Shadow Banking and Economic Development in Developing Countries: Evidence from China[‡]

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Abstract: Using a three-sector general equilibrium model, this paper examines the impacts of shadow banking on real output of a dual developing economy. We find that in the short run the development of the shadow banking sector can increase an economy's social welfare. However, in the long run, due to excessive entry of urban manufacturing firms, the expansion of shadow banking can result in the widening of the wage gap between skilled and unskilled labour, and thus reduce the real output of the economy if firm-entry effect is sufficiently strong. Using China's data, we empirically verify and confirm these theoretical predictions.

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1. Introduction

Shadow banking is broadly defined as "the credit intermediation involving entities and activities outside the regular banking system" (FSB, 2013). The four main functions of credit intermediation according to Kodres (2013) are: maturity transformation, liquidity transformation, leverage and credit risk transfer. These four functions are similar to those conducted by traditional banks, except that they lack protection from the public safety net such as the Federal Reserve's discount window or Federal Deposit Insurance (Pozsar et al., 2012). The composition of shadow banking activities varies with jurisdictions. In advanced economies such as the United States and Europe, shadow banking system is relatively complex compared to the developing economies. The shadow banking activities in advanced economies often revolve around off-balance sheet asset securitization and money market mutual funds. Within developing economies in Asia, shadow banking is referred to as "non-bank financial intermediaries" and "other financial institutions" (FSB, 2014). These entities provide alternative sources of financing to the underserved market segments in the economy. The products involved are much simpler, for example, the main shadow banking products in China are trust products, wealth management products and entrusted loans (Tin, 2015).

Given the sheer size of the shadow banking system, there have been considerable debates on its economic costs and benefits. Since shadow banking is subject to much less or no regulatory oversight, its activities tend to be riskier than those of traditional banks, and could pose risks to financial stability. In fact, shadow banking was identified as one of the factors contributing to the occurrence of 2007 global financial crisis. However, not all shadow banking activities are detrimental to the economy. In developing countries such as China and India, shadow banking fulfils the financing gap in the formal financial system by providing alternative sources of financing to the market segments that are ignored or not served by traditional banks, thus can help promote economic growth (Elliott et al., 2015; Sheng, 2015).

In recent years, there emerge a number of empirical studies examining the economic impacts of shadow banking by focusing on different components of shadow banking. For instance, using the firm-level data from the Investment Climate Survey, Ayyagari et al. (2010) study the performance of

firms using formal bank financing versus those relying on the informal external financing. Employing China provincial data, Cheng and Degryse (2010) explore the difference between the impact of financial development of banks and non-bank financial institutions on economic growth. Focusing on trade credit, one type of informal financing mechanism, Fisman and Love (2003) and Cull et al. (2009) examine the impact of using trade credit to substitute for formal finance on industry/firm growth. Using time series methodologies and different shadow banking estimation methods, Zhang and Peng (2014), Li and Li (2015), Shen and Xie (2013), and Xu and Wang (2015) attempt to shed light on the relationship between shadow banking and economic growth in China. The empirical studies on the economic impacts of shadow banking produce mixed results. For instance, Fisman and Love (2003), Zhang and Peng (2014), and Li and Li (2015) provide support to the positive impacts of shadow banking on growth, while Cull et al. (2009), Ayyagari et al. (2010), Cheng and Degryse (2010), Shen and Xie (2013), and Xu and Wang (2015)'s results cast doubt on whether shadow banking contributes to economic growth.

We contribute to the literature by providing both theoretical and empirical analyses on the relationship between shadow banking and economic growth. In particular, we examine whether shadow banking can affect economic performance, in terms of real output growth, of a dual developing economy, like China. In China and other developing economies, shadow banking provides funding mainly to credit-constrained small and medium-sized enterprises (SMEs) in the urban intermediate goods and rural agricultural sectors. These firms usually have difficulty obtaining loans from formal financing channels. By closing the SMEs' funding gaps, shadow banking thus facilitates the production of urban intermediate goods and rural agricultural firms. We find that shadow banking benefits the economy by not only providing cheaper intermediate inputs to the urban manufacturing sectors, but also raising the wage rates of skilled and unskilled labour. The development of shadow banking can therefore increase social welfare of the economy in the short run. However, our theoretical analysis results show that, in the long run, the expansion of shadow banking can cause excessive entry of urban manufacturing firms. This could widen the wage gap between skilled and unskilled labour as well as lower real output of the economy if the firm-entry effect is sufficiently strong.

These theoretical predictions are then verified and supported by China provincial data. The China's setting is suitable for our empirical analysis for two main reasons. First, China, the largest emerging economy in the world, has experienced spectacular growth in shadow banking. The size of China's shadow banking is estimated to range between RMB 5 trillion and RMB 46 trillion (Elliott et al., 2015). Second, China is well known for its traditional bank practices that bias against SMEs, in particular small and micro enterprises. The financing needs of SMEs are normally met by external funding outside of the traditional banking system (Elliott et al., 2015). Starting from the China's shadow banking measure estimated in Elliot et al. (2015), we construct the measure of provincial shadow banking for the period from 2002 to 2013. Then, in line with past studies on finance-growth nexus (e.g. Beck et al., 2000; Levine et al., 2000; Hao, 2006; Hasan et al., 2009), we employ a system Generalized-Method-of-Moment (GMM) estimator to examine the relationship between shadow banking and real per capita gross domestic product (GDP). Our findings show that a 1% rise in shadow banking can raise China's real per capita GDP growth by 0.48% in the short run, while in the long run the effect of shadow banking on the growth of real GDP becomes much weaker when the firm-entry effect is taken into account.

The rest of the paper is organized as follows: Section 2 briefly describes the financial system in China. Section 3 presents a brief review of the related literature. Section 4 provides a general-equilibrium model to examine the short- and long-run effects of shadow banking on factor returns and real output of the economy, while section 5 describes the data and econometric methodology employed to empirically estimate the corresponding output growth effects of shadow banking for the Chinese economy. Section 6 provides a discussion of the empirical results and Section 7 concludes.

2. **Financial System in China**

The financial system reform in China started later than many other developing countries. The People's Bank of China (PBOC) began to assume the role of the central bank since 1984. The promulgation of the Law of the People's Bank of China and the Law of the People's Republic of China on Commercial Banks marked the beginning of modern banking operation system in China. The joint

stock reform of state-owned banks, which began in 2004, had speeded up the marketization of Chinese banking institutions. Further, in 2006 – the final transition year of full liberalization of Chinese banking sector – not only was the listing of all state-owned banks successfully completed, but also there was substantial growth in the China's securities market. Further, in October 2015, the PBOC lifted the interest rate ceiling on deposit imposed on the commercial banks and rural cooperative financial institutions. As such, this concludes the 20-odd years' long of interest rate liberalization with the price of financial products is now determined by market forces. Despite facing various conflicts and experiencing large external shocks such as the Asian financial crisis and the global financial crisis during the reform process, the financial system with Chinese characteristics had gradually been formed.

China's financial system is currently under the leadership of the State Council with the PBOC functioning as the central bank and under the supervision and management of three regulatory bodies (i.e., China Banking Regulatory Commission (CBRC), China Securities Regulatory Commission (CSRC) and China Insurance Regulatory Commission (CIRC)). In general, the state-owned and controlled banks form the main part of present China's financial system, complemented by joint-stock commercial banks, urban commercial banks, rural credit cooperatives, policy banks, foreign banks and non-bank financial institutions such as securities companies, mutual funds companies, insurance companies, trust and investment companies, leasing companies, credit guarantee companies, finance companies, Internet finance and so on. The present China's financial system is complex; not only it inherits the characteristics of traditional Chinese financial system, but also contains elements of frontier financial innovation. In addition, it offers both strictly supervised formal financial products and risky informal financial products. The complexity arising from the interconnections between the formal and informal financial businesses has weakened the transparency in many areas, leading to increased vulnerabilities in the financial system. As a result, when the term "shadow banking" began to be used in the aftermath of the US financial turmoil, the China's informal financial business was widely seen as an integral part of shadow banking that poses systemic risk to its financial system. However, with more research conducted on the China's financial system, many scholars have begun to question the excessive emphasis placed on negative aspects of shadow banking activities. Tsai

(2016) argues that informal finance does not necessary imply illegal financing channel. In fact, informal finance has also existed in many developed countries and played an important role of supplying capital to credit-restrained SMEs. Thus, shadow banking is not unique to developing countries, and it continuous to exist within a country's financial system, regardless of the country's development status. Further, according to FSB (2013), a uniform definition of shadow banking may not even exist. Whether a financial intermediary is considered as part of shadow banking will largely depend on the characteristics of the country's financial system and its supervision mechanism. In the context of China's financial system, since all financial institutions are involved in the shadow banking activities to some degree, it would be inappropriate to put the entire blame on the non-formal financial intermediaries, an important source of financing to SMEs in China, for posing excessive systemic risks to the financial system (Chen, 2016).

2.1 The formal financial system in China

The development of China's formal financial system since reform and opening-up can be divided into three stages: 1979-1983 is the initial stage in which the major breakthrough to the traditional "unified" system occurred; 1984-1993 is the stage where diversified financial intermediaries were gradually formed; and after 1994 is the last stage where the modern financial intermediaries continued to undergo on-going improvement.

The structure of China's formal financial system is as follows. The PBOC is the regulatory body that implements China's monetary policy. Along with the State Administration of Foreign Exchange, the PBOC manages huge amount of foreign exchange reserves and maintains the stability of Renminbi (RMB) exchange rate. In terms of the supervision mechanism, CBRC, CSRC and CIRC, respectively, supervised the conducts of banks, securities market and insurance market, which collectively form the three-pillar system in the financial sector. The financial institutions corresponding to these three pillars are widely distributed throughout the country. In addition, owing to the growth in the demand of social capital and the advent of information technology in China's financial sector, the number of non-bank financial intermediaries such as financial holding companies, small loan companies, peer-to-peer lending and pawnbrokers has been growing rapidly in recent years.

As of October 2016, the size of social capital channeled through PBOC, authorized deposit-taking financial intermediaries (including banks, credit unions and finance companies) and non-bank financial intermediaries (including trust and investment companies, financial leasing companies, auto finance companies and loans Companies) has reached at least 156.7 billion yuan[1].

2.2 The shadow banking activities in China

As discussed earlier, all China's for-profit financial intermediaries and some quasi-not-for-profit financial institutions have a stake in the shadow banking activities to some degree. The factors contributing to the emergence of such phenomenon is complex. However, restrictive and unequal access to capital caused by financial regulations that bias towards large state-owned enterprises is undoubtedly an important factor. From a historical point of view, shadow banking is not a novel concept in China. In fact, it refers to the financial activities, which have been largely ignored by regulatory and supervision authorities, but are now growing at an unprecedented pace in line with the growth in private businesses. In contrast to the shadow banking activities in developed nations which focus on asset securitization, shadow banking activities in China are rather simple in terms of the financial innovation involved and the products' structure. However, the participants in China's shadow banking sector are more diverse; this makes it difficult to develop a uniform definition of shadow banking for China. Despite lacking a uniform definition, most scholars have generally agreed that the wealth management products offered by banks and trust products by trust companies form the core of shadow banking activities in China.

In regard to the shadow banking regulation, in January 2014 the State Council released the *Notice of the State Council on Relevant Issues Concerning the Strengthening of Shadow Banking Regulation* ("Circular 107"), which outlines the framework to regulate the shadow banking activities in China. Recognizing the value and necessity of the existence of shadow banking activities, for the first time, Chinese government provides a clarification from the regulatory perspective on the institutions involved in the shadow banking activities and their business boundaries. This initiative not only helps promote transparency in China's shadow banking system, but also contributes towards developing a single-agreed method to estimate the size of shadow banking. According to Circular 107,

shadow banking in China mainly comprises the following three types of organizations (Yao, 2015; Tsai, 2016):

(1) Unlicensed and unregulated financial intermediaries (including innovative internet finance, third-party wealth management institutions);

(2) Unlicensed financial intermediaries which are under inadequate regulatory supervision (including credit guarantee companies, microcredit companies); and

(3) Licensed financial intermediaries which are subject to inadequate regulatory supervision (including money market funds, asset securitization, part of the wealth management business).

3. Literature Review

Literature on shadow banking has been growing over the last decade with many of the earlier studies focus mainly on the impact of shadow banking on systemic risk. For example, Pozsar et al. (2012) warned that the collapse of a country's shadow banking system could lead to a serious financial crisis. Mao and Wan (2012), on the other hand, conclude that when the size of shadow banking is below a threshold, its development could help improve the stability of the banking system. Many latter studies began to explore the impact of shadow banking on the real economy. In general, past studies find that shadow banking may not have negative impacts only, and that its existence could benefit a country's economic development. Below we provide a brief review of the related literature on shadow banking and economic development from two different perspectives.

3.1 Macro level

The literature investigating the relationship between shadow banking and China's economic development provides inconclusive evidence. On the one hand, past studies find that shadow banking promotes economic growth in China. Based on a survey results, Allen et al. (2005) argue that alternative financing and governance mechanisms played an important role in supporting the growth of private sector in China. Further, using panel VAR model to test the effect of shadow banking on the stability of commercial banks and economic growth, Zhang and Peng (2014) find that shadow

banking has a positive impact on China’s economic development, and the changes in the size of shadow banking could affect the rate of economic growth. In similar vein, Jerome (2015) suggests that shadow banking positively affect the economic development of an emerging economy like China because shadow banking is an alternative source of financing for small investors and investors who are not able to obtain capital from formal financing channels. Moreover, according to Jerome (2015), in line with the progress of China's financial reform, Chinese shadow banking business has become more transparent, and gradually been absorbed into the formal financial business. Moreover, building upon the background of China's interest rate liberalization, Li and Li (2015) conduct the impulse response function analysis in a SVAR model and show that shadow banking has a significant effect on the real economy, but the positive effect is transitory and exists in the initial stage only.

On the other hand, some studies find that China's shadow banking did not contribute to economic growth. Using a set of China provincial panel data over the period 1995-2003, Cheng and Degryse (2010) study the impact of formal and informal finance on economic growth and find that formal finance contributed significantly to the local economic growth, while informal finance did not seem to have any impact. The author concludes that banks instead of non-formal financial institutions played an important role in the local funding allocation. Based on the cross-section analysis on a survey data consisting of 2400 Chinese firms for the year 2003, Ayyagari et al. (2010) also concludes that formal finance rather than informal finance is positively associated with growth. Further, a study by Shen and Xie (2013) estimates the size of China's shadow banking using macro-financial flow analysis method, and applies the Granger causality test to investigate the relationship between shadow banking and economic growth. The authors confirm the existence of a single-directional causality between shadow banking and China's economic growth - that is, economic growth leads to the expansion of shadow banking. Xu and Wang (2015) obtain similar result by estimating the size of shadow banking from the perspective of credit demand and employing the VAR model.

3.2 SME

From the firm perspective, shadow banking provides a channel that allows rational allocation of resources (Ba, 2013); in particular, the existence of private lending institutions enables many financially restrained SMEs to meet their funding needs. Accordingly, there has been a growing number of studies investigating the impact of shadow banking on the performance of SMEs in China. Similarly, the empirical evidence on the impact of Shadow Banking on SMEs' performance is also inconclusive. Xu (2013) argues that shadow banking in China is closely linked to the formal financial sector, and thus could easily be used by the formal financial intermediaries to circumvent regulatory supervision. The author finds that private lending and microfinance, the two most representative types of informal financing, are not the important sources of financing to support SMEs' growth. Instead, these two informal financing types play a negative role in the dual-financial system which biases against SME financing. Not only they contribute to the creation of obstacles for SMEs to obtain formal financing, but also increase the cost of informal private lending.

However, based on a survey of five cities in Gansu province, Yang and Fang (2014) show that, although the interest rate charged by shadow banking on loan extended to the local SMEs is at least two times higher than the cost of bank loans (the former is 18.63%, and the latter 9.2%), shadow banking contributes positively to the promotion of SMEs' growth. According to the authors, China's SMEs, in particular those small and micro enterprises, are generally lacking internal capital, thus they have to rely on external capital to fund their business growth. However, these enterprises have difficulty accessing formal financing because they have limited credit history and are widely seen as having a high risk profile by formal financial intermediaries. This result is further confirmed in Li and Zhao (2015) using VAR model, where they find that China's shadow banking helps alleviate the financial constraints faced by SMEs. However, their empirical result shows that the positive effect exists in short term only. In the long run, shadow banking seems to restrict the growth of SMEs. Further, Tsai (2016) concludes that the SMEs in China are having difficulty accessing formal credit, and thus are relying on alternative sources of financing, such as informal finance, online peer-to-peer platforms, registered non-banking financial institutions, and underground financiers, to meet their

funding needs. They point out that informal financial institutions in China operate in a manner quite different from their counterparts in the advanced economies. The China's informal financial institutions appear to play an important role in resolving the persistent funding gap faced by SMEs.

4. A general-equilibrium model with shadow banking

We consider a general-equilibrium model for a developing economy with shadow loans. The economy consists of urban and rural regions with uneven development a la the dual economy of Harris and Todaro (1970): The urban region produces a manufacturing good X by n monopolistic firms, while the rural region produces an agricultural good Y in a competitive market. In addition, an intermediate good Z, produced in the urban periphery, is used as an input to the production of manufacturing good X. Urban manufacturing firms raise capital through formal, regulated financial intermediaries, but the producers in the intermediate and agricultural sectors rely mostly on less regulated shadow loans from informal financial or nonfinancial institutions.[2]

Manufacturing and agricultural goods are final goods to consume, with consumers' demands by D_X and D_Y respectively, and the associated utility function can be presented by quasi-linear preference: $U(D_X, D_Y) = D_Y + u(D_X) = D_Y + D_X - D_X^2/2$. Utility maximization, subject to the budget constraint, $I = pD_X + D_Y$, yields the inverse demand function for the manufacturing good X: $p = 1 - D_X$, which gives p_X (= $\partial p/\partial D_X$) = - 1, where I denotes the income and p is the relative price of manufacturing good X in terms of agricultural good Y. The indirect utility function of the consumers is thus given by: $V = V(p, I) = I - (1 - p)^2/2$, with $V_p = - D_X$ and $V_I = 1$ by the envelope theorem. For the goods-market equilibrium, total demand for the manufacturing good X is equal to its supply in the economy, i.e., $D_X = X$. There are n manufacturing firms in the urban sector, by imposing a symmetry condition, we have $X = nx$, where x expresses output per firm.

On the supply side of the economy, urban manufacturing firms raise capital (K_f) via traditional banking and the corresponding official loan rate is r_f. Urban manufacturing firms, with fixed equipment and management, produce good X by employing unskilled labor and physical capital. The production technology is under increasing returns to scale, by involving in fixed cost, $f(w_S, r_f)$,

and marginal cost, $m(w_U, r_f)$, where w_s is the skilled wage rate and w_U is the urban unskilled wage rate. The former comes from wage payment to nonproduction skilled labor and rental cost to capital, while the latter is associated with the payments to urban unskilled labor and physical capital for production. Total factor cost for a firm to produce good x in the urban sector is therefore: $c(w_S, w_U, r_f, x) = f(w_S, r_f) + m(w_U, r_f)x$. By utilizing the envelope property, employments of skilled and unskilled labor for a urban manufacturing firm are given, respectively, by $s_x = f_w(w_S, r_f)$ and $l_x = m_w(w_U, r_f)x$, and the use of capital is captured by $k_x = f_r(w_S, r_f) + m_r(w_U, r_f)x$, where the subscript represents the partial derivative. In equilibrium, industrial demand for capital by n firms in urban manufacturing must be equal to the supply of capital via traditional banking, i.e., $nk_x = K_f$. Note that total employment of unskilled labor in urban manufacturing is $L_X = nl_x$.

In addition, to produce manufacturing good X, an intermediate input Z is needed.[3] Without loss of generality, it is assumed that one unit of output x requires one unit of input z. The profit of urban firm is therefore given by: $\pi = p(X)x - c(w_U, w_S, r_f, x) - qz$, where q denotes the price of the intermediate input. By choosing output x, firm maximizes profits to yield the equality of marginal revenue to marginal cost:

$$p(X) + p_x(X)x = m(w_U, r_f) + q. \tag{1}$$

Note that Cournot quantity competition between urban manufacturing firms is used in deriving the first-order profit-maximization condition in Eq. (1).

We turn next to the urban intermediate sector, in which good Z is produced by using unskilled labor and capital, $Z = Z(L_Z, K_Z)$, under a constant return-to-scale technology. It is noted that capital here is financed from shadow banking loans with the loan rate r_s, which exceeds the official rate r_f.[4] The intermediate-good market is perfectly competitive, in equilibrium unit cost is equal to its price:

$$\alpha(w_U, r_s) = q, \tag{2}$$

where $\alpha(\cdot)$ denotes the unit cost function for producing good z. Note that α_w and α_v express respectively the demand for unskilled labor and capital for producing one unit of intermediate good Z, and hence we have $L_Z = \alpha_w(w_U, r_S)Z$ and $K_Z = \alpha_r(w_U, r_S)Z$.

Finally, using unskilled labor (L_Y) and capital (K_Y), the rural sector produces agricultural good Y, where capital is financed from shadow banking. Under the constant returns-to-scale technology, the production function of good Y is: $Y = Y(L_Y, K_Y)$ and the corresponding unit cost is given by $g(w_R, r_s)$, where w_R denotes the rural wage rate of unskilled labor. The demands for unskilled labor and capital in the rural sector are then expressed by: $L_Y = g_w(w_R, r_s)Y$ and $K_Y = g_r(w_R, r_s)Y$. Assuming that the agricultural good market is perfectly competitive, in equilibrium zero profit prevails:

$$g(w_R, r_s) = 1, \tag{3}$$

where the price of agricultural good Y is normalized to unity. We can plot the equilibrium condition of the rural agricultural good market in the northwest quadrant of Figure 1.

Insert Figure 1 about here.

We consider next the factor markets. Following Harris and Todaro (1970), the dual developing economy is unevenly developed: the modern urban sector is more advanced compared to the traditional rural sector. In the urban sector, a minimum wage rate, w_U, is set for unskilled labor, which is above the market-determined rural unskilled wage rate, w_R. The above-market urban minimum wage rate leads to unemployment of unskilled labor (L_U) in the urban sector. The higher urban wage rate attracts rural workers to migrate to the urban sector, but only a probability of $1/(1 + \mu)$ of them to be employed, where μ [$= L_U/(L_X + L_Z)$] signifies the ratio of urban unemployment since total employment of unskilled labor in the urban sector is $L_X + L_Z$. Labor migration from the rural to the urban sector stops until the expected urban unskilled wage rate equals the rural wage rate:

$$w_U/(1 + \mu) = w_R. \tag{4}$$

This equation is known as the Harris-Todaro (H-T) migration equilibrium, which can be depicted as the rectangular hyperbola curve in the northeast quadrant of Figure 1 since Eq. (4) can be rewritten as: $w_R(L_X + L_Z) = w_R(L_X + L_Z + L_U)$.[5]

For the factor markets, the market-clearing conditions for unskilled labor, skilled labor, formal capital and shadow capital in the economy are respectively given by

$$(1 + \mu)[m_w(w_U, r_f)nx + \alpha_w(w_U, r_s)Z] + g_w(w_R, r_s)Y = L, \tag{5}$$

$$nf_w(w_S, r_f) = S, \tag{6}$$

$$n[f_r(w_S, r_f) + m_r(w_U, r_f)x] = K_f, \quad (7)$$

$$\alpha_v(w_U, r_s)Z + g_v(w_R, r_s)Y = K_s, \quad (8)$$

where L and S are the supplies of unskilled labor and skilled labor, and K_f and K_s denote the capital loans from official and shadow banking in the economy. Note that in Eq. (6), full employment is assumed to prevail in the market of skilled labor, which determines its wage rate w_S, with $w_S > w_U > w_R$. In addition, under the fixed supply of skilled labor in the economy, the skilled wage rate is a function of the official capital rental rate and the number of urban manufacturing firms, $w_S = w_S(r_f, n)$, by Eq. (6). Furthermore, from Eq. (7), the official capital rental rate (r_f) depends positively on the production of urban manufacturing good X. This relationship is illustrated in the southeast quadrant of Figure 1.

As for the good market, the demand for the intermediate input by urban manufacturing firms must meet its supply:

$$X = Z. \quad (9)$$

Accordingly, this equilibrium condition determines the price q of intermediate good Z in the economy.

Finally, to complete the setup of the model, the number of urban manufacturing firms n needs to be considered: it is fixed in the short run, while urban manufacturing firms can freely enter or exit in the long run until zero profit reaches:

$$p(X)x - f(w_S, r_f) - m(w_U, r_f)x - q = 0. \quad (10)$$

The model specified in Eqs. (1) – (10) describes the dual structure of the developing economy, in which Eqs. (1) – (9) determine nine unknowns, w_R, w_S, r_f, r_s, μ, x, Y, Z and q in the short run with a fixed number of urban firms n, while in the long run the number of urban firms n is endogenously determined by the free entry/exit condition described in Eq. (10). We will use this framework to examine the short- and long-run impacts of a rise in shadow loans K_s on factor returns, sectoral output and social welfare of the economy. Note that the rise in shadow loans may come from unregulated fund from financial institutions or from informal fund of firms and households in the economy.

4.1 Shadow banking, factor returns and social welfare

We begin with the analysis on the effects of shadow loans on factor returns and then to the impacts on sectoral output and social welfare for the short and the long run. In the short run for the given number of urban manufacturing firms n, the model in Eqs. (1) – (9) is block recursive: By inspecting Eqs. (1) – (4), (6) and (7), the factor returns, manufacturing output and urban unemployment ratio (r_f, r_s, w_R, w_S, x and μ) can be expressed by functions of q alone, while intermediate and agricultural outputs (Z and Y) are functions of q and K_s by Eqs. (5) and (8). Then, using Eq. (9), the price of intermediate good Z can be solved as a function of shadow loans K_s. As for the long run, we can determine the number of urban manufacturing firms n from Eq. (10).

We proceed the analysis by considering a fall in the intermediate input price q and by following a rise in shadow loans K_s [as shown in Eq. (25)]. From Eq. (2), we obtain:

$$\hat{r}_s / \hat{q} = 1/\theta_{KZ} > 0, \tag{11}$$

where θ_{ji} represents the cost share of the jth production factor in producing good i and the "^" expresses a percentage change of the variable.[6] For the intermediate good sector Z, under the given minimum wage rate for urban unskilled labor, the fall in the intermediate price will be reflected on the reduction in the rental rate of shadow capital. Nonetheless, the lowered rental cost benefits the agricultural sector, thereby raising the unskilled wage rate in the rural sector by Eq. (3):

$$\hat{w}_R / \hat{q} = - (\theta_{KY}/\theta_{LY})(\hat{r}_s / \hat{q}) < 0. \tag{12}$$

Hence, the rise in the rural wage rate gives less incentive for rural workers to migrate to the urban region. This lowers the ratio of unemployment in the urban sector according to Eq. (4):

$$\hat{\mu} / \hat{q} = - [(1 + \mu)/\mu](\hat{w}_R / \hat{q}) > 0. \tag{13}$$

Furthermore, we can obtain the effects of the fall in the intermediate input price q on manufacturing output x and the associated official capital rate r_f in the urban sector. This can be achieved by totally differentiating Eqs. (1), (6) and (7) to obtain:

$$(1 + 1/n)\hat{x} = - \varepsilon b \theta^m_{KX} \hat{r}_f - \varepsilon\tau\hat{q} - \hat{n}, \tag{14}$$

$$\hat{w}_S = \hat{r}_f + \hat{n}/s^f_{SX}, \tag{15}$$

$$s_{KX}^{m}\,\hat{r}_f = \lambda_{KX}^{m}\,\hat{x} + (1 + s_{KX}^{f} / s_{SX}^{f})\hat{n}, \tag{16}$$

where $b = m/p$ and $\tau = t/p$. Note that λ_{jX}^{m} is the allocative shares of variable factor j in sector X, θ_{jX}^{m} represents the variable cost share of factor j in producing good X, and s_{jX} signifies the factor substitution effect in demand for factor j.[7] In addition, $\varepsilon = - p/p_x X$ expresses the price elasticity of demand for good X. Therefore, from Eq. (14), a decrease in the production cost for good x via a fall in the input price q will increase the production of good x, but it can yield a repercussion on the official capital rental rate by Eq. (16). This can cause a factor substitution effect toward skilled labor and hence raise the skilled wage rate by Eq. (15). It is also noted that market competition by manufacturing firms (n) can affect the production of good x and hence the capital rental rate and skilled wage rate in Eqs. (15) and (16).

Finally, we can obtain the impacts of the fall in the intermediate input price q on intermediate-good output Z and agricultural output Y. By totally differentiating Eqs. (5) and (8) to yield:

$$(1+\mu)\lambda_{LZ}\hat{Z} + \lambda_{LY}\hat{Y} = - (1 + \mu)\,\lambda_{LX}^{m}\,(\hat{x} + \hat{n}) - (1+\mu)\,s_{LX}^{m}\,\hat{r}_f$$

$$- [(1+\mu)s_{LZ} + s_{LY}]\,\hat{r}_s + [(1+\mu)(\lambda_{LX}^{m} + \lambda_{LZ}) + s_{LY}]\,\hat{w}_R\,, \tag{17}$$

$$\lambda_{KZ}\hat{Z} + \lambda_{KY}\hat{Y} = \hat{K}_s + (s_{KZ} + s_{KY})\,\hat{r}_s - s_{KY}\,\hat{w}_R\,, \tag{18}$$

where λ_{jY} is the allocative share of production factor j in sector Y. The outputs of goods Z and Y will be directly affected by the increase of shadow capital loans K_s, and then further adjusted through the changes in factor returns and the number of manufacturing firms as indicated in Eqs. (17) and (18).

4.1.1 Short-run effects

As shown in Eq. (12), the fall in the intermediate good price q raises the wage rate of unskilled labor in the rural sector. Furthermore, from Eqs. (14) - (16), we can solve the impacts of the fall in the intermediate price on manufacturing output and the factor returns, as follows:

$$\hat{x}/\hat{q} = - \varepsilon\tau s_{KX}^{m}/D < 0. \tag{19}$$

$$\hat{w}_S/\hat{q} = \hat{r}_f\,/\hat{q} = - \varepsilon\tau\,\lambda_{KX}^{m}/D < 0. \tag{20}$$

where $D = (1 + 1/n)\, s^m_{KX} + \varepsilon b\, \lambda^m_{KX}\ \theta^m_{KX} > 0$. The fall in the price of the intermediate input q lowers the cost of producing manufacturing good, thereby increasing the production of good x and also raising the skilled wage rate w_S and the rate of returns on manufacturing capital r_f. Note that for a given number of manufacturing firms in the short run, Eq. (19) gives the supply of good X (= nx) = $X(q)$, with $\partial X/\partial q < 0$.

We can also use Eqs. (17) and (18) to obtain the effects regarding the reduction in the intermediate good price q on the outputs of goods Z and Y:

$$\hat{Z}/\hat{q} = (\lambda_{KY}A + \lambda_{LY}B)/|\lambda|, \tag{21}$$

$$\hat{Y}/\hat{q} = -\,[\lambda_{KZ}A + (1 + \mu)\lambda_{LZ}B]/|\lambda|, \tag{22}$$

$$\hat{Z}/\hat{K}_s = \lambda_{LY}/|\lambda| > 0, \tag{23}$$

$$\hat{Y}/\hat{K}_s = -\,(1 + \mu)\lambda_{LZ}/|\lambda| < 0, \tag{24}$$

where $A \lessgtr 0$, $B > 0$ and $|\lambda| = \lambda_{KZ}\lambda_{LY} - (1 + \mu)\lambda_{LY}\lambda_{KY}$.[8] For stability, $|\lambda|$ is required to be positive, i.e., the intermediate good sector is capital intensive relative to the agricultural sector.[9] Furthermore, to have the normal supply responses, we need $A > 0$ to ensure $\hat{Z}/\hat{q} > 0$ and $\hat{Y}/\hat{q} < 0$.

Now, we are ready to examine the effect of the rise in shadow loans on the price q of intermediate good Z. From Eqs. (5) and (8), we can obtain $Z = Z(q, K_s)$, with $Z_q > 0$ and $Z_K > 0$ under the stability condition. From Eq. (9), we have $X(q) = Z(q, K_s)$. This gives

$$dq/dK_s = Z_K/(X_q - Z_q) < 0. \tag{25}$$

Hence, using Eqs. (11), (12) and (20), we conclude the effects of the rise in shadow loans on factor returns as: $dw_R/dK_s > 0$, $dw_S/dKs >$, $dr_s/dK_s < 0$ and $dr_f/dK_s > 0$. This helps examine the profit effect of shadow loans for urban manufacturing firm, as follows:

$$d\pi/dK_s = -\,x(dq/dK_s) - [f_w(dw_S/dK_s) + f_r(dr_f/dK_s) + xm_r(dr_f/dK_s)] \lessgtr 0. \tag{26}$$

We have $d\pi/dK_s > 0$ in Eq. (26) if the cost saving from the intermediate input dominates the cost rising from capital and labor.

Using the above results on urban production and unemployment, we can evaluate the short-run welfare impact of shadow loans in the dual developing economy. Social welfare is represented by

the indirect utility function, $V = V(p, I)$, where $I = w_U L_X + w_U L_Z + w_R L_Y + w_S S + r_f K_f + r_s K_s + n\pi$. Totally differentiating the welfare function and using Eqs. (1) – (7), we obtain the change in social welfare for the economy:

$$dV/dK_s = r_s - w_R(L_X + L_Z)(d\mu/dK_s) + n(p - m - q)(dx/dK_s), \quad (27)$$

where $p - m - q = -xp_x > 0$ with $p_x = -1$. The welfare effect of the rise in shadow loans in Eq. (27) expresses a direct gain by the loan rate r_s, plus two indirect effects via distortions in the economy: urban unemployment and market imperfection. Since $d\mu/dK_s < 0$ by Eq. (13) and $dx/dK_s > 0$ by Eq. (17), we have $dV/dK_s > 0$

In summary, we have:

Proposition 1. For a developing economy with shadow banking, the rise in shadow loans can increase both the skilled and unskilled wage rates as well as raise social welfare of the economy in the short run with a given number of manufacturing firms in the urban sector.

It is worthwhile to illustrate the above short-run impact of shadow banking on factor returns in Figure 2. The rise in shadow banking (K_S) increases the supply of intermediate input Z and hence the production of manufacturing good X. This raises urban demand for unskilled labor by shifting the combined VMPL curve (values of marginal product of labor by $pX_L + qZ_L$) upwards as shown in the northeast quadrant of Figure 2, while shifting the rural agricultural VMPL curve (Y_L) downwards. Nonetheless, the former shift dominates, and consequently unskilled wage increases. In addition, skilled wage rises because urban manufacturing firms substitute skilled labor for capital in face of the increased official capital rental rate.

Insert Figure 2 about here

4.1.2. Firm dynamics

In the previous section, we have considered the short-run situation in which the number of firms in the urban manufacturing sector is exogenously given and shown that the rise in shadow loans can raise profits of urban firms in Eq. (26) when the cost saving from intermediate input outweighs the cost rising from labor and capital. The profit incentive can attract new firms to enter into the urban

manufacturing sector. The effects of firm entry via the increase in the manufacturing firms are given as follows:

$$\hat{x}/\hat{n} = -[\, s_{KX}^{m} + \varepsilon b\, \theta_{KX}^{m}\, (1 + s_{KX}^{f} / s_{KX}^{f})]/D < 0, \tag{28}$$

$$\hat{r}_f /\hat{n} = [(1 + 1/n)\, (1 + s_{KX}^{f} / s_{KX}^{f}) - \lambda_{KX}^{m}] /D > 0, \tag{29}$$

$$\hat{w}_S /\hat{n} = \hat{r}_f / \hat{n} + 1/s_{SX}^{f} > 0. \tag{30}$$

The entry of urban manufacturing firms results in a business-stealing effect by reducing individual firm output in Eq. (28) and raising factor costs on capital and skilled labor in Eqs. (29) and (30). This in turn lowers the profit of urban manufacturing firm:

$$d\pi/dn = -[f_w(dw_S/dn) + f_r(dr_f/dn) + xm_r(dr_f/dn)] < 0. \tag{31}$$

As for the welfare effect of firm entry, we differentiate the welfare function, $V = V(p, I)$, to obtain:

$$dV/dn = \pi - w_R L_X(d\mu/dn) + n(p - m - q)(dx/dn), \tag{32}$$

where $d\mu/dn = 0$. Note that $dx/dn < 0$ for the business-stealing effect by Eq. (28), while $\pi\,[= p(X)x - f(w_S, r) - m(w_U, r)x]$ is the profit of the new urban manufacturing firm. By setting $dV/dn = 0$ in (32), the socially optimal number of urban manufacturing firms is determined at a level of positive profit:

$$\pi_S^o = -n(p - m - q)(dx/dn) > 0. \tag{33}$$

This implies that due to market imperfection, free entry of urban manufacturing firms to zero profits would end up with too many firms in the urban manufacturing sector.[10]

In summary, we have the following proposition regarding firm dynamics to the urban manufacturing sector:

Proposition 2. In a dual developing economy, due to market imperfection, free entry to zero profits leads to excessive number of manufacturing firms in the urban sector. Moreover, the entry of manufacturing firms raises skilled wage rate and capital rental rate, thereby lowering firm output and profit in the urban sector.

4.1.3 Long-run effects

In the long run, firms can freely enter into or exit from the urban manufacturing sector. To obtain the total effect of the rise in shadow loans on firm dynamics, we totally differentiate Eq. (10) to have:

$$[1 + \varepsilon(1-b)(\theta_{KX}^{f} / s_{SX}^{f})]\hat{n} = -(1-1/n)\hat{x} - \varepsilon[(1-b)\,\theta_{KX}^{f} + b\,\theta_{KX}^{m}]\,\hat{r}_f - \varepsilon\tau\hat{q}. \qquad (34)$$

Eq. (34) states that number of urban manufacturing firms depends on firm output, official capital rental and intermediate input price. By solving Eqs. (14) – (16) and (34), we obtain the long-run effect of the rise in shadow loans (via a lower price of the intermediate price) on the number of urban manufacturing firms:

$$\hat{n}/\hat{q} = \varepsilon\tau\lambda_{LX}^{m}\,[\varepsilon(1-b) - (2/n)\sigma_X^m\theta_{KX}^m]/\Delta, \qquad (35)$$

where $\Delta > 0$.[11] Note that $\hat{n}/\hat{q} < 0$ in Eq. (35) if the demand for manufacturing good X is price-inelastic (ε is small) and/or the production of good X is flexible (σ_X^m is large). Thus, in the long run, a rise in shadow loans can lead to new entry of manufacturing firms in the urban sector.

In the long run, from Eq. (15), the firm-entry effect induced by shadow loans yields a repercussion on the skilled wage rate:

$$\hat{w}_S/\hat{q} = \hat{r}_f/\hat{q} + (1/s_{SX}^{f})(\hat{n}/\hat{q}), \qquad (36)$$

where the change in the official rental rate in the urban manufacturing sector can be obtained by Eqs. (9) – (14) and (29) as

$$\hat{r}_f/\hat{q} = -\varepsilon\tau[\varepsilon(1-b)\,\lambda_{LX}^{m}\,\theta_{KX}^{f} / s_{SX}^{f} + (2/n)(1 + s_{KX}^{f} / s_{SX}^{f})]/\Delta < 0\,. \qquad (37)$$

This gives $\hat{w}_S/\hat{q} < 0$ in Eq. (36). Thus, the increase in urban manufacturing firms n further raises the skilled wage rate in the long run. This firm-entry effect on skilled wage can be depicted in the southeast quadrant of Figure 2 by a further shift of the capital rental line downwards.

In addition, from Eqs. (9) – (14) and (29), the fall in the intermediate price can raise the production of urban manufacturing output as

$$\hat{x}/\hat{q} = -\varepsilon^2\tau(1-b)(1 + s_{KX}^{f} / s_{SX}^{f} + s_{KX}^{m}\,\theta_{KX}^{f} / s_{SX}^{f})/\Delta < 0\,. \qquad (38)$$

Due to the lowered price of intermediate input *z*, the rise in shadow loans increases the manufacturing output in the long run. The long-run welfare consequence of shadow loans is therefore:

$$dV/dK_s = r_s - w_R(L_X + L_Z)(d\mu/dK_s) + n(p - m - q)(dx/dK_s) + \pi(dn/dK_s), \qquad (39)$$

where $d\mu/dK_s < 0$ by Eq. (13), $dx/dK_s > 0$ by Eq. (38) and $dn/dK_s > 0$ by Eq. (35). Note that along the long-run equilibrium with free entry/exit, the profit of urban manufacturing firm is zero. Thus, new entry of manufacturing firm induced by the rise of shadow loans ($dn/dK_s > 0$) will bear a negative profit ($\pi < 0$), thereby making the welfare effect of shadow loans in Eq. (39) indeterminate. This excessive firm-entry effect could lower social welfare of the economy in the long run if it is sufficiently strong.

In summary, we have the following long-run results when excessive firms enter into the urban manufacturing sector:

Proposition 3. For a dual developing economy, the rise in shadow loans can result in an excessive entry of urban manufacturing firms in the long run. This firm-entry effect worsens the wage gap by further raising the skilled wage rate. In addition, the rise in shadow loans can lower social welfare of the economy in the long run if the firm-entry effect is sufficiently strong.

The validity of the above theoretical predictions on the short- and long-run impacts of shadow loans on the economy will be examined through empirical study.

5 Empirical Analysis

In this section, we empirically examine both the short- and long- run theoretical predictions obtained in Propositions 1 and 3 in Section 4. The main predictions of our theoretical model are:

1) In the short run with the fixed number of firms, a rise in shadow loans can raise real output (social welfare) of the economy, partly via the rises in the wage rates of skilled and unskilled labor.

2) In the long run with free entry of urban manufacturing firms, a rise in shadow loans can result in an excessive entry of urban manufacturing firms. If the firm-entry effect is sufficiently strong, the rise in shadow loans could lower real output (social welfare) of the economy.

Next, we describe the data sources, construction of measure of shadow banking and the econometric methodology to examine the effect of shadow banking on economic growth.

5.1 Data sources and variables

To examine the effect of shadow banking on real output of the economy, we set up a growth regression model with annual growth rate of real per capita GDP as the dependent variable, shadow banking as the main independent variable and a set of control variables. Our data are drawn primarily from multiple issues of China Statistical Yearbook, China Provincial Yearbooks and Almanac of China's Banking and Finance compiled in WIND Chinese Economic Database and CEIC China Premium Database. Our sample covers the period from 2002 to 2013 because the information to estimate the size of shadow banking is only available from 2002.

5.1.1 Measure of output growth and income inequality

To measure output growth, we calculate the real per capita GDP for each province by deflating nominal per capita GDP with provincial level consumer price index (CPI) with base year of 1999.[12] The information of the provincial nominal GDP and CPI is obtained from WIND Economic Database. The annual growth rate of real per capita GDP is defined as the change in the logarithm of real per capita GDP.

5.1.2 Measure of shadow banking and firm-entry effect

The structure of Chinese shadow banking is quite complex and relevant statistical data is either not transparent or unavailable. A few approaches have been proposed in the past studies to estimate the size of shadow banking in China. These approaches can be classified into two broad categories, depending on whether the size of shadow banking is determined from the perspective of the supplier or user of capital.

The approaches in the former category rely on the PBOC's measure of Total Social Finance (TSF). TSF refers to the loans extended to private sectors in China. It includes loan in local currency, loan in foreign currency, entrusted loan, trust loan, undiscounted banker's acceptances, net corporate bond financing, and non-financial enterprises equity financing. The size of shadow banking has been

estimated using the shadow banking relevant components in TSF. Of which, the aggregation of the entrusted loans, trusted loans and undiscounted banker's acceptances has been considered by Moody's Investors Service (2016) as the size of core shadow banking (Hu et al., 2016; Zhang and Gong, 2016; Moody's Investors Service, 2016). On top of the core shadow banking components, a few estimation approaches have added various other types of financing. For example, apart from the core shadow banking, Elliott et al. (2015) include interbank entrusted loan payments, financial leasing and small loan companies, and Pei and Yin (2014) include net corporate bond financing. Overall, these approaches follow closely the definition of shadow banking and are intuitive. However, since some components of shadow banking are reported by different government agencies in China under different financing items, they might be double counted or omitted. Thus, in reality it is difficult to obtain an accurate estimation of the size of China's shadow banking.

The approach in the latter category was proposed by Li (2010), where the size of shadow banking is estimated using the modelling technique for informal financial sector, which focuses on the capital demanding pattern of various types of borrowers. The model assumes that the generation of a certain level of GDP for a certain time period requires the support of corresponding amount of loan capital. However, in China the loan capital provided by the formal financial institutions generally flows to state-owned enterprises and large corporations, with farmers and private enterprises relying on capital from the informal sector or shadow banking. The merits of this approach are that it partially avoids the issue of data unavailability and opaqueness, and enables the estimation of the size of shadow banking for an extended period covering earlier years from 1978. However, this approach suffers from a number of shortcomings. First, by focusing on the farmers and private enterprises, this approach fails to take into account the fact that other entities, such as large corporations which might also obtain capital through shadow banking. Second, it imposes a restrictive assumption where the ratio of loan to farmers and private enterprises over GDP for these entities must not be smaller than the ratio of total loan over GDP, though in reality this relationship might not hold. Third, this approach might result in a negative value for the informal loan (shadow loan) extended to farmers and/or private enterprises.

The PBOC does not report the components of provincial TSF until 2013. We, therefore have to find a way to estimate the size of shadow banking for each province from 2002 to 2013. Our proposed approach is closely in line with the approaches in the former category, where we utilise the shadow banking relevant components in TSF. We start with the size of shadow banking for China as a whole by using the core components of shadow banking defined in Moody's Investors Service (2016). Borrowing the principle from Li's (2010) model, we assume that the output produced by the farmers and private enterprises are supported by loans from the informal sector or shadow banking, given that it is widely known in China that these entities have difficulty accessing formal finance. Accordingly, we define the size of provincial shadow banking as follows:

$$SB_i = \frac{GDP_{s,i}}{GDP_s} \times SB \tag{40}$$

where SB_i denotes the size of shadow banking for province *i*, $GDP_{s,i}$ the *GDP* produced by farmers and private enterprises in province *i*, GDP_s the *GDP* produced by the farmers and private enterprises for China as a whole and *SB* the size of shadow banking for China as a whole. This approach implies that a province with a higher value of GDP generated by farmers and private enterprises will require a higher level of informal loans from shadow banking. The data on SB is obtained from Elliot et al. (2015). To check the sensitivity of our regression results, we also adopt an alternative measure of shadow banking. Following Moody's Investors Service's (2016) definition, we calculate SB as the sum of entrusted loan, trusted loan and banker's acceptances. The data on entrusted loan, trusted loan and banker's acceptances are collected from CEIC China Premium database.

To determine the mediating effect of firm entry on the relationship between shadow banking and economic growth as stated in Proposition 3, we use net entry as the proxy for firm entry and exit. The net entry is the difference between the number of industrial enterprises registered in the current year and previous year. The data of the number of industrial enterprises is obtained from CEIC China Premium database.

5.1.3 Control variables

To control for province characteristics on the economic growth, we include a set of control variables commonly used in the finance-growth literature (e.g. Cheng and Degryse, 2010; Hao, 2006; Zhang et al., 2012). We employ two indicators to measure the degree of development of the financial intermediaries in China adopted in past studies (i.e. Cheng and Degryse, 2010; Hao, 2006; Zhang et al., 2012). *Formal Credit* is the first indicator and it measures the financing provided to private sector by formal financial intermediaries. It is equal to the value of total loans provided by formal financial intermediaries to private sector in province *i* divided by GDP of province *i*. The second indicator *Savings*, which measures the efficiency of formal financial system in mobilizing household savings, is the ratio total household savings deposited in the formal financial intermediaries in province *i* to GDP in province *i*.

Other control variables included are the conventional determinants of economic growth (Hao, 2006, Zhang et al., 2012) such as the logarithm of lagged real per capita GDP, human capital accumulation, degree of trade openness, infrastructure, and size of local government. We include the logarithm of lagged real per capita GDP to control for convergence. The proxy for human capital accumulation, *Education*, is the percentage of population receiving secondary school education. The degree of trade openness is measured by the ratio of foreign direct investment (FDI) to GDP. The ratio of total fixed asset investments to GDP is the proxy for the investment in infrastructure (Liu and Li, 2001; Chen et al., 2013). Finally, the size of local government is the ratio of local government expenditure to GDP and is the proxy for macroeconomic stability (Easterly and Rebelo, 1993).

5.1.4 A first glance at the data

Table 1 presents the summary statistics of the variables used for the entire sample and the correlations between annual real per capita GDP growth and the key explanatory variables. Table 2 reports the summary statistics for key variables across provinces. From Panel A of Table 1, we can see that there are considerable variations in all variables. The average annual growth rate in real per capita GDP is 11.6% with a standard deviation of 4.3%. Both shadow banking indicators show large variation across provinces. Shadow banking 1 ranges from 2.9% to 64.2% with a mean of 18.3%,

while Shadow banking 2 ranges from 3.4% to 48.8% with a mean of 15.1%. The average Formal Credit is 107%, which is about six times larger than the average Shadow Banking indicators. The average Savings is 69.8%, which is at least four times larger than the average Shadow Banking indicators. Panel B shows negative correlations between annual real per capita GDP growth and the key explanatory variables. Table 2 shows that Inner Mongolia has the highest average annual real per capita GDP growth rate of 15.9% and Shanghai has the lowest average growth rate with 6.6%. Hainan has the highest percentage of average shadow banking (25.5% for Shadow banking 1 and 21.1% for Shadow Banking 2), while Tianjin has the lowest percentage for both ratios (9.9% for Shadow Banking 1 and 8.3% for Shadow Banking 2).

Insert Table 1 about here

Insert Table 2 about here

5.2 Methodology

We aim to estimate the effect of shadow banking on the provincial economic growth. To this end, we employ the following growth equation commonly applied in the finance-growth literature (Levine et al., 2000; Hao, 2006; Guariglia and Poncet, 2008; Hasan et al., 2009; Zhang et al., 2012) as our baseline regression:

$$\Delta y_{i,t} = \alpha + (\gamma - 1) y_{i,t-1} + \beta_1 SB_{i,t} + \beta_2{}' X_{i,t} + \varphi_i + \upsilon_t + \varepsilon_{i,t}, \quad (41)$$

where i and t denote province and year, respectively; $y_{i,t}$ represents the logarithm of real per capita GDP; $SB_{i,t}$ the size of shadow banking; $X_{i,t}$ the set of explanatory variables (including the degree of financial intermediary development and other control variables, but excluding the logarithm of lagged real per capita GDP); φ_i an unobserved province-specific effect; υ_t a time-specific effect; and $\varepsilon_{i,t}$ the error term. Our main coefficient of interest for testing the short-run prediction in Proposition 1 is the coefficient β_1. We examine whether the coefficient β_1 is statistically positive.

To test the long run effect outlined in Proposition 3, we introduce the interaction term for shadow banking to capture the impact of firm entry on shadow banking as follows:

$$\beta_1 = \rho_1 + \rho_2 Entry_{i,t}, \quad (42)$$

where $Entry_{i,t}$ is the measure of the net entry of urban manufacturing firms. Substituting Eq. (42) into Equation (41), we obtain:

$$\Delta y_{i,t} = \alpha + (\gamma - 1)y_{i,t-1} + (\rho_1 + \rho_2 Entry_{i,t}) * SB_{i,t} + \beta_2{}' X_{i,t} + \varphi_i + \upsilon_t + \varepsilon_{i,t}, \quad (43)$$

where the combined coefficient of shadow banking variable ($\rho_1 + \rho_2 Entry_{i,t}$) consists of the direct effect ρ_1 and the indirect effect via firm entry $\rho_2 Entry_{i,t}$ on economic growth. To test the long run effect in Proposition 3, we determine whether the total effect is statistically positive or negative.

For estimation purposes, we can rewrite Eqs. (41) and (43) as follows:

$$y_{i,t} = \alpha + \gamma y_{i,t-1} + \beta_1 SB_{i,t} + \beta_2{}' X_{i,t} + \varphi_i + \upsilon_t + \varepsilon_{i,t}, \quad (44)$$

$$y_{i,t} = \alpha + \gamma y_{i,t-1} + (\rho_1 + \rho_2 Entry_{i,t}) * SB_{i,t} + \beta_2{}' X_{i,t} + \varphi_i + \upsilon_t + \varepsilon_{i,t}. \quad (45)$$

There are two econometric issues associated with the estimation of Eqs. (44) and (45). The first issue is the existence of lagged dependent variable and province-specific effect among the regressors on the right-hand side of Eqs. (44) and (45). To control for the province-specific effect, we can estimate Eqs. (44) and (45) using the within-group estimator. However, with lagged dependent variable among the regressors in Eqs. (44) and (45), the within-group estimation produces inconsistent parameter estimates even if $\varepsilon_{i,t}$ is serially uncorrelated because the lagged dependent variable is correlated with the error term. The second issue is the endogeneity problem arising from the fact that many of the explanatory variables on the right-hand side of Eqs. (44) and (45) are likely endogenously determined. To avoid the potential biases arising from reverse causality, there is a need to control for the endogeneity of explanatory variables. In past cross-country studies, which employ the growth equation, external instrument such as legal origin has been used to mitigate the endogeneity problem (Beck et al., 2000; Levine et al., 2000). However, legal origin cannot be used as the external instrument in our case because all provinces in China are subject to a common legal system (Guariglia and Poncet, 2008). Thus, the panel GMM estimator proposed by Arellano and Bond (1991), which relies on the internal instruments, can be used to solve the endogeneity problem. For brevity sake, below we discuss the procedures to deal with endogeneity issue for Eq. (44) using the GMM estimator. The same procedures are applicable to Eq. (45).

To this end, Eq. (44) is first-differenced to eliminate the time invariant province-specific effect:

$$y_{i,t} - y_{i,t-1} = \gamma(y_{i,t-1} - y_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\upsilon_t - \upsilon_{t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}). \quad (46)$$

For simplicity, let $X_{i,t}$ contains the measure of shadow banking and other explanatory variables. By construction the new error term $\varepsilon_{i,t} - \varepsilon_{i,t-1}$ is correlated with the lagged dependent variable $y_{i,t-1} - y_{i,t-2}$. To address the issue of endogeneity of explanatory variables and correlation between $\varepsilon_{i,t} - \varepsilon_{i,t-1}$ and $y_{i,t-1} - y_{i,t-2}$, the panel GMM estimator uses lagged explanatory variables as the instruments for $y_{i,t-1} - y_{i,t-2}$ by assuming that the error term $\varepsilon_{i,t}$ is serially uncorrelated and the explanatory variables $X_{i,t}$ are weakly exogenous. For the estimation purposes, Arellano and Bond (1991) propose the following two moment conditions for the panel GMM estimator:

$$E[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0, \quad \text{for } s \geq 2;\ t=3,\ldots,T,$$

$$E[X_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0, \quad \text{for } s \geq 2;\ t=3,\ldots,T.$$

The panel GMM estimator uses the above two moment conditions is referred to as the difference estimator. The two moment conditions imply that the lagged two periods or more value of $y_{i,t}$ and $X_{i,t}$ can be used as the instruments for Eq. (46) because both are uncorrelated with $\varepsilon_{i,t} - \varepsilon_{i,t-1}$, while the lagged two periods or more value of $y_{i,t}$ and $X_{i,t}$ are, respectively, correlated with $y_{i,t-1} - y_{i,t-2}$ and $X_{i,t} - X_{i,t-1}$.

However, according to Alonso-Borrego and Arellano (1996) and Blundell and Bond (1997), the lagged values of these variables are weak instruments for the first-difference regression equation when the lagged dependent variable and explanatory variable are persistent over time. The weak instruments can result in large finite sample bias and can produce biased coefficients based on the results of Monte Carlo experiments for small samples. To reduce potential biases and imprecisions, we can use the system GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1997), which combines both the first-difference equation (Eq. (46)) and levels equation (Eq. (44)) into a system. In this estimator, there is no change to the instruments for the first-difference equation and the instruments for the levels equation are the lagged differences of the corresponding variables. To ensure the validity of instruments, an additional assumption is imposed: the first

difference of the lagged dependent variable and explanatory variables are uncorrelated with the province-specific effect. Similar to Levine et al. (2000), Guariglia and Poncet (2008) and Hasan et al. (2009), we employ the system GMM estimator for the estimation of all the regression equations in this paper.

To test the validity of the assumptions of no serial correlation in the error term and the validity of the instruments, we perform two specification tests proposed by Arellano and Bond (1991). The first test examines the second order serial correlation of the residuals with the null hypothesis of no second-order serial correlation. While the second one, the Hansen test of over-identifying restrictions, examines the overall validity of the instruments. The null hypothesis of this test is the validity of the instruments. Failure to reject these two hypotheses provides support to the aforementioned two assumptions.

6 Results

6.1 Base results

Table 3 presents the regression results. Column (1) reports the results of the baseline model, which include the financial intermediary indicators and control variables only. Column (2) displays the regression results with Shadow Banking, financial intermediary indicators and other control variables. This is the scenario where the effect of firm entry is not taken into account. Column (3) introduces the interaction between Shadow Banking and Entry. The interaction term is introduced to capture the dynamic effect of firm entry. The net entry is used as the measure of firm entry and exit.

Insert Table 3 about here

Column (1) of Table 3 shows that the formal credit is positively associated with economic growth but the relationship is not statistically significant. This result is partially consistent with Hasan et al. (2009), which find that bank lending is not positively associated with economic growth. Hasan et al. (2009) suggest that this observation could be due to bad lending practices adopted by Chinese financial institutions during the sample period and government interference in bank lending practices. Savings has a positive but not significant impact on the economic growth.

We now add shadow banking into the regression. Column (2) of Table 3 reports a positive and statistically significant relationship between shadow banking and economic growth. That is, a 1% increase in shadow banking raises economic growth by 0.48%. This finding suggests that shadow banking, rather than formal credit, promotes economic growth in China in the short run when the firm-entry effect is not considered. Nonetheless, in the long run, urban manufacturing firms can freely enter or exit. To capture this firm-entry effect, we use net entry as the proxy. This introduces an interactive term between shadow loans and firm entry in column (3) of Table 3. Consequently, the combined coefficient for shadow banking is significantly reduced and statistically significant. In fact, when the firm-entry effect is present, the magnitude of the coefficient of shadow banking is reduced by about 42%. In other words, shadow banking has a lesser impact on Chinese economic growth in the long run when the firm-entry effect is taken into account. This finding is in line with the findings in Allen et al. (2005), Zhang and Peng (2014) and Jerome (2015) that shadow banking has a positive influence on the economic growth. In addition, Formal Credit is now statistically significant and positively associated with economic growth when the firm-entry effect is taken into consideration. This finding partially confirms the findings in Ayyagri et al. (2007) and Cheng and Degryse (2010) that formal credit rather than informal credit plays a role in promoting economic growth. In Li and Li (2015) the authors find that the positive effect of shadow banking on economic growth is transitory. Thus, our results contradict with the abovementioned three studies where we show that informal credit does spur economic growth in the long run, although at a lesser degree. In sum, the above two findings support our theoretical predictions where shadow banking promotes economic growth in the short run, and the effect of shadow banking on economic growth weakens in the long run.

Furthermore, saving deposit becomes significantly negative in the specification with the firm-entry effect. This result is in line with the findings in Guariglia and Poncet (2008) and Zhang et al. (2012). Zhang et al. (2012) argue that a high saving rate may lead to low household consumption as a share of GDP and thus impede economic growth and Guariglia and Poncet (2008) suggests that the negative impact could be due to inefficient allocation of savings.

With regards to test statistics, all models pass the Hansen test of overidentifying restrictions, indicating the validity of the instruments. The p-value of all regression models are greater than 0.1,

indicating no second-order serial correlation in error term. Thus, this result provides evidence that the relation between shadow banking and economic growth is not due to simultaneity bias.

6.2 Sensitivity analyses

We perform a variety of robustness tests to evaluate the sensitivity of our results. First, we re-run the regressions using an alternative measure of shadow banking: Shadow Banking 2. In comparison to Table 3, the sensitivity results in Table 4 show significantly consistent results for Shadow Banking, Formal Credit and Savings. However, the economic impact of the shadow banking is much stronger than those in Table 3.

Insert Table 4 about here.

Second, to confirm the robustness of our results with respect to data frequency, we reproduce our main results using the data averaged over 3-year intervals. The data for all variables are averaged over four three-year periods, except that the initial GDP is the value of the initial year of the three-year period. Table 5 reports the results. We find a significantly positive relationship between shadow banking and economic growth in the short run (Column (1)). However, the combined coefficient of shadow banking become statistically insignificant when the firm-entry effect is taken into account. In other words, shadow banking has no impact on Chinese economic growth in the long run when the firm-entry effect is considered. This shows that the mediating effect of firm-entry on the relationship between shadow banking and economic growth is much stronger than those in Tables 3 and 4, although the qualitative conclusions remain the same. Moreover, we find that Formal Credit and Savings are now no longer statistically significant.

Due to the limited sample size for each province, we were not able to obtain the results for AR(2) tests in the estimations using system GMM estimator. Thus, we are not able to confirm the absence of second-order serial correlation. To further validate our results, we re-run the regressions on data averaged over 3-year intervals using the fixed-effects regressions. The qualitative conclusions are again confirmed by the results reported in columns (3) and (4) of Table 5.

Insert Table 5 about here.

Third, we investigate whether the sensitivity of the results depends on the number of industrial enterprises in the region a province belongs to. The six regions are North China (i.e., Beijing, Tianjin, Hebei, Shanxi, and Inner Mongolia), Northeast China (i.e., Liaoning, Jilin, and Heilongjiang), East China (i.e., Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, and Shandong), South Central China (i.e., Henan, Hubei, Hunan, Guangdong, Guangxi, Hainan), Southwest China (i.e., Chongqing, Sichuan, Guizhou, Yunnan, Tibet) and Northwest China (i.e., Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang). Northwest China is the least private enterprises intensive region which the lowest combined average number of enterprises in its five provinces (see Table 6). This indicates that industrial activities are least active in this region. On the other hand, East china is the region with the largest base for industrial enterprises. We exclude Northwest China from our sample and re-run the regressions using annual data. Table 6 shows that shadow banking has a positive impact on the economic growth in the short run, but not in the long run when the firm-entry effect is taken into consideration. Therefore, excluding Northwest China from the sample does not change our conclusions concerning the short and long run effects of shadow banking on the Chinese economic growth.

Insert Table 6 about here.

7 Conclusions

This paper theoretically and empirically examines whether shadow banking affects economic performance, in terms of real output growth, of a dual developing economy. Using the three-sector general equilibrium model with urban manufacturing, urban intermediate and rural agricultural sectors, we find that an increase in loans extended via shadow banking to firms in urban intermediate and rural agricultural sectors could result in a reduction in the capital user cost. This can then lead to an improvement in the social welfare of the economy in the short run. However, in the long run, the expansion of shadow banking can induce excessive entry of urban manufacturing firms, which could exacerbate the wage gap between skilled and unskilled labour and reduce real output of the economy if the firm-entry effect is sufficiently strong.

Using Chinese provincial data, our empirical analysis supports the theoretical predictions. We find that shadow banking has a significant positive effect on real GDP growth in the short run. In particular, our finding shows that a 1% rise in shadow banking can raise China's real per capita GDP growth by 0.48% in the short run. However, the effect of shadow banking on the economic growth significantly weakens when the firm-entry effect is taken into consideration. Our finding that the firm-entry effect significantly weakens the effect of shadow banking on economic growth in the long run is robust to different indicator of shadow banking, data frequency and composition of data set. This finding is partially consistent with the result obtained in Li and Li (2015) that shadow banking has only a transitory effect on the economy growth.

Endnotes

1. The data is obtained from the National Bureau of Statistics.
2. Gupta (1997) considers informal capital that is mobile between the rural and the urban informal sector.
3. See Arvin-Rad, et al. (2010) for the case that the urban informal sector produces a non-traded intermediate good which is used by the urban formal sector.
4. In china, the shadow loan rates can be allowed to be four times higher than the official loan rates.
5. See Corden and Findlay (1975) and Neary (1981). Also see Beladi and Marjit (1996) for a related application of the Harris-Todaro (1970) model.
6. Mathematical notations are taken from Jones (1965).
7. The unit fixed cost of urban firm is $f(w_S, r_U)$, and the elasticity of factor substitution between skilled labor and capital is defined as: $\sigma_X^F = ff_{wr}/f_w f_r$. Following Jones (1965), the factor substitution effect in demand for skilled labor is: $s_{SX}^f = \sigma_X^f \theta_{KX}^f \lambda_{SX}^f$, where θ_{KX}^F (= rf_r/f) is the cost share of capital in the fixed cost of sector X. Similarly, for the agricultural sector, we define: $s_{LY} = \sigma_Y \theta_{KY} \lambda_{LY}$, where $\sigma_Y = gg_{wr}/g_w g_r$.
8. $A = -\mu(\lambda_{LX}^m + \lambda_{LZ})(\hat{\mu}/\hat{q}) - (1+\mu)[\lambda_{LX}^m(\hat{x}/\hat{q}) + s_{LX}^m(\hat{r}_f/\hat{q}) + s_{LZ}(\hat{r}_s/\hat{q})] - s_{LY}[(\hat{r}_s/\hat{q}) - (\hat{w}_R/\hat{q})]$ and $B = (s_{KY} + s_{KZ})(\hat{r}_s/\hat{q}) - s_{KY}(\hat{w}_R/\hat{q}) > 0$.
9. This factor intensity condition of the Harris-Todaro (1970) model was stated by Khan (1980) and used by Chao and Yu (1992).
10. See Mankiw and Winston (1985) for socially optimal number of firms.
11. $\Delta = (1 + \varepsilon(1-b)\ \theta_{SX}^f / s_{SX}^f)[\varepsilon b \lambda_{KX}^m\ \theta_{KX}^m + (1 + 1/n)\, s_{KX}^m] + [2b\theta_{KX}^m + (1+1/n)\varepsilon(1-b)](1 + s_{KX}^f / s_{SX}^f)] + \varepsilon\lambda_{KX}^m\ [(1-b) + b\theta_{KX}^m] - (1 - 1/n)\ s_{KX}^m > 0$.
12. The year 1999 is the first year when the data for CPI is available for Tibet.

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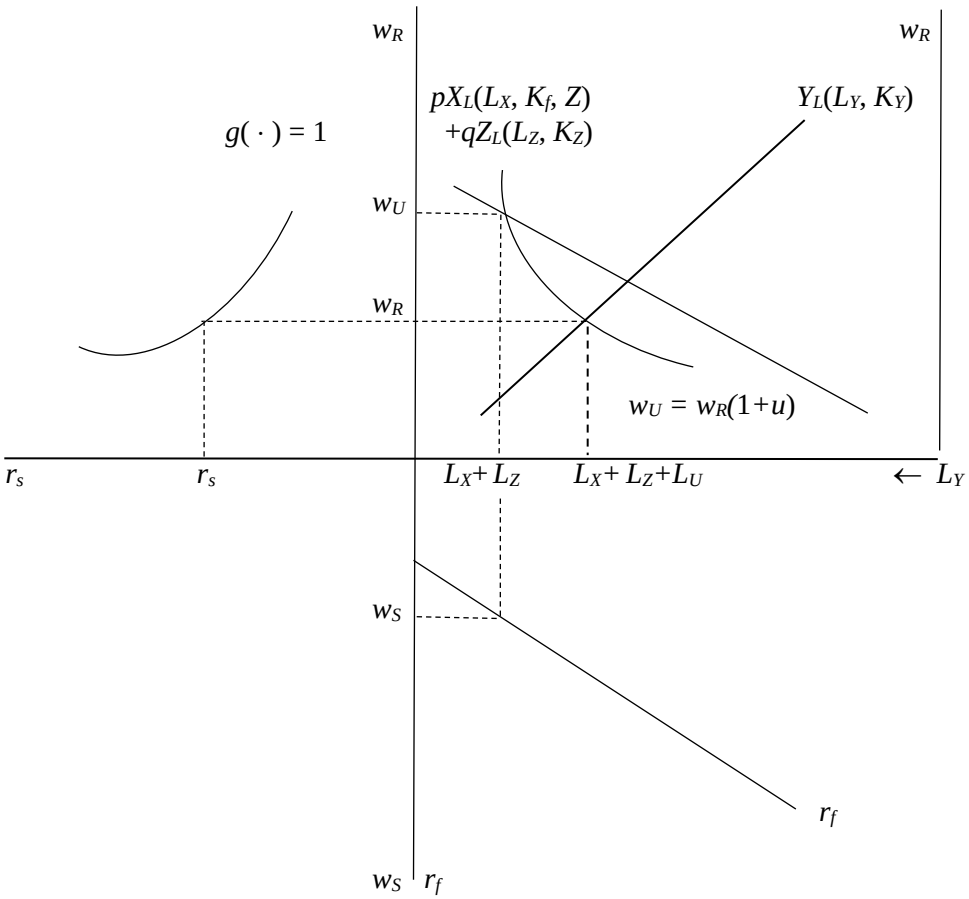

Figure 1. General equilibrium

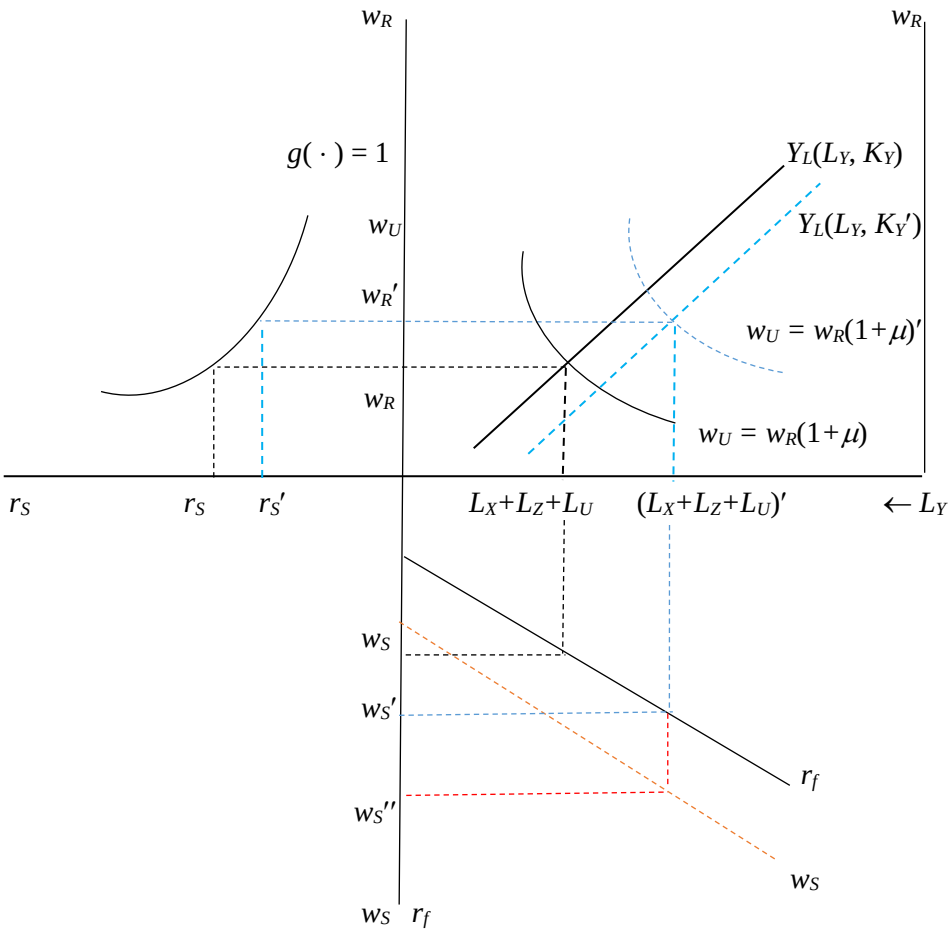

Figure 2. A rise in shadow loans on factor returns

Table 1

Summary statistics: entire sample

Obs. denotes the number of observations from 31 provinces during the period 2002 – 2013 and SD is the standard deviation. GDP growth rate is the change in the logarithm of annual real per capita GDP. $Shadow\ banking\ 1_i = \frac{GDP_{s,i}}{GDP_s} \times SB$ with $Shadow\ Banking\ 1_i$ denotes the size of shadow banking for province *i*, $GDP_{s,i}$ is the *GDP* produced by farmers and private enterprises in province *i*, GDP_s is the *GDP* produced by farmers and private enterprises for China as a whole and *SB* is the size of shadow banking for China as a whole. The data on SB are from Elliot et al. (2015). Shadow banking 2 is calculated using the same equation as the one of Shadow banking 1 where SB is the sum of entrusted loan, trusted loan and banker's acceptances. Data on entrusted loan, trusted loan and banker's acceptances are from CEIC China Premium database. Formal Credit is the value of total loans provided by formal financial intermediaries to private sector divided by GDP. Savings is total household savings deposited in the formal financial intermediaries divided by GDP. Initial GDP is the lagged real per capita GDP. Education is the percentage of population receiving secondary school education. FDI is the ratio of foreign direct investment to GDP. Infrastructure is the ratio of total fixed asset investments to GDP. Government is the ratio of local government expenditure over GDP. Entry is the difference between the number of industrial enterprises registered in the current year and previous year. Bonferroni-adjusted significance levels are reported in the parentheses. *, **, and *** denote significance levels of 10%, 5% and 1%, respectively.

Panel A: Descriptive statistics

Variable	Obs.	Mean	SD	Min	Max
Dependent variable:					
GDP growth	372	0.116	0.043	-0.086	0.235
Shadow banking indicators:					
Shadow banking 1	369	0.183	0.138	0.029	0.642
Shadow banking 2	369	0.151	0.100	0.034	0.488
Financial intermediary indicators:					

Formal Credit	372	1.073	0.362	0.537	2.585
Savings	372	0.698	0.145	0.378	1.211
Control variables:					
Initial GDP (RMB)	341	20,138	13,989	3,231	70,409
Education	372	0.020	0.005	0.007	0.030
FDI	327	0.040	0.040	0.001	0.213
Infrastructure	372	0.570	0.184	0.254	1.113
Government	372	0.214	0.163	0.079	1.291
Entry	372	533.755	3250.225	-29666	23654

Panel B: Correlation matrix

	GDP growth	Shadow banking 1	Shadow banking 2	Formal Credit	Savings
GDP growth	1.000				
Shadow banking 1	-0.314***	1.000			
	(0.000)				
Shadow banking 2	-0.307***	0.997***	1.000		
	(0.000)	(0.000)			
Formal Credit	-0.276***	0.212***	0.228***	1.000	
	(0.000)	(0.010)	(0.003)		
Savings	-0.235***	0.022	0.031	0.658***	1.000
	(0.000)	(1.000)	(1.000)	(0.000)	

Table 2

Economic growth, shadow banking and formal finance indicators across provinces

The sample period is 2002 – 2013. Annual real per capita GDP growth rate is the change in the logarithm of real per capita GDP. $Shadow\ banking\ 1_i = \frac{GDP_{s,i}}{GDP_s} \times SB$ with $Shadow\ Banking\ 1_i$ denotes the size of shadow banking for province *i*, $GDP_{s,i}$ the *GDP* produced by the farmers and private enterprises in province *i*, GDP_s the *GDP* produced by the farmers and private enterprises for China as a whole and *SB* the size of shadow banking for China as a whole. The data on SB are from Elliot et al. (2015). Shadow banking 2 is calculated using the same equation as the one of Shadow banking 1 where SB is the sum of entrusted loan, trusted loan and banker's acceptances. Data on entrusted loan, trusted loan and banker's acceptances are from CEIC China Premium database. Formal Credit is the value of total loans provided by formal financial intermediaries to private sector divided by GDP. Savings is total household savings deposited in the formal financial intermediaries divided by GDP.

		Shadow banking indicators		Financial intermediary indicators	
Province	Average GDP growth	Shadow banking 1	Shadow banking 2	Formal Credit	Savings
Beijing	0.086	0.219	0.180	2.312	1.100
Tianjin	0.113	0.099	0.083	1.337	0.615
Hebei	0.102	0.141	0.118	0.742	0.748
Shanxi	0.116	0.134	0.110	1.073	0.983
Inner Mongolia	0.159	0.213	0.175	0.701	0.454
Liaoning	0.112	0.205	0.170	1.076	0.791
Jilin	0.123	0.207	0.170	0.944	0.670
Heilongjiang	0.093	0.119	0.107	0.756	0.716
Shanghai	0.064	0.251	0.206	1.766	0.833

Jiangsu	0.122	0.226	0.183	0.955	0.563
Zhejiang	0.104	0.204	0.168	1.454	0.693
Anhui	0.126	0.146	0.122	0.892	0.636
Fujian	0.109	0.151	0.125	0.946	0.555
Jiangxi	0.126	0.173	0.142	0.811	0.654
Shandong	0.120	0.145	0.120	0.798	0.506
Henan	0.118	0.131	0.109	0.735	0.602
Hubei	0.127	0.188	0.153	0.913	0.634
Hunan	0.125	0.158	0.130	0.680	0.593
Guangdong	0.099	0.170	0.139	1.079	0.805
Guangxi	0.127	0.184	0.152	0.848	0.617
Hainan	0.104	0.255	0.211	1.173	0.752
Chongqing	0.135	0.198	0.162	1.196	0.726
Sichuan	0.127	0.166	0.137	1.043	0.790
Guizhou	0.144	0.182	0.149	1.175	0.668
Yunnan	0.105	0.214	0.176	1.258	0.711
Tibet	0.107	0.218	0.180	0.753	0.507
Shaanxi	0.144	0.185	0.152	1.053	0.828
Gansu	0.113	0.174	0.143	1.113	0.840
Qinghai	0.116	0.173	0.144	1.313	0.639
Ningxia	0.126	0.209	0.170	1.403	0.743
Xinjiang	0.099	0.210	0.175	0.978	0.679

Table 3

Shadow banking and economic growth: system GMM estimator, annual data

The dependent variable is annual real per capita GDP growth rate. $Shadow\ banking\ 1_i = \frac{GDP_{s,i}}{GDP_s} \times SB$ with $Shadow\ Banking\ 1_i$ denotes the size of shadow banking for province *i*, $GDP_{s,i}$ the *GDP* produced by farmers and private enterprises in province *i*, GDP_s the *GDP* produced by farmers and private enterprises for China as a whole and *SB* the size of shadow banking for China as a whole. The data on SB are from Elliot et al. (2015). Formal Credit is the value of total loans provided by formal financial intermediaries to private sector divided by GDP. Entry is the difference between the number of industrial enterprises registered in the current year and previous year. Savings is total household savings deposited in the formal financial intermediaries divided by GDP. Initial GDP is the lagged real per capita GDP deflated to the base year 1999. Education is the percentage of population receiving secondary school education. FDI is the ratio of foreign direct investment to GDP. Infrastructure is the ratio of total fixed asset investments to GDP. Government is the ratio of local government expenditure over GDP. Initial GDP, Education, FDI, Infrastructure, and Government are expressed in the natural logarithm of the respective value. The robust standard errors are reported in the parentheses under the respective coefficient. *, **, and *** denote significance levels of 10%, 5% and 1%, respectively.

Variables	(1)	(2)	(3)
Shadow banking 1		0.480**	0.277**
		(0.209)	(0.135)
Shadow banking 1*Entry			4.61e-07
			(9.45e-07)
Formal Credit	0.00828	-0.0734	0.225**
	(0.0601)	(0.0615)	(0.0878)
Savings	0.0286	0.0864	-0.382***
	(0.234)	(0.141)	(0.147)

Initial GDP	-0.0262	0.0210	-0.118*
	(0.0458)	(0.0441)	(0.0618)
Education	0.0461	0.0172	0.102***
	(0.0761)	(0.0511)	(0.0396)
FDI	0.00672	-0.000805	0.00982
	(0.00887)	(0.00841)	(0.0102)
Infrastructure	0.0907	0.115***	0.131***
	(0.0623)	(0.0410)	(0.0451)
Government	-0.0491	-0.0782**	-0.110**
	(0.0392)	(0.0341)	(0.0521)
Constant	0.528	-0.0667	1.549***
	(0.344)	(0.450)	(0.546)
Observations	296	294	294
Number of provinces	31	31	31
Province Dummies	YES	YES	YES
Year Dummies	YES	YES	YES
p-value of Hansen test	0.100	1.000	1.000
p-value of AR(2) test	0.129	0.247	0.231

Table 4

Alternative measure of shadow banking and economic growth: system GMM estimator, annual data

The dependent variable is annual real per capita GDP growth rate. $Shadow\ banking\ 2_i = \frac{GDP_{s,i}}{GDP_s} \times SB$ with $Shadow\ Banking\ 2_i$ denotes the size of shadow banking for province *i*, $GDP_{s,i}$ the *GDP* produced by farmers and private enterprises in province *i*, GDP_s the *GDP* produced by farmers and private enterprises for China as a whole and *SB* the size of shadow banking for China as a whole. SB is the sum of entrusted loan, trusted loan and banker's acceptances. Data on entrusted loan, trusted loan and banker's acceptances are from CEIC China Premium database. Formal Credit is the value of total loans provided by formal financial intermediaries to private sector divided by GDP. Entry is the difference between the number of industrial enterprises registered in the current year and previous year. Savings is total household savings deposited in the formal financial intermediaries divided by GDP. Initial GDP is the lagged real per capita GDP deflated to the base year 1999. Education is the percentage of population receiving secondary school education. FDI is the ratio of foreign direct investment to GDP. Infrastructure is the ratio of total fixed asset investments to GDP. Government is the ratio of local government expenditure over GDP. Initial GDP, Education, FDI, Infrastructure, and Government are expressed in the natural logarithm of the respective value. The robust standard errors are reported in the parentheses under the respective coefficient. *, **, and *** denote significance levels of 10%, 5% and 1%, respectively.

Explanatory variables	(1)	(2)
Shadow banking 2	0.633**	0.314*
	(0.276)	(0.182)
Shadow banking 2*Entry		7.37e-07
		(1.19e-06)
Formal Credit	-0.0680	0.207**
	(0.0592)	(0.0879)
Savings	0.0817	-0.380**
	(0.147)	(0.150)

Initial GDP	0.0176	-0.100*
	(0.0427)	(0.0580)
Education	0.0244	0.111***
	(0.0516)	(0.0398)
FDI	-3.81e-05	0.00832
	(0.00831)	(0.00992)
Infrastructure	0.113***	0.122**
	(0.0414)	(0.0482)
Government	-0.0802**	-0.100*
	(0.0349)	(0.0526)
Constant	-0.0294	1.439***
	(0.431)	(0.526)
Observations	294	294
Number of provinces	31	31
Province Dummies	YES	YES
Year Dummies	YES	YES
Hansen test (p-value)	1.000	1.000
AR(2) test (p-value)	0.233	0.269

Table 5

Shadow banking and economic growth: system GMM estimator, 3-year intervals

The dependent variable is annual real per capita GDP growth rate. $Shadow\ banking\ 1_i = \frac{GDP_{s,i}}{GDP_s} \times SB$ with $Shadow\ Banking\ 1_i$ denotes the size of shadow banking for province *i*, $GDP_{s,i}$ the *GDP* produced by farmers and private enterprises in province *i*, GDP_s the *GDP* produced by farmers and private enterprises for China as a whole and *SB* the size of shadow banking for China as a whole. Data on SB are from Elliot et al. (2015). Formal Credit is the value of total loans provided by formal financial intermediaries to private sector divided by GDP. Entry is the difference between the number of industrial enterprises registered in the current year and previous year. Savings is total household savings deposited in the formal financial intermediaries divided by GDP. Initial GDP is the lagged real per capita GDP deflated to the base year 1999. Education is the percentage of population receiving secondary school education. FDI is the ratio of foreign direct investment to GDP. Infrastructure is the ratio of total fixed asset investments to GDP. Government is the ratio of local government expenditure over GDP. Initial GDP, Education, FDI, Infrastructure, and Government are expressed in the natural logarithm of the respective value. The data for all variables are averaged over four three-year periods, except initial GDP is the value of the initial year of the three-year period. The regressions in columns (1) and (2) are estimated using system GMM estimator, and columns (3) and (4) are fixed effects regressions. The robust standard errors are reported in the parentheses under the respective coefficient. *, **, and *** denote significance levels of 10%, 5% and 1%, respectively.

Explanatory variables	(1)	(2)	(3)	(4)
	(GMM)	(GMM)	(FE)	(FE)
Shadow banking 1	0.148*	0.103	0.102**	0.100**
	(0.0837)	(0.117)	(0.0386)	(0.0410)
Shadow banking 1*Entry		2.65e-06		-5.15e-07
		(4.29e-06)		(2.10e-06)
Formal Credit	-0.0227	0.00341	0.0297	0.0297

	(0.0291)	(0.0184)	(0.0316)	(0.0319)
Savings	0.0198	-0.0462	-0.131***	-0.131***
	(0.0656)	(0.0768)	(0.0453)	(0.0455)
Initial GDP	-0.0351**	-0.0397**	-0.162***	-0.161***
	(0.0162)	(0.0190)	(0.0274)	(0.0289)
Education	0.0331	-0.00264	0.0505**	0.0510**
	(0.0242)	(0.0348)	(0.0230)	(0.0228)
FDI	0.0132*	0.00730	0.00378	0.00386
	(0.00786)	(0.00753)	(0.00720)	(0.00736)
Infrastructure	0.0249	0.0436**	0.0546***	0.0551***
	(0.0270)	(0.0193)	(0.0107)	(0.0109)
Government	-0.0389***	-0.0277*	0.0183	0.0185
	(0.0127)	(0.0156)	(0.0239)	(0.0241)
Constant	0.567***	0.492***	1.972***	1.967***
	(0.144)	(0.140)	(0.324)	(0.333)
Observations	87	87	87	87
Number of provinces	31	31	31	31
Province Dummies	YES	YES	YES	YES
Year Dummies	YES	YES	YES	YES
R-squared	-	-	0.860	0.860
Hansen test (p-value)	0.599	0.561	-	-
AR(2) test (p-value)	-	-	-	-

Table 6

Summary statistics and regional analysis of shadow banking and economic growth (system GMM estimator, annual data)

The six regions in China are North China (i.e., Beijing, Tianjin, Hebei, Shanxi, and Inner Mongolia), Northeast China (i.e., Liaoning, Jilin, and Heilongjiang), East China (i.e., Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, and Shandong), South Central China (i.e., Henan, Hubei, Hunan, Guangdong, Guangxi, Hainan), Southwest China (i.e., Chongqing, Sichuan, Guizhou, Yunnan, Tibet) and Northwest China (i.e., Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang). Northwest China is excluded from the sample. The dependent variable is annual real per capita GDP growth rate. $Shadow\ banking\ 1_i = \frac{GDP_{s,i}}{GDP_s} \times SB$ with $Shadow\ Banking\ 1_i$ denotes the size of shadow banking for province *i*, $GDP_{s,i}$ the *GDP* produced by farmers and private enterprises in province *i*, GDP_s the *GDP* produced by farmers and private enterprises for China as a whole and *SB* the size of shadow banking for China as a whole. Data on SB are from Elliot et al. (2015). Formal Credit is the value of total loans provided by formal financial intermediaries to private sector divided by GDP. Entry is the difference between the number of enterprises registered in the current year and previous year. Savings is total household savings deposited in the formal financial intermediaries divided by GDP. Initial GDP is the lagged real per capita GDP deflated to the base year 1999. Education is the percentage of population receiving secondary school education. FDI is the ratio of foreign direct investment to GDP. Infrastructure is the ratio of total fixed asset investments to GDP. Government is the ratio of local government expenditure over GDP. Initial GDP, Education, FDI, Infrastructure, and Government are expressed in the natural logarithm of the respective value. The robust standard errors are reported in the parentheses under the respective coefficient. *, **, and *** denote significance levels of 10%, 5% and 1%, respectively.

Panel A: Summary statistics

Region	Combined average number of	Average GDP growth	Average Shadow banking	Average Shadow banking	Average Formal Credit	Average Savings

	enterprises	1	2			
Northeast	23404	0.110	0.183	0.153	0.925	0.726
Northwest	8603	0.120	0.190	0.157	1.172	0.746
North	30528	0.115	0.161	0.133	1.233	0.780
Southwest	20254	0.124	0.196	0.161	1.085	0.680
East	163585	0.110	0.185	0.152	1.089	0.634
South Central	80073	0.117	0.181	0.149	0.905	0.667

Panel B: Regressions analysis

Explanatory variables	(1)	(2)
Shadow banking 1	0.637***	0.279
	(0.229)	(0.336)
Shadow banking 1*Entry		9.32e-07
		(1.79e-06)
Formal Credit	-0.108	0.200
	(0.0985)	(0.230)
Savings	-0.0333	-0.162
	(0.171)	(0.185)
Initial GDP	0.0545	-0.00871
	(0.0553)	(0.0634)
Education	-0.0256	-0.0732
	(0.0630)	(0.0944)
FDI	0.00969	-0.0115
	(0.00994)	(0.0149)
Infrastructure	0.139**	0.250**
	(0.0651)	(0.101)

Government	-0.108**	-0.0291
	(0.0549)	(0.0620)
Constant	-0.437	-0.0588
	(0.582)	(0.678)
Observations	243	243
Number of provinces	26	26
Province Dummies	YES	YES
Year Dummies	YES	YES
Hansen test (p-value)	1.000	1.000
AR(2) test (p-value)	0.108	0.122