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Regional capital flows and economic regimes: Evidence from China

Liuchun Deng^{a,1}, Boqun Wang^{a,b,*}

^a Department of Economics, The Johns Hopkins University, Baltimore, MD 21218, USA ^b School of Economics, Peking University, Beijing 100871, China

HIGHLIGHTS

• Using provincial data from China, we analyze how the pattern of capital flows evolves over different economic regimes.

- We find the "allocation puzzle" that fast-growing provinces experience less capital inflows can be dated back to the pre-reform era.
- After the large-scale economic reform, the "allocation puzzle" becomes much less pronounced.

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1. Introduction

Using Chinese data, this paper investigates how the pattern of capital flows at the provincial level evolves with the transition of economic regimes. According to the standard neoclassical growth theory, fast-growing economies should borrow aggressively to finance their consumption and investment, resulting in current account deficits. However, cross-country studies, Gourinchas et al. (2013) in particular, suggest the "allocation puzzle" of capital²: capital flows out of developing countries with high productivity growth. We take a regional perspective to explore the nexus

ABSTRACT

Using provincial data from China, this paper examines the pattern of capital flows in relation to the transition of economic regimes. We show that fast-growing provinces experienced less capital inflows before the large-scale market reform, contrary to the prediction of the neoclassical growth theory. As China transitioned from the central-planning economy to the market economy, the negative correlation between productivity growth and capital inflows became much less pronounced. From a regional perspective, this finding suggests domestic institutional factors play an important role in shaping the pattern of capital flows.

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between economic regimes and capital flows. Our model-based regression analysis reveals an intriguing picture of the evolving pattern of capital flows across Chinese provinces. The "allocation puzzle" became much less pronounced after the large-scale economic reform since 1978, while continued reform had little impact on further reversing the direction of capital flows.

This paper, to our knowledge, is the first paper that explores the dynamics of the "allocation puzzle" through the lens of regime change. This paper is closely related to a growing body of work that investigates the "allocation puzzle" using regional data. One advantage of taking a regional perspective is that cross-border frictions are less of concerns (Alfaro et al., 2008; Reinhardt et al., 2013). Based on a parsimonious dynamic general equilibrium model, Kalemli-Ozcan et al. (2010) find that inter-state capital flows in US are consistent with the theoretical prediction. In contrast, using Chinese provincial data, Cudré and Samuel (2014) and Cudré and Mathias (2014) document the "allocation puzzle" in the post-reform era and examine the underlying mechanism via a structural framework. They provide compelling evidence that do-





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^{*} Corresponding author at: School of Economics, Peking University, Beijing 100871, China. Tel.: +1 443 540 8013; fax: +1 410 516 7600.

E-mail addresses: ldeng5@jhu.edu (L. Deng), boqunwang@jhu.edu (B. Wang).

¹ Tel.: +1 443 831 9748; fax: +1 410 516 7600.

² Various explanations have been proposed to rationalize the "allocation puzzle" of capital (among many others, Alfaro et al., 2014, Caballero et al., 2008, Jin and Keyu, 2012).

mestic frictions could also give rise to the "allocation puzzle" of capital. Our work complements the existing regional studies by opening up the dimension of economic regimes, thus shedding further light on the importance of institutional factors in explaining the "allocation puzzle".

This paper is also related to the strand of literature that studies (in)efficiency of China's domestic capital allocation. As a seminal work, Boyreau-Debray et al. (2005) point out various pathological issues of the state-dominated financial system and argue that government intervention tends to reinforce capital flows in the "wrong" direction. Li and Cheng (2010) further confirm that capital allocation is not efficient in China, which is suggested by the positive correlation between saving and investment at the provincial level. Armed with more sophisticated econometric tools, Chan et al. (2011); Lai et al. (2013), and Chan et al. (2013) provide systematic evidence that capital mobility, private capital mobility in particular, has been improved over the course of economic reform. Brandt et al. (2013) measure productivity losses due to capital and labor misallocation. They find that misallocation between private firms and state-owned enterprises becomes more prominent since mid-1990s. By estimating a structural model, Song et al. (2014) confirm that capital misallocation results in substantial revenue losses for Chinese firms. Most of the existing work focuses on post-reform era, but our paper explores the pattern of capital flows back to prereform era by employing a model-based but parsimonious framework

The rest of the paper is structured as follows. Section 2 discusses empirical specification and sample construction. Section 3 presents the regression results. Section 4 concludes.

2. Empirical specification and data

Based on a standard neoclassical growth model, Gourinchas et al. (2013) demonstrate that capital inflows of a country depend on productivity catchup, initial capital abundance, population growth, and initial external debt. Their model-based empirical specification is of the form

$$\frac{\Delta D_i}{Y_i^0} = \beta_0 + \beta_1 \pi_i + \beta_2 n_i + \beta_3 \frac{K_i^0}{Y_i^0} + \beta_4 \frac{D_i^0}{Y_i^0} + \varepsilon_i$$

where $\Delta D_i/Y_i^0$ is capital inflows normalized by initial output, π_i is productivity catchup, n_i is population growth, K_i^0/Y_i^0 is normalized initial capital abundance, D_i^0/Y_i^0 is normalized initial debt level, and ε_i is an error term. Parameter β_1 governs the relationship between capital flows and productivity growth. A negative estimate of β_1 implies the "allocation puzzle": fast growing economies see less capital inflows, opposite to the theoretical prediction.

Our sample is an unbalanced panel of 29 provinces from 1963 to 2007. Chongqing and Tibet are dropped because of data availability. The sample period is divided into three economic regimes (Wang et al., 2015): (1) 1963–1977 central-planning regime; (2) 1978–1992 transition regime; (3) 1993–2007 market regime. Two watersheds are "Reform and Opening up" in 1978 and Deng Xiaoping's Southern Tour in 1992.³ Our key departure from the existing empirical work is to open up the regime dimension. We achieve this by introducing two interaction terms into the baseline setting in Gourinchas et al. (2013)

$$\frac{\Delta D_{i,r}}{Y_{i,r}^{0}} = \beta_{0} + \beta_{1}\pi_{i,r} + \gamma_{1}\pi_{i,r} \times R_{i,r}^{Transition} + \gamma_{2}\pi_{i,r} \times R_{i,r}^{Market} + \beta_{2}n_{i,r} + \beta_{3}\frac{K_{i,r}^{0}}{Y_{i,r}^{0}} + \beta_{4}\frac{D_{i,r}^{0}}{Y_{i,r}^{0}} + \varepsilon_{i,r}$$

where $R_{i,r}^{Transition} = 1$ if it is under the transition regime and $R_{i,r}^{Transition} = 0$ otherwise; $R_{i,r}^{Market} = 1$ if it is under the market regime and $R_{i,r}^{Market} = 0$ otherwise; subscript *r* stands for one of the three regimes. If γ_1 or γ_2 substantially differs from zero, we say regime change plays a role in shaping the regional capital flows.

Our provincial data is obtained from China Compendium of Statistics: 1949–2008 published by National Bureau of Statistics. The construction of provincial total factor productivity (TFP henceforth) closely follows Gourinchas et al. (2013). Provincial output (Y_t) is measured by gross regional product. Using annual fixed capital formation data, we construct capital stock (K_t) series by the perpetual inventory method with an annual depreciation rate of 6%. Labor supply (L_t) is measured by provincial total employment. We set capital share α to be 0.3. Therefore, provincial TFP can be calculated⁴ by $Y_t/(K_t^{\alpha}L_t^{1-\alpha})$. Using Hodrick–Prescott filter (smoothing parameter = 6.25), we obtain the trend component of provincial TFP (\overline{A}_t), and the productivity catchup (π) is given by $\overline{A}_T/(\overline{A}_0 \cdot g)$, where g is the country-average TFP growth. Following Cudré and Samuel (2014), regional capital inflows are measured by the cumulative difference between provincial investment and saving over each regime. Initial debt is obtained as cumulative regional capital inflows.⁵ We also create additional variables for robustness check. As a standard practice (Reinhardt et al., 2013), financial development is obtained as the total deposits and loans. Provincial financial friction is proxied by the difference between deposits and loans. As most of the loans are channeled towards state-owned enterprises, the amount of remaining funds in the banking system can be viewed as a proxy of financial friction. Government expenditure is measured by the provincial general budgetary expenditure. All the variables in level terms (capital inflows, initial capital abundance, initial debt, financial development & friction, government expenditure) are normalized by regional gross output. Throughout our data construction, we use province-specific gross regional product implicit deflator.

Table 1 presents summary statistics for three economic regimes. Productivity catchup is adjusted by the country-average, so its mean is always zero.

3. Results

Table 2 reports the results of our regression analysis. Column (1) is our baseline setting. The coefficient of productivity catchup, β_1 , captures the effect of productivity catchup on capital inflows in the central-planning regime. The negative coefficient suggests that fast-growing provinces experienced less capital inflows in the pre-reform era. The estimate is statistically significant and economically sizable. A one-percentage-point increase of productivity catchup yields about 15-percentage-point decrease of normalized capital inflows. Positive coefficients of two interaction terms (γ_1 and γ_2) imply that the "allocation puzzle" became much less evident since 1978. The effect of productivity catchup on capital inflows during transition regime ($\beta_1 + \gamma_1$) and market regime $(\beta_1 + \gamma_2)$ is also reported in the table and close to zero. Interestingly, by comparing γ_1 with γ_2 ,⁶ we find deepened economic reform since 1992 had limited effects on further adjusting the direction of capital flows. Throughout our sample period, capital inflows are estimated to be negatively correlated, or at best

 $^{^{3}\,}$ Our results are not sensitive to the specific timing of these three regimes.

⁴ As a cross-check, we compare our provincial TFP estimates with that in Wu and Yanrui (2009) and they are highly correlated.

⁵ As is pointed out by Cudré and Samuel (2014), estimates of initial debt may not be quite reliable, so we re-estimate our model by excluding initial debt as a covariate and find our results are largely unchanged.

⁶ The difference between these two estimates is statistically insignificant.

Variables	Ν	Mean	Std. Dev.	Min	Max
Central-planning Regime: 1963–1977					
Productivity catchup	24	0.000	0.213	-0.292	0.556
Population growth	29	0.402	0.160	0.012	0.701
Capital inflows	28	-1.246	6.190	-18.347	11.902
Initial capital abundance	25	2.205	1.250	0.280	6.843
Initial debt	25	-0.236	2.108	-5.017	5.005
SOE employment growth	26	0.394	0.270	-0.064	0.951
Financial development	27	0.939	0.317	0.604	2.220
Financial friction	27	-0.115	0.329	-0.559	1.291
Government expenditure	27	0.183	0.146	0.075	0.859
Transition Regime: 1978-1992					
Productivity catchup	28	0.000	0.185	-0.304	0.496
Population growth	29	0.229	0.054	0.130	0.356
Capital inflows	28	0.438	3.929	-7.144	11.023
Initial capital abundance	28	1.889	0.849	0.289	3.923
Initial debt	28	-0.381	2.344	-6.092	5.065
SOE employment growth	28	-0.028	0.105	-0.247	0.179
Financial development	29	1.306	0.315	0.949	2.508
Financial friction	29	-0.138	0.216	-0.500	0.720
Government expenditure	29	0.153	0.061	0.079	0.310
Market Regime: 1993–2008					
Productivity catchup	29	0.000	0.138	-0.188	0.400
Population growth	29	0.137	0.099	0.011	0.469
Capital inflows	29	0.707	4.165	-8.513	10.292
Initial capital abundance	29	1.983	0.593	0.400	3.503
Initial debt	29	0.081	1.612	-3.949	4.384
SOE employment growth	28	-0.521	0.097	-0.746	-0.311
Financial development	29	2.197	0.640	1.398	4.606
Financial friction	29	0.183	0.273	-0.202	1.356
Government expenditure	29	0.133	0.046	0.071	0.261

Table 1Summary statistics.Source: China Compendium of Statistics 1949–2008.

uncorrelated, with productivity catchup. This result echoes earlier findings by Gourinchas et al. (2013) using cross-country data and Cudré and Mathias (2014) using post-reform Chinese data. Columns (2)–(6) summarize a battery of robustness checks. In light of Song et al. (2011), we control for differential access to external financing between private firms and state-owned enterprises by including provincial growth rate of SOE employment. According to Boyreau-Debray et al. (2005), capital allocation is heavily influenced by the government intervention, so we add provincial government expenditure into our regressions as well. Financial indicators are also included to capture heterogeneity of regional financial institutions. Under a wide range of additional controls, main results are largely unchanged.

Our three-regime analysis reveals an interesting dynamic picture of regional capital flows. Consistent with the conventional wisdom, the large-scale market reform substantially alleviated the "allocation puzzle" at its outset. There are two possible channels through which the market reform had a large impact on capital flows. First, the price reform, which was a major component of the market reform, rendered price signals more informative. Compared with the price system under the central-planning economy, creation of a dual-track price system allowed prices to be determined by supply and demand at the margin (Wu et al., 1987). Gradual lifting of price controls reduced distortion, thus adjusting the capital flows more consistent to the prediction of a standard growth model. Second, pre-reform regional capital flows were exclusively determined by the central planning system. As collective and private enterprises were permitted to operate on a market base, decentralization of investment decisions allowed capital flows not to solely follow the preference of the central planner. Market forces started to have influence on the pattern of capital flows.

However, deepened market reform, marked by Deng Xiaoping's 1992 speech in particular, did not yield appreciable effect on further adjusting the direction of capital flows. A complete explanation of the evolving "allocation puzzle" is out of the scope of this paper, but we provide a tentative explanation in line with Song et al. (2011). According to their theory, the negative correlation between productivity growth and capital inflows is driven by a specific channel of financial friction: state-owned enterprises usually have preferential access to credit, while private firms have to rely on their own entrepreneurial saving to invest (Chong et al., 2013). For a province that hosts many private firms, it tends to achieve higher productivity growth accompanied by less capital inflows, because fast-growing private firms have limited access to external financing and thereby saving outgrows investment. In contrast, a province that is dominated by state-owned enterprises tends to enjoy capital inflows because state-owned enterprises are preferentially treated in the credit market. In their cross-province regressions, Song et al. (2011) document a positive correlation between provincial net surplus (capital outflows) and the employment growth of private firms. By adding SOE employment growth into our baseline model, we also find a negative estimated coefficient, but this coefficient is statistically insignificant and not robust under inclusion of a full range of controls. This suggests a complete understanding of the persistent "allocation puzzle" in the postreform era, albeit to a lesser degree, calls for future research.⁷

4. Conclusion

In this paper, we study the dynamic pattern of capital flows under different economic regimes. Though the "allocation puzzle"

⁷ Other than composition of SOE and private firms, Cudré and Mathias (2014) demonstrate that a province's integration into the global market and its sectoral composition also play a significant role in shaping the pattern of capital flows.

	(1)	(2)	(3)	(4)	(5)	(6)
Productivity catchup (β_1)	-15.05***	-14.07***	-10.50***	-15.08***	-14.11***	-7.768*
	(3.674)	(4.258)	(3.676)	(3.781)	(3.653)	(4.349)
Productivity catchup	12.71**	11.89	10.12**	12.71	12.00**	8.955
$\times R^{Transition}(\gamma_1)$	(5.029)	(5.567)	(4.767)	(5.120)	(4.960)	(5.170)
Productivity catchup	13.95	13.09	10.98	14.03	14.33	10.92
$\times R^{Market}(\gamma_2)$	(5.246)	(5.650)	(4.958)	(5.382)	(5.170)	(5.208)
Population growth	-1.006	-0.00513	-3.277	-0.915	1.640	0.343
	(2.554)	(4.015)	(2.500)	(2.601)	(2.800)	(3.927)
Initial capital abundance	2.241	2.329	1.312	2.210	1.926	0.378
	(0.560)	(0.637)	(0.589)	(0.571)	(0.571)	(0.671)
Initial debt	1.393	1.368***	1.106***	1.401	1.427***	1.250
	(0.211)	(0.220)	(0.211)	(0.214)	(0.208)	(0.219)
SOE employment growth		-0.358				1.602
		(1.334)				(1.783)
Government expenditure			31.92			31.42
			(8.744)			(9.354)
Financial friction				-0.118		-4.456
				(1.099)		(1.568)
Financial development					1.104**	3.369***
					(0.529)	(0.935)
Constant	-4.005****	-4.454^{***}	-6.374^{***}	-3.949	-5.677***	-10.39
	(1.138)	(1.404)	(1.240)	(1.159)	(1.394)	(1.674)
$\beta_1 + \gamma_1$	-2.344	-2.184	-0.380	-2.363	-2.109	1.187
	(3.144)	(3.271)	(2.974)	(3.186)	(3.094)	(2.872)
$\beta_1 + \gamma_2$	-1.096	-0.977	0.476	-1.050	0.220	3.153
	(4.213)	(4.365)	(3.951)	(4.270)	(4.187)	(3.810)
Observations	81	78	80	80	80	76
R-squared	0.674	0.668	0.725	0.675	0.694	0.775

Table 2 Regression results.

Dependent variable = capital inflows. Standard errors in parentheses.

p < 0.01.

p < 0.01. p < 0.05.

p < 0.03.p < 0.1.

is estimated to become substantially less pronounced after the initial reform, continued and deepened economic reform seems to have limited effects on reversing the "wrong" direction of capital flows. This finding sheds further light on the nexus between capital flows and institutional factors of the economy.

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