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Bank's Profit Efficiency Under China Economic Structure Rebalancing: Empirical Evidence Using Index of Economic Freedom

Woon Kan Yap

Taylor's Business School of Taylor's University, Subang Jaya, Selangor, Malaysia

Fadzlan Sufian

Professor of Taylor's Business School of Taylor's University, Subang Jaya, Selangor, Malaysia

This present study argues that economic freedom is a necessary antecedent to China's structural economic rebalancing. Therefore, using an index of economic freedom, it seeks to examine the implications of economic rebalancing on banks' profit efficiency following a freer Chinese economy. Our dataset includes an unbalanced panel of 514 annual observations from 138 commercial banks that operated from 2007 to 2013. This study found evidence that higher freedom index of government spending, which denotes contraction of government expenditure, will result in lower profit efficiency. However, on a more granular level, the reduction of efficiency does not apply to state-connected banks, which are seen to be more profit efficient. On the other hand, the reduction of profit efficiency that afflicts other commercial banks that are less connected to the state authority can be mitigated by the increased aggregate demand from the private sector, following greater fiscal freedom and trade freedom through cutback on the tax rates and lower trade barriers, respectively. In addition, save for state-owned commercial banks, lower monetary freedom is found to significantly increase profit efficiency across banks of all ownership types. This corroborates the fact that banks have more extensive capacity to anticipate inflation compared to depositors and thus, they are more likely to thrive in an inflationary environment.

Keywords: China, economic freedom, economic rebalancing, profit efficiency, stochastic frontier analysis

INTRODUCTION

China's traditional growth model relied so extensively on gross fixed capital formation that it constituted 46% of its GDP in 2014. However, such a model that entails broad interventionism has proven to contain a lack of sustainability as it gives rise to soft budget

Address correspondence to Woon Kan Yap, Taylor's Business School of Taylor's University, No 1 Jalan Taylor's, 47500 Subang Jaya, Selangor Darul Ehsan, Malaysia. E-mail: woonkan06@gmail.com
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constraints (Kornai, 1979) that lead to inefficient allocation of resources, which gradually wears out the impetus behind the economic growth. In reference to China, this is supported by Li, Lin, and Selover (2014), who found evidence that Chinese state-owned enterprises (SOE) are less efficient than private firms in many aspects including cost and financing. Therefore in its twelfth five-year economic plan, structural rebalancing has ascended to be China's main priority. It entails putting the economy on a sustainable growth path by inducing growth in private consumption relative to GDP while reducing the dominance of fixed investment.

To facilitate structural rebalancing, transfer of wealth from the state to the private sector—especially households— has to take place. In addition, classical economic theory holds that wealth accumulation is facilitated by freedom to undertake desirable economic activities. Hence, this present study seeks to examine the implications of economic freedom on the Chinese bank profit efficiency as the economy structurally rebalances by adopting greater extent of laissez-faire principles.

Economic freedom is measured by the Heritage Foundation's Index of Economic Freedom (IEF) and is defined as "the absence of government coercion or constraint on the production, distribution, or consumption of goods and services beyond the extent necessary for citizens to protect and maintain liberty itself. In other words, people are free to produce, consume, and invest in the ways they feel are most productive" (Beach & Miles, 2006, p. 1).

The underlying structure of China's economy exemplifies findings from Tadesse (2002) and Rajan and Zingales (1998), which accentuated the merits of bank-based or relationship-based finance as the impetus for economic growth in an underdeveloped financial sector with low contractibility. Since the transition of China's economy in the late 1970s, its banking sector, which is very much under the state control has played a pivotal role in the allocation of resources to finance targeted growth sectors. From the political point of view, this is due to China's underlying socialist ideology to maintain adequate control over the economy. Hence, at the onset, authorities are apprehensive toward market-based finance and the effectiveness of market monitoring. Thus, until present, financial markets are still relatively underdeveloped as compared to the banking sector in China. Consequently, as at 2014, China's banking assets have ballooned to 290% of its GDP; that is, every 1% of nonperforming loans (out of total assets) will cost almost 3% of its GDP. This indicates the extensive linkage between the real sector and financial sector.

Unfortunately, Figure 1 shows that the linkage between the financial sector and real sector is being tested in recent years. As seen, the Chinese banks' NPL has started to inch up with a steep rise in 2014. This increases the risk of China's banking sector to become the Achilles' heel of its economy once again since its banking crisis in the early 1990s. As a result, it is imperative to assess the implications of the resultant economic freedom following structural rebalancing on not just the banks' performance but their performance from the highest perspective, that is, profit efficiency, which measures the banks' ability to maximize profit under an environment with minimal coercion and backstop from the government.

While the implications of economic freedom on economic growth have been studied extensively, studies that examine the implications of economic freedom on the financial sector are still limited in comparison. (See Baier, Clance, and Dwyer 2012; Blau, Brough, & Thomas, 2014; Chortareas, Girardone, & Ventouri, 2013, 2016; Gropper, Jahera, & Park, 2015; Lin, Doan, & Doong, 2015; Sufian & Habibullah, 2010, 2011; Sufian & Zulkibri, 2015). Moreover,

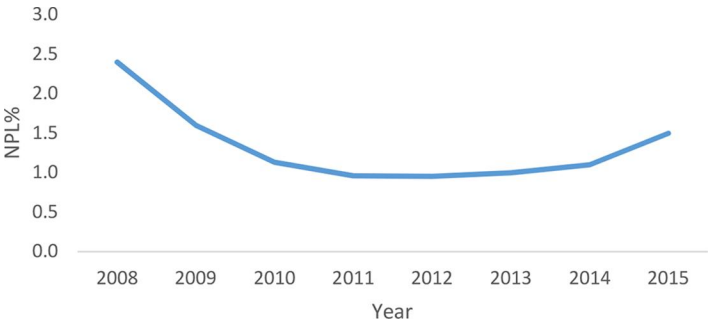

FIGURE 1 NPL% (of total assets).

upon reviewing the extant literature, it is apparent that the correlation between economic freedom and the most definitive abstraction of banks' relative performance, that is, profit efficiency, has either not been examined at all or if there has been, it is largely inadequate. This constitutes a dire gap in the extant literature which is exceptionally critical at the point of writing when China is pressured to restructure its economy with rising Non-performing loan (NPL) and therefore run the risk of stoking a banking crisis. Furthermore, this present study builds on Sufian and Habibullah (2011) by attempting to provide greater insight through the decomposition of the freedom effects by banks' ownership.

This present study uses a one-step Stochastic Frontier Analysis (SFA) model proposed by Battese and Coelli (1995) to construct the efficient profit frontier. The dynamism of the Chinese banking sector warrants SFA as the most compatible method due to its stochastic property. More important, the one-stage approach avoids the limitation of the conventional two-stage approach, which violates the assumption that the inefficiency effects are independently and identically distributed. Furthermore, the one-stage approach has the advantage of estimating the profit efficiency scores by simultaneously accounting for the heterogeneities across the banks.

Our analysis found evidence to support the correlation between banks profit efficiency and the extent of freedom in an economy. Given a finite amount of goods and services as well as resources in a country, higher government expenditure will crowd out and constrict the private sector's freedom to consume. In relation to the banking sector, increasing government expenditure from 2007 to 2013 has rendered banks with high state-ownership to be less profit efficient, while elevating the profit efficiency of banks with lesser state-ownership. In addition, higher freedom in fiscal budget and trade during the same period are also found to increase profit efficiency of the banks with lesser state-ownership. Finally, increasing monetary freedom has delivered lower profit efficiencies to banks across all ownership types except for state-owned commercial banks.

This article is organized as follows: The next section lays out the recent and relevant literatures on banks profit efficiency and economic freedom in relation to financial sector performance, while deriving the relevant testable hypotheses. The third section is reserved for model specification and methodology, prior to the reporting of empirical results, discussion, and policy recommendation in the fourth section. The final section contains the concluding remarks.

REVIEW OF RELATED LITERATURE

Profit Efficiency as a Measurement of Banks' Performance

Since the seminal work of Farrell (1957), which was the first attempt to empirically estimate efficiency by constructing an industry isoquant, the first wave of literature on efficiency focused on perfecting the estimation method. Notable contributors especially in the SFA method are: Meeusen and Van den Broeck (1977), Aigner, Lovell, and Schmidt (1977), Stevenson (1980), Jondrow, Lovell, Materov, and Schmidt (1982) and Battese and Coelli (1988, 1992, 1995).

The proliferation of empirical research on efficiency gives rise to diverse measurements: technical efficiency, allocative efficiency, cost efficiency[1] and profit efficiency. However, Pasiouras, Tanna, and Zopounidis (2009), Maudos, Pastor, Perez, and Quesada (2002) and Berger and Mester (1997) have opined that profit efficiency is a more superior concept than cost efficiency to evaluate banks' performance, as the construction of a profit frontier would have enveloped both cost and revenue efficiency simultaneously.

Internal Determinants of Profit Efficiency

Subsequent studies attempt to explain banks efficiency by evaluating the relevant determinants based on financial and economic theories. Extant studies categorize these determinants into: 1) internal determinants, which are peculiar to and under the control of the banks' management; and 2) external determinants, which are representations of the macroeconomic climate and institutional qualities of the countries that the banks operate in. These studies show a certain level of consistency in the effects of the internal determinants. Chief among them is the size of the banks. Though bank size is widely acknowledged to be pertinent in determining bank efficiency, results from past studies allude variability in its direction of influence. Studies which found evidence for a positive relationship between profit efficiency and bank size include Bardhan (2013), Reddy and Nirmala (2013) and Vu and Nahm (2013), while Han, Kim, and Kim (2012) and Aiello and Bonanno (2016) found that profit efficiency is negatively related to bank size. The contradiction suggests that size as the determinant of profit efficiency is highly circumstantial.

The first three studies that supported a positive relationship are conducted on banking sectors of developing countries, for example, India and Vietnam, while the remaining two studies are of developed countries, for example, Korea and Italy. Thus, it is conjectural that the role of bank size is dependent on the level of sophistication and development of the banking sector. Other studies, such as Yin, Yang, and Mehran (2013), Ariff and Can (2008), and Maudos et al. (2002) have yielded results that implied a nonlinear relationship between profit efficiency and size. This is reinforced by Mesa, Sánchez, and Sobrino (2014), which plotted the efficiency ratios against ten intervals by total assets and found that the relationship that underlies efficiency and size is not constant.

Since China is an emerging economy and until now it is still largely premised on a low-cost approach, economies of scale is likely to be a dominant factor that underlies the banks' performance. Thus, our first testable hypothesis is:

H1: The size of Chinese banks has a significant direct relationship with profit efficiency.

Capitalization is another commonly found determinant in most studies on banks efficiency. The conventionality that capital ratio determines efficiency is alluded by Hughes and Mester (1998), who investigated the implication of banks' capital structure on cost-minimization. However, Berger and Mester (1997) hypothesized that equity capital is linked to the banks' measured cost in two digressing manners. First, unlike interest paid on debts or deposits, dividend payout is not considered as cost. Therefore, in lieu of other forms of working capital, a higher level of equity increases profit. Second, the cost of raising equity is known to be higher than raising deposits and thus, resulting in lower profit. Studies that are in support of the latter are García-Herrero, Gavilá, and Santabárbara (2009) and Trujillo-Ponce (2013), while the former found support in studies such as Djalilov and Piesse (2016) and Fiordelisi, Marques-Ibanez, & Molyneux (2011).

As China's interest rate is controlled and its capital market is heavily regulated, we do not expect the market forces will factor in the banks' capital strength when determining the cost of financing. On the other hand, higher capitalization especially due to higher state-ownership will likely reduce the bank profit efficiency. Therefore, our hypothesis is as below:

H2: Higher capitalization will lead to lower profit efficiency among the Chinese banks.

Credit risk, which reveals the adequacy of the banks' risk management policies to safeguard assets quality, is often an incontestable determinant of profit efficiency in most studies. There are two postulations that underlie the relation between credit risk and profit efficiency. Given a competent risk-pricing mechanism, higher credit risk may lead to higher profitability as a result of higher pricing for loans. Otherwise, as found in Podpiera and Weill (2008) and Tabak, Noronha, and Cajueiro (2011), cost efficiencies are found to reduce, following the higher credit risk as the NPL rate rises without due compensation from pricing. Given that the government heavily intervenes in China's banking sector to finance risky projects under the state, we do not expect the market to be sufficiently efficient to price for risk. Therefore, we hypothesize that:

H3: Higher credit risk will cause lower profit efficiency.

In the context of China, this is consistent with Zhang and Daly (2014) that Chinese banks with lower credit risk tend to be more profitable.

Following Vu and Nahm (2013), net interest margin is expected to be a significant positive determinant of profit efficiency. On the contrary, studies that measure managerial efficiency and economic efficiency often associate excessive net interest margin with inefficiencies (see Chortareas, Garza-García, & Girardone, 2012; Sanchez, Hassan, & Bartkus, 2013). Such association is supported by structure-conduct-performance (SCP) hypothesis that alludes high net interest margin as a consequence of tighter regulation and more concentrated market structure, which then bring about slack in the banks' performance (see Demirguc-Kunt, Laeven, & Levine, 2003; Maudos & De Guevera, 2004).

Until end of 2015, China's interest rate system was regulated by the state to purportedly ensure a comfortable margin to keep the banks afloat so that they can finance risky state-driven projects. Hence, we hypothesize that:

H4: Net interest margin is positively correlated with bank profit efficiency.

Bolt and Tieman (2004) have modelled and argued that faced with resultant margin compression from market competition, banks are likely to undertake higher asset risk in order to maintain their profits. However, such collective behavior by banks will undermine stability of the banking sector. A more viable strategy is to pursue economies of scope. Income diversification has been one of the critical aspects that researchers often investigate to determine its relationship with bank efficiency. Results yielded from these studies have often been mixed. Since diversification of income sources is an exemplification of economies of scope following a competitive environment, it is intuitive to suggest a positive link between diversification and efficiency. Studies that have found evidence of such positive association include Alhassan, Tetteh, and Brobbey (2016), Reddy and Nirmala (2013), and Rogers (1998). On the contrary, studies that have concluded a negative relationship between income diversification and efficiency are Bian, Wang, and Sun (2015), Yin et al. (2013), and Fiordelisi et al. (2011), while Carvallo and Kasman (2005) found that income diversification is only beneficial to underperforming banks.

There are few possibilities that give rise to the polarized results. First, it may allude to a nonlinear relationship between income diversification and efficiency as the benefits of nontraditional activities will only be realized when scale economies within the scope is attained. Second, as suggested by Stiroh (2004) higher nontraditional income—especially from trading revenue—is often associated with higher risk and hence, it leads to lower risk-adjusted profit. Given the equally convincing evidence from these polarized results, it is not easy to put forward a hypothesis. Since China has been operating in a managed interest rate environment and its banking assets is close to three times of its GDP, in all probability, diversifying the banks' income source is expected to increase return.

H5: Income diversification is positively associated with bank profit efficiency.

External Determinants of Profit Efficiency

With respect to external determinants, extant studies regularly include macroeconomic variables such as GDP growth rate and inflation rate or institutional qualities such as political risk index. However, studies that consider the effect of economic freedom is scarce especially for China. Since an economy comprises of incentivized market activities from multiple domains such as production and consumption of goods and services or financial intermediation, economic freedom is measured by multiple indexes. Each index attempts to quantify the amount of freedom in carrying out those economic activities of that particular domain. The economic freedom indexes range numerically from 0 to 100 with higher values representing greater extent of freedom.

The fact that China is a recently transitioned economy implies that whether it is out of inclination or necessity, centrally planned expenditure has always been the primary stimulus for growth. However, planned expenditure constitutes a form of coercion that disrupts the market forces mechanism. Given a fixed pool of financial resources, centrally planned projects may crowd out private investments, which tend to be more profit-driven and efficient. Therefore, following Djalilov and Piesse (2016), Chortareas et al. (2013), and Chortareas,

Kapetanios, & Ventouri (2016), we expect centrally planned expenditure, which is a form of government involvement in the economy, to be negatively linked to bank profit efficiency.

H6: Higher level of government expenditure will reduce bank profit efficiency.

Another channel that the government can potentially influence the market is through its fiscal policy. A higher tax burden will reduce the households' discretionary income and firms' profit after tax. This inevitably deprives them from pursuing wider choices. Therefore, higher tax burden is synonymous to the act of extracting economic power from the people to the government. A past study, such as Djalilov and Piesse (2016), has alarmingly found that the relationship between fiscal freedom and banks' performance is not significant. This is intriguing as the same study has found that banks' profitability is significantly determined by government spending and that the latter is highly correlated with fiscal freedom.

Hence, contrary to Djalilov and Piesse (2016), we expect the underlying relationship between fiscal freedom and profit efficiency to be significant. Moreover as higher tax rate is known to contract the economy and GDP growth rate has been found to positively influence profit efficiency (see Pasiouras et al., 2009 among others), we further hypothesize that the underlying relationship between fiscal freedom and profit efficiency is inverse in nature.

H7: Higher level of fiscal freedom will increase bank profit efficiency.

Monetary independence is a consequence of stable and sustainable supply of money, which then gives rise to price stability and predictable inflation rate. These properties though not exhaustive, are necessary for the private sector to thrive. Despite the apparent benefits of monetary independence to the growth of the private sector, extant literature shows that it negates banks' profitability (see Djalilov & Piesse, 2016; Sufian & Habibullah, 2010). One of the reasons for such a negative relationship is attributable to the banks' insulation from inflation due their proficiency in anticipating inflation. Thus, banks are usually the winning parties in an inflationary environment caused by excessive money supply. Therefore, our hypothesis is:

H8: Higher monetary freedom that is associated with stable prices and interest rate will lead to lower profit efficiency.

Each on their own, freedom in trade, business setting, and investment is expected to promote productivity and output expansion especially in the private sector. This leads to higher demand for credit. Hence, allowance for freedom in these three domains will be conducive for the development of the banking sector. Therefore, following extant literature such as Chortareas et al. (2013, 2016) and Sufian and Habibullah (2010), business freedom is expected to improve profit efficiency. In the same vein, a positive impact is also expected from trade freedom as suggested by Chortareas et al. (2016).

H9: Higher trade freedom or business freedom or investment freedom will lead to higher profit efficiency.

It should be noted that despite the fact that financial freedom and property rights are often accounted for in studies that examine the impact of freedom on banking sector, we do not include these indexes in this present study as they have remained constant throughout the sample period for China. Therefore, any variation in the efficient profit cannot be attributed to these constant indexes.

METHODOLOGY AND DATA

Method of Estimation

Two methods are available in frontier analysis to measure efficiency: Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA); the former is our choice to undertake this present study. Each method is underpinned by vastly different ontological assumptions. Therefore, Bauer, Berger, Ferrier, and Humphrey (1998) and Berger and Mester (1997) along with other studies have noted that results yielded from these two methods are largely not comparable. SFA is a parametric approach, therefore it is stochastic in nature. On the other hand, DEA is deterministic in its approach as it employs linear mathematical programming. Hence, unlike DEA, SFA requires a priori assumption on the distribution of the error term.

SFA method was originally proposed by both Meeusen and Van den Broeck (1977) and Aigner et al. (1977) on separate occasions. Early literature proliferated the use of a "two-step" approach. The first step involves estimating the stochastic frontier. In the second step, an auxiliary regression is specified to examine the strength of correlation between the estimated inefficiencies and a set of determinants (see Carvallo & Kasman, 2005; Maudos et al., 2002 among others). However, such approach has been widely contested. The estimated inefficiencies, which composes a part of the disturbance terms of the stochastic frontier are assumed to be identically and independently distributed. Thus, regressing the estimated inefficiencies on a set of variables will contradict the a priori assumption. (See Battese & Coelli, 1995; Coelli, 1996; Kumbhakar & Lovell, 2000.)

Hence, in this present study, following Pasiouras et al. (2009), we use the Battese and Coelli (1995) (BC95) model to estimate bank efficiency in a single-step, as shown below:

$$\ln PBT_{kt} = \pi(Q_{kt}, P_{kt} : \beta + \varepsilon_{kt}) \tag{1}$$

where, *ln PBT* is the profit before tax in logarithm for k^{th} bank at t^{th} period. Q_{kt} is the vector of output quantities, P_{kt} is the vector of input prices of an alternative profit function, and β is a vector of unknown parameters to be estimated. Π denotes the appropriate functional form. ε_{kt} is the composed error term, which can be decomposed into the below based on Aigner et al. (1977):

$$\varepsilon_{kt} = v_{kt} - u_{kt} \tag{2}$$

where $v \sim iid\, N\left(0, \sigma_v^2\right)$ is the random error. On the other hand, u_{kt} is a nonnegative variable that denotes profit inefficiencies, which is assumed to be independently distributed and truncated at zero in a half-normal distribution. (See Stevenson, 1980.)

The novelty of BC95 is that u_{kt} is further defined as:

$$u_{kt} = z_{kt}\delta + w_{kt} \tag{3}$$

where z_{kt} is a vector of profit inefficiency determinants. Our model accounted for two categories of profit inefficiency determinants, such as 1) internal determinants, which are bank-specific factors and 2) external determinants, which are economic freedom indexes that measure freedom from numerous economic domains. δ is a vector of parameters to be estimated. w is a random disturbance term with zero mean, constant variance as σ^2, and truncated at $-z_{kt}\delta$ from below. Therefore, u_{kt} is assumed to be truncated at zero and $\sim iid\ N\left(z_{kt}\delta, \sigma^2\right)$. Once the profit inefficiencies are determined, profit efficiency score is radially computed as below:

$$ProEff_{it} = \exp(-u_{it}).$$

BC95 model can be estimated using Frontier 4.1 software, which uses maximum likelihood estimator (MLE) to select values of the parameter estimates that are most likely, given the observed data. The likelihood function is derived from the reparameterization of the variance parameters as shown in Battese and Coelli (1993).

Model Specification

Following Bardhan (2013), Rogers (1998), and Vivas (1997), the stochastic profit frontier in this present study is constructed by using alternative profit function (APF), which was first proposed by Humphrey and Pulley (1997). In an APF, the explanatory variables consist of output quantity and input prices. This differs from standard profit function (SPF), which assumes that profit is determined by output price and input price. Therefore the latter was conceived based on the assumption that perfectly competitive market prices are fixed and therefore profit can only be maximized through productivity. On the contrary, the former relaxes such assumption and makes allowance for banks' market power (output quantity is fixed, instead of price). Hence, in accordance to Berger and Mester (1997) APF is the preferred functional form in an imperfectly competitive market, where banks can maximize profit by maximizing their margins.

For the purpose of estimation, the APF is specified in transcendental logarithmic (translog) form. It is a second order approximation and known for its flexibility especially over the Cobb-Douglas specification. Thus, the econometric model is specified below (time and bank subscripts are dropped for clarity):

$$\begin{aligned} \ln PBT = a_0 + \sum_{i=1}^{2} \alpha_i \ln Q_i \ + \frac{1}{2}\sum_{i=1}^{2}\sum_{j=1}^{2} \alpha_{ij} \ln Q_i \ln Q_j + \sum_{m=1}^{3} \beta_i \ln P_m \\ + \frac{1}{2}\sum_{m=1}^{3}\sum_{n=1}^{3} \beta_{ij} \ln P_m \ln P_n + \sum_{i=1}^{2}\sum_{m=1}^{3} \tau_{ij} \ln Q_i \ln P_m + \sum_{i=1}^{2} \vartheta_i \ln Q_i d + \gamma d + v - u \end{aligned} \tag{5}$$

where $Q_{i/j}$, $i = 1, 2$; $j = 1, 2$ are banks' outputs; and $P_{m/n}$, where m = 1, 2, 3 and $n = 1, 2, 3$ are the input prices. d is a dummy variable to control for the Global Financial Crisis (GFC) effect, which takes the value of 1 for year 2008 and 2009 and 0 otherwise. As profit before tax enters the model as a dependent variable in logarithmic form, it is necessarily to be augmented with

PBT^{min}, which is the maximum negative value of profit before tax. The result of such transformation is a nonnegative *PBT*.

Data and Observations

Parameter Specification for Frontier Arguments

This paper is guided by the intermediation approach proposed by Sealey and Lindley (1977) in the selection of variables to denote the inputs and outputs variables that make up the frontier arguments in Equation 5. Contrary to the production approach, which treats deposits, loans, and investments as outputs produced by banks through the use of labor and capital, the intermediation approach treats loanable funds or deposits as input that is used for the production of loans (Q_1) and other earning assets (Q_2).

The rest of the frontier arguments consist of input prices, which comprise: 1) Price of loanable funds (P_1) to denote the opportunity cost of using the banks' fund to generate revenue, which is derived as the quotient of interest expense and total deposits; 2) Price of fixed capital (P_2) as the opportunity cost of using the banks' fixed asset, which is computed as the ratio of nonpersonnel overhead to fixed assets; and 3) Price of labor (P_3) as the opportunity cost of human capital, which is the personnel cost normalized by total assets.

Parameter Specification for Profit Inefficiency Determinants

Internal determinants variables. There are five bank-specific heterogenous effects which are controlled for as internal determinants in this present study: bank size, capitalization, credit risk, net interest margin, and income diversification. The logarithm of banks' total assets (*lnTA*) is conventionally used to capture the effect of bank size (see Djalilov and Piesse, 2016; Reddy and Nirmala, 2013, and Vu and Nahm, 2013). The quadratic term implies the nonlinear relationship between size and banks' performance, which is commonly acknowledged in extant literature.

Following Yin et al. (2013), Gardener, Molyneux, Nguyen-Linh (2011), and many other studies, capitalization is measured as the share of total equity out of total asset (*EQASS*). Credit risk, which measures the probability of default, reflects the quality of the banks' assets. Since the adoption of the five-category loan classification system in 2004 as mandated by CBRC, Chinese banks are required to make adequate and appropriate provision for loan loss based on the asset classes. Hence, the level of loan loss provisions is a telling indicator of the banks' assets quality. Thus, following Djalilov and Piesse (2016) and Sufian and Habibullah (2010, 2011), credit risk is measured as the quotient of loan loss provision and total loan (*LLP/TL*).

In Vu and Nahm (2013), net interest margin is proxied as the difference between the average lending rate and average deposit rate of the four largest banks. Inevitably, net interest margin is treated as a macroeconomic variable in their study instead of being a bank-specific variable. Hence, our specification of net interest margin is closer to the definition of Demirguc-Kunt et al. (2003) as the ratio of net interest income to total assets (*NII/TA*). With regard to the measure of income diversification, we are consistent with extant literature, such as Reddy and Nirmala (2013) and Lin et al. (2015) to use the share of noninterest income out of total assets.

Economic freedom variables. Index of Economic Freedom provided by the Heritage Foundation comprises ten components to measure the extent of freedom in every domain of an economy, of which six relevant components are included in Equation 3 as the z-variables to determine profit inefficiencies: 1) Government Spending (Gov_Spend), 2) Fiscal Freedom (Fis_Free), 3) Monetary Freedom (Mone_Free), 4) Business Freedom (Bus_Free), 5) Investment Freedom (Invest_Free) and 6) Trade Feedom (Trade_Free).

Table 1 shows the descriptive statistics and descriptions for the variables that are entered into the model. The scale of operation among the banks in China is diverse. For example, SOCBs are predominantly involved in the financing of national projects, while CCB are engaged in the local city projects. Hence, the variability is expected to be large as noted in the standard deviation for *PBT,* Q_1 and Q_2.

Issue of multicollinearity among economic freedom variables. Decomposing the overall economic freedom index to individual indexes will probably court the problem of multicollinearity as indicated by Sufian and Zulkibri (2015). Therefore Appendix 1 shows the Pearson correlation coefficient for all the profit inefficiency determinants.

The correlation coefficients among internal determinants are rather small. Based on Kennedy (2008), multicollinearity is only a problem if the correlation coefficient is higher than 0.8. Hence, multicollinearity is not an issue for internal determinants. However, as expected, quite a number of the correlation coefficients among economic freedom variables show moderate to strong correlation (above 0.5). As a result, each economic freedom variable will be entered one at a time into the base model so that the computed t-statistics for the partial slope coefficients will not be biased and lead to misleading conclusions from hypothesis testing. Therefore, our analysis consists of seven models. Model 1, which is the base model includes only bank-specific effects as internal determinants of profit inefficiency, while subsequent models will include one economic freedom variable in addition to the bank-specific effects, of which Model 2 considers Gov_Spend, Model 3 incorporates Fis_Free, Model 4 includes Mone_Free, Bus_Free enters Model 5, while Model 6 and 7 contain Invest_Free and Trade_Free, respectively. That is to say Model 1 is the special or restricted case of the subsequent models.

Observations

As of 2014, there are three policy banks, namely Agricultural Development Bank of China, Export and Import Bank of China, and China Development Bank (CDB); five large commercial banks, of which four are state-owned commercial banks (SOCB), and the remaining is Bank of Communication, which is categorized as a joint-stock commercial bank (JSCB). Hence, in total there are 13 JSCBs. Other commercial banks are comprised of 133 city commercial banks (CCB), 665 rural commercial banks (RCB), and 41 locally incorporated foreign commercial bank[2]. The Chinese government holds equities to various degrees across the domestic banks. Based on Hsiao, Shen, and Bian (2015), as of 2012, the average state-ownership for SOCB, JSCB, CCB, and RCB were 70.24%, 35.16%, 26.95%, and 10.71%, respectively.

Out of the 857 commercial banks, only 178 are updated in Bankscope,[3] which are further restricted to 138 samples due to data availability in specific fields. Thus, in total there are 514 annual observations (unbalanced panel) for a seven-year observation period from 2007 to 2013.

TABLE 1
Descriptive Statistics for Output and Input Prices

Acronym	*Variable*	*Description*	*Mean*	*SD*	*Source*
Dependent Variables					
PBT	Profit before tax	Amount of revenue over total cost	2,674	7,783	Bankscope (Bureau Van Dijk) database
Profit Frontier Arguments					
Q_1	Loans (USD' million)	Book value of net loans (exclude loans to FI)	82,054	227,160	Bankscope (Bureau Van Dijk) database
Q_2	Other earning assets (USD million)	Earning assets minus net loans	53,822	141,083	Bankscope (Bureau Van Dijk) database
P1	Price of loanable funds	Opportunity cost incurred for the usage of one unit of funds to generate earning assets. Computed as the quotient between interest expense and total deposits	0.023	0.017	Bankscope (Bureau Van Dijk) database and author's computation
P2	Price of fixed capital	Opportunity cost incurred for consuming the one unit of fixed assets for production. Computed by dividing non-personnel overheads with fixed assets	1.8	2.91	Bankscope (Bureau Van Dijk) database and author's computation
P3	Price of labor	Opportunity cost for one unit of manpower. Computed as the ratio between personnel expense and total assets	0.006	0.003	Bankscope (Bureau Van Dijk) database and author's computation
Bank Specific Effects (BSE)					
LLP/TL	Loan loss provision per total loan	Loan Loss Provision to Total Loan ratio, which shows the amount of provision that banks set aside in year *t* relative to total assets, in anticipation of defaults. It measures the banks' asset quality	0.83	3.37	Bankscope (Bureau Van Dijk) database and author's computation
EQ/TA	Capitalization Ratio	Equity to Total Asset ratio, which indicates the capital strength the banks have in year *t,* which have implications on measured cost and the banks' risk preference. Banks with higher level equity are generally more prudent	9.65	0.37	Bankscope (Bureau Van Dijk) database
LNTA	Size	Log of total assets, which captures the size effects such as cost advantages to control for scale bias	9.90	2.10	Bankscope (Bureau Van Dijk) database

(*Continued*)

TABLE 1
Continued

Acronym	*Variable*	*Description*	*Mean*	*SD*	*Source*
NII/TA (%)	Net interest margin	Net Interest Income to Total Asset ratio. It indicates the amount of interest revenue extracted from the earning assets in year *t*. It is also a proxy measure of the banks' ability to price their interest-generating products	2.56	0.04	Bankscope (Bureau Van Dijk) database and author's computation
NIOI/TA (%)	Fees Margin	Noninterest Operating Income to Total Asset ratio. It is a proxy measure on the banks' ability to diversify their sources of income for year *t*	0.44	0.42	Bankscope (Bureau Van Dijk) database and author's computation
Economic Freedom Effects (EFE)					
Gov_Spend	Government Spending	Gov_Spend primarily gages the extend of public spending in crowding out private expenditure	86.87	0.90	Heritage Foundation
Fis_Free	Fiscal Freedom	Fis_Free measures the level of autonomy that individuals and businesses have over their own wealth created. Hence it concerns primarily on the tax regime	69.24	0.71	Heritage Foundation
Bus_Free	Business Freedom	Bus_Free measures the ease of individual setting up business from the regulatory perspective	48.96	0.72	Heritage Foundation
Mone_Free	Monetary Freedom	Principally, Mone_Free concerns on the stability of the currency and domestic prices, while upholding market forces to determine price levels. Hence enable the state to do without intervention through monetary policy	73.80	0.82	Heritage Foundation
Invest_Free	Investment Freedom	Invest_Free looks into restrictions on movement of capital within or cross border	26.43	1.43	Heritage Foundation
Trade_Free	Trede Freedom	Trade_Free reveals the trade relations that the country has with the rest of the world: whether the citizens can freely access international markets as buyers as well as sellers	71.00	0.56	Heritage Foundation

Findings and Discussions

Implications of Internal Determinants

As shown in Table 2, across all the models, the five internal determinants variables evaluated are consistently significant at the conventional levels except for EQASS. Consequently, hypothesis H2, which is associated with capitalization is rejected. It implies that the banks' capital strength is not accounted for by market forces in determining the price of credit. This could be the result of distortion due to the purported interest rate controls implemented prior to 2015.

LnTA, which is a proxy to control for bank size, is found to be a significant determinant of profit inefficiency at the level of 1%. The negative sign associated with the coefficient indicates that larger asset size leads to lower profit inefficiency. This shows that economies of scale is an important property that underlies the Chinese banks' performance. Hence, like many other studies, such as Bardhan (2013) and Reddy and Nirmala (2013), hypothesis H1 that bank size is a positive significant determinant of profit efficiency is not rejected.

The model suggests a positive sign for the LLP/TL variable, which is a measure of the banks' asset quality. This implies that higher level of loan loss provision relative to total loan increases profit inefficiency and hence, in the same vein, reduces profit efficiency. This is consistent with hypothesis H3 that higher credit risk leads to lower profit efficiency. There are two digressing effects of LLP/TL ratio on profit inefficiency. If the banks are able to adequately price for risk, undertaking higher asset risk will lead to higher interest income. Otherwise, a riskier portfolio will increase profit inefficiency, led by higher write-offs without due compensation from the output price. The suggested positive sign of LLP/TL ratio, which is significant at the level of 1%, implies that the latter effect dominates. Again this does not seem surprising given the price distortion following the mechanism of managed interest rate.

NII/TA and NIOI/TA are the two variables that measure banks' ability to optimize revenue from their interest-earning and noninterest earning activities, respectively. Both variables are found to be significant at the level of 1% across all models and their coefficients take on the negative sign, which are expected by hypotheses H4 and H5, respectively. The negative impact of NII/TA on profit inefficiency is indicative of the impending threat on profit efficiency as competition intensifies with the removal of the lending rate floor in 2013 and the deposit rate ceiling in 2015 to complete the final lap toward full interest rate liberalization. Nevertheless, the significant negative relationship between NIOI/TA and profit inefficiency indicates that diversifying their income sources to noninterest earning products is a viable strategy to sustain profitability as interest rate softens. This is consistent with Reddy and Nirmala (2013) and Rogers (1998) which found that nontraditional outputs that generate noninterest income are significant contributors to bank profit efficiency in the U.S. commercial banking sector.

Implications of Economic Freedoms and Their Significance

When considering the economic freedom variables that are entered into the model, four out of six are found to have significant impact on bank profit inefficiency at the conventional levels as shown in Table 2. These variables are Gov_Spend, Fis_Free, Mone_Free and Trade_Free. Likelihood ratio test shows that the inclusion of Gov_Free, Fis_Free and Trade_Free separately

TABLE 2
Result of Analysis

	Model 1		*Model 2*		*Model 3*		*Model 4*		*Model 5*		*Model 6*		*Model 7*	
	Coeff_t	*T-ratio*	*Coeff_t*	*T-ratio*	*Coeff_t*	*T-ratio*	*Coeff_t*	*T-ratio*	*Coeff_t*	*T-ratio*	*Coeff_t*	*T-ratio*	*Coeff_t*	*T-ratio*
Coefficients for frontier argument														
	4.30***	4.30	3.80***	3.45	4.20***	4.13	3.92***	3.75	2.91**	2.51	3.29***	3.49	4.08***	3.75
lnQ1	−0.70***	−2.66	−0.75***	−2.85	−0.69***	−2.56	−0.68**	−2.17	−0.64**	−2.03	−0.72***	−2.62	−0.72***	−2.66
lnQ2	−0.15	−0.62	−0.08	−0.33	−0.13	−0.50	−0.05	−0.19	0.00	0.01	−0.11	−0.44	−0.10	−0.41
[lnQ1^2]/2	−0.89***	−3.29	−0.97***	−3.57	−0.77***	−2.80	−0.77**	−2.41	−0.88***	−2.69	−0.99***	−3.53	−0.80***	−2.87
[lnQ2^2]/2	−0.46**	−2.12	−0.45**	−2.04	−0.41*	−1.69	−0.7***	−2.56	−0.51*	−1.76	−0.56**	−2.41	−0.44**	−1.98
[lnQ1*lnQ2]/2	−0.82***	−3.78	−0.85***	−4.07	−0.86***	−4.13	−0.48**	−2.13	−0.58***	−2.52	−0.74***	−3.70	−0.88***	−4.15
lnP1	0.04***	3.61	0.04***	3.66	0.04***	3.05	0.06***	4.51	0.06***	4.36	0.06***	5.16	0.04***	3.29
lnP2	−0.03***	−2.57	−0.03***	−2.61	−0.03**	−2.08	−0.04***	−2.81	−0.03**	−1.97	−0.03***	−2.53	−0.03***	−2.15
lnP3	0.09***	18.43	0.08***	18.06	0.08***	18.74	0.08***	13.73	0.07***	12.07	0.08***	17.41	0.08***	18.31
[lnP1^2]/2	−0.17***	−3.26	−0.17***	−3.56	−0.16***	−3.05	−0.19***	−3.04	−0.18***	−2.79	−0.21***	−4.04	−0.16***	−3.13
[lnP1*lnP2]/2	−0.01	−0.41	−0.01	−0.31	0.00	−0.13	−0.01	−0.36	0.00	0.02	0.00	−0.08	0.00	−0.12
[lnP1*lnP3]/2	0.01	0.45	0.01	0.20	0.02	0.82	0.06*	1.85	0.04	1.45	0.03	1.26	0.02	0.76
[lnP2^2]/2	0.03	1.33	0.03	1.42	0.03	1.25	0.01	0.25	0.02	0.63	0.03	1.16	0.03	1.28
[lnP2*lnP3]/2	−0.06**	−2.01	−0.06**	−2.05	−0.06*	−1.85	−0.09**	−2.24	−0.08**	−1.97	−0.06*	−1.78	−0.06**	−2.00
[lnP3^2]/2	−0.04	−1.3	−0.04	−1.39	−0.05*	−1.66	−0.03	−0.91	−0.03	−0.94	−0.06**	−2.08	−0.05*	−1.64
lnQ1*lnP1	0.03	0.96	0.03	0.87	0.05	1.36	0.06	1.42	0.05	1.22	0.05	1.46	0.04	1.26
lnQ1*lnP2	0.01	0.35	0.01	0.54	0.01	0.56	0.02	0.7	0.01	0.58	0.02	0.83	0.02	0.64
lnQ1*lnP3	0.02	0.65	0.01	0.34	0.01	0.14	0.01	0.23	0.01	0.28	0.01	0.35	0.01	0.16
lnQ2*lnP1	0.01	0.15	0.01	0.26	−0.01	−0.31	−0.01	−0.28	0.00	0.11	−0.01	−0.3	−0.01	−0.17
lnQ2*lnP2	0.00	−0.14	−0.01	−0.31	−0.01	−0.36	0.00	0.13	0.00	−0.1	0.00	0.16	−0.01	−0.35
lnQ2*lnP3	0.02	0.67	0.03	0.97	0.04	1.24	0.02	0.65	0.03	0.75	0.02	0.64	0.04	1.29
d	0.24**	2.03	0.37***	2.81	0.34**	2.44	0.15	1.05	0.18	1.15	0.33**	2.36	0.29**	2.17
d*lnY1	0.01	0.15	0.00	−0.08	0.00	−0.04	0.04	0.72	0.00	−0.05	0.01	0.19	0	0.01
d*lnY2	−0.05	−1.1	−0.05	−1.00	−0.05	−0.91	−0.07	−1.34	−0.03	−0.57	−0.06	−1.17	−0.05	−0.91

Coefficients for inefficiency determinants														
Intercept	6.46***	20.81	4.79***	6.09	8.64***	10.94	3.57***	5.57	4.57***	6.47	4.95***	142.61	9.68***	9.66
LLP/TL	0.04***	7.99	0.04***	8.53	0.04***	9.01	0.04***	7.57	0.04***	5.88	0.05***	10.71	0.04***	8.55
EQ/ASS	0.00	−0.25	0.00	−0.16	0.00	−0.25	0.00	−1.27	0.00	−1.02	0.00	−1.63	0.00	−0.28
LNTA	−0.45***	−16.77	−0.44***	−12.54	−0.43***	−16.27	−0.33***	−11.86	−0.33***	−9.42	−0.36***	−33.99	−0.43***	−16.81
NII/TA	−0.33***	−20.91	−0.33***	−20.25	−0.34***	−18.25	−0.37***	−14.85	−0.37***	−13.41	−0.34***	−14.06	−0.34***	−17.87
NIOI/TA	−33.5***	−11.5	−33.7***	−12.3	−34.4***	−12.9	−39***	−13.2	−39.1***	−12.5	−33.9***	−11.2	−34.3***	−11.67
Coefficients for freedom variables														
Gov_Spend			0.02**	2.4										
Fis_Free					−0.03***	−3.31								
Mone_Free							0.02**	2.20						
Bus_Free									0.00	0.37				
Invest_Freedom											0.01	1.40		
Trade_Free													−0.05***	−3.67
Sigma-squared	0.05	15.14	0.05	14.73	0.04	13.82	0.05	11.34	0.05	12.01	0.05	14.85	0.04	14.6
gamma	0.65	9.87	0.65	30.29	0.62	26.84	0.61	18.18	0.62	17.98	0.54	22.72	0.64	30.32
Log-likelihood	104.64		107.96		111.92		79.58		78.45		82.15		112.63	
Likelihood Ratio Statistic			6.64***		14.56***		−50.12		−52.38		−44.98		15.98***	

Notes: N = 514; *Statistical significance at the 10% level, **statistical significance at the 5% level, and ***statistical significance at the 1% level; estimation obtained from Battese and Coelli (1995) model.

Model 1 includes only bank-specific effects as profit inefficiency determinants, while subsequent models include one economic freedom variable in addition to the bank-specific effects, of which Model 2 considers gov_spend, Model 3 incorporates fis_free, Model 4 includes mone_free, bus_free enters Model 5, while Model 6 and 7 contain invest_free and trade_free, respectively.

into the model improves the goodness-of-fit significantly, while inclusion of Mone_Free reduces the model fit, despite the fact its partial slope coefficient is found to be statistically significant.

The positive partial slope coefficient that is associated with Gov_Spend index suggests that a higher level of government expenditure (lower Gov_Spend index) is associated with lower banks' profit inefficiencies and radially increases profit efficiencies. Hence, hypothesis H6 that higher government expenditure leads to lower profit efficiency is rejected. On the other hand, the negative coefficients associated with Fis_Free and Trade_Free support the hypotheses of H7 and H9. The inverse relationships found between profit inefficiency and fiscal freedom as well as trade freedom indicate that reduction of taxes (increase of Fis_Free index) and lower trade barriers (increase of Trade_Free index) will lead to lower profit inefficiencies and therefore, banks become more profit efficient.

Given that taxes are constituted as withdrawals, lower taxes will inevitably lead to increased aggregate demand. In the same vein, higher demand for consumer credit will ensue due to higher household consumption, which will directly contribute to banks' profitability. In addition, based on the conventional AD-AS model, the increased aggregate demand would have to be balanced off with a higher quantity of aggregate supply. This leads to increased outputs by private firms. In the case of China, this is validated by Ding (2015), which found a positive correlation between consumer credit and GDP growth.

Meanwhile lower trade barriers lead to higher trade openness, which Le, Kim, and Lee (2015) and Do and Levchenko (2004) have found to be one of the key determinants of financial depth. In the case of China, approximately 80% of its imports are raw material and intermediate goods,[4] therefore, reduction of trade tariff decreases the cost of production and leads to the expansion of firms' outputs. As a result, both elevated trade freedom and fiscal freedom will bring about higher demand for external financing as the private sector expands their outputs. This then leads to increase in the price of credit.

The Mone_Free variable enters the model with a positive sign and hence affirms the hypothesis H10 that banks are less profit efficient when greater monetary freedom prevails. The positive relationship indicates that price stability, which restrains PBOC from implementing contractionary monetary intervention, will lead to higher bank profit inefficiencies. This is expected as given a perfectly anticipated inflationary environment (lower Mone_Free index) and the lending rate will be adjusted upward to compensate for the corrosion of money value. As a result, bank profit efficiency increases (not adjusted for inflation). Such increase is made feasible as individual depositors has lesser capacity and capability to accurately anticipate inflation. Therefore, having bequeathed with key political connections and competent managers, which lead to information efficiency, banks will most likely emerge as the winner in an inflationary environment.

Implications of Economic Freedoms by Banks' Types of Ownership

The previous section illustrates the implications of economic freedoms on the overall banking sector as revealed by the results of the estimated profit frontier. Such generalized implications could be made more insightful for policy makers if they are decomposed by banks' ownership types. However, as profit inefficiencies in this present study are measured by constructing a global frontier, the implications of freedoms can only be examined at a more granular level

through the comparison of mean efficiency scores before (Model 1) and after consideration of various freedom effects (Model 2 onward), across all banks' ownership types. The significance of the differences are then inferred by using pairwise sample mean t-test (parametric)[5] as shown in Table 3.

Increasing public investment by the Chinese government as shown in Figure 2a with falling Gov_Spend Index will reduce bank profit inefficiencies and radially increases profit efficiencies. However, the Model 2 column in Table 3 shows that increase of profit efficiencies are only observable for CCB, RCB, and Foreign Banks, which have minimal or no state-ownership. Instead, profit efficiencies for banks with high state-ownership, that is, SOCB and JSCB are found to have decreased, albeit only the reduction of the former is of statistical significance.

Public investment is usually financed by SOCB and to a lesser extent by JSCB with below market interest rate. This causes the average output price for SOCB and JSCB to be lower than others. Since SOEs are less efficient than private firms as asserted by Li et al. (2014), SOCBs and JSCBs are taking on substantial credit risk. By adjusting NPL as negative outputs, Matthews, Zhang, and Guo (2009) found that the average productivity growth for SOCB was zero or negative. Yet, SOCBs and JSCBs are not compensated for assuming this additional risk as they are restrained from adjusting the output price to make allowances for these negative outputs. Consequently, higher government investment and involvement in the private sector will reduce their profit efficiencies.

On the contrary, CCBs, RCBs, and foreign banks stand to be more profit efficient resulting from higher government investment as loan margin increases due to a crowding out effect. Xu and Yan (2014) have highlighted that the Chinese government's investment to the private sector through SOEs significantly "crowds out" private investment as they compete for financing in the capital market. Therefore, this consequently leads to an increase in the price of credit for private investment, which is normally financed through CCBs, RCBs, and foreign banks.

TABLE 3
Comparison of Profit Efficiency Across Models

Bank Cluster	*Model 1 w/o Freedom variables*	*Model 2 (inc. Gov_Spend)*	*Model 3 (include Fis_Free)*	*Model 4 (include Mone_Free)*	*Model 7 (include Trade_Free)*
Profit efficiency scores					
SOCB	0.9663	0.9634	0.9649	0.9657	0.9638
JSCB	0.7794	0.7767	0.7802	0.8624	0.7818
CCB	0.3681	0.3779	0.3808	0.5944	0.3842
RCB	0.4144	0.4254	0.4297	0.6609	0.4340
Foreign	0.2010	0.2066	0.2105	0.3736	0.2130
Overall	0.4204	0.4268	0.4301	0.6025	0.4329
Differences in sample mean to model 1 (%)					
SOCB		–0.3%**	–0.1%	–0.1%	–0.3%**
JSCB		–0.3%	0.1%	10.7%***	0.3%
CCB		2.7%***	3.5%***	61.5%***	4.4%***
RCB		2.6%***	3.7%***	59.5%***	4.7%***
Foreign		2.8%***	4.8%***	85.9%***	6.0%***
Overall		1.5%***	2.3%***	43.3%***	3.0%***

Note: Pairwise sample mean t-test is used to determine the significance of the sample mean difference. ***and **indicate 1% and 5% level of significance, respectively.

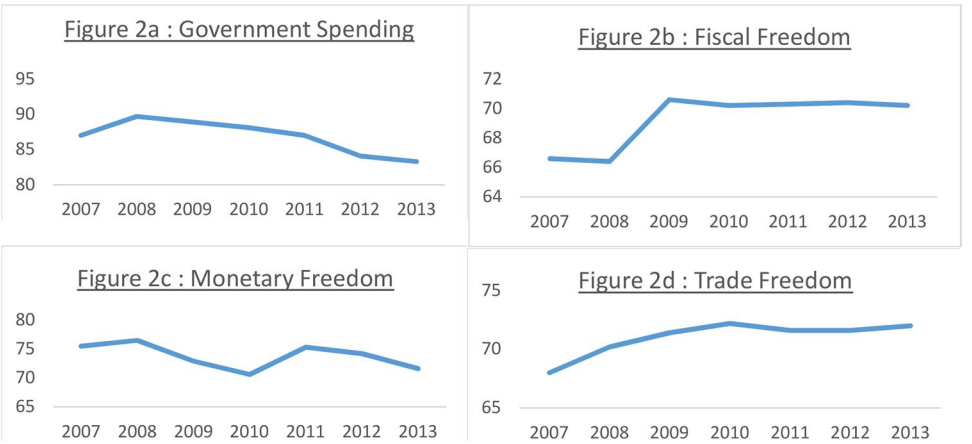

FIGURE 2 Trends of freedom indexes.

On the other hand, the implications of higher fiscal freedom (higher Fis_Free index) on banks profit efficiency by ownership types reveals a contrasting outcome to that of an increase in the freedom from government expenditure (higher Gov_Spend index). While the latter is expected to reduce profit efficiencies of CCB, RCB, and Foreign banks, increasing fiscal freedom as shown in Figure 2b enhances the profit efficiencies of the trio, as shown in Table 3 (Model 3). In the same vein, increasing trade freedom as shown in Figure 2d is also found to exert positive implications only on these three banks, which have minimal or zero state-ownership.

This further reinforces the AD-AS model put forward in the previous section as the underlying framework that underpins the implication of fiscal freedom and trade freedom on bank profit efficiency. Higher freedom in both domains will increase aggregate demand. This promotes the expansion of the private sector, which is usually financed by banks that are of little or no vested interest from the state. As a result, profit efficiencies of these banks increase. On the other hand, banks such as SOCB and JSCB, which are substantially owned by the state will be constrained by unprofitable financing of state's projects. Therefore, they do not stand to benefit from the higher freedom in trade and fiscal budget.

The falling monetary freedom index as depicted in Figure 2c causes a uniform increase in profit efficiencies for all ownership types except for SOCB. The impediment to SOCB's profit efficiency following lower monetary freedom can possibly be attributed to the constraint imposed on the adjustment of output price as a large portion of SOCB's loan portfolio is comprised of public financing.

Policy Implication and Recommendation

Annulation of government spending is necessary to shrink the state's subsidies to SOEs in order to reduce the dominance of public investment on the economy. Having been coerced to finance the SOEs' fixed investment that are associated with a higher default risk at an unprofitable

price, SOCB and JSCB stand to benefit from structural rebalancing with improved profit efficiencies following reduced coercion from the state. In contrast, this is expected to impede profit efficiency of banks with minimal or zero state-ownership due to the softening of price of credit resulting from capital glut caused by shortage of public expenditure in the market. Yet, such negative implication on the profit efficiency of these three banks can be moderated with corresponding reduction in tax rate and promotion of trade openness by cutting back on trade barriers, which will then lead to an increase in aggregate demand. This correspondingly provides support for the falling demand and henceforth avoids further reduction on the price of credit.

While China's corporate tax rate at 25% has been competitive among BRIC (Brazil, Russia, India, and China) and Asia countries, its top marginal tax rate on individual income at 45% is the highest among BRIC countries, which average 24.8%; also, this is much higher than the average of Asia's countries at 22.6%.[6] Therefore, there is much slack that the government can cut to stimulate aggregate demand through household consumption. Following the government's agenda to scale back on public investment to rebalance the economy structurally, the government's coffer should reduce commensurately by lowering personal taxes and trade tariffs as well as other barriers so that the private sector is empowered to assume a larger slice of the economic pie in order to take the place of traditional public investment.

CONCLUDING REMARKS

This present study empirically evaluates the impacts of economic freedom on Chinese bank efficiency in light of an impending structural rebalancing that necessitates a cutback on the state's coercion and participation in the economy. By employing the single-step SFA approach, we have estimated the annual profit efficiency scores of 138 commercial banks for the period 2007 to 2013.

All the internal determinants except for capitalization ratio are found to be significant at conventional levels with expected direction of influence. Higher asset risk is found to increase profit inefficiency, as expected. This reflects the banks' inability to price for risk due to distortion in the risk-reward mechanism resulting from the state's coercion, especially on SOCB and JSCB. Thus, the state authority should play the role as an efficient monitor rather than a controller to ensure effective credit risk evaluation and transparency as well as accuracy in asset classification. Apart from that, having been able to exploit economies from their large scale, banks with a larger size are found to be more profit efficient. Both income ratios, NII/TA and NIOI/TA are found to be negatively associated with profit inefficiency, indicating that compression of net interest margin following greater freedom will impede profit efficiency. However, banks that are able to diversify their sources of income are rewarded by the model with lower profit inefficiency.

Generally the effect of economic freedom on bank profit efficiency is premised on the framework of AD-AS. Reduction of government spending, which causes lower aggregate demand is found to increase the overall profit inefficiency as the demand for credit moderates. The resultant surplus in savings will inevitably instigate a fall in the price of credit. In addition, liberalization of interest rates to facilitate structural rebalancing, which leads to greater monetary freedom, will further impede profit efficiency as banks lose their protected margins to competition.

Nevertheless, such resultant negative implication on profit efficiency can be moderated through CCBs, RCBs, and foreign banks with greater fiscal and trade freedom, which require the government to shrink its tax revenue and reduce the tariff and nontariff trade barriers, in order to stimulate higher level of aggregate demand from the household and export sectors. This will result in increasing the demand for banks' financing and therefore the price of credit.

NOTES

1. Technical efficiency denotes the banks' capability to use minimum quantity of input in producing a given level of output. Allocative efficiency measures the banks' use of optimal mix of input given prevailing input price. Cost efficiency, which measures each bank's costs relative to what a best-practice bank's cost should be for the same quantity of outputs with similar conditions, encapsulates an even wider aspect as it takes into consideration both technical efficiency and allocative efficiency.
2. CBRC Annual Report (2014).
3. CDB is categorized as "commercial bank" in Bankscope since it has been restructured to undertake market-oriented banking activities. Hence, it is included in the sample observations as one of the SOCBs.
4. Based on the statistics of World Integrated Trade Solution at www.wits.worldbank.org.
5. Sample mean t-test is a parametric test that was advocated by Banker, Zheng, and Natarajan (2010) to evaluate the significance of difference in mean inefficiencies between two groups. However, direct application of sample mean t-test is not feasible as inefficiencies are half-normally distributed, while a t-ratio follows a normal distribution. Hence, Banker et al. (2010) recommended to compare the inefficiencies in logarithmic form instead of in their levels. Nevertheless, in this present study, we do not evaluate the differences between mean inefficiencies, in its place, we evaluate the differences between mean efficiency scores. The latter would be a better approach as efficiency scores are expected to follow the normal distribution like the t-ratio. The same approach is seen in Fries and Taci (2005) and in more recent studies such as Tamadonnejad, Abdul-Rahman, Abdul-Majid, and Jusoh (2015) and Abdul-Karim, Sok, and Hassan (2010).
6. Source from KPMG Global at https://home.kpmg.com.

ORCID

Woon Kan Yap http://orcid.org/0000-0002-3730-4628
Fadzlan Sufian http://orcid.org/0000-0001-7092-2324

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APPENDIX 1
Correlation Matrix for Profit Inefficiency Effects Variables

	LLP/TL	*EQ/ASS*	*LNTA*	*NII/TA*	*NonIntInc/NII*	*Gov_Spend*	*Fis_Free*	*Mone_Free*	*Bus_Free*	*Invest_Free*	*Trade_Free*
LLP/TL	1										
EQ/ASS	−0.08**	1									
LNTA	0.26***	−0.49***	1								
NII/TA	0.04	−0.07	−0.10***	1							
NonIntInc/NII	−0.01	0.10**	0.02	−0.30***	1						
Gov_Spend	−0.09**	0.07	−0.09**	0.02	−0.04	1					
Fis_Free	0.02	−0.05	0.08*	−0.07	−0.01	−0.44***	1				
Mone_Free	−0.04	0.04	−0.06	0.11***	0.05	0.32***	−0.54***	1			
Bus_Free	−0.06*	0.07	−0.05	−0.01	−0.04	0.79***	−0.07	−0.01	1		
Invest_Free	−0.01	0.08*	−0.06	0.03	0.00	0.28***	−0.56***	0.61***	0.19***	1	
Trade_Free	0.03	−0.04	0.07	−0.05	0.02	−0.36***	0.80***	−0.63***	0.07	−0.69***	1

Notes: N = 514; * Statistical significance at the 10% level, ** statistical significance at the 5% level, and *** statistical significance at the 1% level, respectively.