Real Exchange Rate Movements and Markup Dispersion within China's Manufacturing industries

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Outline

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Introduction

- The exchange rate of RMB become more volatile and unpredictable in recent years.
- Existing studies well documented how trading firms respond to exchange rate changes in terms of price, export sales, tfp, variety and markup and so on (Pricing to Market, e.g., Ohno,1990; Knetter,1993; Goldberg &Knetter,1997; Atkeson&Burstein,2008; Gopinath & Itskhoki, 2010;Berman,et al.,2012;Amiti,et al.,2014; Li et al.,2015).
- To my best knowledge, few studies have empirically examined how real exchange rate changes affect intra-industry allocation efficiency.
- we aim to clarify the linkage between real exchange rate movements and allocation efficiency, measured by markup dispersion within an industry

Related Literature

- This paper is highly relevant to development of trade theories in recent years, misallocation measured by TFP dispersion versus Markup dispersion.
- New generation of trade theories, represented by Krugman (1979), Eaton and Kotum (2002), Melitz (2003), Bernard et al. (2003), all assume that firm's markup is invariable and are not suitable for fully understanding the trade welfare generated by pro-competitive effects with the decline of trade cost.
- Misallocations measured by TFP dispersion (Restuccia and Rogerson, 2008; Midrigan and Xu, 2010; Syverson, 2003; Hsieh and Klenow, 2009; Alfaro, et al., 2008; Moll, 2014), only capturing the marginal cost variation, while markup dispersion reflecting both price dispersion and cost dispersion.
- More studies in recent years emphasize the importance of variable markup assumption in trade models to clarify the welfare effects of trade liberalization(Melitz and Ottaviano, 2008; De Blasand Russ, 2010; Edmond, et al., 2011; Peters, 2013; Holmes, et al, 2014; Opp et al. 2014; Feenstra, 2014).

Mechanism

- Movements of real exchange rate affects a trading firm's performance mainly through three channels, i.e. export share, import input and import competition(e.g., Campa & Goldberg, 2001, 2005, 2010; Moxnes, et al., 2012).
- Our theoretical framework also indicate impacts of real exchange rate shocks on markup dispersion associated with above three channels.

  Export channel (The special character of Chinese exporters versus non-exporters,

  Lu, et al.2010;Dai,et al.2016)

  Import input(Amiti,et al.,2014)

  Import competition

- Two More Aspects

I. Intensive & extensive margins through three channels, caused by real exchange rate shocks, extensive margins play even more important role in impacting the markup dispersion of firms (Epifaniand Gancia, 2011; Peters, 2013).

II. Asymmetric response of markup to exchange rate changes (or asymmetric behavior of PTM, Marston, 1990; Ohno, 1990; Kasa, 1992; Kanas, 1997; Knetter, 1994; Koutmos and Martin, 2003; Fang, et al.,2009)

Markup Measurement

- To recover firm-level markup, we adopt the framework of De Loecker and Warzynski(2012). Assuming that the production function of firm i at time t have the following general form,

$$Q_{it} = Q_{it}(L_{it}, K_{it}, M_{it}, \omega_{it}) \quad (1)$$

$$\min_{L,K,M} w_{it}L_{it} + r_{it}K_{it} + s_{it}M_{it} \quad (2)$$

$$\text{Subjected to : } Q_{it}(L_{it}, K_{it}, M_{it}, \omega_{it}) \geq \overline{Q_{it}} \quad (3)$$

- The Lagrangian function of firm's costs on optimization problem can be written as

$$L(L_{it}, K_{it}, M_{it}, \lambda_{it}, \eta_{it}) = w_{it}L_{it} + r_{it}K_{it} + s_{it}M_{it} + \delta_{it}(\overline{Q_{it}} - Q_{it}) \quad (4)$$

Markup Measurement

- The first-order condition for intermediate input demand is

$$\frac{\partial L_{it}}{\partial M_{it}} = s_{it} - \delta_{it}\frac{\partial Q_{it}}{\partial M_{it}} = 0 \qquad (5)$$

$$\frac{\partial Q_{it}}{\partial M_{it}}\frac{M_{it}}{Q_{it}} = \frac{1}{\delta_{it}}\frac{s_{it}M_{it}}{Q_{it}} = \frac{P_{it}}{\delta_{it}}\frac{s_{it}M_{it}}{P_{it}Q_{it}} \qquad (6)$$

$$\mu_{it} = \theta_{it}^{m}/\alpha_{it}^{m} \quad ; \quad \theta_{it}^{m} = \frac{\partial Q_{it}}{\partial M_{it}}\frac{M_{it}}{Q_{it}} \; ; \quad \alpha_{it}^{m} = \frac{s_{it}M_{it}}{P_{it}Q_{it}}$$

$$\begin{aligned} q_{it} = {} & \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_{ll} l_{it}^2 + \beta_{kk} k_{it}^2 + \beta_{mm} m_{it}^2 \\ & + \beta_{lk} l_{it} k_{it} + \beta_{km} k_{it} m_{it} + \beta_{lm} l_{it} m_{it} + \beta_{lkm} l_{it} k_{it} m_{it} \\ & + \omega_{it} + \varepsilon_{it} \end{aligned} \qquad (7)$$

$$\theta_{it}^{m} = \widehat{\beta_m} + 2\widehat{\beta_{mm}} m_{it} + \widehat{\beta_{km}} k_{it} + \widehat{\beta_{lm}} l_{it} + \widehat{\beta_{lkm}} l_{it} k_{it} \qquad (8)$$

Markup Measurement

- Estimation

I. We adopt control function approach developed by Ackerberg, Caves, and Frazier (2015), usually referred to as ACF method, to solve the issue of unobserved productivity shock in production function estimation.

II. We estimated the translog production function separately for each two-digit industry.

III. We combine the ASIF data with the product-level data which contains the information on physical output of firms in ASIF.

IV. We follow De Loecker et al. (2016) to correct omitted input price bias using a control function approach.

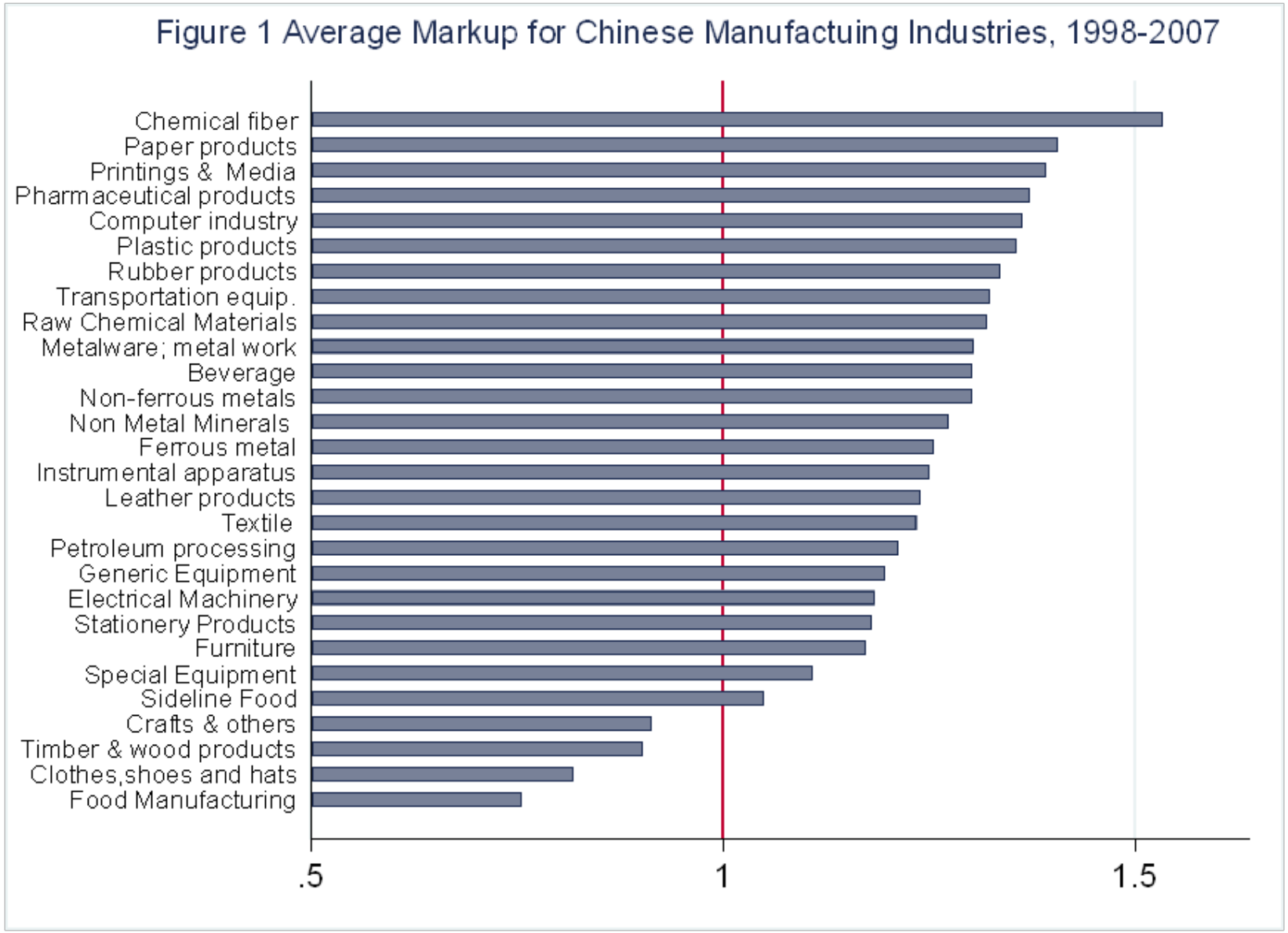
Data

Table 1: Summary Statistics for Key Variables (1998-2007)

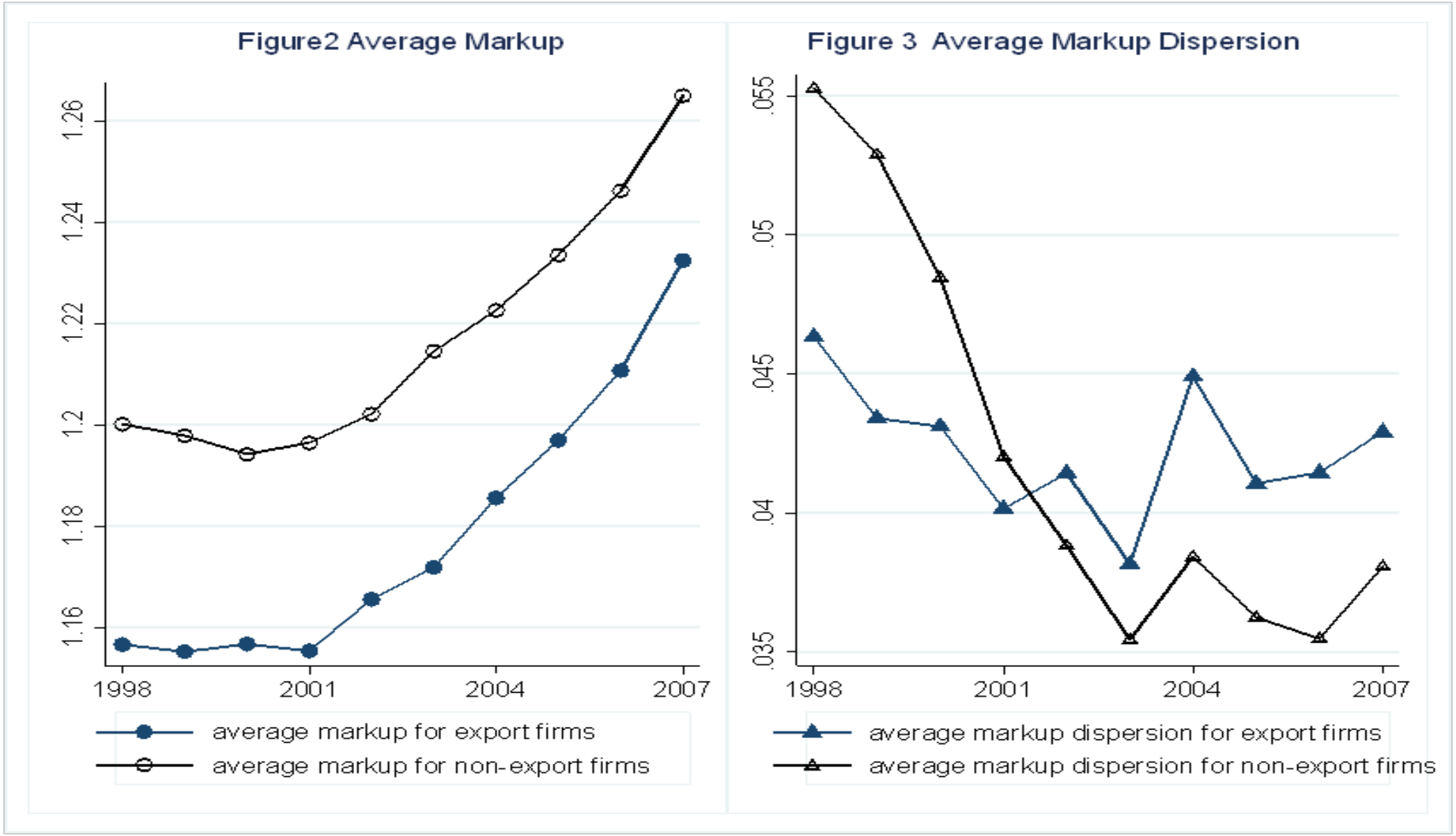
Year	No.of Firms	No.of Export Firms	FIEs Ratio	SOE Ratio	No.of Employment	Export Ratio	Import Input Ratio	Import Penetration Ratio	Profit Ratio
1998	124889	42075	0.086	0.442	411	0.148	——	——	0.024
1999	142630	47470	0.081	0.411	358	0.145	——	0.155	0.032
2000	137618	49563	0.086	0.374	351	0.158	0.088	0.172	0.052
2001	147040	56629	0.088	0.324	327	0.166	0.082	0.168	0.051
2002	158295	62999	0.100	0.282	310	0.174	0.082	0.168	0.053
2003	169146	70011	0.106	0.224	304	0.183	0.084	0.172	0.06
2004	220055	91805	0.121	0.164	253	0.198	0.083	0.173	0.061
2005	240378	96543	0.123	0.143	256	0.179	0.071	0.149	0.060
2006	274389	103148	0.117	0.196	246	0.169	0.063	0.139	0.063
2007	304418	104772	0.119	0.168	237	0.159	0.052	0.123	0.068
Average	191886	72502	0.103	0.273	305	0.168	0.076	0.158	0.052

Note: 1. FIEs has excluded firms from Hong Kong, Macao and Taiwan; 2. The import input ratio is measured by the share of import input over total intermediate inputs plus total wages within industries. 3. Exporters are defined as firms that have export records from 1998 to 2007. FIEs is defined as firms with their proportion of foreign registered assets in total assets (not including HMT capital) is more than 50%. SOEs is defined as firms with their share of state-owned assets in total assets over 50%.

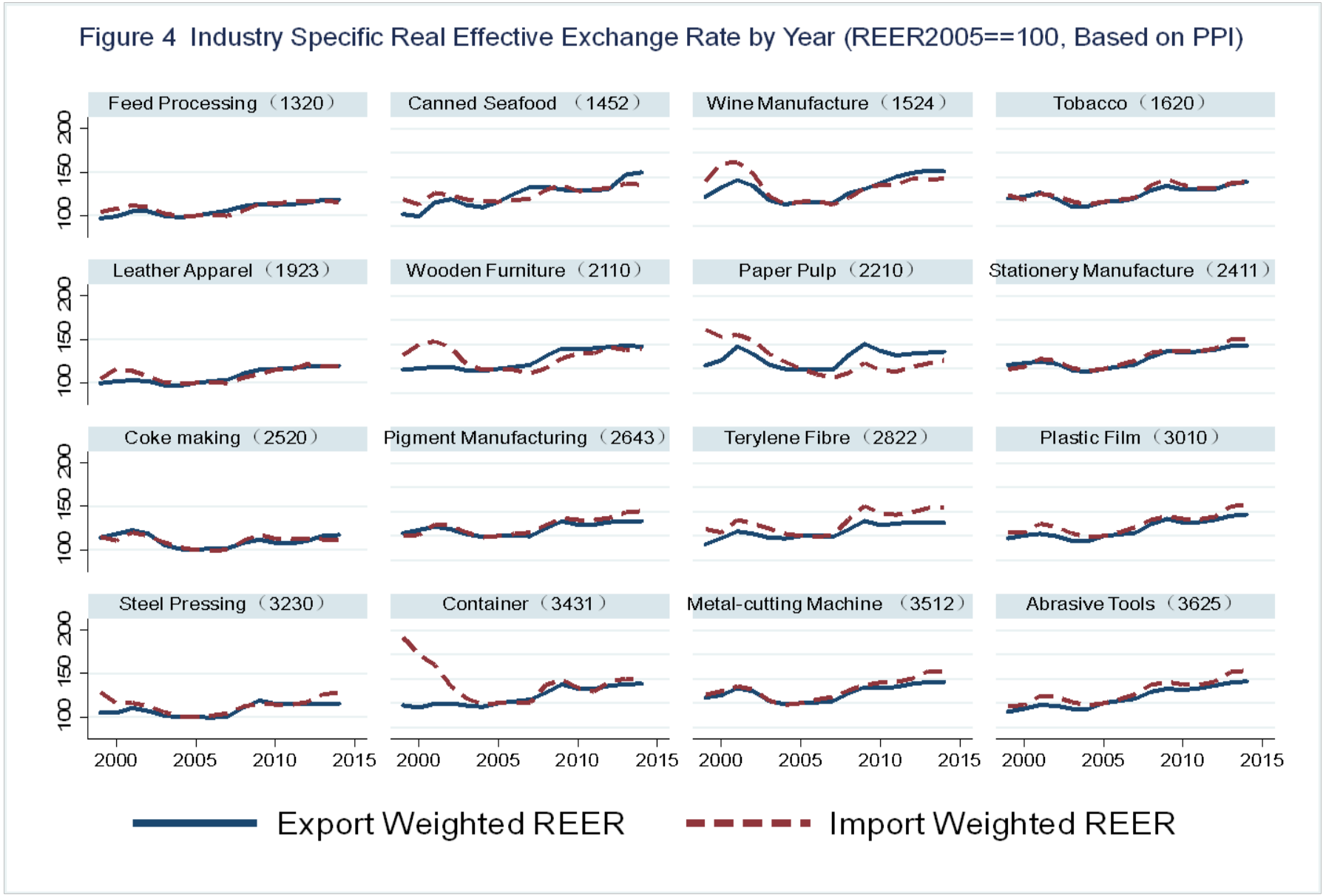
Aver. Markup across Industries



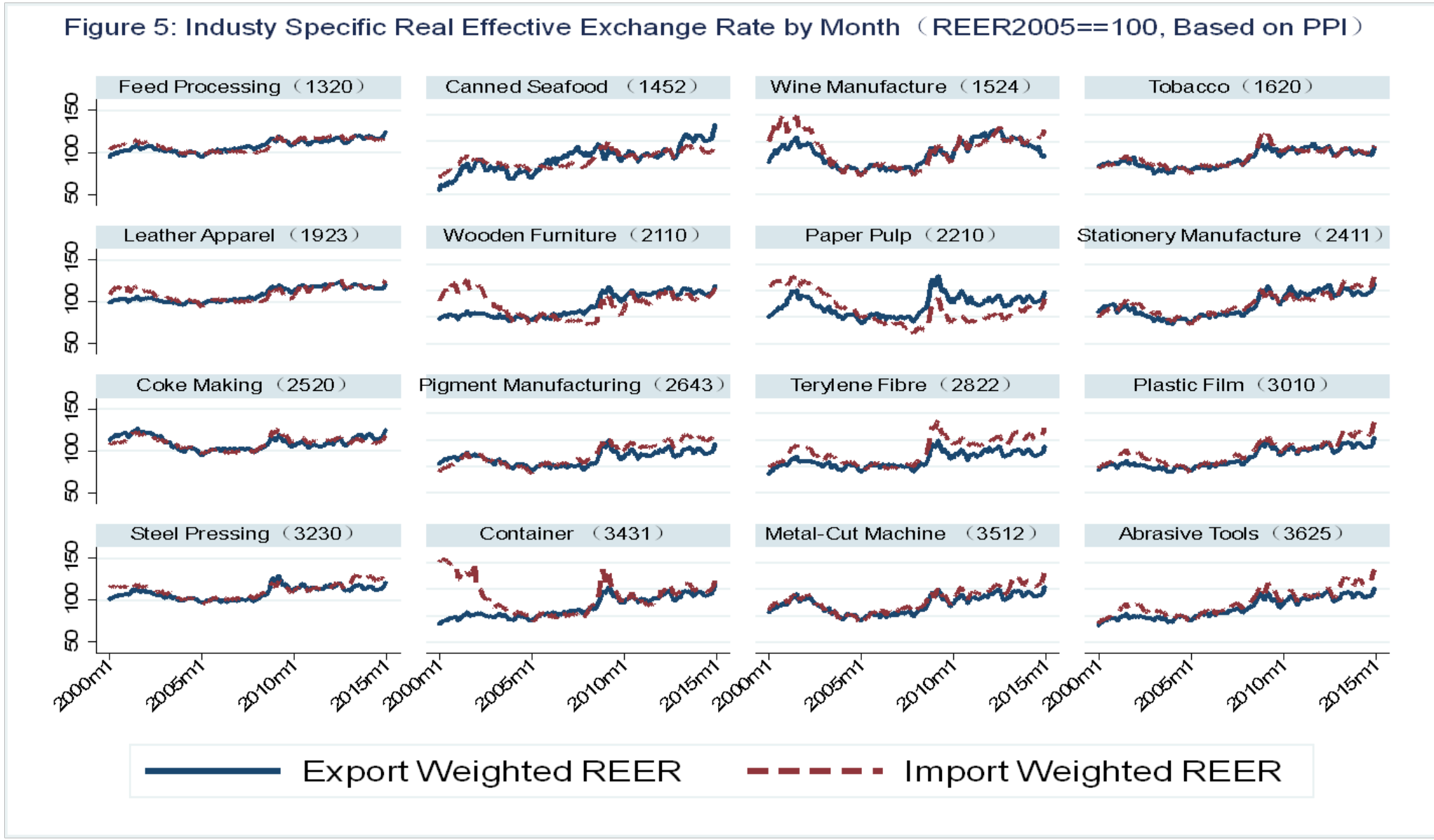
Markup of Exporter versus Non-exporter



Industry Specific Real Exchange Rate



Industry Specific Real Exchange Rate



Baseline Regression Model

- Referring to our theoretical models and previous empirical studies estimating impacts of real exchange rate shocks on employment, investment and export (Klein, et al., 2003; Campa and Goldberg, 2005, 2010; Moser, et al., 2010; Berman, et al, 2012; Li, et al 2015), our baseline regression model is specified,

$$\Delta LnMkpdisp_{it} = \mu + \alpha \Delta LnREER_{it} + \Delta X_{it}\beta + \delta_i + \pi_t + \varepsilon_{it}$$

$$X_{it} = [LnVREER_{it}, SOE_{it}, FDI_{it}, AGE_{it}, LnN_{it}]$$

Baseline Estimation

Table 2 Baseline Estimation (Dependent Var.=$\Delta \ln Theil\_mkp_{it}$)

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln REER_{it}$	-1.322***	-1.536**	-1.657***	-2.190***	-1.984***	-2.320**
	(0.504)	(0.667)	(0.516)	(0.703)	(0.758)	(1.026)
$\Delta \ln VREER_{it}$			-0.049	-0.045	-0.064	-0.050
			(0.053)	(0.059)	(0.057)	(0.070)
Covariates	No	No	No	No	Y	Y
Industry Fixed Effects	No	Y	No	Y	Y	Y
Year Fixed Effccts	Y	Y	Y	Y	Y	Y
Industy*Year	N	N	N	N	N	Y
Observations	3,222	3,222	2,824	2,824	2,802	2,802
R-squared	0.041	0.062	0.048	0.076	0.086	0.152
sector	406	406	406	406	405	405

Robust standard errors in parentheses, clustered in 4-digit industry level *** p<0.01, ** p<0.05, * p<0.1

Robustness Check

Table 3 Robustness Checks using different measurements of markup dispersion

	(1)	(2)	(3)	(4)
Dependent Var.=	$\Delta \ln Gini\_mkp_{it}$	$\Delta \ln Cov\_mkp_{it}$	$\Delta \ln Gini\_mkp_{it}$	$\Delta \ln Cov\_mkp_{it}$
$\Delta \ln REER_{it}$	-0.800***	-1.259***	-0.784**	-1.369**
	(0.243)	(0.434)	(0.365)	(0.624)
$\Delta \ln VREER_{it}$	-0.013	-0.023	-0.016	-0.026
	(0.022)	(0.036)	(0.026)	(0.044)
Covariates	Y	Y	Y	Y
Industry & Year fixed effects	Y	Y	Y	Y
Industry*year	N	N	Y	Y
Observations	2,824	2,824	2,802	2,802
R-squared	0.096	0.069	0.173	0.142
sector	406	406	405	405

Robust standard errors in parentheses, clustered at 4-digit industry level *** p<0.01, ** p<0.05, * p<0.1

Mechanism

Table 5 Mechanism of exchange rate fluctuations (Dependent Var.=$\Delta \ln Theil\_mkp_{it}$)

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln REER_{it}$	-1.829***	-0.940	-1.742**	-2.497**	-1.155	-1.780*
	(0.694)	(0.758)	(0.781)	(1.042)	(1.210)	(1.066)
EXS_{it-1}	-0.143			-0.050		
	(0.191)			(0.589)		
$\Delta \ln REER_{it} * EXS_{it-1}$	1.730			1.052		
	(1.725)			(2.353)		
IMS_{it-1}		-0.001			-1.244*	
		(0.245)			(0.716)	
$\Delta \ln REER_{it} * IMS_{it-1}$		-4.301**			-8.061***	
		(2.077)			(2.939)	
IM_{it-1}			-0.065			-0.158
			(0.435)			(0.803)
$\Delta \ln REER_{it} * IM_{it-1}$			-8.735**			-12.673**
			(3.767)			(5.297)
$\Delta \ln VREER_{it}$				-0.045	-0.019	-0.034
				(0.072)	(0.072)	(0.072)
Covirates	Y	Y	Y	Y	Y	Y
Industry&year fixed effects	Y	Y	Y	Y	Y	Y
Industry*year	N	N	N	Y	Y	Y
Observations	3,222	3,222	2,811	2,802	2,802	2,802
R-squared	0.063	0.065	0.081	0.156	0.165	0.164
Sectors	406	406	405	405	405	405

Robust standard errors in parentheses, clustered at 4-digit industry level.*** p<0.01, ** p<0.05, * p<0.1

Mechanism

Table 6 Real exchange rate changes and markup dispersion of incumbent firms
(Dependent Var.=$\Delta \ln Theil\_mkp_{it}$)

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln REER_{it}$	-0.964	-1.031	-1.213	-1.306	-0.805	-0.997
	(0.614)	(0.916)	(1.072)	(1.011)	(1.535)	(1.485)
$\Delta \ln VREER_{it}$	-0.117**	-0.112*	-0.110*	-0.106	-0.092	-0.093
	(0.058)	(0.065)	(0.065)	(0.067)	(0.084)	(0.085)
EXS_{it-1}			0.064	0.025	0.478	0.450
			(0.354)	(0.354)	(0.793)	(0.795)
$\Delta \ln REER_{it} * EXS_{it-1}$			4.360**	4.204**	6.066**	5.941**
			(2.036)	(2.127)	(2.543)	(2.645)
IMS_{it-1}			-0.279		-0.380	
			(0.269)		(0.549)	
$\Delta \ln REER_{it} * IMS_{it-1}$			-3.367		-4.664	
			(2.565)		(3.060)	
IM_{it-1}				-0.074		-0.321
				(0.497)		(0.870)
$\Delta \ln REER_{it} * IM_{it-1}$				-4.080		-5.244
				(4.027)		(5.299)
covariates	N	N	N	N	Y	Y
Industry&year fixed effects.	Y	Y	Y	Y	Y	Y
Industry*year	N	N	N	N	Y	Y
Observations	2,819	2,819	2,819	2,806	2,819	2,806
R-squared	0.034	0.066	0.070	0.067	0.152	0.150
Sectors	406	406	406	405	406	405

Robust standard errors in parentheses, clustered at 4-digit industry level, *** p<0.01, ** p<0.05, * p<0.1

Mechanism

Table7 Real Exchange Rate and Firm Entry & Exit Rates.

	(1) ΔEX_{it}	(2) ΔEN_{it}	(3) $\Delta EXEN_{it}$	(4) $\Delta EXEN_{it}$	(5) $\Delta EXEN_{it}$	(6) $\Delta EXEN_{it}$
$\Delta \ln REER_{it}$	0.026	0.306*	0.331**	0.436*	0.208	0.351**
	(0.107)	(0.170)	(0.163)	(0.235)	(0.144)	(0.149)
$\Delta \ln VREER_{it}$	0.002	-0.009	-0.007	-0.008	-0.012	-0.008
	(0.006)	(0.007)	(0.008)	(0.009)	(0.009)	(0.009)
EXS_{it-1}				-0.037		
				(0.082)		
$\Delta \ln REER_{it} * EXS_{it-1}$				-0.034		
				(0.352)		
IMS_{it-1}					0.330***	
					(0.066)	
$\Delta \ln REER_{it} * IMS_{it-1}$					0.841**	
					(0.391)	
IM_{it-1}						0.229**
						(0.089)
$\Delta \ln REER_{it} * IM_{it-1}$						1.493*
						(0.770)
Covariates	Y	Y	Y	Y	Y	Y
Industry&Year fixed effects.	Y	Y	Y	Y	Y	Y
Industry*Year	N	N	N	Y	Y	Y
Observations	2,850	2,850	2,850	2,850	2,850	2,831
R-squared	0.645	0.800	0.676	0.740	0.750	0.745
sector	409	409	409	409	409	408

Robust standard errors in parentheses, clustered at 4-digit industry level, *** p<0.01, ** p<0.05, * p<0.1

Asymmetric Effects of REER Movements

Table 6 Asymmetric Effects of Exchange Rate Fluctuations

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta\ln Theil\_mkp_{it}$	$\Delta\ln Gini\_mkp_{it}$	$\Delta\ln Theil\_mkp_{it}$	$\Delta\ln Gini\_mkp_{it}$	$\Delta\ln Theil\_mkp_{it}$	$\Delta\ln Gini\_mkp_{it}$
$\Delta\ln REER_{it}$	-3.594***	-1.314***	-3.409***	-1.239***	-3.641***	-1.339***
	(1.066)	(0.374)	(1.110)	(0.374)	(1.331)	(0.480)
APR_{it}	-0.073	-0.019	-0.065	-0.017	-0.088	-0.022
	(0.050)	(0.018)	(0.052)	(0.019)	(0.072)	(0.026)
$\Delta\ln REER_{it} * APR_{it}$	3.731**	1.277**	3.576**	1.255**	4.033*	1.526*
	(1.552)	(0.553)	(1.577)	(0.539)	(2.280)	(0.819)
$\Delta\ln VREER_{it}$	-0.041	-0.011	-0.058	-0.018	-0.045	-0.013
	(0.060)	(0.023)	(0.058)	(0.022)	(0.072)	(0.027)
Covariates	N	N	Y	Y	Y	Y
Industry&Year dum.	Y	Y	Y	Y	Y	Y
Industry*Year	N	N	N	N	Y	Y
Observations	2,824	2,824	2,802	2,802	2,802	2,802
R-squared	0.079	0.098	0.092	0.118	0.159	0.184
sector	406	406	405	405	405	405

Robust standard errors in parentheses, clustered at 4-digit industry level, *** p<0.01, ** p<0.05, * p<0.1

Conclusion

- Real exchange rate changes generate significant and substantial effects on markup dispersion. A depreciation will greatly increase markup dispersion—increasing misallocation within industries.
- Real exchange rate fluctuation effects on markup dispersion are more significantly associated with import penetration and import inputs rates than with export openness overall.
- Real exchange rate fluctuation effects on markup dispersion can take place both at extensive (import channel) and intensive margins(export channel).
- There is strong evidence of asymmetric effects of exchange rate shocks on allocation efficiency, a depreciation will have much larger effects on misallocation within sectors that those effects on allocation efficiency improvement caused by an appreciation.