EXCHANGE RATES AND MARGINS OF TRADE:
EVIDENCE FROM CHINESE EXPORTERS

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Motivation

- Many regard China's currency policy as one of the main reasons of the looming global imbalance.

- Important policy implications to understand how future appreciation of the RMB (against other major currencies) would weaken China's export performance and growth in general.

- Existing studies find a small exchange rate elasticity of exports in both developed and developing nations ("Exchange Rate Disconnect" puzzle) (Obstfeld and Rogoff, 2000).
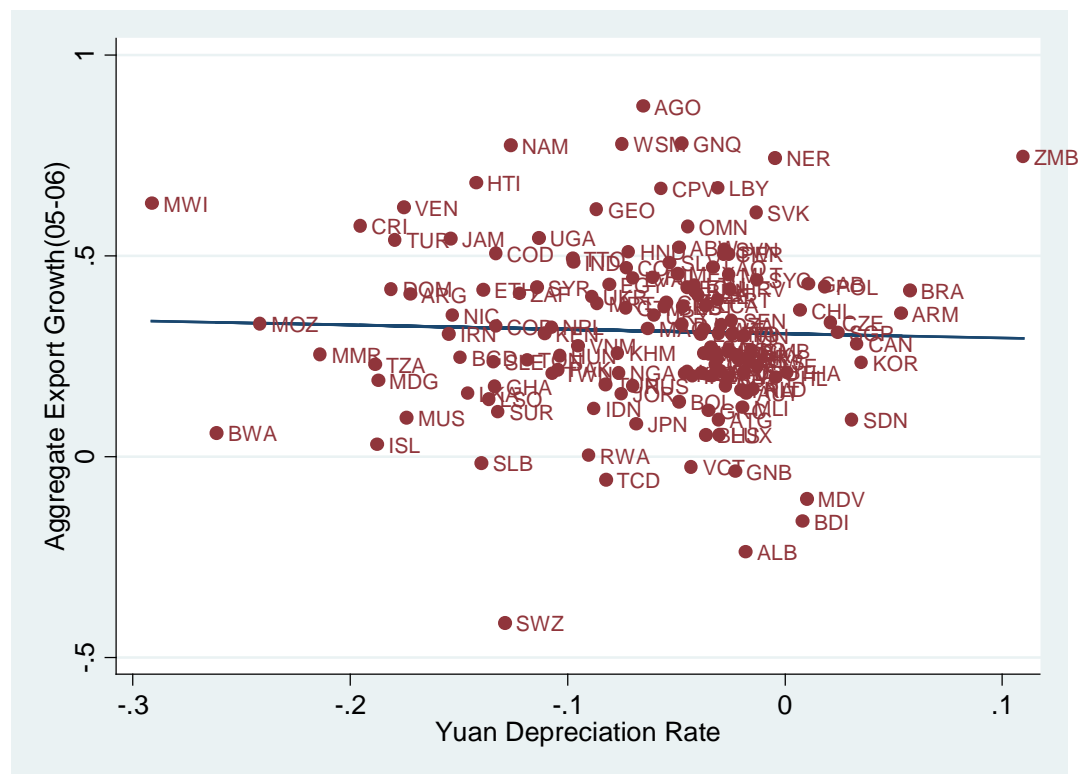
Contribution

- We use transaction-level data (firm-product-country) to investigate Chinese firms' export behavior in response to exchange rate movements over 2000-2006.

- Most existing studies use import prices in developed countries.
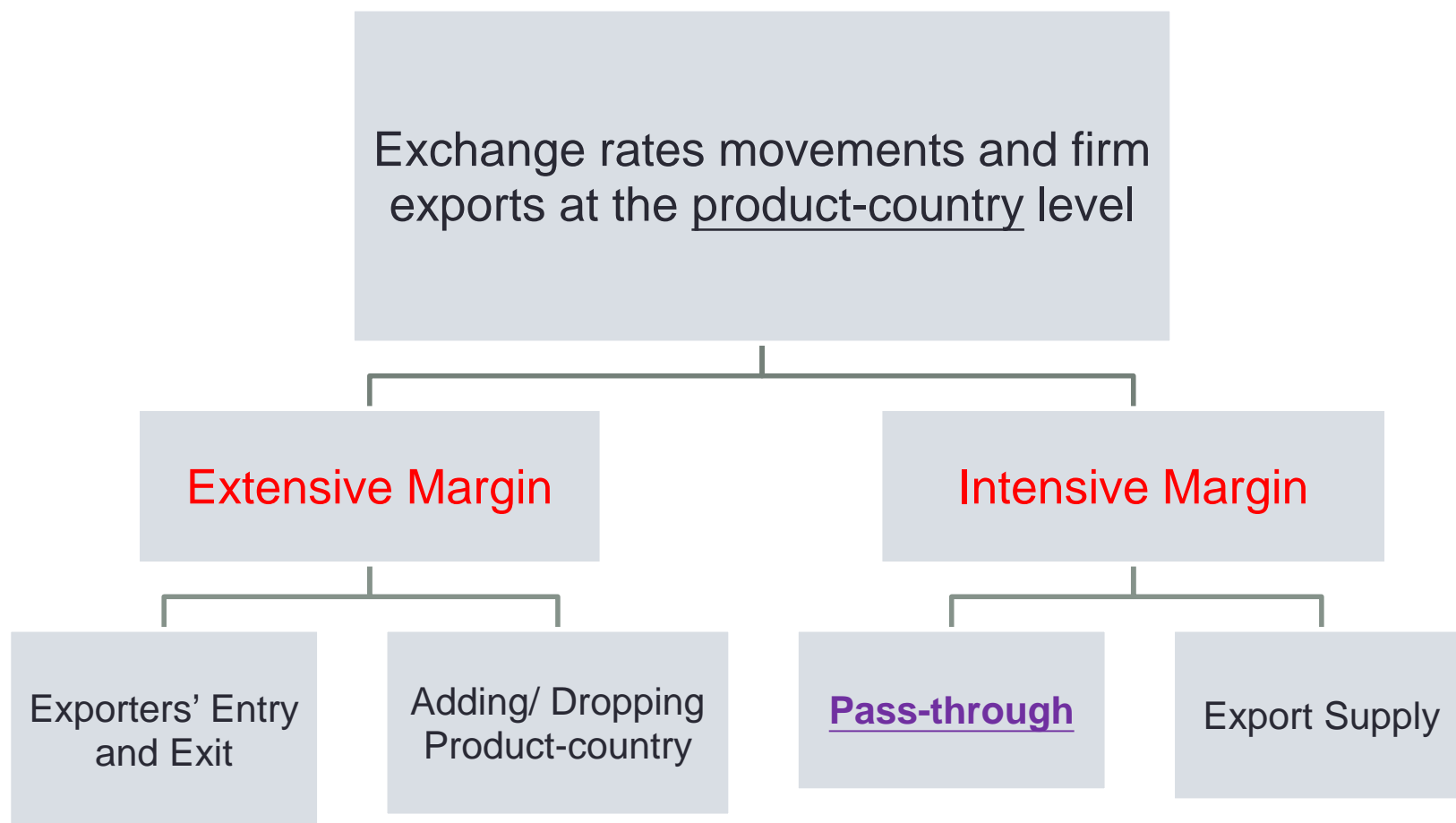
Monthly RMB Exchange Rate Index (2000-2006)

Legend: real effective exchange rate (cpi based) — trade-weighted exchange rate index
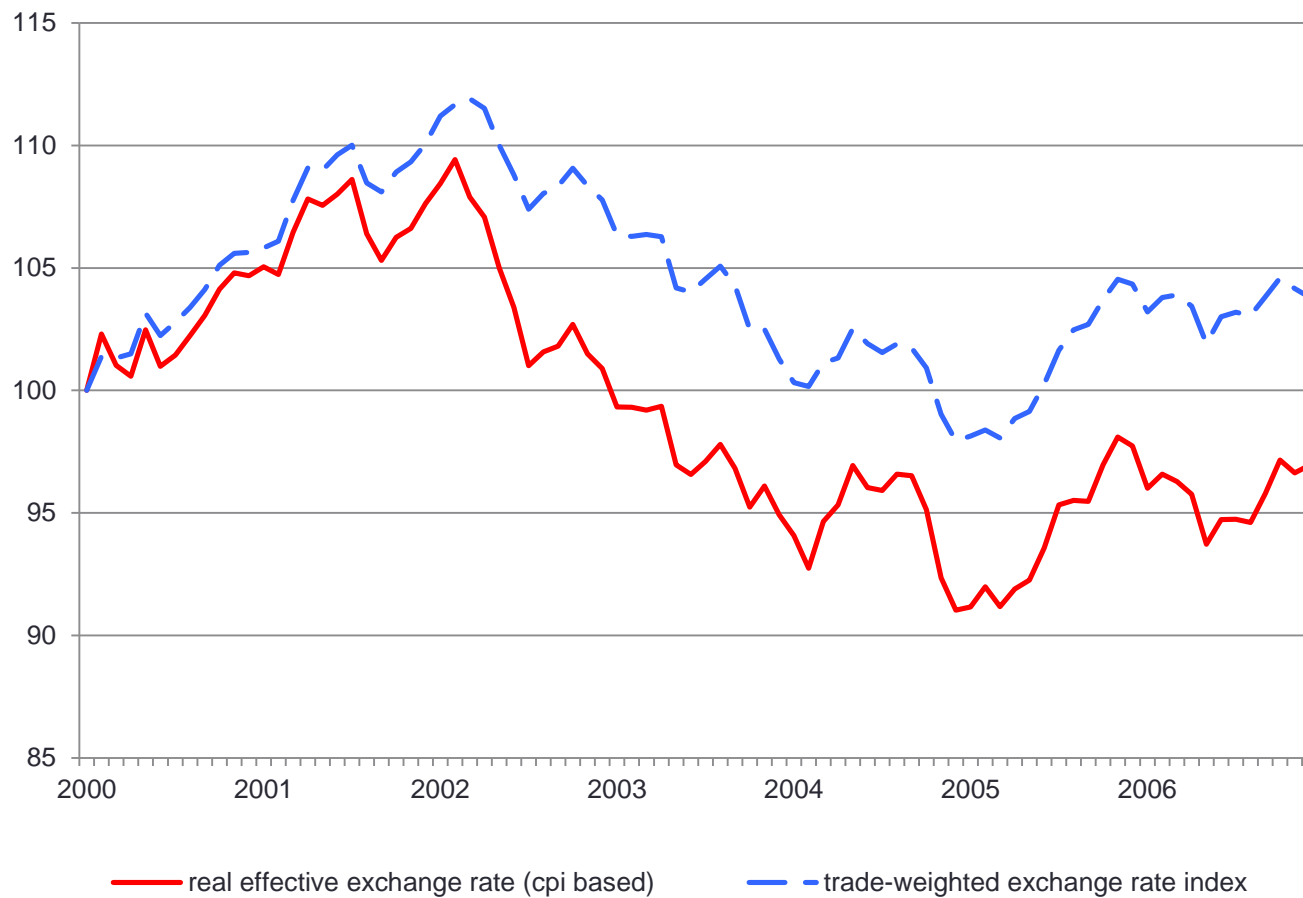
Aggregate export growth and RMB depreciation (2005-2006)

Slope = -0.108 (0.293); N = 146

Road Map

Exchange rates movements and firm exports at the <u>product-country</u> level

Extensive Margin

Intensive Margin

Exporters' Entry and Exit

Adding/ Dropping Product-country

<u>Pass-through</u>

Export Supply

Advantages of using transaction-level data

1. Avoid aggregation bias and omitted variable problems
   - e.g. Blundell and Stoker (2005); Dekle, Jeong and Ryoo, (2009, 2010); Campos (2010)
2. Better identification of the effects of exchange rate shocks across markets within firms, firm-products, or firm-product-year (controlling for unobserved firm-specific supply situations).
3. Examine firm heterogeneous responses to exchange rate shocks (Berman, Martin and Mayer, 2010)

Summary of the findings

1. The extensive margin plays an important role in driving China's exports.

2. Exchange rate movements have statistically significant (but quantitatively small) impacts on exporters' entry and exit, and product-country churning (addition and termination).

3. The elasticity of export supply to exchange shocks is 0.32-0.44 over a year.

4. We find almost zero pass-through (0.08-0.2) into producers' prices in RMB.

Data

- Transaction-level trade dataset at the monthly frequency for China over 2000-2006.
  - e.g. Ahn, Khandelwal and Wei, 2011; Manova and Zhang, 2011; Feenstra, Li and Yu, 2011)
- A product = HS 8-digit
- Data cover the universe of all Chinese importers and exporters between 2000 and 2006.
- Information on
  - Import and export sales and quantities → Unit values;
  - Destination country, ownership type, customs regime;

Summary statistics

	Total Exports (billion USD)	Total Imports (billion USD)	Trade Balance (billion USD)	Total Number of Exporters	Average Export Value per Exporter (million USD)	Number of Products per Exporter		Number of Countries per Exporter	
						Mean	Median	Mean	Median
2000	249.20	225.09	24.11	62,771	3.97	14.4	3	6.8	2
2001	266.10	243.55	22.55	68,072	3.90	14.0	3	7.0	2
2002	325.60	295.17	30.43	78,612	4.14	15.2	3	7.4	3
2003	438.23	412.76	25.47	95,629	4.58	15.4	3	7.6	3
2004	593.32	561.23	32.09	120,589	4.92	15.2	3	7.7	3
2005	761.95	659.95	102.00	144,030	5.29	15.9	4	8.0	3
2006	968.94	791.46	177.48	171,205	5.66	17.0	4	8.3	3

Note: Authors' Calculation based on China transactions data.

Brief Literature Review: the extensive margin of trade

- Dixit (1989) and Krugman and Baldwin (1989) – slow and non-linear response of entry, exit, and export quantity to exchange rate fluctuations.
- Parsley and Wei (1993) find little evidence.
- The extensive margin and international trade dynamics:
  - Melitz (2003)
  - Alessandria and Choi (2007)
  - Chaney (2008)
  - Arkolakis and Muendler (2009)
  - Bernard, Redding and Schott (2010)
  - Gopinath and Neiman (2011)

Brief Literature Review: exchange rate pass-through

- Knetter (1993)
  - Pass-through rates differ across industries.
- Campa and Goldberg (2005)
  - Lower pass-through rates in countries that have lower inflation and less volatile exchange rates.
- Gopinath, Itskhoki and Rigobon (2010)
  - The choice of invoice currency is an important determinant of the pass-through rate.
- Campos (2010)
  - The entrant of the high-price exporters result in low pass-through at the aggregate level, even without price stickiness.
- Fitzgerald and Haller (2010)
  - Full pass-through into exporters' prices when prices are invoiced in destination currency
- Berman, Martin and Mayer (2011)
  - Distribution costs denominated in destination currencies, firms' pricing behavior depends on firm productivity.
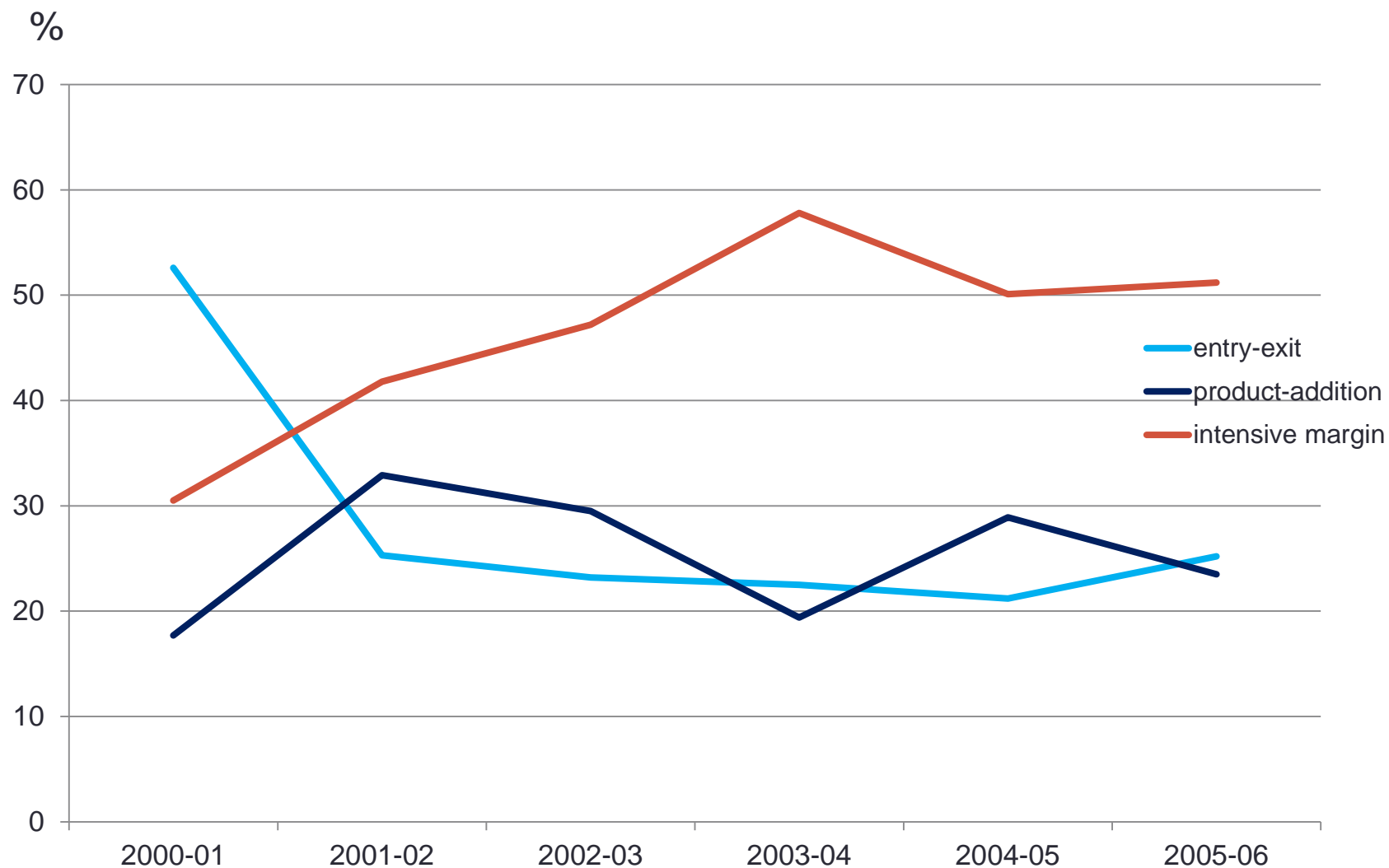
Decomposition of export growth

- Decompose the export growth between *t* and *t* - 1 into growth due to new firms (N), exiting firms (E) and continuing firms (C) (Bernard et al., 2009) :

$$\Delta x_t = \sum_{f \in N} x_{ft} - \sum_{f \in E} x_{ft-1} + \sum_{f \in C} \Delta x_{ft}$$

- For continuing firms, we can further decompose their export growth into that due to adding or dropping country-products, and that due to expansion and contraction of continuing firms:

$$\sum_{f \in C} \Delta x_{ft} = \sum_{j \in A} x_{fjt} - \sum_{j \in D} x_{fjt-1} + \sum_{j \in G} \Delta x_{fjt} + \sum_{j \in S} \Delta x_{fjt}$$

Different margins of China's export growth

%

Legend:
- entry-exit
- product-addition
- intensive margin

Y-axis: 0, 10, 20, 30, 40, 50, 60, 70

X-axis: 2000-01, 2001-02, 2002-03, 2003-04, 2004-05, 2005-06

Real exchange rates

- We define real exchange rate in a standard way:

$$q_c = \frac{E_c P_c}{P}$$

- The log difference in real exchange rate is:

$$\Delta q_{ct} = (\ln E_{ct} - \ln E_{ct-1}) + (\ln P_{ct} - \ln P_{ct-1}) - (\ln P_t - \ln P_{t-1})$$

$\Delta q_{ct} > 0$ implies a real depreciation.

Country-level Evidence

Decomposing aggregate export growth

$$X_c = F_c N_c D_c \overline{X}_c,$$

$$\text{where } D_c = \frac{o_{pfc}}{F_c N_c} \text{ and } \overline{X}_c = \frac{1}{o_{pfc}} \sum_f \sum_p X_{cpf},$$

- F_c = the number of unique exporters to country c;
- N_c = the number of unique HS8 products exported;
- D_c = the density of exports defined as the fraction of firm-product combinations with positive exports;
- X_c = the average value of exports per firm-product exported to c, conditional on exporting.

Correlation between RMB depreciation and export growth (country-level)

	First Differences				
	ln(Total)	ln(Num. Exporters)	ln(Num. Products)	ln(Density)	ln(Avg. Export Value)
ln(RER)	0.162	0.160**	0.131*	-0.066	-0.0633
(> = depreciation)	(1.05)	(2.04)	(1.69)	(-1.01)	(-0.42)
ln(Real GDP)	0.815	0.283	0.319	-0.134	0.347
	(1.53)	(1.26)	(1.36)	(-0.72)	(0.68)
Country Fixed Effects	√	√	√	√	√
Year Fixed Effects	√	√	√	√	√
N	628	628	628	628	628
R_sq	0.194	0.306	0.324	0.397	0.0771

Notes: Standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. t stats in parentheses.

Transaction-level Evidence

Entry, Exit, and REER
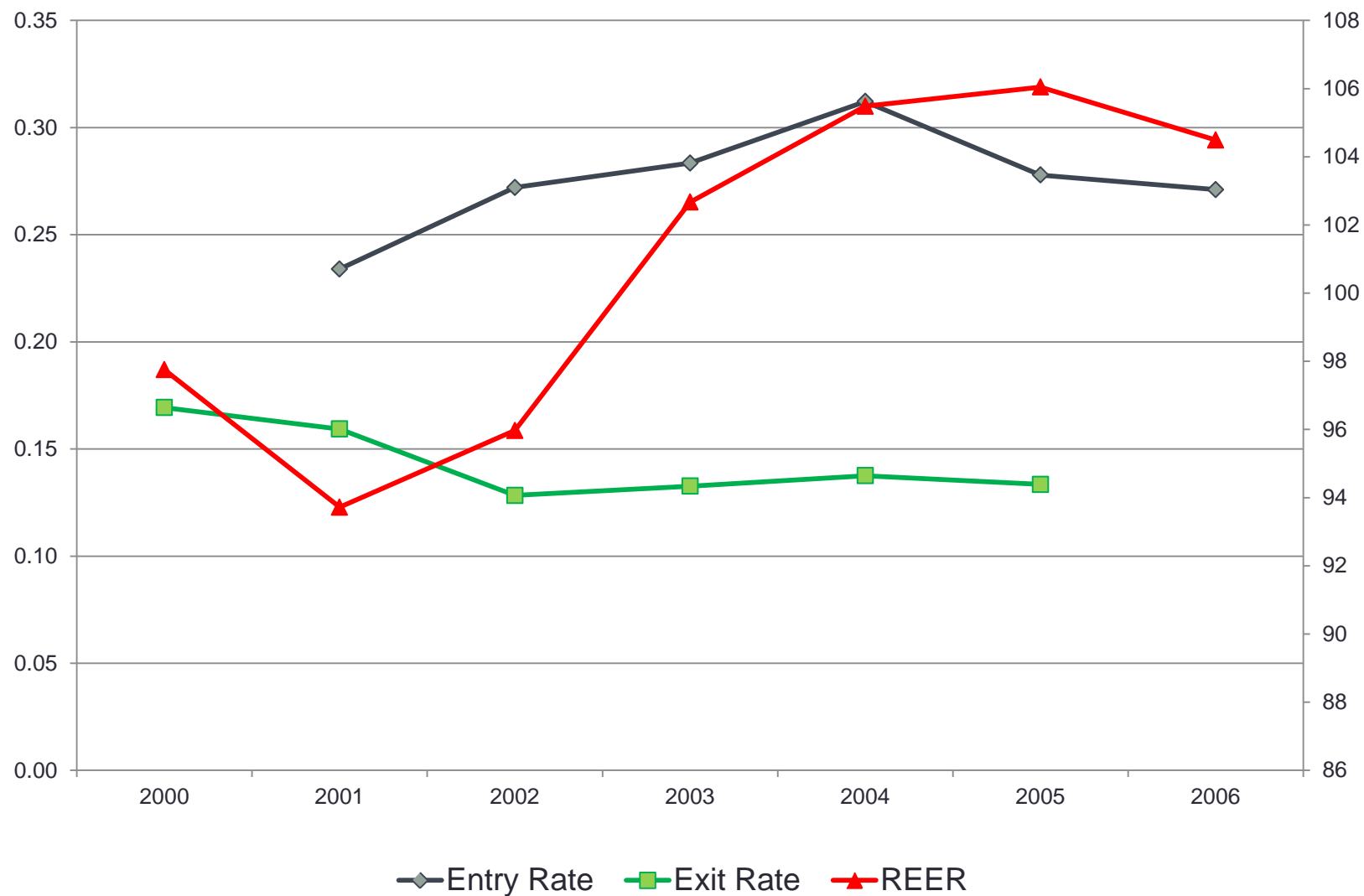
Exporter entry and exits

Exporter exit estimation:

$$\Pr\left(EXIT_{it} = 1\right) = \Phi\left(\beta \Delta q_{it} + Z_{it-1}\gamma + \left[F_t + F_S\right]\right)$$

where q is the firm-specific *weighted average* of the real exchange rates of the countries that the firm exports to; i = firm.

Exporter entry estimation:

$$\Pr\left(ENTRY_{it} = 1\right) = \Phi\left(\beta'\Delta q_{it} + Z_{it}\gamma' + \left[F_t + F_S\right]\right)$$

Exporter Entry and Exit Regressions

Probit	Exit			Entry		
	All firms	Foreign-invested Firms	Domestic Firms	All firms	Foreign-invested Firms	Domestic Firms
ΔRER (> = depreciation)	**-0.125*****	**-0.263*****	**-0.079**	**0.343*****	**0.547*****	**0.167*****
	(0.047)	**(0.079)**	**(0.059)**	**(0.040)**	**(0.059)**	**(0.054)**
ΔDestination's Import	-0.126**	-0.110	-0.151**	0.310***	0.445***	0.361***
	(0.051)	(0.098)	(0.062)	(0.042)	(0.070)	(0.054)
ln(total export)	-0.226***	-0.237***	-0.223***	-0.201***	-0.203***	-0.197***
	(0.005)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Importer dummy	-0.151***	-0.283***	-0.064***	-0.217***	-0.038***	-0.382***
	(0.005)	(0.007)	(0.006)	(0.005)	(0.006)	(0.006)
Trading firm dummy	-0.086***	0.289**	-0.132***	-0.025***	0.035***	-0.036***
	(0.007)	(0.027)	(0.008)	(0.005)	(0.006)	(0.005)
Ownership dummy	√	-	-	√	-	-
Year fixed effects	√	√	√	√	√	√
Marginal effect of ΔExchange Rate	**-0.023*****	**-0.036*****	**-0.018**	**0.098*****	**0.173*****	**0.048*****
	(0.009)	**(0.011)**	**(0.013)**	**(0.011)**	**(0.014)**	**(0.015)**
(Pseudo) R-sq	0.165	0.181	0.168	0.141	0.117	0.135
N	566,767	304,534	262,233	652,612	331,256	321,356

Notes: Standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Product-Country Add and Drop Regressions

Probit	**Drop**			**Add**		
	All firms	Foreign-invested Firms	Domestic Firms	All firms	Foreign-invested Firms	Domestic Firms
ΔRER (>= **depreciation**)	**-0.228***** **(0.002)**	**-0.201***** **(0.004)**	**-0.233***** **(0.002)**	**0.243***** **(0.002)**	**0.279***** **(0.004)**	**0.234***** **(0.002)**
ΔDestination's Imports	√	√	√	√	√	√
ln(total export)	√	√	√	√	√	√
Importer dummy	√	√	√	√	√	√
Trading firm dummy	√	√	√	√	√	√
Ownership dummies	√	-	-	√	-	-
Year fixed effects	√	√	√	√	√	√
Pseudo R-sq	0.106	0.105	0.083	0.095	0.101	0.079
N	15,749,032	3,612,350	12,136,682	17,060,643	4,128,844	12,931,799

Notes: Standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Summary of the extensive margin results

A 10 real depreciation of the RMB:

- 1 percentage-point increase (0.2 ppt decrease) in the probability of entry (exit) within a sector-year.
  - About 4% (1%) of the average entry (exit) rate.
  - Foreign firms appear to be more responsive on this margin.
  - French exporters: Berman et al. (2011) find 2.5 ppt.
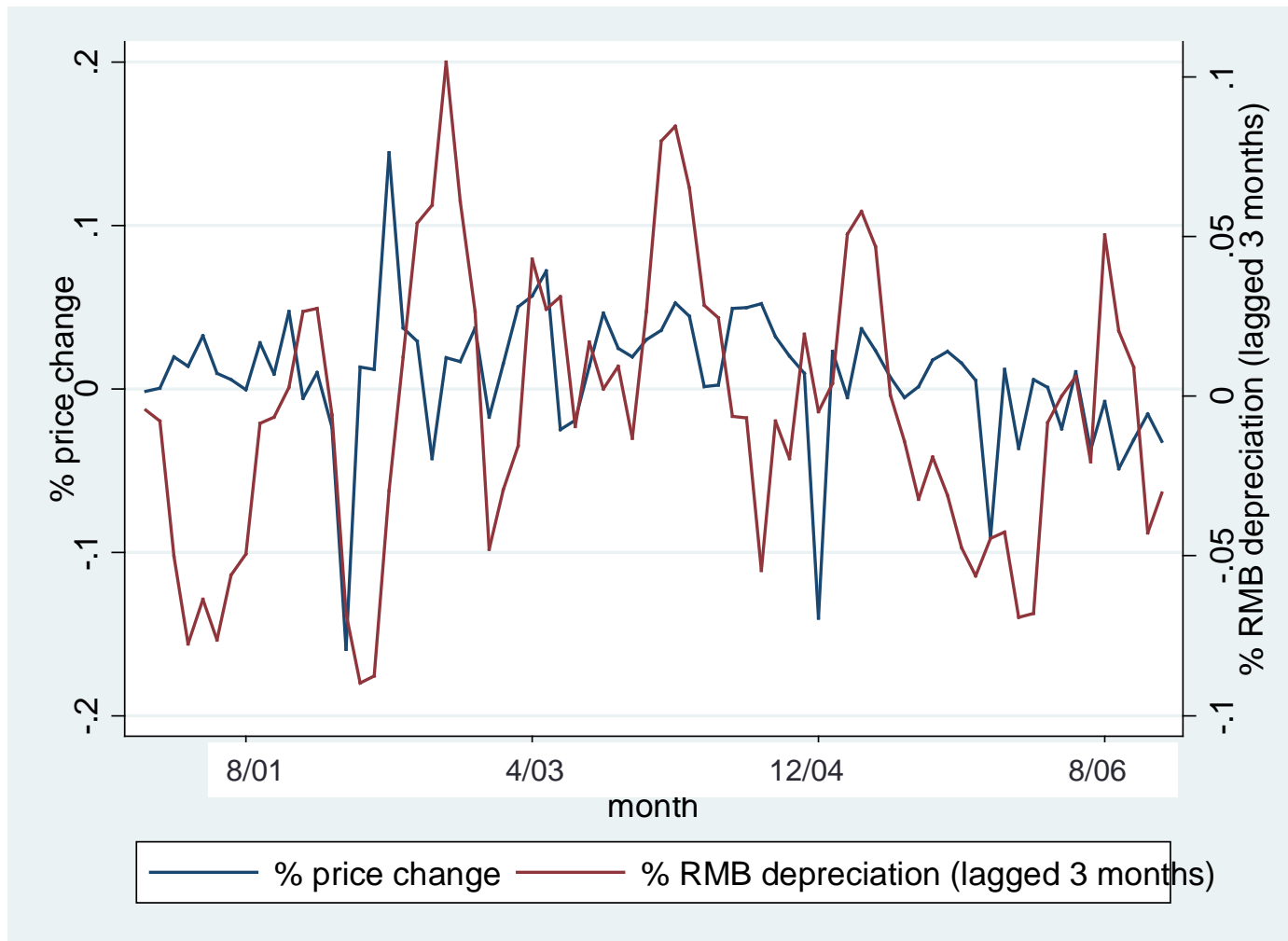 - Irish exporters: Fitzgerald and Haller (2010), similar magnitude.

Exchange Rate Pass-through

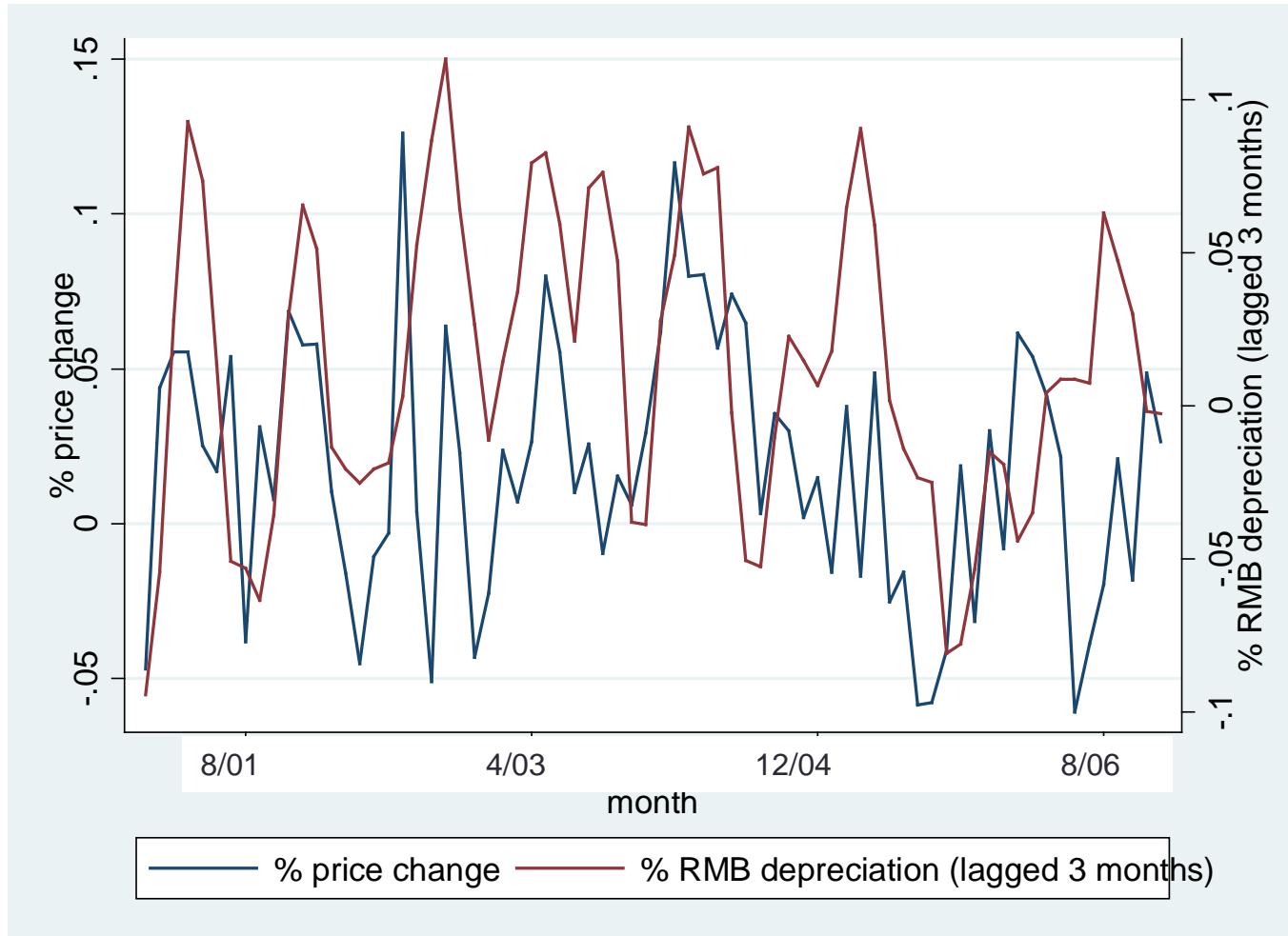# Price Adjustment and RMB Depreciation Textile and textile products; to Germany (2001-06)
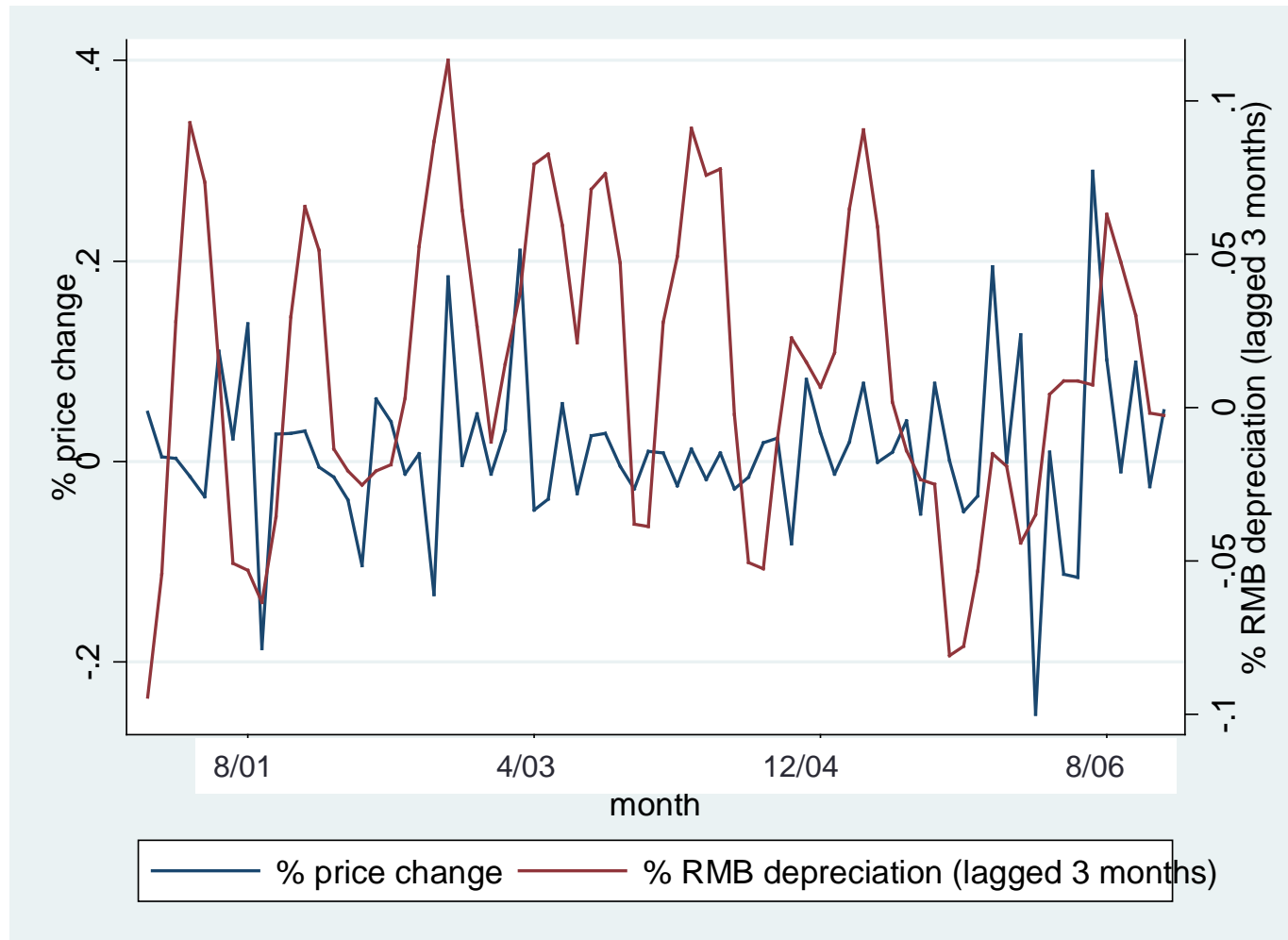
corr = 9.8%

Price Adjustment and RMB Depreciation Textile and textile products; to Japan (2001-06)
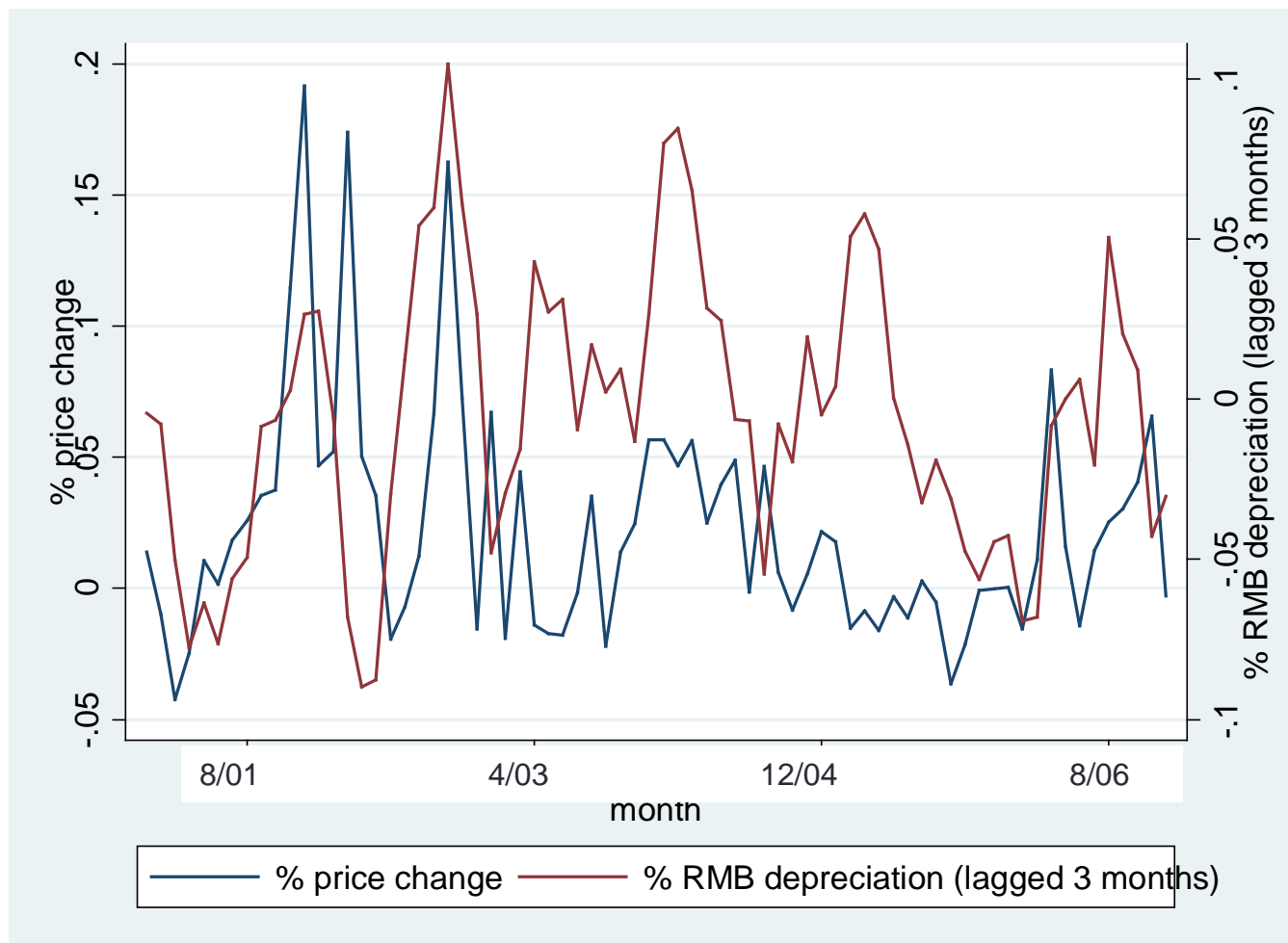

corr = 18.8%

Machinery and mechanical appliances; to Germany (2001-06)

corr = 30.6%

Machinery and mechanical appliances; to Japan (2001-06)

corr = 20.6%

Export supply elasticity

Regression specification:

$$\Delta \ln(x_{ijct}) = \sum_{k=0}^{3} \delta_k \Delta q_{ic(t-k,t-k-3)} + Z_{ct}\lambda$$

$$+ [F_i + F_j + F_c + F_t] + \varepsilon_{ijct}$$

i = firm; j = product; c = country; t = year.

Regression Results for the Intensive Margin

	All	Exclude Intermediaries	Exclude USD-pegged Countries	Euro Only	Ordinary Trade	Processing Trade
Δq t, t-3 (> = depreciation)	0.197*** (0.003)	0.241*** (0.004)	0.244*** (0.006)	0.267*** (0.005)	0.167*** (0.004)	0.197*** (0.003)
Δq t-3, t-6	0.043*** (0.009)	0.067*** (0.012)	0.054*** (0.015)	0.048*** (0.017)	0.051*** (0.013)	0.043*** (0.009)
Δq t-6, t-9	0.105*** (0.031)	0.091*** (0.042)	0.132*** (0.049)	0.107** (0.051)	0.094*** (0.041)	0.105*** (0.031)
Δq t-9, t-12	-0.021 (0.020)	-0.004 (0.024)	-0.042 (0.064)	0.009 (0.051)	-0.047 (0.031)	-0.021 (0.020)
Sum of Coefficients	**0.324**	**0.395**	**0.388**	**0.431**	**0.262**	**0.324**
N	17,789,038	11,701,935	11,323,040	2,923,415	5,796,380	11,992,658

Firm, product, destination, and year fixed effects are always included.
The numbers in parentheses are standard errors. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Exchange rate pass-through

- Regression Specification (Campa and Goldberg, 2005):

$$\Delta \ln(p_{ijct}) = \sum_{k=0}^{3} a_k \Delta E_{ic(t-k,t-k-3)}$$

$$+ \sum_{k=0}^{3} b_k \Delta \ln CPI_{Chn(t-k,t-k-3)} + \sum_{k=0}^{3} c_k \Delta \ln CPI_{c(t-k,t-k-3)}$$

$$+ [F_{ij} + F_c + F_t] + \varepsilon_{ijct}$$

i = firm; j = product; c = country; t = year.

Export Price Pass-Through Regressions

Sample	(1) All	(2) Foreign	(3) SOEs	(4) Private	(5) Processing Trade	(6) Ordinary Trade	(7) Exclude US-Pegged Countries	(8) Exclude US	(9) Exclude Euro Zone	(10) Euro Zone
$\Delta E(t, t-3)$	0.0552***	0.0614***	0.107***	-0.0233**	0.0329***	0.0636***	0.0440***	0.0469***	0.0563***	0.0608***
	(13.77)	(11.67)	(10.92)	(-2.88)	(5.54)	(12.04)	(10.46)	(11.68)	(12.38)	(6.09)
$\Delta E(t-3, t-6)$	0.0619***	0.0702***	0.0499***	0.0529***	0.0737***	0.0574***	0.0706***	0.0596***	0.0655***	0.0729***
	(16.36)	(14.09)	(5.26)	(7.16)	(13.04)	(11.56)	(17.92)	(15.80)	(14.99)	(8.50)
$\Delta E(t-6, t-9)$	0.0103**	-0.00146	0.0120	0.0352***	-0.00972*	0.0231***	0.00560	0.0116**	-0.00198	0.00144
	(2.80)	(-0.29)	(1.36)	(4.91)	(-1.72)	(4.84)	(1.45)	(3.16)	(-0.47)	(0.18)
$\Delta E(t-9, t-12)$	-0.0313***	-0.0460***	0.0492***	-0.0691***	-0.0343***	-0.0318***	-0.0311***	-0.0274***	-0.0200***	-0.0314***
	(-8.62)	(-9.49)	(5.40)	(-10.12)	(-6.18)	(-6.76)	(-8.20)	(-7.55)	(-4.77)	(-3.89)
N	16641558	8627668	3183848	4775984	5455794	11185764	12245108	13885823	14332621	2308937
Sum of Coeff.	**0.097**	**0.080**	**0.218**	**-0.002**	**0.067**	**0.111**	**0.090**	**0.088**	**0.102**	**0.105**

Firm-product, country, and year fixed effects are always included.

The numbers in parentheses are t stats. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Export pass-through by product category

Category Name	HS Code	PT into RMB Price
Live animals; animal products	01–05	0.071***
Vegetable products	06–14	0.073***
Animal or vegetable fats and oils	15	-0.012***
Prepared foodstuffs	16–24	0.034***
Mineral products	25–27	0.004***
Products of the chemical/allied industries	28–38	0.082***
Plastics and rubber articles	39–40	0.081***
Raw hides and skins, leather, etc.	41–43	0.089**
Wood and articles of wood	44–46	-0.004***
Pulp of wood/other fibrous cellulosic material	47–49	0.065***
Textile and textile articles	50–63	0.056***
Footwear, headgear, etc.	64–67	0.057***
Miscellaneous manufactured articles	68–70	0.003***
Precious or semiprecious stones, etc.	71	0.074***
Base metals and articles of base metals	72–83	0.078***
Machinery and mechanical appliances, etc.	84–85	0.066***
Vehicles, aircraft, etc.	86–89	0.063***
Optical, photographic, etc.	90–92	0.087***
Arms and ammunition	93	-0.121
Articles of stone, plaster, etc.	94–96	0.032***
Works of art	97-99	0.031***

Summary of the intensive margin results

RER elasticity of exports
- Chinese exporters: 0.32-0.43
- French exporters: 0.5 (Berman et al., 2011).

Pass-through to producers' prices in domestic currency
- Chinese exporter-product: 6-7%
- Sharp contrast to the existing findings of "pricing to market" (Campa and Goldberg, 2005; Frankel, Parsley, and Wei, 2005)
- French exporter-product: 17% (Berman et al., 2011).

Exchange rate exposure

- Bernard (2008): Based on survey data of 250 apparel and textile exporters in 2007 (after our sample, and the RMB unpegged with the dollar).

- Understanding direct exposure:

$$\pi = (p/E)q - wl$$

- On average a 10-percent appreciation of the RMB against the dollar would reduce operating profits by 5.4 percent if the RMB prices (p) are left unchanged.

Explanations for low pass-through to RMB export prices

- US dollar as invoice currency;

- Before and after July 2005;

- Asymmetry between depreciation and appreciation;

- Chinese exporters are unaware of their indirect currency risk to currencies other than the dollar (Bernard, 2008).

Concluding Remarks

1. Exchange rate movements have significant impact on the *extensive margins* of exports. A real exchange rate appreciation

    - ↑ (↓) the probability of a firm's exiting from (entering) exporting;
    - ↑ (↓) the probability of dropping an existing (adding a new product) by an existing exporter.

2. Near-zero exchange rate PT to Chinese exporters' domestic-currency prices (contrasts with the pricing-to-market phenomenon)

3. The RER elasticity of exports is estimated to be around 0.3-0.4 in a year, with most of the adjustment happening in the first six months.

Future Research

- Examine the characteristics of new exporters (Ma, Tang and Yue, 2011);
- Understand how these new exporters affect the pass-through rates;
- Heterogeneous responses
- Focus on how the pass-through rate change after the unpeg in July 2005 (17 months until the end of 2006).