Financial Repression in China and Global Economic Imbalances

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Abstract

We apply the old concept of financial repression, originally due to Mckinnon (1973) and Shaw (1973), to the Chinese financial system and argue that it might explain the country’s current account surplus. In a two-country model, we show that financial repression in one country (China), modeled as a tax on domestic investment, would drive capital out and render its trading partner (US) with tax-arbitrage opportunity that is used to fund the latter’s current-account deficit. Calibration demonstrate that the effect is quantitatively significant. In contrast to a common view, this intervention would decrease wages, employment and welfare in the financially-repressed country.

*Said business school and University of Oxford.
"I will label China as it is, a currency manipulator...."

Mitt Romney, Republican Presidential Debate, October 11th, 2011

Imbalances have been one of the most distinct characteristics of the global economy. The United State had a current-account deficit of around 4.4% of its GDP in 2010, and an accumulated negative position of Net Foreign Assets (NFA) of $2.5 trillion, or 16.8% of its GDP. At the same time, China had a substantial current-account surplus of around 4.94% of its GDP and an accumulated reserves of $3.5 trillion, or 58% of its GDP. This is puzzling since standard theory predicts that capital would flow from the developed countries, where it is abundant, to the developing countries, where it is scarce. A popular explanation to the phenomenon is that the reversion is a result of “currency manipulation” by the Chinese government, in breach of free trade agreements.

In a recent paper, Mendoza, Quadrini and Rois-Rull (2009), henceforth MQR, argue that the root cause of the imbalance may be found in the capital market rather than in the foreign-exchange (FX) market. In their two-country model, the developed country has an advantage over the developing country in contract enforcement. For example, it is cheaper to enforce a contract between an American citizen and a Chinese citizen relative to a contract between two Chinese citizens. Weak contract enforcement increases the probability that the borrower would divert cash to his own private benefit, which reduces the insurance value of the contract and causes, in equilibrium, a net capital outflow from the costly-enforcement country towards the cheaply-enforcement country.

Our work elaborates and further-develops the MQR argument. Like them, we argue that the root problem is to be found in the capital market rather than the in FX market. Yet, we model the structural difference between developed and developing countries using the old concept of “financial repression”, developed by Mckinnon (1973) and Shaw (1973). In an open-economy DSGE framework, we model the excessive regulation of the capital market as a financial intermediation tax, which gives rise to a large spread between the lending rate and the borrowing rate (in the developing country). Crucially, we assume that investors from the developed country, can arbitrate the intermediation tax when investing in the developing country. As a result, they build a substantial NFA position and use the rent created by the tax arbitrage in order to fund a permanent current account deficit. At the same time, domestic investors in
the developing country are crowded out of their home market and accumulate a large NFA position in the developed country.

While similar in spirit to MQR, our approach adds to their argument in two important respects. First, financial repression is an observable phenomenon. That resolves an issue in the MQR approach which finds it “difficult to derive a direct mapping from these indicators [namely, the model parameters that capture the cost of contract enforcement] to the actual values [of those parameters]”. We calibrate our model using data of Chinese reserve requirements, which are at extraordinarily high level of above 30%, to show that it yields a significant order of magnitude of current-account imbalances. Our model predicts that in equilibrium, with a gross foreign asset of 186.3%, and gross foreign liability of 168.9% of its GDP, developed country runs a negative NFA around 17.4% of its GDP. On the other hand, the yield of developed country’s foreign asset, 13.2% is 2.04% higher than that of its foreign liability, 11.1%. Those number results in a positive capital account of \((168.9\% \times 13.2\% - 186.3\% \times 11.1\%) = 1.61\%\) of its GDP. That is enough to fund a permanent current-account deficit of 1.57% of its GDP in our model. Second, since financial repression is a policy variable, welfare accounting seems to be the right approach to evaluate it. It turns out that financial repression decreases the level of capital stock in the developing country and, as a result, its labor income. In contrast with much currency-manipulation rhetoric, the actual winners of the financial-repression are the investors and the labor in the developed country, not those in the developing one. The aggregated welfare loss relative to the no financial repression regime indicates the social sub-optimal nature of this policy.

**Literature**

Another line of DSGE models attempts to explain the international imbalances as a result of differences of risk exposure across developed-developing countries, which generate precautionary savings of the later, see Bernanke (2005) as an example. Gourinchas, Rey and Govillot (2010) argue developed countries are populated with investors of a higher tolerance for risk and monopolize the creation of risk-free assets\(^1\). That creates a strong insurance motive to trade across the developing-developed countries and at the same time allocates the developed

\(^1\)Regarding that asymmetric supply of assets see also Caballero, Farhi and Gourinchas(2008).
country some rent that can be used to fund a permanent trade deficit. Fogli, Alessandra, and Perri (2006) explain the higher demand for insurance in the developing countries on a more erratic business cycle there while Durdu, Bora, Mendoza and Terrones (2009) attribute that phenomenon to a higher likelihood of being affected by a sudden-stop type of financial crisis. See however some skeptical notes by Jeanne (2007) regarding this approach. The closest paper to our approach is Song, Storesletten and Zilibotti (2011). They emphasize the dual nature of the Chinese capital market by assuming that State-Owned Enterprises (SOEs) have exclusive access to Chinese banks that decline loan requests from private enterprises. As the SOE sector shrinks due to low productivity, the banks accumulate surpluses that only can be directed abroad. Again, our main contribution of this paper is in being able to calibrate the financial imperfection on observable data.

1 Financial repression in China

The term financial repression is introduced by Mckinnon (1973) and Shaw (1973), henceforth MS, to describe the excessive regulation of financial markets. Originally, MS focused their analysis on a market where \( i \) a) a concentrated banking industry dominates any other forms of financial intermediation and \( ii \) the government puts a ceiling on the time-deposit rate. In such circumstances, the supply of funds, \( f_s \), turns inelastic at the quantity where the ceiling rate binds, a level smaller than the un-repressed equilibrium lending \( f_0 \); see Figure 1. The main observable implication of financial repression is an exceptionally high spread between the risk-free borrowing rate \( i_d \) and the risk-free lending rate \( i_s \). As a result, financial repression can be modelled by an intermediation tax, \( \tau = i_d - i_s \), with the equivalent equilibrium effect. The main objective of the policy is to lower the cost of servicing the national debt. Eventually, the concept was used in the literature to describe various other regulatory measures that, likewise, generate exceptionally-high credit spreads\(^2\). We use, below, the concept of financial repression to describe the Chinese financial market, with a special emphasis in \( i \) its dominating and SOE-biased banking sector and \( ii \) exceptionally-high reserve requirements. We then demonstrate that financial repression, by causing pervasive credit deprivation among SMEs, is equivalent to a 20% tax on domestic investment\(^3\).

\(^2\)Brock (1984, 1989) analyze reserve requirements’ effect on the interest rate wedge.
\(^3\)we refrain from speculating on Chinese government’s motivation in implementing financial repression. Bai et. al. (1999) modelled financial repression in China as an implicit way
Chinese commercial banks dominate its financial sector in terms of scale and functionality. By 2010, The total bank asset, which exceeds 11.7 Trillion USD or 200% of Chinese GDP, more than double the sum of Chinese stock markets’ capitalization and corporate bond outstanding. More than 90 percent of external funding to Chinese corporation is channelled by commercial banks. The banking sector is highly concentrated: the top 4 state-owned banks possess more than 47 percent of total asset and generate more than half of total revenues of the whole sector\(^4\). Chinese banks are also highly biased in favor of SOEs whose political connection and government’s implicit guarantee help putting these unproductive corporations in front of credit queue (see Genevieve Boyreau-Devray and Wei, 2005). SOEs contribute 25% of Chinese GDP but receive 65% of total bank loans (see also Pitsilis et al., 2004).

Chinese commercial banks face a labyrinth of reserve requirement measures and (sometimes implicit) administrative orders. The official reserve requirement ratio (reserve/deposit) was raised from 6% in 2002 to 21% in 2011, see Figure 2. A requirement for loan to deposit ratio, henceforth LTD ratio, which has been strictly implemented since 2005, imposes a ceiling on loanable capital as percentage of total deposit, which reached, by 2011, 65% for the “big four” banks\(^5\) and 75% for other banks, equivalent to a roughly 30% reserve ratio. On top of the formal regulations, implicit intervention by the authorities in the

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\(^4\)Data from People’s Bank of China (PBC), 2010.

\(^5\)Chinese government set individual LTD ratio for each “big-four” bank for each year. By the end of 2011, LTD ratios for “big four” banks range from 57% (Agriculture Bank of China) to 72% (Bank of China) with average value of 65%, equivalent to a 35% reserve ratio.
banks' asset management, known as “windows guidance”, may further limit the capability of banks of generating credit\(^6\). Though reserves and other low-interest bonds are far less profitable than loans (usually negative real interest rate), banks are holding more than 30% of deposit in the form of those low-yield assets (also see Figure 2). This indicates that above policies impose a binding constraint that greatly distorts asset allocation behaviors of Chinese banks; its 65% loan-to-deposit ratio is not only more than 30% lower compared with its un-repressed level (90%) in 1998 before LTD ratio requirement came in to effect but also significantly short of its US (85%) or Europe (114%) counterparts.

**Figure 2 Required and Actual Reserve Ratio as Percentage of Total Deposit**

![Figure 2](image)

*Data resource: People’s bank of China*

Since financial repression brings about a reduction in the total volume of credit, Chinese non-SOEs firms, which tend to be more productive and profitable\(^7\) than SOEs, suffer from pervasive credit deprivation. In a “Chinese Entrepreneur Group Financing Need Survey”, which sampled more than one thousand SMEs all over the country, 41% of respondents had no formal external finance at all. For those who do have access to bank finance, loans are usually short-term working capital (80% mature in less than one year), and account for

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\(^6\)Chinese central government is the controlling shareholder for majority of Chinese commercial banks, which therefore always put political needs before economic interests. See Lin Cai and Li (1998) and Bai et al (2000). In a recent paper, Deng, Morck, Wu and Yeung (2011) argue that government intervention is the reason to Chinese banks’ great credit expansion and Chinese economic boost in 2009.

\(^7\)See Islam, Dai and Sakamoto (2006) and Brandt, Hsieh, and Zhu (2008) for difference in total factor productivity between SOE and non-SOE enterprises.
only a small portion of their total asset. More than 61.9% of respondents claim that their expansion of business is limited by the absence of external financing channels. That is consistent with a finding by Allen, Qian and Qian (2005) who show that non-SOEs have to internally finance 60% of their investments. The credit deprivation is also suggested by China’s growing private lending; 12% of Chinese households lend and 33% borrow on “gray” markets, many of whom are entrepreneurs raising capital for their SMEs. Interest rates for private lending soar as high as four times of base interest rate (see Tsai, 2002 and Farrell et al. 2006).

The above discussion shows that compared with un-repressed situation, repressed Chinese banking system creates at least 20% less loans than could be used to finance profitable projects of non-SOE enterprises. Considering the dominating role of Chinese banking sector in capital intermediation, that is equivalent to an approximately 30% tax on Chinese domestic investment, one key parameter we will use in the calibration exercise.

Financial repression leads to a simultaneous capital import and capital export. Foreign funds, which are raised abroad and exported to China, provide an tax-arbitrage opportunity and retain a higher rate of return. Capital flows into China are in the form of foreign direct investment and portfolio investment; the former amounted to 1.95 trillion USD (23% of Chinese GDP) in 2012 and made China the top FDI destination and the latter, usually referred to as ”hot money”, is likely to be of the same order of magnitude. As for capital export, there is much anecdotal evidence of wide-spread (illegal) capital flight away from China so as to benefit from investment opportunities abroad: illicit capital outflows that are hidden in current-account terms are estimated to be 8% of Chinese GDP. For the sake of the argument, we assume that cross-border capital flows are costless. In order to explore quantitative effect and welfare implication of these capital flows, we turn to the modelling and calibration exercise.

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8 for more than half enterprises bank loans are account for less than 10 percent of their total liabilities.

9 Chinese law stipulates that any private borrowing from more than 30 people could be charged by “illegal-fund raising”, a offense with highest maximum penalty death.

10 “Chinese Household Finance Survey” is the first national-wide survey on household finance. It collect data from more than 8000 households from over 25 (out of total 34) provinces.

11 See Sun, Yang and Xiao (2010) for evidence that foreign investor gains a higher rate or return for their Chinese investment relative to domestic investors.

12 The non-FDI inflow is estimated between 500 billion and 1.75 trillion USD, see Li (2008), Zhang (2008) and Setser (2008). Those scholars use the differential between increment of foreign reserve and the sum of trade surplus and net FDI inflow to estimate the non-FDI inflow into China.

13 See Kar and Cartwright-Smith (2009), Schneider (2003) and Sicular (1998) who use the differences between export value reported by Chinese and import value reported by China’s trading partners to estimate the capital inflow hidden in current account.
Many real estate companies choose to raise capital from the Hong Kong market when the Chinese central government tightens the monetary policy. Foreign capitals control more than 15% of total house value of China.

2 The DSGE model

Consider a world with two countries, \( i = ch, us \), where \( ch \) stands for the financially repressed economy. Each country is populated by a single, infinitely lived, representative agent with a Von-Neumann Morgenstern CRRA utility function:

\[
U^i = \sum_{t=0}^{\infty} \beta^t E u(c^i_t), \quad u(c) = \frac{c^{1-\sigma}}{1-\sigma},
\]

where \( \beta \) is the subjective discount factor and \( \sigma \) is the coefficient of relative risk aversion, same for both countries.

Two factors, labor and capital, are used to produce one type of divisible commodity that can be used for either consumption or investment. Each representative agent is endowed with one unit of labor. He chooses the total amount of investment \( s \) and the proportion \( \alpha \) of investment which is allocated towards the domestic market. The total capital received by country-\( i \) in period \( t \) is from both agents’ allocations of capital in that country:

\[
k^i_t = s^i_t \alpha^i_t + s^j_t (1 - \alpha^j_t),
\]

where \( j \neq i \). Each agent is endowed with one unit of labour and a Cobb-Douglas production technology \( f(k) = k^\nu \), affected by a random productivity shock with a Markov transition process \( z_{t+1} = g(z_t) \). Hence, per-capita output in country-\( i \) in period \( t \) is:

\[
y^i_t = z^i_t f(k^i_{t-1}) = z^i_t (k^i_{t-1})^\nu.
\]

Where \( \nu \) is the out elasticity of capital. Agent-\( ch \)’s domestic investment is subject to a tax so that the interest rate he earns is lower than his MPK by \( \tau \) percent. The tax revenue is rebated to country-\( ch \) agent’s as a lump-sum transfer. In contrast, agent-\( us \) can arbitrate the tax: the return on his investment in country-\( ch \) equals to MPK. Both agents’ investments in US are tax-free so their interest rate equals to MPK in country-\( us \).

Each agent’s total income \( a^i_t \) consists of labor income \( w^i_t \), capital income \( CI^i_t \)
and tax rebate $T_t$ (only for agent-$ch$). Labor income is the total production net the capital returns:

$$w^i_t = f(z^i_t, k^i_{t-1}) - r^i_t k^i_{t-1},$$

where $r^i_t$ is the marginal productivity of capital (MPK).

$$r^i_t = f'_k(z^i_t, k^i_{t-1}) = z^i_t (k^i_{t-1})^{v-1}.$$  

The capital income for each agent is defined as: $CI^i_t = s^i_{t-1} R^i_t$, where $R^i_t$ is the effective weighted average rate of return for agents’ global portfolios. For agent-$ch$:

$$R^{ch}_t = 1 + \alpha^ch_{t-1} r^{ch}_t (1 - \tau) + (1 - \alpha^ch_{t-1}) r^{us}_t.$$  

For each period, each agent’s total income are put into usage of either consumption or investment. Thus, the budget constraint of agent-$ch$ is:

$$a^{ch}_t = w^{ch}_t + CI^{ch}_t + T_t = c^{ch}_t + s^{ch}_t,$$  

where $T_t = \alpha^{ch}_{t-1} s^{ch}_{t-1} r^{ch}_t \tau$ is the tax refund to the economy. Notice that when taking the first-order condition, we treat $r^i_t$ as exogenous in line with the price-taking behavior of the agent-$ch$ (Same for agent-$us$ later). The first-order conditions with respect to investment $s^{ch}_t$ and domestic allocation $\alpha^{ch}_t$, after plugging in equilibrium interest rate from equation (1), are:

$$u'(c^{ch}_t) = \beta E[R^{ch}_{t+1} u'(c^{ch}_{t+1})]$$  

and

$$E[(r^{ch}_t (1 - \tau) - r^{us}_t) u'(c^{ch}_t)] = 0$$  

Correspondingly, for agent-$us$ the effective weighted average rate of return is:

$$R^{us}_t = 1 + \alpha^{us}_{t-1} r^{us}_t + (1 - \alpha^{us}_{t-1}) r^{ch}_t.$$  

In period $t$ the agent-$us$’s budget constraint and first order conditions with respect to investment $s^{us}_t$ and domestic allocation $\alpha^{us}_t$ are:

$$a^{us}_t = w^{us}_t + CI^{us}_t = c^{us}_t + s^{us}_t$$  

and

$$u'(c^{us}_t) = \beta E[R^{us}_{t+1} u'(c^{us}_{t+1})]$$  

9
\[ E[(r_t^{ch} - r_t^{us})u'(c_t^{us})] = 0. \] (6)

The set of aggregate states \( \omega \) consists of the current total incomes \( a_t^i \) and previous productivities \( z_{t-1}^i \) of both countries. Therefore, \( \omega_t^i = \{a_t^i, z_{t-1}^i\}(i = \text{ch, us}). \)

**Definition:** The recursive equilibrium is characterized by a set of functions for (i) agents’ policies \( c_t^i(\omega), s_t^i(\omega) \) and \( \alpha_t^i(\omega) \); (ii) price \( r_t^i(\omega) \). Such that (i) agents’ policies satisfy the optimality conditions (3),(4),(6),(7) given the interest rate \( r_t^i(\omega) \) and the law of motion for aggregate states \( \omega_{t+1}^i = H(\omega_t^i) \); (ii) the interest rates \( r_t^i(\omega) \) are the market clearing prices that equal to the MPK for each country (borrowing rate in country-ch).

### 3 Calibration

We now calibrate the model to see whether a financial-repression parameter of \( \tau = 30\% \), in line with the empirical observations made above, actually predicts orders of magnitude of the developed country’s negative NFA and current-account deficit. We also make the standard assumptions that \( \beta = 0.9 \) and \( v = 0.3 \). We set up \( \sigma = 10 \). This is higher than the commonly-assumed level, but in the current setting can be justified on the basis that it captures a home bias: at low levels of relative risk aversion, agents will take advantage of the arbitrage opportunity much more aggressively, cross-holding almost the entire market of their trading partner. The country-specific productivity shocks are independent with standard deviations of 3%. Therefore, there is scope for international diversification of country-specific shocks. Table 1 summarizes above parameters.

#### Table 1 Parameters for Calibration

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>subjective discount factor (( \beta ))</td>
<td>0.9</td>
</tr>
<tr>
<td>risk averse coefficient (( \sigma ))</td>
<td>10</td>
</tr>
<tr>
<td>output elasticity of capital (( v ))</td>
<td>0.2</td>
</tr>
<tr>
<td>s.d. of productivity shock (( \varepsilon ))</td>
<td>3%</td>
</tr>
<tr>
<td>tax rate (( \tau ))</td>
<td>30%</td>
</tr>
</tbody>
</table>

We implement Parametrized Expectation Algorithm (PEA), an algorithm first proposed by Marcet (1988) to solve the heterogeneous-agent DSGE model;
see Appendix for more details. Calibration results and corresponding actual magnitudes are presented in Table 2. Evidently, the calibrated model predicts, reasonably well, the phenomenon that we try to explain. The model predicts that in the long run, the foreign asset and foreign liability of country-us are 186.3% and 168.9% of its GDP, respectively\textsuperscript{14}, leaving a negative 17% of net foreign asset. The yield of US’s foreign asset, 13.2%, is 2% above the yield of its foreign liability, 11.1%. This render a positive capital account of US of (168.9%*13.2%-186.3%*11.1%) 1.61% of its GDP. That is more than enough to cover US’s current account deficit, which is 1.57% of its GDP. This prediction is consistent with ”Exorbitant Privilege” of US, one phenomenon that over the last 50 years, interest income of US’s smaller foreign asset exceeds the interest expenditure of its larger foreign liability, leaving a positive net capital income.

Table 2 Positive Prediction: US’s Balance of Payment in long run equilibrium

(a) Foreign asset, foreign liability, net foreign asset, current account and capital account are all measured by percentage of GDP. (b) Estimations used in this column are from Gourinchas and Rey (2007)

<table>
<thead>
<tr>
<th>Description</th>
<th>Model</th>
<th>calibration values</th>
<th>Empirical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Foreign Asset ((a))</td>
<td>((1 - \alpha_{t-1}^{as} )y_{t-1}^{as} / y_{t}^{as})</td>
<td>168.9%</td>
<td>100%\textsuperscript{(b)}</td>
</tr>
<tr>
<td>Gross Foreign Liability</td>
<td>((1 - \alpha_{t-1}^{ch} )y_{t-1}^{ch} / y_{t}^{as})</td>
<td>186.3%</td>
<td>75%</td>
</tr>
<tr>
<td>Net Foreign Asset</td>
<td>(((1 - \alpha_{t-1}^{as} )\sigma_{t-1}^{as} - (1 - \alpha_{t-1}^{ch} )\sigma_{t-1}^{ch}))/ y_{t}^{as})</td>
<td>-17.4%</td>
<td>-25%</td>
</tr>
<tr>
<td>Yield on Foreign Asset (YFA)</td>
<td>(r_{t}^{as})</td>
<td>13.2%</td>
<td>5.72%</td>
</tr>
<tr>
<td>Yield on Foreign Liability (YFL)</td>
<td>(r_{t}^{ch})</td>
<td>11.1%</td>
<td>3.61%</td>
</tr>
<tr>
<td>YFA-YFL</td>
<td>(r_{t}^{as} - r_{t}^{ch})</td>
<td>2.04%</td>
<td>2.11%</td>
</tr>
<tr>
<td>current account</td>
<td>(((1 - \alpha_{t-1}^{as} )\sigma_{t-1}^{as} - (1 - \alpha_{t-1}^{ch} )\sigma_{t-1}^{ch}))/ y_{t}^{as})</td>
<td>1.61%</td>
<td>[0.09%, 1.2%]</td>
</tr>
<tr>
<td></td>
<td>((y_{t}^{as} - c_{t}^{as}) / y_{t}^{as})</td>
<td>-1.57%</td>
<td>[-2.8%, -5.7%]</td>
</tr>
</tbody>
</table>

\textsuperscript{14} The number is higher than the standard reported value which we believe under-estimates the actual scale of international position of US. Gros (2006a) point out that the foreign liability data of US is probably larger. For the survey of foreign portfolio investment, only those securities held by a US-based custodians are included, missing all securities held by foreign-based contodians. This may also cause a tax-avoid motivated transfer from a surveyed US-based custodians to unsurveyed foreign-based contodians, which may be reflected in a 400 billion USD fall by the end of 2000. Mostover, acquisitions by foreigner of US’s real estate is not accounted at all due to lack of data resource. Hausmann and Sturzenegger (2007) believe that the US’s foreign asset is under-estiamted asset well because of commonly used measure of foreign direct investment (FDI) only account for its book value, which could be greatly different from its market value.
Table 3 shows that financial repression has significant welfare implications. Compared with a un-repressed situation, country-\textit{ch} loses while country-\textit{us} measures by of GDP consumption and total welfare. All loses and gains are economically significant. It indicates that great welfare is transferred from country-\textit{ch} to country-\textit{us} via the net capital flow driven by financial repression. The shifts in welfare are also universal across classes as within each country the capital income, main resource for the better-offs, and the labor income, main resource for the worse-offs, experiences similar changes. In contrast with prevailing view that Chinese employees benefit from the export boom, our model predicts that Chinese employees are worse off: labor income declines by 2.4 percent resulting from declined the capital stock per unit of labor and correspondingly reduced labor productivity. Also note that the welfare loss of country-\textit{ch} is more than the welfare gain of country-\textit{us}, suggesting the financial repression is socially undesirable.

\begin{table}[h]
\centering
\begin{tabular}{lcc}
\hline
 & \textbf{Model} & \textbf{CH} & \textbf{US} \\
\hline
GDP & \(y_i^R/y_i^{UR} - 1\) & -2.75\% & 4.6\% \\
labor income & \(w_i^R/w_i^{UR} - 1\) & -1.3\% & 6.1\% \\
capital income & \(CI_i^R/CI_i^{UR} - 1\) & -5.8\% & 1.25\% \\
consumption & \(c_i^R/c_i^{UR} - 1\) & -4.6\% & 6.4\% \\

welfare gain & \((U_i^R - U_i^{UR})\) & -0.85 & 0.70 \\
\hline
\end{tabular}
\caption{Normative Analysis: welfare increment of Repressed regime (R) relative to Un-Repressed (UR) regime}
\end{table}

4 Discussion

This simple model draws attention to the possibility that financial repression in China causes international trade imbalances. The question remains open is why China, with small government debt and little need to levy inflation tax, implement financial repression that decrease its own welfare.

Future research may benefit from exploring political-economy channels that are masked by our representative agent assumption. Stigler (1971) propose that regulations are actively sought by the industries which would potentially benefit from being regulated. Although Chinese commercial banks losses for having

\footnote{As Mitt Romney put it in his campaign for US president in 2012, “China...have 20 million people coming out of farm... and they want to be able to put them to work...but they cannot artificially lowering their prices and killing American jobs”.}
less loanable funds, they could gain more from the artificially augmented loan-
deposit spread brought about by financial repression, see lardy (2008). That
may encourage banks to support such a regulation to sustain their economic
interest at the cost of labor and the rest of the society.

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Appendix: Calibration Procedure

In this section, we will describe the calibtarion procedures in detail. We use the Marcet (1988) method of Parameterized Expectation Algorithm(PEA)
to solve the DSGE model. The idea of PEA is to choose a flexible form of function $\phi$ with a set of parameters $\delta$ to approximate the conditional expectations in the stochastic growth model. By solving the parameters $\delta$ with iteration, the substitute function $\phi$ approaches the conditional expectations arbitrarily well.

The policy functions contained in the Euler equation is solved simultaneously. The state variables of this model are the current total incomes of each agent $a_{ch}^t, a_{us}^t$ and last period productivity shocks $z_{ch}^{t-1}, z_{us}^{t-1}$. We choose the linear function:

$$
\phi_k(a_{ch}^t, z_{ch}^{t-1}, a_{us}^t, z_{us}^{t-1}; \delta^k) = \delta_{1k} + \delta_{2k} a_{ch}^t + \delta_{3k} z_{ch}^{t-1} + \delta_{4k} a_{us}^t + \delta_{5k} z_{us}^{t-1}
$$

to approximate four Euler equations (3),(4),(6) and (7) derived from the utility-maximization problems, where $k=1,2,3,4$. The main advantage of linear function over power function (used by Haan and Marcet (1990)) is that it gives the model extra stability during the iteration process. Only first-order linear approximation is implemented. The system of Euler equations after conditional expectation replaced by $\phi$ can be written as:

$$
\begin{align*}
uc_t' &= \beta \phi_1(a_{ch}^t, z_{ch}^{t-1}, a_{us}^t, z_{us}^{t-1}; \delta_1) \\
0 &= \beta \phi_2(a_{ch}^t, z_{ch}^{t-1}, a_{us}^t, z_{us}^{t-1}; \delta_2) \\
\upsilon_t' &= \beta \phi_3(a_{ch}^t, z_{ch}^{t-1}, a_{us}^t, z_{us}^{t-1}; \delta_3) \\
0 &= \beta \phi_4(a_{ch}^t, z_{ch}^{t-1}, a_{us}^t, z_{us}^{t-1}; \delta_4)
\end{align*}
$$

The parameters $\delta^k$ of parameterized function $\phi^k$ is achieved with the following iteration procedures.

Step 1: Generate a series of shocks $\{z_{it}^{t-1}\}_{t=2}^T, i = ch, us$.
Step 2: Make an initial guess of $\delta^k$.
Step 3: Calculate the linear approximation of conditional expectation function: $\{\phi_t^k((a_{ch}^t, z_{ch}^{t-1}, a_{us}^t, z_{us}^{t-1}; \delta^k))\}_{t=2}^T$. Use the $\phi_t^k$ to derive consumption and investment decisions $\{s_t^k(\delta^k), a_t^k(\delta^k)\}_{t=2}^T$. Use those policy function to update the future expected total income based on investment decisions $\{(a_{ch}^{t+1}, a_{us}^{t+1})\}_{t=2}^T$.
Step 4: Calculate the new approximation using new total income $\{\xi_t^k((a_{ch}^t, z_{ch}^{t-1}, a_{us}^t, z_{us}^{t-1}))\}_{t=2}^T$. Update $\delta^k$ with regression:

$$\delta^k = \text{argmin} \ (\xi_t^k - \psi_t^k(\delta^k))^2.$$

Step 5: Repeat step 3 and 4 until $\delta^k$ converge.