Monetary Rules and Policy Targets under Managed Exchange Rates and Capital Controls: *Lessons from China*

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Abstract

This paper examines the performance of capital controls and exchange-rate management when the economy finds itself in dark corners. These are times when the real sector experiences a sequence of prolonged negative shocks from world demand, while the central bank faces low world interest rates on its foreign-exchange reserve holdings. We examine two regimes, one of a fixed exchange rate with strong capital controls and another with a more open capital account with a managed exchange rate.

Our results show that the more flexible but controlled exchange-rate system, based on welfare-based Ramsey rules, acts as an effective shock absorber when the economy is in a "dark corner", thus reducing the fall in real GDP and consumption . However, this benefit comes at a cost. In this more open but managed system, there is a much larger fall in employment and loss in foreign exchange reserves, as the managed exchange rate appreciated, than in the more restricted fixed-rate environment.

By contrast, if the movement to a more open capital account and more flexible but managed exchange rate takes place with greater flexibility in domestic price setting, the dark corners are much less dark, in the more open managed exchange-rate regime, relative to the closed fixed exchange-rate regime.

The results of our model are consistent with recent experiences of China with respect capital-account liberalization and exchange-rate management.

JEL Codes: E58, F411

Key words: Ramsey rule, dark corner dynamics.

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1 Introduction

Chinese monetary policy has received considerable attention in recent research. Chang et al. (2015), for example, have drawn attention to the mix of capital controls, exchange-rate management, and sterilized intervention as a constraint on the ability of monetary policy to stabilize the economy in the wake of external shocks. Making use of a calibrated DSGE model capturing a few characteristics of the Chinese macroeconomic setting, these authors conclude that greater capital account liberalization as well as a more flexible managed exchange-rate regime, based on a welfare-based Ramsey rules, would increase welfare by a factor slightly less than one-percent of GDP per year.[1]

Using the same model our results show that such a managed exchange-rate system, based on a Ramsey rule for the exchange rate, aimed at welfare optimization, acts as an effective shock absorber for GDP and consumption in good times and bad. However, in dark corner episodes, when there are recurring negative shocks to world demand an lower interest rates, there are large loss in reserves and a drop in employment. When there is a fall in world demand, domestic consumption falls. To improve welfare, the exchange rate appreciates, when the economy experiences a prolonged sequence of negative shocks. there is a large loss of reserves and a steep fall in employment, relative to the more controlled fixed-rate system.

Of course, managed exchange rates are not unique to China. Chow et al. (2014) examined the managed-exchange rate system in Singapore. They found that a simple Taylor-like rule for the exchange rate outperforms a Taylor rule for the nominal interest rate, when the principle driving forces are terms-of-trade shocks, while a traditional Taylor rule does better, in terms of welfare, if the principle driving forces come from productivity shocks. Of course, unlike China, the capital account in Singapore is almost completely open, on a par with the index for the United States.[2]

Figure 1 pictures the evolution of policy instruments for the central bank: namely real bond rate and the annualized change in the exchange rate. It is clear that the People's Bank of China made a major policy change in 2005, with respect to the active use of exchange-rate management.

The Chinese economy, to be sure, has enjoyed high growth, but it has not been exempt from experiencing dark corners. Figure 2 pictures the annualized growth rates of Industrial Production and the CPI since 1998. We see that the interval between 2008 and 2010, in the wake of the global financial crisis, was a period of severe decline in production as well as deflation. We also see broad co-movement between the growth rates of the CPI and Industrial Production.[3]

[1] Welfare-based Ramsey rules for bench-marking monetary policy regimes came to the forefront of research with the work of Erceg et al. (2000).

[2] Singapore is equal to the United States in the index of capital-account openness developed by Chinn and Ito (2006), with a measure slightly below 2.5 in 2014, while China remains slightly below -1 in the same period of time.

[3] Due to the seasonal effects of Chinese New Year taking place in the period Jan-March of each year, the IP index was averaged over these periods in each calendar year.

Figure 1: Treasury Bond Rate and Exchange Rate Growth, 1998-2016

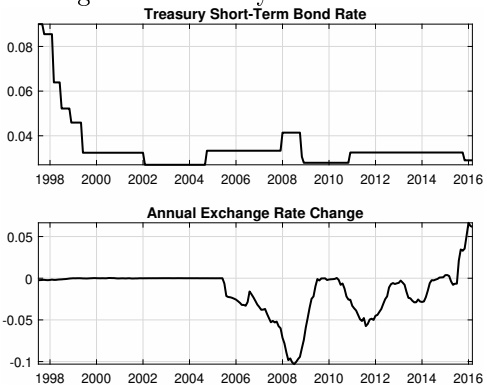


Figure 2: IP and CPI Annual Growth Rates, 1998-2016

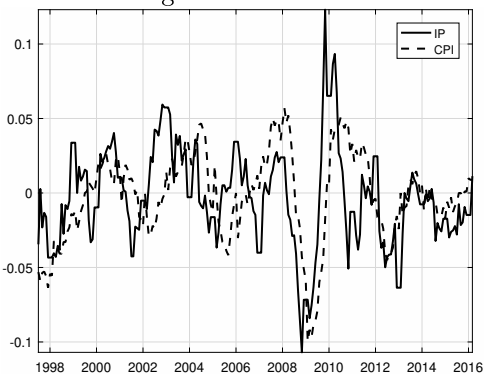


Figure 3: Annualized Growth Rates of Money and Foreign Exchange Reserves, 1998-2016

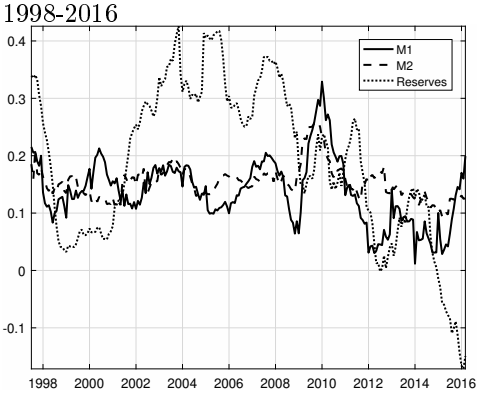


Figure 3 pictures the rate of growth of M1 and M2 as well as Foreign Exchange Reserves in China since 1998. From this figure we see that in periods of crisis, or "dark corners", M1 growth is higher than M2 growth. We see this in the wake of the Asian financial crisis in the late 90's, as well as at the time of the global financial crisis in 2008, and most recently, since 2015. In all of these periods, the growth rate of foreign exchange reserves is slowing down, and turning negative.

Much of the international pressure for China to move to a more flexible exchange-rate system comes from a presumption that the RMB, at least prior to 2005, was undervalued, relative to the US Dollar. However, as Cheung et al. (2007) pointed out, comparisons of misalignment between the United States and China, based on a range of statistical criteria, did not confirm any statistically significant degree of undervaluation.

The July 2005 policy change was a switch to a more flexible but managed exchange-rate system, in which the central parity would be tied not just to the US Dollar, but to a basket index of currencies. As for understanding China's switch, as well as any country's choice of exchange-rate regime, for that matter, as Rose (2011) points out, comparisons before/after or across countries are quite difficult to make.

While welfare criteria are standard tools for policy comparison across regimes, they miss an important issue, and contrary to Rose (2011), the consequences may be larger than we think. As Mendoza (2010) noted in his work on sudden stops, standard welfare measures often show little difference across policy regimes, since most of the data are generated by the model when the variables are close to their steady-state or stochastic-mean values. What is of interest is how much of a difference these alternative rules make when the economy is in a prolonged crisis or malfunctions badly, and falls into a "dark corner", in the words of Blanchard (2014).

The monetary framework of China is evolving in steady ways, with different instruments coming to the fore at different times. Fernald et al. (2014), for

example, found that increases in the bank required reserve ratio were effective for inflation stabilization. However, they also found that Central-bank determined changes in interest rates also played a significant role, while changes to M2 or credit conditions did not play a significant role. Moreover, Chen et al. (2017) find that the transmission of monetary policy shocks is remarkably similar to that of more advanced economies in terms of both output growth and inflation. However they also find that window guidance has a major influence on bank lending, and that monetary policy has asymmetric effects on asset prices.

Before turning to our assessment of likely monetary rules for China in the context of incomplete financial openness, we first analyze what happened before and after 2005 in the next section. We use the disconnectedness approach of Diebold and Yilmaz (2013). Originally used for measuring volatility spillovers among financial markets in Diebold and Yilmaz (2012), this method makes use of forecast-error variance decomposition analysis among the likely targets of monetary policy. Since the error-variance decomposition matrix is asymmetric, we can assess both the inward and outward degrees of disconnectedness among the monetary targets and indicators.

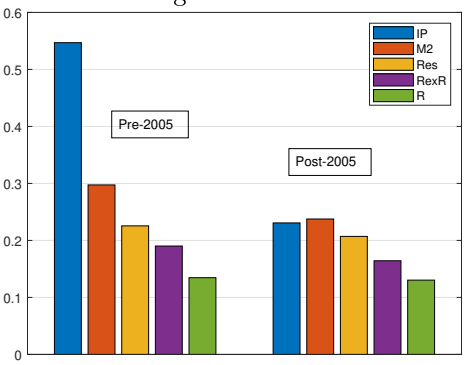
Our results show little difference in the measures of disconnectedness before and after 2005, given the incomplete and partial financial liberalization.

The third section then gives a brief summary of the model used by Chang et al. (2015) for assessing Chinese monetary policy. Specifically we assess the performance of two versions of the model, one with a relatively closed capital account and a fixed exchange rate, and another with a more open capital account and a more flexible but managed exchange rate. We examine the properties of the model in terms of the inward and outward disconnectedness of key variables. Then we examine the distributions of the key variables of the model under the two regimes, making use of kernel density estimation due to Epanechnikov (1969). Finally we assess the performance of the two versions of the model when the economy is in a dark corner.

As noted above, we find that in periods when the economy is in a dark corner, when GDP is 1.96 standard deviation below its stochastic mean, that a more open, more flexible managed exchange-rate regime, based on a welfare-based Ramsey rule, does indeed act as a shock absorber, in that sense that it mitigates the fall in GDP and real consumption. But this benefit, however, comes at a very high cost, which does not show up in standard welfare criteria for optimal policy. However, under the more open and more flexible regime, the real exchange rate appreciates, leading to an increase in imported inputs for production, with a consequent large decrease in foreign reserves and losses in employment.

In the final section, we show that the darkness of the dark corner periods under the more open, managed exchange-rate system may become less dark if there is greater price flexibility in the model. Given that administered prices play a significant role in China, as noted by Cheung et al. (2007), our results suggest that the sequencing of reform should start with great market-oriented price flexibility before the adoption of a more open capital account with a managed exchange-rate regime.

Figure 4: Connectedness Measures Pre-and Post 2005



2 Connectedness of Policy Targets

Figure 4 gives the outward connectedness measures, based on forecast error variance decomposition, for the growth of Industrial Production (IP) as well as the growth of real money (M2) ,Foreign Exchange Reserves, the Real Effective Exchange Rate and the Real Bond Rate of Return. The connectedness measures come from a VAR regression, on all five variables, with a forecast horizon of two years. Following the example of Chen et al. (2016), we make use of the five-variable VAR. To eliminate serial correlation, we used alternative lag specifications. We report the results for the shortest lag length, for which we obtain serial independence in the residuals. As in Chen et al. (2016), we made of a generalized VAR method by varying the order of the variables in the estimation process, and averaging the results over 100 possible permutations of the system. We report the mean values for the outward measures of connectedness.

What stands out in Figure 4 is that the only measure which shows any appreciable change from pre- and post-2005 is that of the index for industrial production. This should not be surprising, since the more flexible managed exchange-rate regime acts as a shock-absorber insulating the system from real GDP shocks.

Of course, over this period, there have been other regime changes, besides the liberalization of the exchange rate in 2005 towards greater flexibility, such as the reduction in the restrictions for the access of foreigners to financial markets. But the implication of these results is that the regime change generated only small effects on the interconnections of key macroeconomic variables. The key effect was to make key financial variables less reactive to shocks coming from industrial production.

3 The Model

The model is in many ways a new Keynesian open-economy model. The main departure is the imperfect substitutability of domestic and foreign bonds, due to

adjustment costs for changing the proportion of domestic debt in one's portfolio. There are sticky prices in the Rotemberg (1982) framework. But in contrast to the widely-used framework of Smets and Wouters (2007), there are no real-sector frictions in the form of habit persistence or adjustment costs on investment. In fact there is no capital accumulation. Production is simply a function of domestic labor and an intermediate good. The intermediate good, in turn, is a CES composite good of domestically-produced and imported foreign output. Imports are solely for this purpose. There is no explicit banking sector, nor government spending nor taxation.

3.1 Specification

3.1.1 Households and Utility

The representative household optimizes an inter temporal welfare function based on consumption (C_t), real balances (M_t/P_t) and labor (L_t) :

$$\boldsymbol{W}_t = \boldsymbol{E_t} \sum_{t=0}^{\infty} \beta^t \left\{ ln(C_t) + \Phi_m \left(\frac{M_t}{P_t} \right) - \Phi_l \frac{L_t^{1-\eta}}{1-\eta} \right\} \tag{1}$$

subject to the following budget constraint:

$$\begin{aligned} C_t + \frac{M_t}{P_t} + \frac{B_t + e_t B^*_{p,t}}{P_t} \left[i1 + \frac{\Omega_b}{2} \left(\frac{B_t}{B_t + e_t B^*_{p,t}} - \bar{\psi} \right)^2 \right] \\ \leq w_t L_t + \frac{M_{t-1}}{P_t} + \frac{R_{t-1} B_{t-1} + e_t R^*_{t-1} B^*_{p,t-1}}{P_t} + \frac{D_t}{P_t} \end{aligned} \tag{2}$$

The variable and parameter definitions are those used by Chang et al. (2015), p. 5. The key wedge with pure uncovered interest parity is the portfolio adjustment cost parameter Ω_b. The household chooses its paths for consumption, C_t, labor L_t,money balances $m_t = M_t/P_t$,real domestic debt B_t/P_t, and privately-held foreign debt, $e_t B^*_t/P_t$, to maximize equation 1 given equation 2.

The first-order conditions yielding the demand for real balances ($m_t = M_t/P_t$), the real wage, and the generalized UIP condition (with portfolio adjustment costs) have the following expressions:

$$\frac{\Phi_m}{\Lambda_t m_t} = 1 - \boldsymbol{E_t} \frac{\beta \Lambda_{t+1}}{\Lambda_t} \frac{1}{\pi_{t+1}} \tag{3}$$

$$w_t = \frac{\Phi_l L_t^{\eta}}{\Lambda_t} \tag{4}$$

$$\Omega_b(\psi_t - \bar{\psi}) = \boldsymbol{E_t} \frac{\beta \Lambda_{t+1}}{\Lambda_t} \frac{1}{\pi_{t+1}} \left[R_t - R^*_t \frac{e_{t+1}}{e_t} \right] \tag{5}$$

The variable $\Lambda_t$is the Lagrange multiplier associated with equation 2. The symbol ψ_t represents the share of domestic to total debt, $\psi_t = \frac{B_t}{B_t + e_t B^*_{p,t}}$.

3.1.2 Production and Pricing

The production function for differentiated retail goods Y_t(j) has the following form, based on intermediate goods and labor inputs:

$$Y_t(j) = \Gamma_t(j)^{\phi} \left[Z_t L_t(j)\right]^{1-\phi} \tag{6}$$

The variable $Z_t$is a labor-augmenting technology-progress variable. It grows at the constant rate $\lambda_{z,t} = Z_t/Z_{t-1}$.

In turn, intermediate goods Γ_t are CES composites of domestically produced and imported goods, given by $\Gamma_{h,t}$ and $\Gamma_{f,t}$:

$$\Gamma_t = \Gamma_{h,t}^{\alpha} \Gamma_{f,t}^{1-\alpha} \tag{7}$$

The relative price $q_{m,t}$ of these goods is function of the the real exchange rate, $q_t = e_t P_t^*/P_t$:

$$q_{mt} = \tilde{\alpha} q_t^{1-\alpha} \tag{8}$$

Cost minimization yields the equilibrium value of the real exchange rates:

$$q_t = \frac{1-\alpha}{\alpha} \frac{\Gamma_{h,t}}{\Gamma_{f,t}} \tag{9}$$

The formulae for the real marginal cost and the factor-price ratio have the following form:

$$\nu_t = \tilde{\phi} q_{mtt}^{\phi} \left(\frac{w_t}{Z_t}\right)^{1-\phi} \tag{10}$$

$$\frac{w_t}{q_{mt}} = \frac{1-\phi}{\phi} \frac{\Gamma_t(j)}{L_t(j)} \tag{11}$$

Optimal pricing based on Rotemberg (1982) implies the following forward-looking inflation equation:

$$\nu_t = \frac{\theta_p - 1}{\theta_p} + \frac{\Omega_p}{\theta_p} \frac{C_t}{Y_t} \left[\left(\frac{\pi_t}{\pi} - 1\right) \frac{\pi_t}{\pi} - \beta E_t \left(\frac{\pi_{t+1}}{\pi} - 1\right) \frac{\pi_{t+1}}{\pi}\right] \tag{12}$$

The parameters θ_p, Ω_p represent, respectively, the mark-up factor over marginal cost and the cost of adjusting prices (measured in terms of a percentage of GDP. The larger the adjustment cost, ceteris paribus, the slower the adjustment of prices, and the lower the value of θ_p,the larger the markup of prices over marginal costs.

3.1.3 Current Account and External Sector

The current account, ca_t, is the sum of the trade surplus and the net interest income from foreign assets (both those held by households and by the government):

$$ca_t = X_t - q_t \Gamma_{t,f} + \frac{e_t(R^*_{t-1} - 1)B^*_{t-1}}{P_t} \tag{13}$$

Of course, current account balances imply changes in the stock of aggregate foreign assets:

$$ca_t = e_t \frac{B^*_t - B^*_{t-1}}{P_t} \tag{14}$$

The foreign interest rate follows an autoregressive process:

$$\ln R^*_{t-1} = (1 - \rho_r) \ln R^* + \rho_r \ln R^*_{t-1} + \sigma_r \epsilon_{r,t} \tag{15}$$

Export demand is a function of the real exchange rate, world demand, augmented by domestic productivity (for reasons of generating balanced growth):

$$X_t = q_t^{\theta} \tilde{X}^*_t Z_t \tag{16}$$

World demand follows an autoregressive process:

$$\ln \tilde{X}^*_{t-1} = (1 - \rho_x) \ln \tilde{X}^* + \rho_x \ln \tilde{X}^*_{t-1} + \sigma_x \epsilon_{x,t} \tag{17}$$

There is no government spending in the model, nor taxation. The government purchases privately held foreign assets with financing either from domestic bond expansions or money creation:

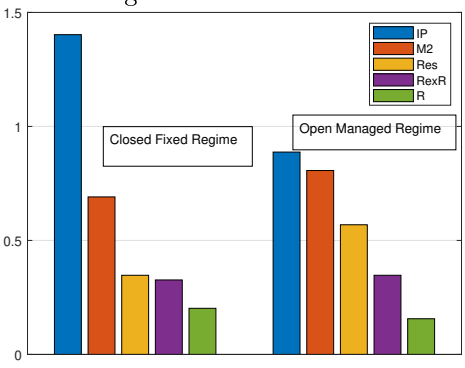
$$e_t(B^*_{g,t} - R^*_{t-1} B^*_{g,t-1}) \leq B^s_t - R_{t-1} B^s_{t-1} + M_t - M_{t-1} \tag{18}$$

3.1.4 Simulation and Replication

We make use of the numerical calibration in Chang et al. (2015), p. 9, Table 1. We compare two of the three versions of the model, one with a fixed exchange rate and a relatively closed capital account, with $\Omega_b = .6$, with a welfare-based Ramsey rule for the interest rate. Then we simulate the more open, flexible regimes, with Ω_b=.2, with a specification of a standard Taylor rule for inflation and output growth, and a welfare-based Ramsey rule for the rate of change of the nominal exchange rate. We designate the first regime the Closed Fixed Regime (CFR) , and the latter, the Open Managed Regime (OMR). In both cases there are two stochastic shocks, one for the foreign interest rate, and the other for the world demand, appearing in equations 15 and 17, respectively.

We note in the model above that the real exchange-rate is a two-edged sword. An appreciation lowers the cost of imported intermediate goods, but it also reduces the world demand for exports. This two-edged effect plays a crucial role for understanding the costs and benefits of moving to a more open capital account with a managed exchange rate, especially in times of dark corners.

Figure 5: Connectedness Measures under Alternative Regimes



4 Simulations of the Model

The next sub-section examines the connectedness properties of the two versions of the model. Then we examine the distributions of key variables as well as their dynamics when the economy falls into a dark corner, under the two regimes of the model. This paper makes use of the same methodology found in Lim and McNelis (2016). They compared the distributions and the dark corner dynamics for evaluating the effectiveness of non-traditional policy rules for the central bank and the fiscal authority, relative to a base case of no-policy intervention. In this paper, we compare the closed fixed regime with the more open managed-exchange rate regime.[4]

4.1 Connectedness properties of the model

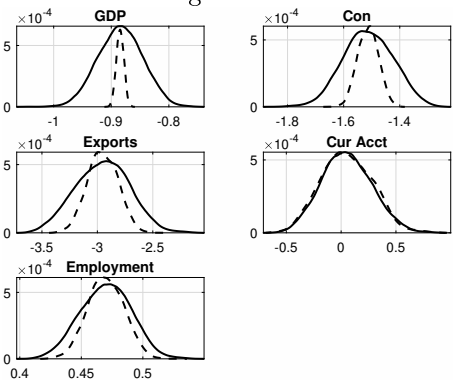
Table 5 presents the outward connectedness of the same variables discussed above.

As with the historical data before and after 2005, the only connectness measure which changes is that of GDP or industrial production. Again, this should not be surprising since the more to the more flexible but managed rate acts as a shock abor for the transmission of shocks to the overall macroeconomic system.

But what stands out in this comparison is how little the other connectedness measures change, under the two regimes. This is also true for the measures based on the actual data. Granted, the change in regime is neither moving from the completely closed economy to a completely open economy, nor from a fixed rate to a market-determined flexible exchange rate. The movement is one from a fixed rate, financially closed model with a Ramsey rule for the interest rate, to a regime with a Taylor rule and a welfare-based Ramsey rule for the managed exchange rate, and a slightly more open capital account. While Chang et al.

[4]In Lim and McNelis (2016), the comparison was to evaluate the effectiveness of using optimal simple rules for quantitative easing and tax rates relative to a base do-nothing regime. This paper evaluated two regimes, in which Ramsey rules, not optimal simple rules, are used for exchange-rate management.

Figure 6: Distributions: National Income Variables



_ _ _ _ _ Closed Fixed Regime
_ _ _ Open Managed Regime

(2015) report a welfare gain, in terms of consumption compensation, from one regime to the other, of .79%, there appears to be little change, despite the increase in welfare, in the connectedness of key macroeconomic variables, using data based on the overall simulation.

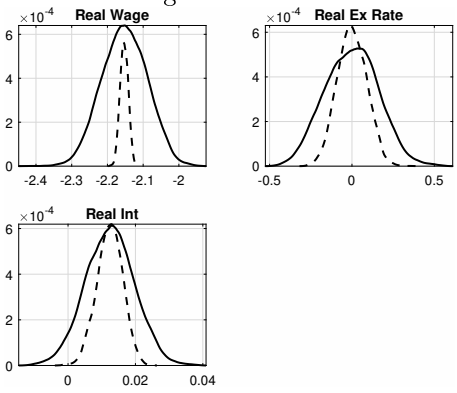
We also note that the statistical properties of the model come from long simulations, with T=20.000, when most of the time, the model is not too far from the stochastic mean. So it should not surprise one that few differences show up between the two regimes, given the change from a fixed, highly restricted capital account to a more flexible less-restricted capital account. The key differences show up when the economy falls into dark corners.

4.2 Distributions: fixed rate vs. welfare-based Ramsey exchange-rate rule

We first examine the distributions of key variables under the two regimes. We first calculate the distributions with Epanechnikov kernel density estimation, for annualized data based on T=20,000 quarters.

Figure 6 pictures the Epanechnikov (1969) densities for GDP, Consumption, Exports, the Current Account/GDP ratio and Employment, under the Fixed/Closed Regime and the relatively Flexible/Open Regime for the exchange rate and the capital account. The results show that the movement towards a more open and flexible system does indeed act as a shock absorber by reducing the volatility of GDP and consumption. However, since exports also depend on exogenous world demand, the effect of the more flexible and open system is more limited. The movement to a more flexible exchange rate has practically no effect on the overall distributions of the current account and employment.

Figure 7: Distributions: Real Wage, Exr. Rate, Interest



_ _ _ _ _ Closed Fixed Regime
_ _ _ Open Managed Regime

Figure 7 pictures the Epanechnikov (1969) kernel density estimates for the real wage, the real exchange rate and the real interest rate under the two regimes. We see that the more open flexible system reduces the volatility of the real wage but has less of an effect on the distributions of the real exchange rate and the real interest rate.

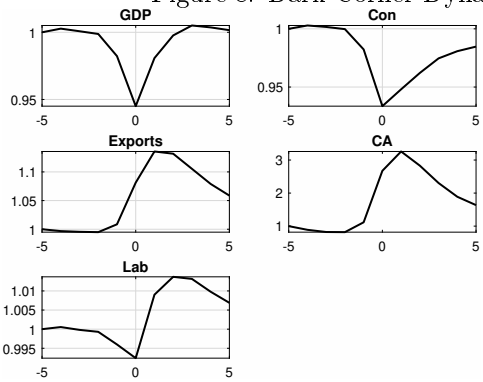
The overall distributions give a broad picture, based on simulations over a very large span of data. These distributions are useful in the sense that they tell is if one regime is more risky relative to another, with risk approximated by the width of the tails at both ends of the curves. However, these distributions are time dimensionless and do not give much information about the relative magnitudes of the before and after changes in key variables during dark corner episodes, when we are on the left side of the distributions.

4.3 Dark corner dynamics: fixed rate vs. welfare-based Ramsey exchange-rate rule

Examining properties of the data based on long simulations, when variables are near to their stochastic mean values most of the time, will show little difference between the regimes. To understand what differences these alternative regimes make, we first examine dark corner dynamics for the benchmark case, when the economy is relatively closed with a fixed nominal exchange rate. Following Mendoza (2010), we simulated the model for T=20,000, and annualized the data. Given that there are two shocks to the economy, one from world demand and the other from the world interest, we isolate periods when the annual GDP growth rate is 1.96 standard deviations below its stochastic mean.

To avoid over-counting of dark corners, we pick the minimum points of GDP growth rates over periods of T = 50, and from these, choose only the periods when the GDP growth rate is less than the critical value. After these periods

Figure 8: Dark Corner Dynamics: National Accounts



Closed Fixed-Exchange Rate Regime

are isolated, at period T_i^*, we then examine the behavior of GDP as well as other key variables. We do this by computing for each variable i, the values from i-5 to i+5. To further understand the relative change of the variables we normalize each of the variables at unity for period i-4. Then we see how the dark corner dynamics change under a more open, flexible exchange-rate regime.

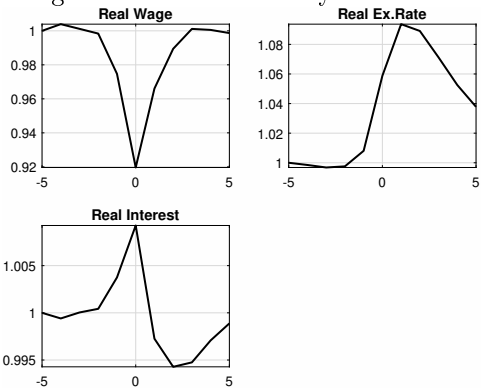
4.3.1 Benchmark closed-fixed rate regime

Figure 8 pictures the dark-corner dynamics of GDP, consumption, exports, the current account and labor (employment) for five years before and five years after the crisis, for the mean values of each variable normalized at unity prior to the crisis, at time t*=-4.

Figure 8 pictures the adjustment of the components of national income. We see that there is a sharp fall in consumption and GDP, and a slight fall in labor (employment), while there is a rise in exports and an increase in the current account. Such dynamics closely resemble those illustrated by Mendoza (2010) during a sudden-stop event for a closed economy. However, in this model, there is no magnification of the crisis due to the collateral constraint becoming binding, leading to Fisherian debt/deflation dynamics. In our setup, the incentive compatibility constraint is always binding.

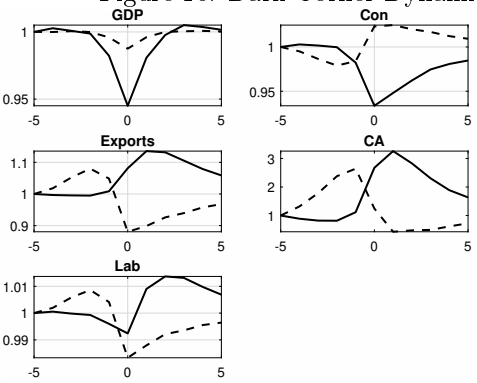
Figure 9 pictures the adjustment of the real wage, the real exchange rate and the real interest rate. We see that there is a sharp drop in the real wage, but a depreciation of the real exchange rate as the real interest rate first rises (due to the fall in prices). The fall in the real wage and the real deprecation explain the increase in exports and the sharp rebound in employment following the onset of the crisis in Figure 8. While there is austerity, the austerity is front end, the employment rate rebounds quickly with the rise in exports and the real depreciation.

Figure 9: Dark Corner Dynamics: Real Wage, Exchange Rate and Interest



Closed Fixed-Exchange Rate Regime

Figure 10: Dark Corner Dynamics: National Income Accounts



_ _ _ _ _ Closed Fixed Regime
_ _ _ Open Managed Regime

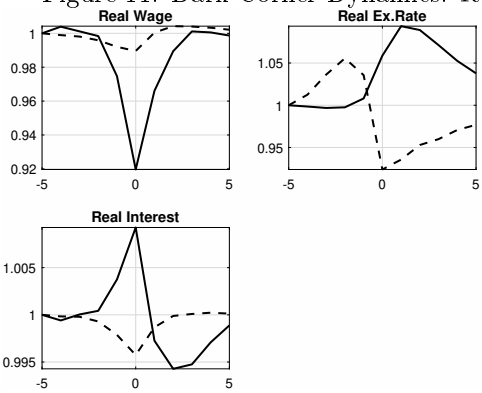
4.3.2 Comparative dynamics: fixed rate vs. welfare-based Ramsey rule

Figure 10 pictures the adjustment of the same national income account components, but under the two regimes. The solid curves represent the base fixed rate, relatively closed financial regime (CF), while the broken curves represent the more flexible managed open regime (OMR).

We see immediately that the more flexible managed exchange-rate regime acts as a shock absorber on GDP, since the fall is considerably dampened. Consumption actually rises as exports and the current account fall at the time of the crisis. Employment also falls and remains low following the onset of the crisis.

Figure 11 pictures the adjustment of the real wage, the real exchange rate

Figure 11: Dark Corner Dynamics: Real Wage, Exchange Rate, Interest



_ _ _ _ _ Closed Fixed Regime
_ _ _ Open Managed Regime

and the real interest rate. As above, the solid curves represent adjustment under the fixed/close regime while the broken curves represent adjustment for the more flexible open regime. We see that the real wage and real interest rates are stabilized, while the real exchange rate appreciates. The appreciation of the real exchange rate, of course, accounts for the fall in exports and the fall in the current account under the more open, flexible regime, while the stability of the real wage accounts for the larger fall in employment and continued stagnation after the onset of the crisis. In a market-determined flexible exchange-rate regime, we would expect the exchange rate to depreciate when there are massive reserve losses and negative shocks to the economy. However, in this case, the exchange rate is managed by a Ramsey rule for optimizing welfare, and minimizing neither foreign- exchange reserve losses nor falls in employment.

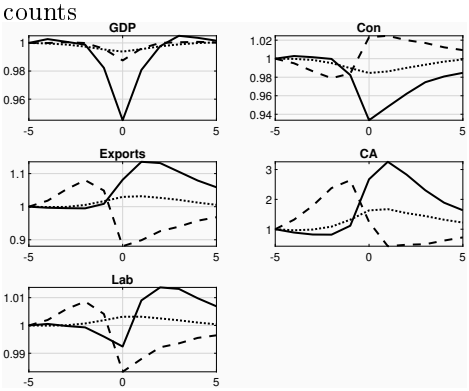
4.4 Dark corners under goods-market liberalization

The results of the previous section show that the switch to the more open managed regime reduces consumption volatility but in dark-corner periods induces a massive loss of reserves and falls in employment. What is the price system became more flexible? Do the dark corner periods become less dark, in terms of reserve losses and unemployment?

Of course, pricing in any economy will never be perfectly competitive and perfectly flexible. But a more market-oriented reform and liberalization in the goods market would imply lower adjustment costs for changing prices and for a fall in the markup factor. We thus approximate a goods-market liberalization by a reduction in the adjustment parameter, Ω_p from 60 to 10, and the markup parameter $\theta_p$from 5 to 10.

We focus on the difference dark corner dynamics between closed fixed regime (CFR) with the initial markup pricing and high adjustment costs for price

Figure 12: Dark Corner Dynamics with Price Reform: National Income Accounts



_ _ _ _ _ Closed Fixed Regime
_ _ _ _ Open Managed Regime
.....Open Managed Reformed Regime

changes ($\Omega_p = 60$,$\theta_p = 10$) with a more open managed regime (OMR) with further goods-market liberalization ($\Omega_p = 10, \theta_p = 20$), which we designate as an Open Manged Reformed Regime (OMRR). We also include the dark-corner dynamics generated under the Closed Fixed Regime.

Figure 12 shows that the price-reform regime (OMRR) greatly reduces the consumption, export,current account, and employment volatility in dark-corner episodes, while delivering similar dynamics for GDP. Given the stabilizing properties of the reformed (but not totally flexible) regime, the results suggest that moving to a more open managed exchange rate regime should go hand-in-hand with good-market price reform.

Figure 13 shows the dark-corner dynamics of the real wage, real exchange rate and the real interest rate. We see that the real exchange rate adjustment is much more stable when the opening and managed exchange-rate system is coupled with price reform. For the real wage and the real interest rate, the adjustment under price reform tracks closely the adjustment under the open managed regime without price reform. The key link, thus, is the ability of the price reform to stabilize the real exchange rate, and with that, stabilize the current account and employment, in periods of recurring negative shocks.

4.5 Decryption policy: current account and real-exchange rate movements

Figure 14 pictures the evolution of the current account/GDP ratio and the real effective exchange rate index for China, compiled by the Bank for International Settlements, for the last two decades. In this formulation an increase is an appreciation, while a fall is a depreciation.

Clearly the world was in a dark corner after the onset of the global financial

Figure 13: Dark Corner Dynamics with Price Reform: Real Wage, Exchange Rate, Interest

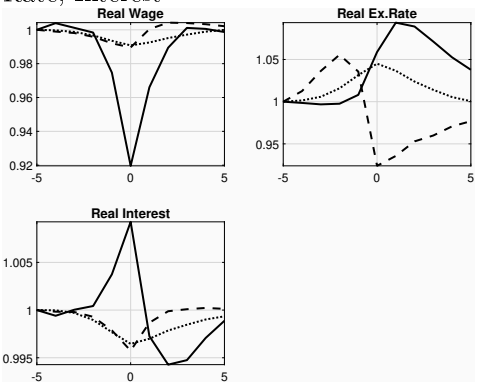
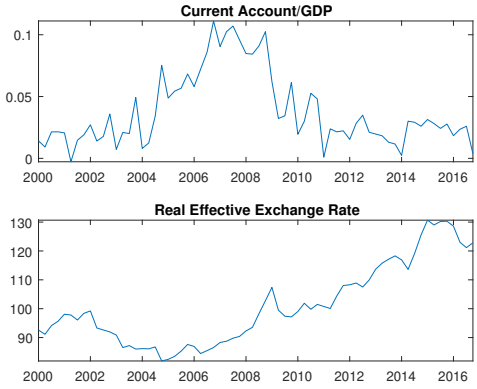


Figure 14: Current Account/GDP Ratio and the Real Effective Exchange Rate



crisis in 2008. Figure 14 shows a steady appreciation of the real exchange rate, with a sharp fall in the current-account/GDP ratio. At this time, the capital account became more open and the exchange-rate moves to a more flexible managed system. This adjustment is consistent with a welfare-based Ramsey rule for managing the exchange rate. [5]

The results of the model simulations indicate that the real appreciation and fall in the current account/GDP ratio would have been greatly mitigated if the Chinese authorities implemented a pricing reform process in tandem with the increased capital account openness and more flexible managed exchange-rate regime.

[5] However as the real exchange rate appreciated and the current-account/GDP ratio declined, relative to historical levels, we also see that a switch in the real exchange rate process took place in 2016, with a mild depreciation and slight improvements in the current account.

5 Conclusion

This paper examined the implications of the switch in the Chinese monetary framework from a fixed and relatively closed financial account to a more open and more flexible one. While the results of the model simulations show that a more flexible exchange rate acts as an effective shock absorber, there are hidden but significant costs, of a welfare-based Ramsey rule, when the economy finds itself in dark corners. The appreciation of the real exchange rate makes imported intermediate goods a desirable substitute for employment, so that there is a large fall in employment, as well as a collapse of exports and a loss in reserves. The results of these simulations indicate that a regime of incomplete liberalization, coupled with greater exchange-rate flexibility, does not bring unambiguous benefits, and lead to greater losses during periods of stagnation, when there are collapses in overall demand.

We do not argue that these outcomes during the dark-corner episodes call for a complete abandonment of welfare targets, but we suggest that a movement toward greater financial-sector openness and greater exchange-rate flexibility should go hand-in-hand with goods-market reform aimed at greater competition and flexibility in pricing.

There experience of China with respect to capital-account liberalization and more flexible exchange-rate management without domestic goods-market reforms calls to mind the proper sequencing of reforms as economies move from more controlled, closed regimes to more open, market-oriented regimes.

Edwards (2009) reviewed the experiences of the Southern Cone countries (Argentina, Chile and Uruguay) in the 1970's, which coupled capital account liberalization and a policy of exchange-rate management, following many decades of regulated and closed markets. These countries soon faced the world demand and world interest rate shocks coming from the Volker stabilization and by 1982, declared debt moratorium. The ensuring decade of the 1980's is termed the lost decade of growth for these countries.[6]

The consensus coming from these experience is that the capital and foreign exchange-markets should have been the last markets to be opened, after policies of inflation stabilization, and domestic goods and labor-market reforms were implemented. Of course, the economy of China in the past two decades is much more dynamic and connected to international markets, than the Southern Cone countries of the 1970's. China also has abundantly more foreign-exchange reserve holdings than these countries. Still, the message is clear, China, like the Southern Cone countries, could have avoided many losses in their respective dark-corner periods, if the domestic goods markets were reformed before or in tandem with the capital account opening.

[6] Edwards (2018) notes that the issue of sequencing of reforms was also an issue raised by Keynes with the US during the Great Depression.

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