment. It is then the financing needs due to greater investment that feed into the demand for platform loans and the corresponding deposits on top of conventional bank loans. Whether to opt for bank or platform loans hence depends on the borrowing rates.

Unlike the case of the conventional credit channel, in which a lower policy rate is transmitted into a lower deposit and lending rate with a reduction in the interest rate spread, monetary policy has no direct role in platform lending and deposit rates. It is the density, which monetary policy can indirectly influence, that shapes platform lending and borrowing rates. Lower bank rates vis-à-vis platform rates direct the financing demand toward bank loans, nullifying the need for platform loans, which results in a shrinking density of platform participants.

Thinning density of borrowers causes platform deposit rates to go north, as expressed in Eq. (3), to attract depositors important for drawing more potential borrowers in, whereas a diminishing quantity of lenders causes platform lending rates to go south to attract borrowers to enrich platform portfolios for bringing more potential depositors on board. But, as expressed in Eq. (3), platform lending and borrowing rates could also feed each other, counterbalancing the density effect. A higher deposit rate, for instance, could offset the negative density effect on the lending rate, resulting in a net increase in the lending rate. The equilibrium outcome then depends on other parameters like the default rate, benefit of interaction, processing and credit-scoring fee, per transaction charge, and fee elasticity.

In conclusion, monetary policy has no leverage on platform transactions. A central bank can only indirectly shape the platform density via its policy impact on the real economy propagated by the conventional credit channel. The resultant change in platform density in turn influences platform yields and financing constraints facing the real economy. We call the latter phenomenon the *platform density channel* of monetary policy.

## 2.2 Public Reviews as a Solution to Asymmetric Information

Our model particularly considers two screening features to mitigate the problem of asymmetric information. First is the credit scoring that costs  $f_l$ , for which we assume that the higher the fee, the more thorough will be the assessment, and second is the public review implicitly reflected by the formation of past loans through the platform.

$$\tilde{L}_{t-1}^P = \int_0^{\mathbb{m}_{l,t-1}} L_{t-1}^P d\mathbb{m}_l = \mathbb{m}_{l,t-1} L_{t-1}^P$$

The intuition is straightforward: if more loans were successfully transacted in the past, it is an indicator of trustworthiness. This eases depositors' worries, prompting depositors to lend via the platform. As a larger sized pool of past borrowers also means more varieties of lending opportunities with tested track records, depending on the degree of trust the depositors have on the platform  $\psi_l$ , utility-maximizing depositors would tend not to behave too differently from the general reviews to avoid adverse selection. The parameter  $\vartheta_d$  thus measures the penalty for deviating too far from the consensus. The empirical importance of the availability of peers and public reviews in trust formation on P2P lending has been accumulating (see, for instance, Iyer et al. 2016; Duarte et al. 2012; Freedman and Jin 2011).

The way we formalize trust and the tendency not to behave too differently from the general reviews (i.e., one is less likely to make a deal with a potential borrower if he was

given bad feedback in past transactions) is rooted in Akerlof and Kranton's (2000) and Benjamin et al.'s (2010) formalization of the role of identity in shaping human behavior. Put in our context, differentiating the utility function against the platform deposits, given the budget flow constraint, gives us the following optimal demand for platform deposits  $D_t^P$

$$D_t^P / P_t = 0.5(N_t^\chi / w_t) \vartheta_d^{-1} (r_{d,t}^P - r_t) + \psi_l (\mathbb{m}_{l,t-1} L_{t-1}^P / P_t) \quad (4)$$

where  $P_t$  is the price level,  $N_t$  is hours worked, and  $w_t$  stands for real wage. The parameter  $\chi$  denotes (inverse) wage elasticity of the labor supply.

Eq. (4) puts forward an important perspective: platform lending-borrowing dynamics, at least in our context, is driven by the borrowing side. Greater loan transactions and density of borrowers in the past incentivize the formation of today's platform deposits and hence loans, especially when trust in the reviews of past deals is stronger. This is coherent with Freedman and Jin's (2017) finding that the social networking feature in Prosper (one of the biggest lending platforms worldwide), through which members can identify each other as friends and impose social pressure on their members to repay their loans, enables borrowers to have their loans funded.

### 3. PARAMETERIZATION

There are generally two categories of parameters to be calibrated, as reported in Table 1. The first group comprises conventional parameters with respect to the real economy and the banking sector, which we largely allow the value to be consistent with the literature on the New Keynesian model. For instance, if the subjective discount rate is set to 0.99%, which gives a policy rate and hence bank deposit rate of 1.01% per quarter, the coefficient for constant risk aversion takes the value of 2, while the (inverse) wage elasticity of the labor supply is 1. Capital depreciates by 2.5% per quarter and accounts for 60% as an input of total production. Prices once set last for four quarters  $\theta = 0.75$ .

Meanwhile, the parameter for labor disutility  $\phi = 6.4159$  is calibrated so that wage equalizes the marginal product of labor and marginal rate of substitution between consumption and hours worked at the given unitary Frisch elasticity on the intensive margin, which is in line with the New Keynesian literature (see, for instance, Gali 2015) and not too far away from the 0.5 proposed by Chetty et al. (2011). Likewise, the rate of recovery during a fire sale of assets is calibrated so that the bank lending rate equals 6.01%, given a bank deposit rate of 1.01% in steady state, to yield an interest rate spread of 5%, coherent with the East Asia and Pacific average (4.8%) and the world average (5.7%) in 2016. A bank's debt-to-equity ratio is set to yield an equity-to-asset ratio that is consistent with Basel III's minimum requirement of capital (4.5%) and conservation buffer (2.5%).

**Table 1: Parameter and Steady State Values**

$\beta$	0.99	Subjective discount rate
$\delta$	0.025	Capital depreciation rate
$\alpha$	0.4	Capital share in production
$\sigma$	2	Risk aversion
$\chi$	1	Wage elasticity of labor supply
$\theta$	0.75	Calvo price stickiness
$\epsilon$	5	Elasticity of substitution between varieties
$\nu_\pi$	1.5	Policy weight on inflation stabilization
$\nu_y$	0.125/4	Policy weight on output gap stabilization
$d$	13.2857	Bank debt-equity ratio in line with Basel III's bank equity-asset ratio of 7%
$\phi$	6.4159	Labor disutility in utility function
$\varphi$	0.2638	Rate of recovery during fire sale of asset
$\bar{\omega}$	6.0315	Scale parameter for asset pledgeability for baseline model
<b>P2P platform</b>		
$\kappa$	0.2	Elasticity of substitution between bank and P2P loans
$f_d$	0.005	Processing fee
$f_l$	0.005	Credit scoring fee
$\eta$	4	Scale parameter for P2P transaction fee (1%–4%)
$\vartheta_d$	0.3115	Disutility for not self-sorting into public reviews
$\psi_l$	0.9	Degree of trust on public reviews on past platform loan transactions
$\alpha_d$	0.001	Benefit of interaction with borrowers for depositors
$\alpha_l$	0.001	Benefit of interaction with depositors for borrowers
$\varepsilon_l$	-5	Fee elasticity of participation by borrowers
$\varepsilon_d$	-5	Fee elasticity of participation by depositors
$\Psi$	0	Default risk facing platform depositors
<b>Selected steady state value</b>		
$N$	0.33	Hours worked
$r, r_d^B$	0.0101	Interest rates
$\omega$	0.85433	Creditworthiness/probability of full payment
$\rho$	1	Share of bank loans for baseline model
$r_l^B - r_d^B$	0.05	Bank lending-deposit rate spread
$r_l^P - r_d^P$	0	By assumption
$r_l^P$	0.05	Platform loan rate
$r_d^P$	0.05	Platform deposit rate

The second group of parameters is about platform lending and borrowing. Due to the lack of relevant empirical evidence and models, parameters that govern platform interest rates and deposit formation are calibrated for platform loans that account for 5% of total investment financing. The platform borrowing default rate is assumed to yield a zero interest rate spread, of which the platform deposit rate takes a value of 5%. We calibrate the model for a high elasticity of substitution between bank and platform loans, where  $\kappa = 19.56$ , to obtain the firm's appetite for a bank loan that is consistent with its creditworthiness. We assume the following specific function for platform participation

$$\begin{aligned} m_{l,t} &= \exp(\alpha_l m_d - f_l) \times m_{d,t} \\ m_{d,t} &= \exp(\alpha_d m_{l,t} - f_d) \times m_{l,t} \end{aligned}$$

In steady state with no entry, which we assume as  $m_l = m_d$ , the benefit of platform participation shall be identical to the fee incurred,  $\alpha_l m_d = f_l$  and  $\alpha_d m_{l,t} = f_d$ . By setting  $\alpha_l = \alpha_d = 0.001$  and  $f_l = f_d = 0.005$ , the corresponding density is 5. Lastly, we make the transaction fee to be 4%,  $\eta = 4$ .

## 4. PLATFORM DENSITY CHANNEL OF MONETARY POLICY

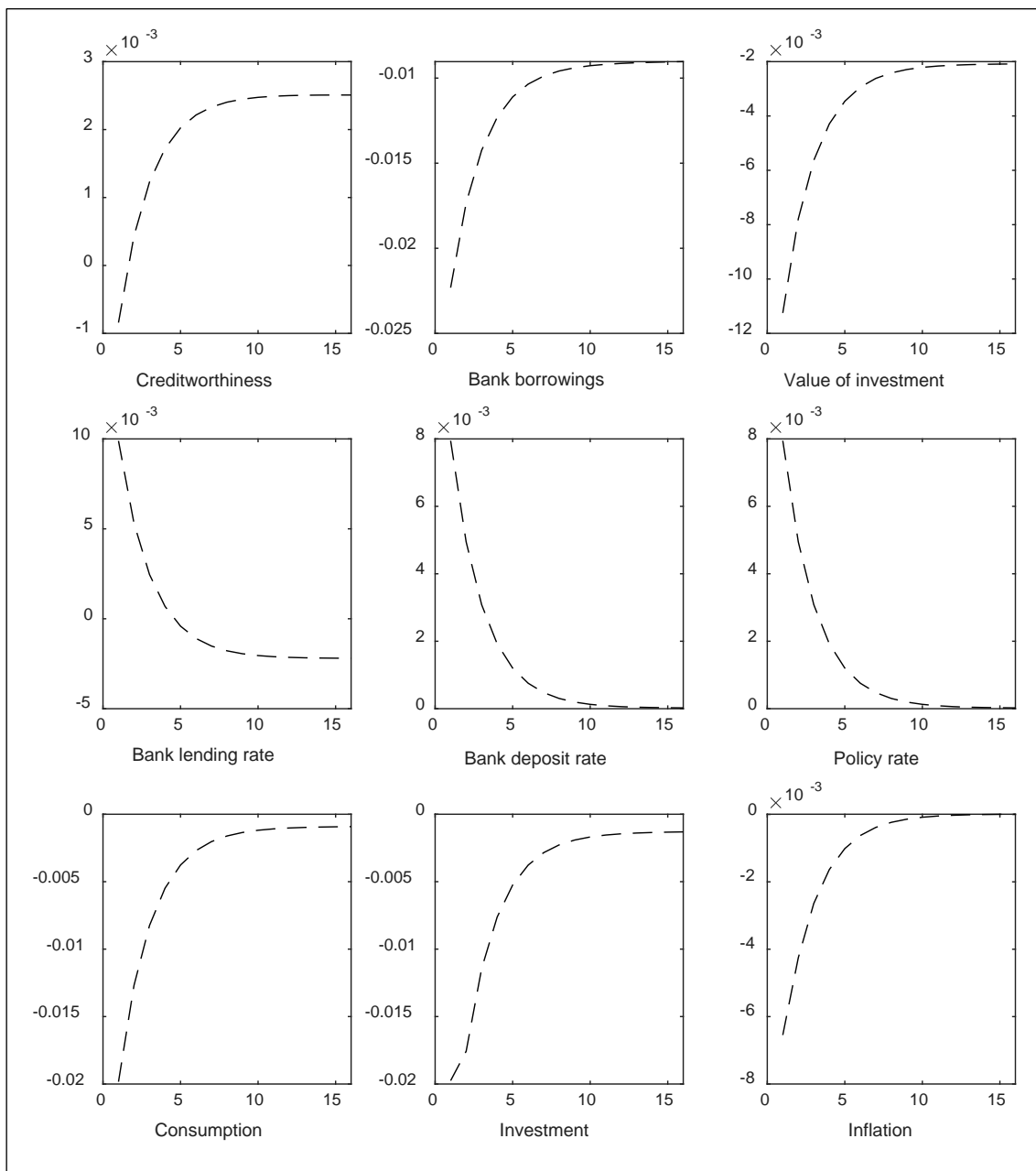
Figure 1 illustrates the dynamic responses of the baseline economy, in which a bank loan is the only external financing for business investment  $\rho = 1$ , when transitory shock raises the monetary policy rate by 1%. A higher bank lending rate in response to rising policy and hence deposit rates raises the cost of external financing that results in falling borrowing and business investment. A drop in the value of investment and deteriorating creditworthiness also weaken a firm's capacity to raise funds for investment. Meanwhile, the usual intertemporal consumption effect of monetary policy is also at work. The combined adverse effects of monetary tightening on investment and consumption then create deflationary forces. These responses are exactly what are expected when credit and balance-sheet channels of monetary policy are in play.

But once platform finance emerges as an alternative source of external finance, monetary transmissions in the real and financial sectors, as shown in Figure 2, are apparently reshaped. In Figure 2, on top of the baseline simulation, we simulate the model calibrated for platform finance that accounts for 5% of total investment financing  $\rho = 0.95$  using parameter values reported in Table 1.

Although positive interest rate shock is transmitted to the bank deposit rate, value of investment, and bank borrowing, as happens in the baseline model, creditworthiness, bank lending rate, and business investment respond differently. In particular, the bank lending rate goes down, not up, largely due to the improving creditworthiness, which, in turn, can be attributed to downsizing bank borrowing alongside expanding business investment. In this respect, credit and balance sheet channels are no longer binding. Monetary tightening does not cause the bank lending rate to rise, whereas getting favorable creditworthiness does not lead to a bank credit boom. Expansion in business investment, despite the immediate drop following a bank interest rate spike, therefore must entail an alternative source of financing.

The answer can be found in platform finance. A higher policy rate, which is supposed to raise the cost of external funds and worsen a firm's creditworthiness, instead induces firms to tap a platform loan that is highly substitutable with a bank loan. That explains the concurrent fall and rise in bank loans and platform loans, respectively. Increasing density of platform borrowers attracts participation of depositors on the one hand, as increasing borrower density enhances the benefits of interaction for platform depositors, and prompts reduction in the per unit processing fee on the other hand, which contributes to the decline in platform deposit rates. The latter is then transmitted to platform lending rates. That a higher policy rate causes lower platform rates is interestingly consistent with Bertsch et al.'s (2016) empirical finding, though for different reasons, that shows the downward pressure a liftoff in federal funds rate has on average loan interest rates in the platform lending market.

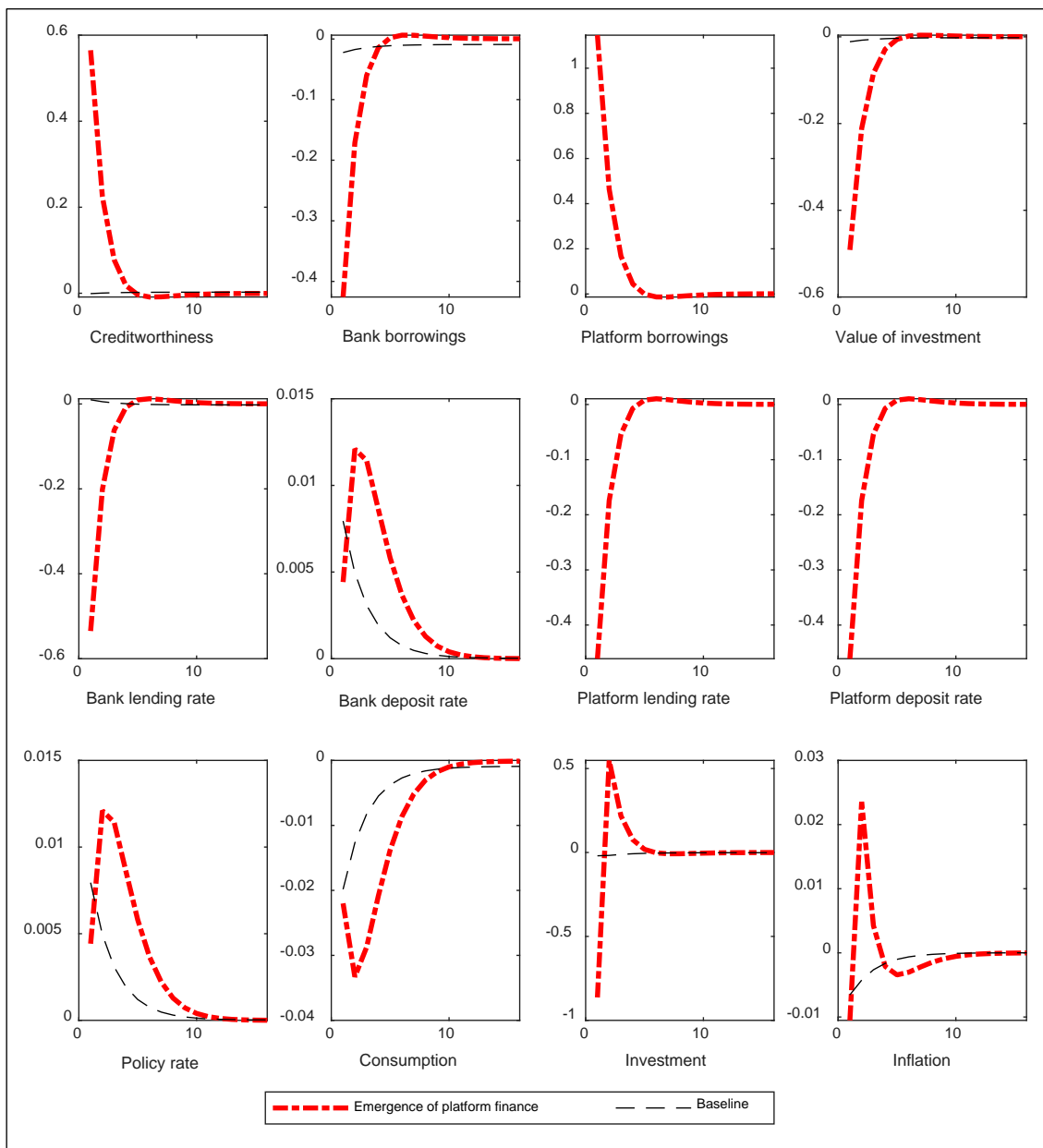
**Figure 1: Responses of the Baseline Model Economy to 1% Increase in Monetary Policy Shock**



Notes: Y-axis: deviation from steady state; X-axis: quarters ahead. Bank loan is the only source of financing in the baseline model economy.

Equally interesting is the impact of monetary tightening on inflation dynamics. While the inflation rate declines on impact in responding to a higher interest rate, it goes up sharply thereafter, even further to the north before taking an inverted “V-turn” when inflation resides. This is by and large a result of stronger business investment performance facilitated by platform borrowing. In other words, a higher policy rate causes a rising inflation rate when platform finance is there to weaken the linkage between business investment and bank loans.

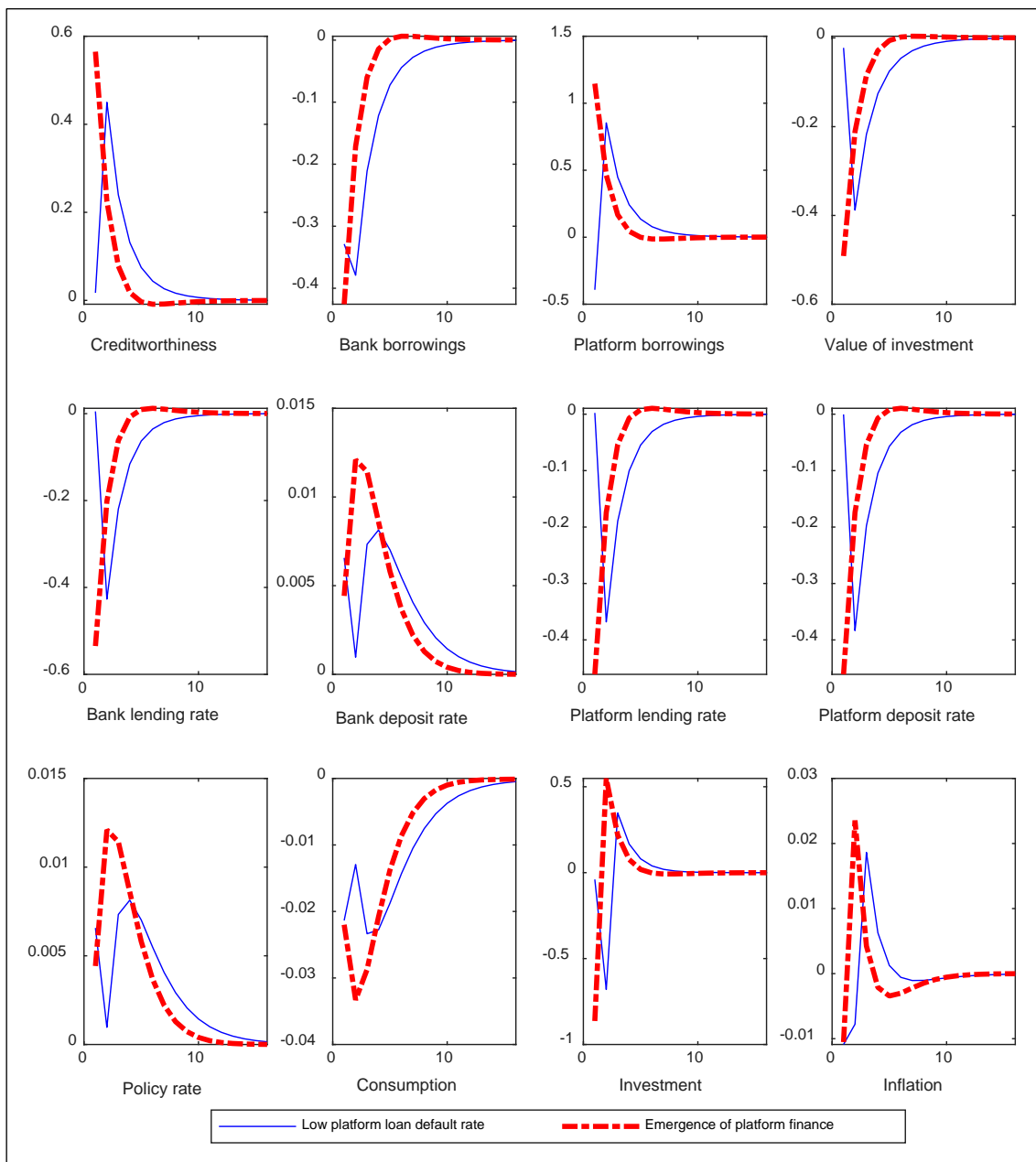
**Figure 2: Responses to Monetary Policy Shock when Platform Finance Became an Alternative Source of Financing**



Notes: Y-axis: deviation from steady state; X-axis: quarters ahead. Share of bank loan in total financing is 95%.

So far, our case is built on the assumption of zero default rates in platform loans. How would a higher platform loan default rate alter monetary transmission? Intuitively, depositors would be demotivated from participating when they perceive a higher risk of doing platform lending. Lack of interest among risk-averse depositors in joining the platform in turn dilutes borrowers' benefit of joining the platform. As a consequence of shallow participation density, one can expect platform interest rates not falling deeply enough, and platform loan formation being less responsive to monetary shock.

**Figure 3: Responses to Monetary Policy Shock when Platform Borrowing has a Low Default Rate**

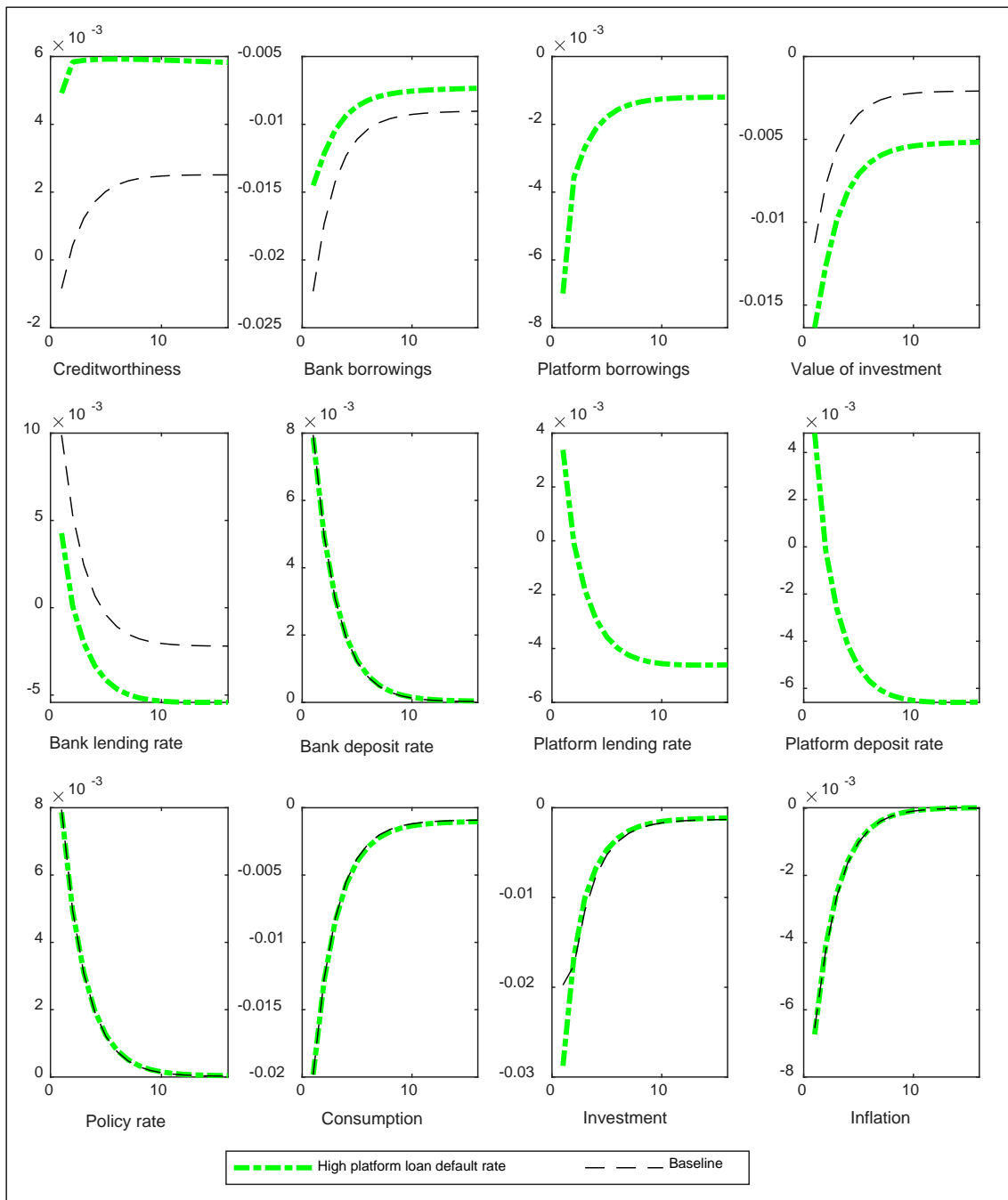


Notes: Y-axis: deviation from steady state; X-axis: quarters ahead. Platform borrowing default rate is set at 4%.

This seems to be the case when the model is re-simulated with a positive platform loan default rate. By setting a platform loan default rate of 4%,  $\Psi = 0.04$ , as Figure 3 illustrates, the magnitude of responses toward monetary policy shock gets smaller in comparison to the model economy with zero default rate,  $\Psi = 0\%$ . If the default rate happens to be 30%,  $\Psi = 0.3$ , as in Figure 4, the dynamic responses are nearly indistinguishable from the baseline model without platform finance. In other words, the platform density channel is nearly absent when there is a risk of default in platform borrowing, giving way to the resurgence of conventional bank lending and balance-sheet channels. This finding is interestingly harmonious with Faia and Paiella (2019) in the

opposite direction, where an increase in the risk of a bank run in the traditional banking sector increases peer-to-peer platform participation.

**Figure 4: Responses to Monetary Policy Shock when Platform Borrowing has a High Default Rate**



Notes: Y-axis: deviation from steady state; X-axis: quarters ahead. Platform borrowing default rate is set at 30%.



## 5. CONCLUDING REMARKS

Decentralized platform finance has been growing impressively over the last decade and is expected to take off once it has a stronger footing enabled by better developed financial technology and a more established regulatory framework is ready. Sooner or later, perhaps sooner than we expect, decentralized finance will pose real challenges to the traditional banking sector as well as monetary policy makers once the direct influence on bank rate determination and loan formation is compromised.

Through a dynamic general-equilibrium macroeconomic model equipped with bells and whistles that capture interest rate determination and deposit formation in platform finance, we show that the key underlying mechanism through which monetary transmissions in the real and financial sectors are reshaped is the mutually reinforcing participation density of platform borrowers and depositors. Greater borrower density facilitates platform deposit formation, drawing in greater formation of platform loans, which in turn contributes to deeper depositor density. Business investment thus gets bolstered and remains financially funded at cheaper cost, rendering the bank lending and balance-sheet channels of monetary policy irrelevant. That said, it means any element that could deter platform participation, which includes the platform loan default rate, would shut off the platform density channel but reinvigorate conventional channels of monetary transmission.

In view of these findings, we call for further investigations on how monetary policy can innovatively regain direct control on interest rate determination in platform transactions, and on the new form of regulatory framework on platform finance that complements the conduct of monetary policy to preserve macro and financial stability.

## REFERENCES

- Akerlof, G.A. and Kranton, R.E. (2000). "Economics and Identity," *Quarterly Journal of Economics*, Vol. 115, No. 3, pp. 715–753.
- . (2010). *Identity Economics: How Our Identities Shape Our Work, Wages and Wellbeing*. Princeton, NJ: Princeton University Press.
- Armstrong, M. (2006). "Competition in Two-Sided Markets," *RAND Journal of Economics*, Vol. 37, No. 3, pp. 668–691.
- Atz, U. and Bholat, D. (2016). "Peer-to-Peer Lending and Financial Innovation in the United Kingdom," *Staff Working Paper No. 598*, Bank of England.
- Barrdear, J. and Kumhof, M. (2016). "The Macroeconomics of Central Bank Issued Digital Currencies," *Staff Working Paper No. 605*, Bank of England.
- Benjamin, D.J., Choi, J.J., and Strickland, A.J. (2010). "Social Identity and Preferences," *American Economic Review*, Vol. 100, pp. 1913–1928.
- Bernanke, B. and Blinder, A. (1988). "Credit, Money, and Aggregate Demand," *American Economic Review*, Vol. 78, pp. 435–439.
- Bernanke, B., Gertler, M., and Gilchrist, S. (1996). "The Financial Accelerator and the Flight to Quality," *Review of Economics and Statistics*, Vol. 78, pp. 1–15.
- Bertsch, C., Hull, I., and Zhang, X. (2016). "Fed Liftoff and Subprime Loan Interest Rates: Evidence from the Peer-to-Peer Lending Market," *Sveriges Riksbank Working Paper Series No. 319*.
- Bordo, M.D. and Levin, A.T. (2017). "Central Bank Digital Currency and the Future of Monetary Policy," *NBER Working Paper No. 23711*, NBER.
- Camera, G. (2017). "A Perspective on Electronic Alternatives to Traditional Currencies," *Sveriges Riksbank Economic Review*, 2017(1), pp. 126–148.
- Chetty, R., Guren, A., Manoli, D., and Weber, A. (2011). "Are Micro and Macro Labor Supply Elasticities Consistent? A Review of Evidence on the Intensive and Extensive Margins," *American Economic Review*, Vol. 101, No. 3, pp. 471–475.
- Duarte, J., Siegel, S., and Young, L. (2012). "Trust and Credit: The Role of Appearance in Peer-to-Peer Lending," *Review of Financial Studies*, Vol. 25, No. 8, pp. 2455–2483.
- Epstein, G.S. and Heizler, O. (2015). "Ethnic Identity: A Theoretical Framework," *IZA Journal of Migration*, Vol. 4, No. 9, pp. 1–11.
- Faia, E. and Paiella, M. (2019). "Information and Substitution in P2P Markets," CEPR D.P. 12235, Centre for Economic Policy Research.
- Fernandez-Villarverde, J. and Sanches, D. (2016). "Can Currency Competition Work?" *NBER Working Paper No. 22157*, NBER.
- Freedman, S.M. and Jin, G.Z. (2011). "Learning by Doing with Asymmetric Information: Evidence from Prosper.com," *NBER Working Paper No. 16855*, NBER.
- . (2017). "The Information Value of Online Social Networks: Lessons from Peer-to-Peer Lending," *International Journal of Industrial Organization*, Vol. 51, pp. 185–222.

- Fung, B.S.C. and Halaburda, H. (2016). "Central Bank Digital Currencies: A Framework for Assessing Why and How," *Staff Discussion Paper 2016-22*, Bank of Canada.
- Gali, J. (2015). *Monetary Policy, Inflation, and the Business Cycle*. Princeton, NJ: Princeton University Press.
- Georgiadis, A. and Manning, A. (2013). "One Nation under a Groove? Understanding National Identity," *Journal of Economic Behavior & Organization*, Vol. 93, pp. 166–185.
- Guo, F., Kong, S.T., and Wang, J. (2016). "General Patterns and Regional Disparity of Internet Finance Development in China: Evidence from the Peking University Internet Finance Development Index," *China Economic Journal*, Vol. 9, No. 3, pp. 253–271.
- Heller, D. (2017). "Do Digital Currencies Pose a Threat to Sovereign Currencies and Central Banks?" *PIIE Policy Brief 17-13*, Peterson Institute for International Economics.
- Iyer, R., Khwaja, A.I., Luttmer, E.F.P., and Shue, K. (2016). "Screening Peers Softly: Inferring the Quality of Small Borrowers," *Management Science*, Vol. 62, No. 6, pp. 1554–1577.
- Kashyap, A., Stein, J.C., and Hanson, S.G. (2010). "An Analysis of the Impact of 'Substantially Heightened' Capital Requirements on Large Financial Institutions," Mimeo, Harvard Business School, Harvard University.
- Korinek, A. and Mendoza, E.G. (2014). "From Sudden Stops to Fisherian Deflation: Quantitative Theory and Evidence," *Annual Review of Economics*, Vol. 6, pp. 299–232.
- Miles, D., Yang, J., and Marcheggiano, G. (2012). "Optimal Bank Capital," *Economic Journal*, Vol. 123, No. 567, pp. 1–37.
- Raskin, M. and Yermack, (2016). "Digital Currencies, Decentralized Ledgers, and the Future of Central Banking," *NBER Working Paper No. 22238*, NBER.
- Rochet, J.-C. and Tirole, J. (2003). "Platform Competition in Two-Sided Markets," *Journal of the European Economic Association*, Vol. 1, pp. 990–1029.
- . (2006). "Two-Sided Markets: A Progress Report," *RAND Journal of Economics*, Vol. 37, No. 3, pp. 645–667.
- Thakor, R. and Merton, R.C. (2018). "Trust in Lending," *NBER Working Paper No. 24788*, NBER.
- Wallen, J. (2017). "The Effect of Bank Capital Requirements on Bank Loans Rates," Mimeo, Graduate School of Business, University of Chicago.
- Wong, C.-Y. and Eng, Y.-K. (2019). "P2P Finance and the Effectiveness of Monetary Controls," Unpublished manuscript, Universiti Tunku Abdul Rahman, Malaysia.

## APPENDIX

The model used for simulation and scenario analysis in this paper is briefly described below. We do not, however, review the optimization problems of households, banks, and firms that underlie the optimal conditions, but instead refer the reader to Wong and Eng (2019) for details.

### Household

The marginal rate of substitution between consumption  $C_t$  and hours worked  $N_t$ , and the Euler consumption function are, respectively, as below.

$$C_t^\sigma N_t^\chi = w_t \quad (\text{A1})$$

$$C_t = \left( \left( \frac{P_{t+1}}{P_t} \right) \left( \frac{1}{\beta} \right) \left( \frac{1}{1+r_t} \right) \right)^{1/\sigma} C_{t+1} \quad (\text{A2})$$

where  $\sigma$  and  $\chi$  denote the risk aversion coefficient and (inverse) wage elasticity of the labor supply, respectively.  $\beta$  is a subjective discount factor. Tobin's marginal  $q$  that proxies the value of investment is given by

$$Q_t = \left( \frac{P_{t+1}}{P_t} \right) \left( \frac{1}{1+r_t} \right) \left( (1-\delta)Q_{t+1} + r_{K,t+1} - \Phi_{I,t} - \Phi \left( \frac{I_{t+1}}{K_t} - \delta \right) \right) \quad (\text{A3})$$

where

$$\Phi_{I,t} = \frac{1}{2} \Phi \left( \frac{I_t}{K_{t-1}} - \delta \right)^2$$

for  $\Phi_I = \Phi'_I = 0$  and  $\Phi''_I > 0$  in steady state. The parameter  $\Phi$  is a scale factor, and  $\delta$  refers to the rate of depreciation. The corresponding investment dynamics can be derived as

$$I_t = (\Phi^{-1}(Q_t - \rho(r_{I,t}^B - r_t) - (1-\rho)(r_{I,t}^P - r_t) - 1) + \delta)K_{t-1} \quad (\text{A4})$$

where  $\rho$  denotes the share of investment projects financed by bank loans.

### Bank

One-period bonds and bank deposits are assumed to be perfectly substitutable, making the bank deposit rate anchored to the bond rate, which happens to be the policy rate too.

$$r_{d,t}^B = r_t \quad (\text{A5})$$

Optimal demand for bank and platform loans, as well as the weighted average cost of funding, can be derived as

$$L_t^B = \rho P_{t+1} I_{t+1} \left( \frac{r_{l,t}^B}{\tilde{r}_{l,t}} \right)^{-\kappa} \quad (\text{A6})$$

$$L_t^P = (1 - \rho) P_{t+1} I_{t+1} \left( \frac{r_{l,t}^P}{\tilde{r}_{l,t}} \right)^{-\kappa} \quad (\text{A7})$$

$$\tilde{r}_{l,t} = \left( \rho r_{l,t}^B{}^{1-\kappa} + (1 - \rho) r_{l,t}^P{}^{1-\kappa} \right)^{1/(1-\kappa)} \quad (\text{A8})$$

where  $\kappa > 0$  denotes the elasticity of substitution between bank loans and platform loans. The expected return on bank loans is rewritten as

$$\mathbb{E}_t(1 + r_{l,t}^B)L_t^B = (\omega_t(1 + r_{l,t}^B) + (1 - \omega_t)\varphi Q_{t+1}\rho^{-1})L_t^B \quad (\text{A9})$$

$\omega_t$  in this context refers to the probability of full repayment

$$\omega_t = \exp\left(-\frac{(1+r_{l,t}^B)L_t^B}{\varpi P_t Q_t I_t}\right) \quad (\text{A10})$$

where  $\varpi$  is a pledgeability parameter. A bank's balance sheet can be presented as

$$L_t^B = D_t^B(1 + d_t^{-1}) \quad (\text{A11})$$

where  $D_t^B$  refers to bank deposits and  $d_t$  is the bank's debt-to-equity ratio (bank leverage henceforth). The equilibrium bank lending rate can be derived as

$$1 + r_{l,t}^B = \frac{1}{\omega_t} (1 + r_{d,t}^B)(1 + d_t^{-1})^{-1} - \left(\frac{1}{\omega_t} - 1\right) \left(\frac{\varphi Q_{t+1}}{\rho}\right) \quad (\text{A12})$$

When borrowers' creditworthiness is strong ( $\omega_t = 1$ ), Eq. (A12) boils down to

$$\frac{1 + r_{l,t}^B}{1 + r_{d,t}^B} = \frac{d_t}{1 + d_t}$$

The lending-deposit rate spread is completely driven by bank leverage (see, for instance, Wallen 2017; Miles et al. 2012; Kashyap et al. 2010).

## Firm

The marginal product of labor and capital, respectively, can be written as

$$w_t = (1 - \alpha)Y_t/N_t \quad (\text{A13})$$

$$r_{K,t} = \alpha Y_t/K_{t-1} \quad (\text{A14})$$

The real marginal cost function is given by

$$\mathcal{R}_t = \alpha^{-\alpha}(1 - \alpha)^{-(1-\alpha)} r_{K,t}^\alpha w_t^{1-\alpha} \quad (\text{A15})$$

Aggregate output is then divided between household consumption, investment expenditure, and convex adjustment cost incurred by the households in the accumulation of capital stock  $\Phi_{I,t}K_{t-1}$ .

$$Y_t \equiv C_t + I_t + \Phi_{I,t}K_{t-1} \quad (\text{A16})$$

Aggregate price level in a New Keynesian economy is a weighted average of last-period aggregate price level and the newly reset price

$$P_t/P_{t-1} = (P_{t+1}/P_t)^\beta (\mathcal{M}_t \mathcal{R}_t)^{(1-\theta\beta)(1-\theta)/\theta} \quad (\text{A17})$$

where  $\mathcal{M}_t (= \epsilon/(\epsilon - 1))$  refers to price markup.