

The Impact of Exchange Rate Volatility on Exports and Export Prices of U.S. Forest Products

Sijia Zhang and Joseph Buongiorno

Department of Forest and Wildlife Ecology
University of Wisconsin-Madison

Background

- Exchange rate fluctuation influences the volume and prices of international trade of forest products.
- No consensus about the effect of the volatility on trade.
- Many studies on effect of exchange rate; few on exchange rate volatility effect (Sun and Zhang (2003))

Overview

- Theory
- Method
- Results

Theory

Negative Effects

- Higher exchange-rate risk lowers the expected revenue from exporting.
- Risk-averse trader favors the domestic market.

Positive Effects

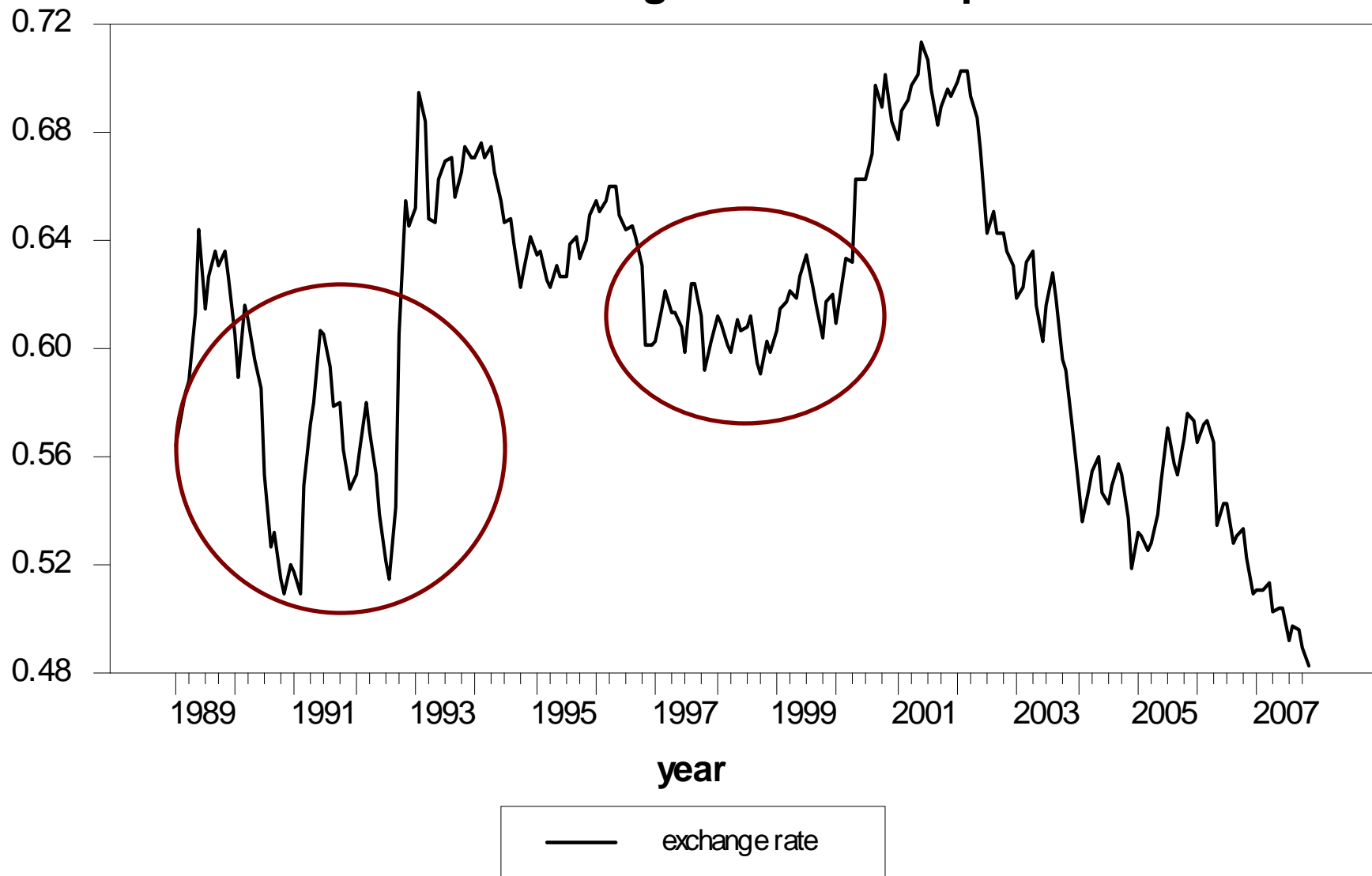
- Exports can be considered options held by firms.
- Value of the option to export can rise with volatility increases.

Ambiguous or Negligible

- The total effect on trade is determined by the signs of the aggregate net foreign currency exposure and the aggregate measure of risk aversion
- In the presence of well-developed forward exchange market, exchange uncertainty only changes the forward position cover of a firm, not production or exports.

Method

U.S. dollar exchange rate to British pound



How to Measure

- Use conditional variance as a proxy of volatility
- Conditional variance is time-dependent

Generalized Autoregressive Conditional Heteroskedasticity Model GARCH (1, 1)

$$\Delta \ln s_t = c \sum_{i=1}^m \Delta \ln s_{t-i} + \varepsilon_{st}$$

$$\varepsilon_{st} \mid \varepsilon_{st-1} \sim N(0, h_t)$$

$$h_t = \gamma_0 + \gamma_1 \varepsilon_{st-1}^2 + \gamma_2 h_{t-1}$$

Autoregressive Distributed Lag (ADL) Model

$$\ln p_t = a_0 + \sum_{i=0}^m d_{pi} h_{t-i} + \sum_{i=1}^m a_{pi} \ln p_{t-i} + \varepsilon_{pt}$$

$$\ln x_t = b_0 + \sum_{i=0}^m d_{xi} h_{t-i} + \sum_{i=1}^m b_{xi} \ln x_{t-i} + \varepsilon_{xt}$$

Data

- U.S exports and export prices:
 - eleven countries:
 - Belgium
 - Canada
 - France
 - Germany
 - Italy
 - Japan
 - Korea
 - Mexico
 - the Netherlands
 - Spain
 - U.K.
 - Seven products (SITC-4):
 - Industrial round wood
 - Sawn wood
 - Plywood & veneer
 - Chemical and semi-chemical wood pulp
 - Newsprint
 - Printing and writing paper
 - Other paper and paperboard
- U.S. nominal exchange rate for these countries' currency

Results

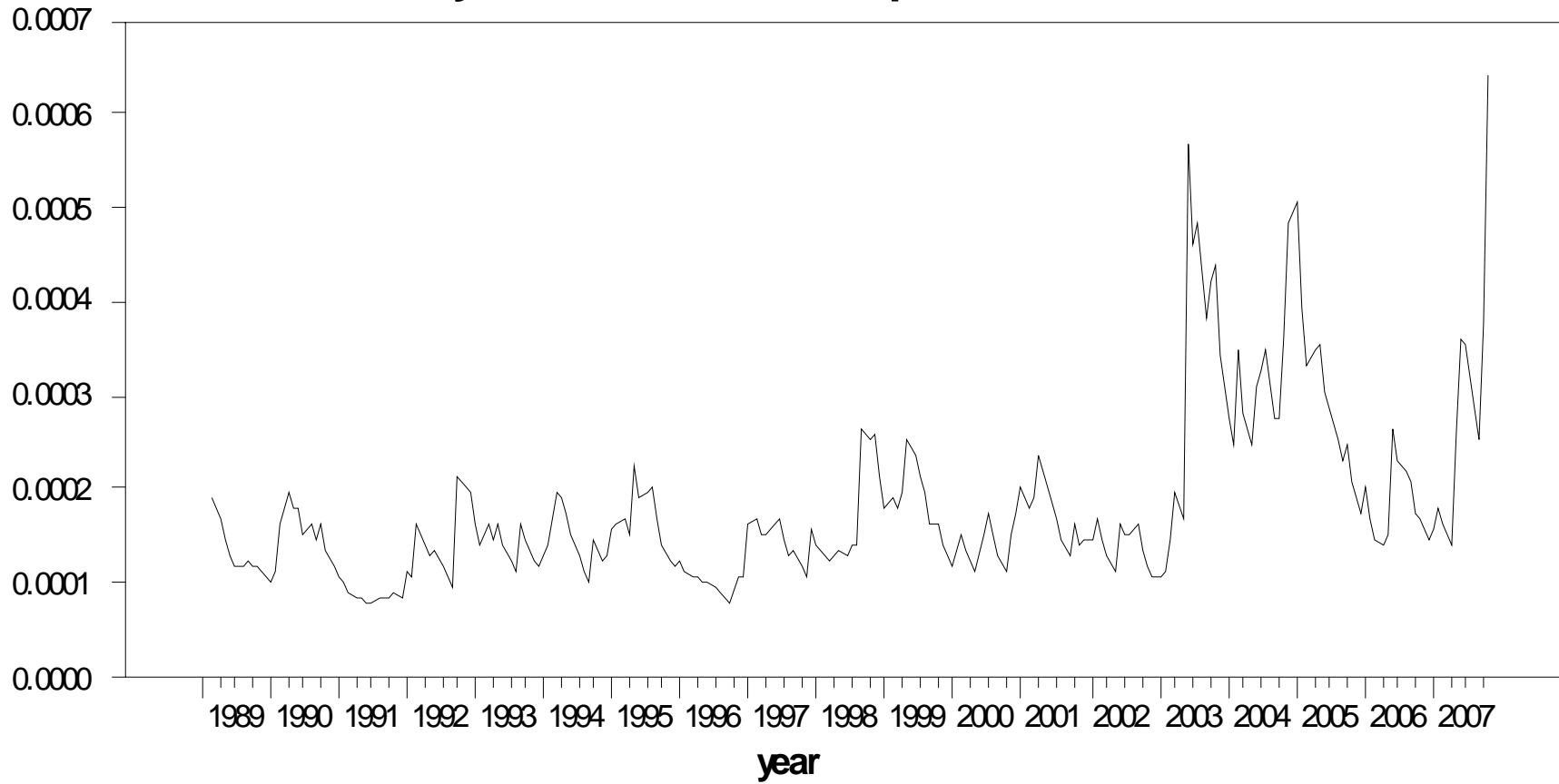
Results

- Negative effect:
 - Italy
 - Japan
 - Korea. R.
 - Mexico
 - the Netherlands
 - Spain and U.K
- Positive effect:
 - Canada
- No effect:
 - Belgium
 - France
 - Germany

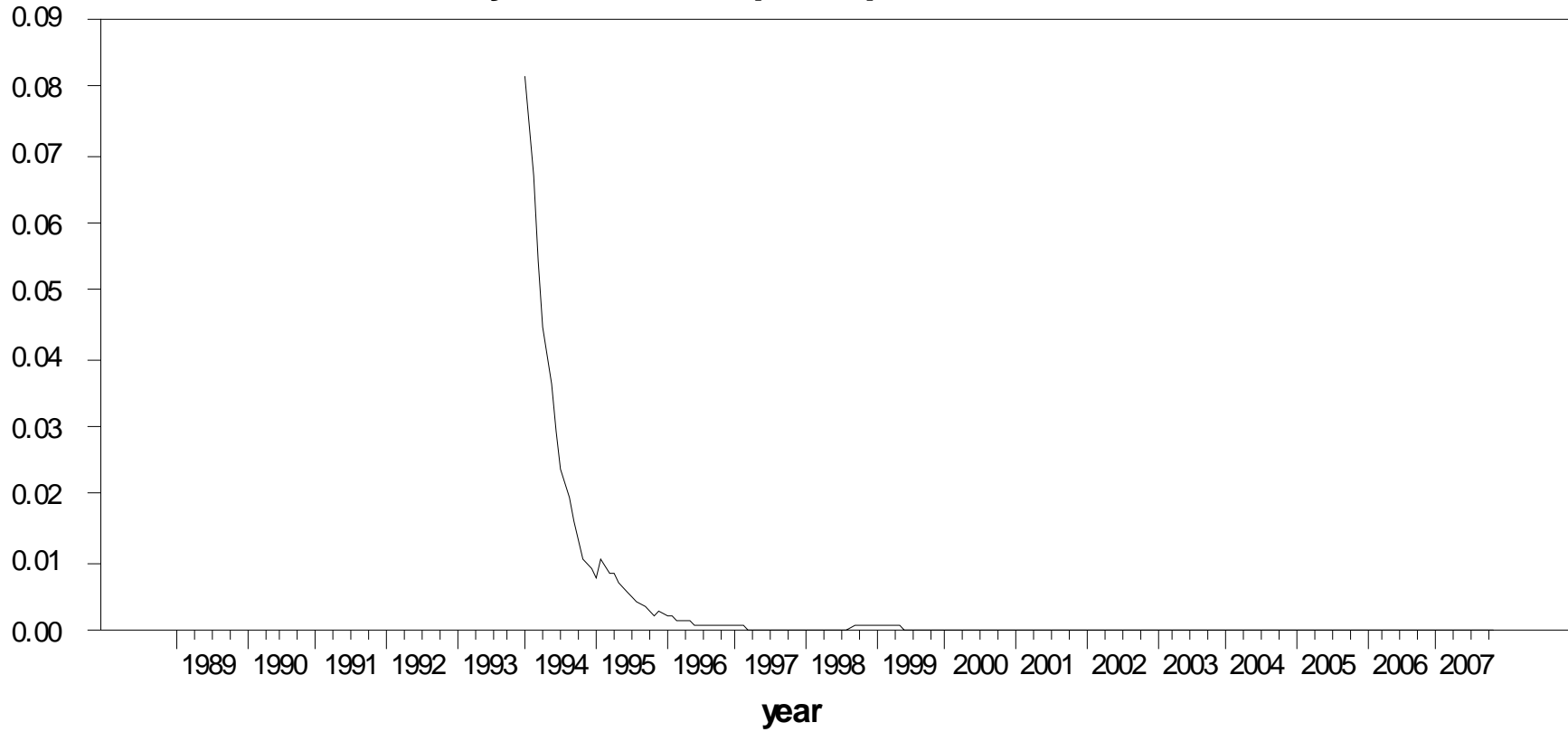
GARCH results

Countries	Equations
Canada	$\Delta \ln s_t = 0.22 \Delta \ln s_{t-1} + \varepsilon_{st}$ <p style="text-align: center;">(0.07) ***</p> $h_t = 0.00002 + 0.17 \varepsilon_{st-1}^2 + 0.74 h_{t-1}$ <p style="text-align: center;">(0.00001) (0.08)** (0.12)***</p>
Mexico	$\Delta \ln s_t = 1.18 \Delta \ln s_{t-1} - 0.17 \Delta \ln s_{t-2} + \varepsilon_{st}$ <p style="text-align: center;">(0.0005)*** (0.0002)***</p> $h_t = 0.00005 + 0.04 \varepsilon_{st-1}^2 + 0.81 h_{t-1}$ <p style="text-align: center;">(0.00001)*** (0.04) (0.03)***</p>
U.K.	$\Delta \ln s_t = 0.17 \Delta \ln s_{t-1} + \varepsilon_{st}$ <p style="text-align: center;">(0.07)***</p> $h_t = 0.00005 + 0.16 \varepsilon_{st-1}^2 + 0.74 h_{t-1}$ <p style="text-align: center;">(0.00003) (0.07)** (0.11)***</p>

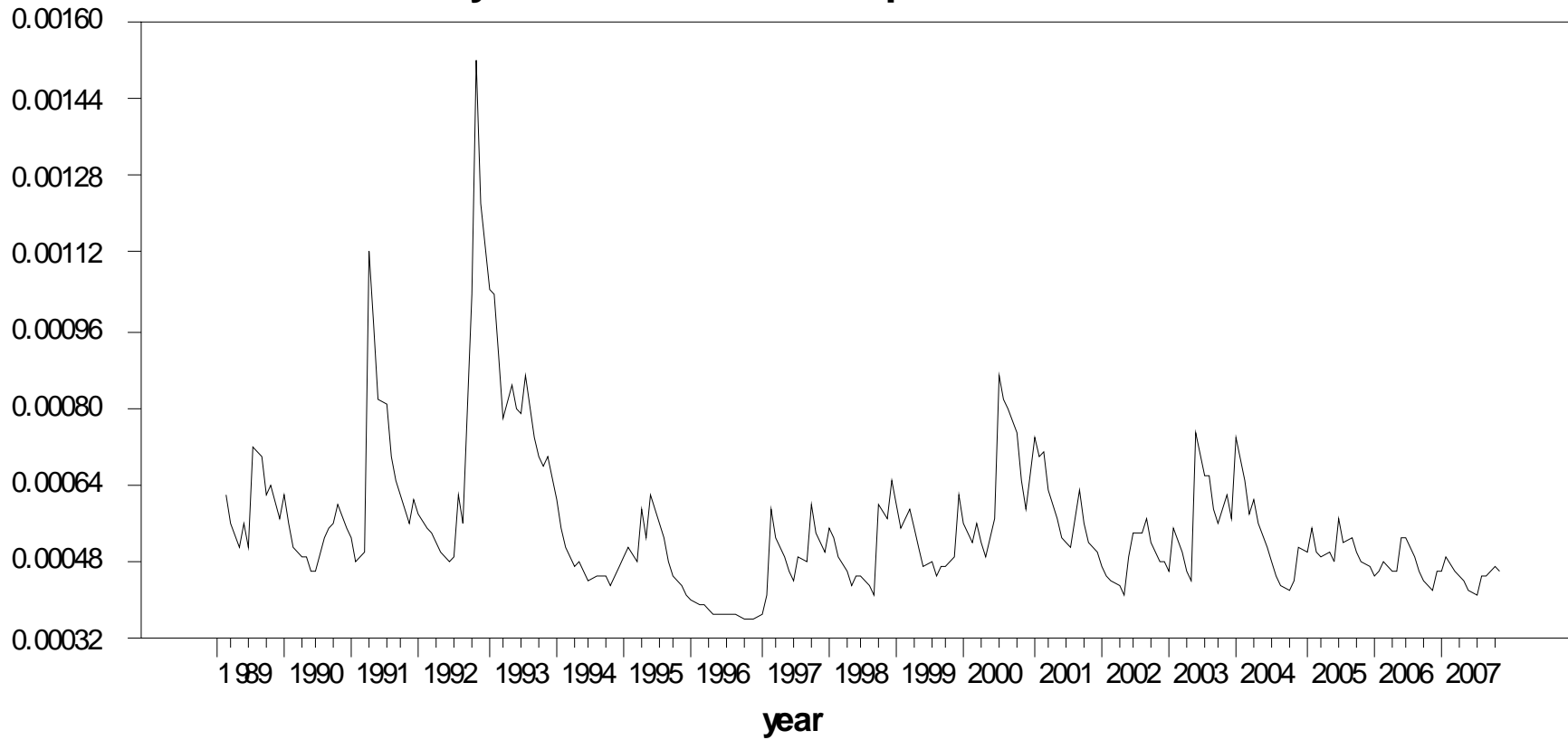
Volatility of Canadian dollar price of U.S. dollar



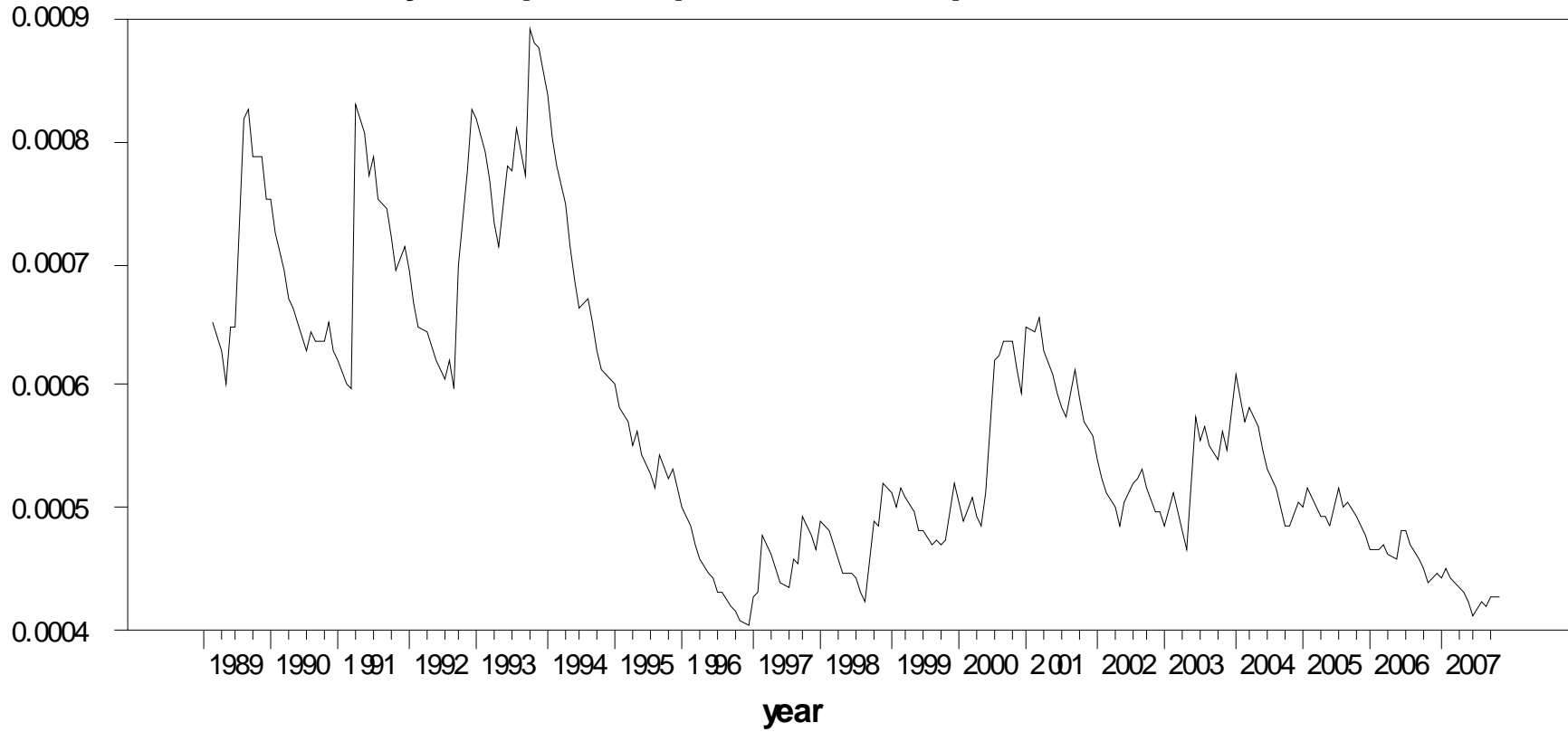
Volatility of Mexican peso price of U.S. dollar



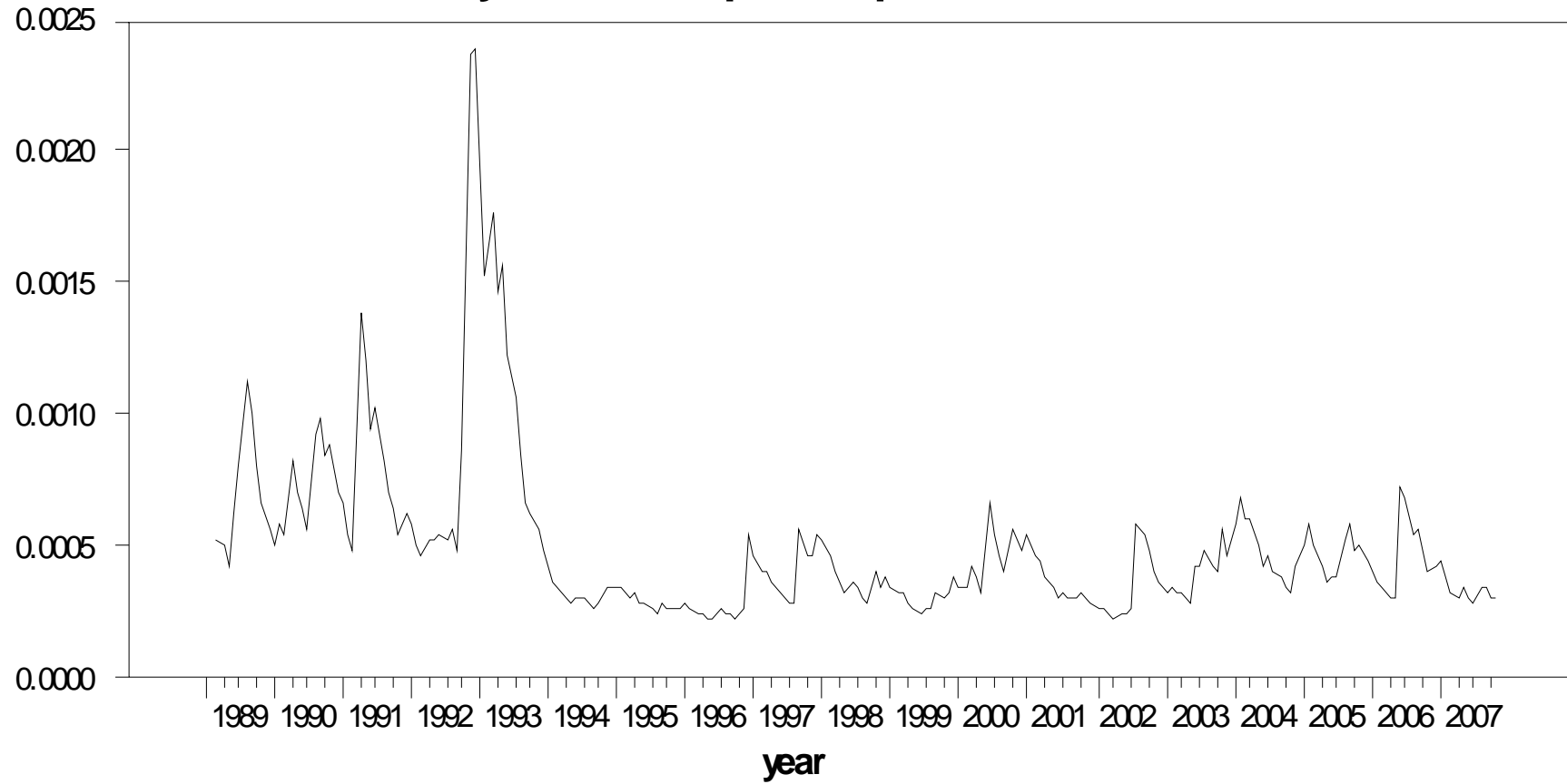
Volatility of Italian lira/euro price of U.S. dollar



Volatility of Spanish peseta / euro price of U.S. dollar



Volatility of British pound price of U.S. dollar



Canada

	SRM on Price	SRM on Quantity
Industrial round wood	-1729 [*]	9513 ^{***}
Sawnwood	28	44
Plywood/veneer	1	-40
Chemical semi-chemical woodpulp	10	160
Newsprint	-34	625 ^{**}
Printing and writing paper	1	43
Other paper and paperboard	2	-104

Mexico

	SRM on Price	SRM on Quantity
Industrial round wood	-116	-269 [*]
Sawnwood	4 [*]	-2
Plywood/veneer	6 ^{**}	-21 ^{***}
Chemical semi-chemical woodpulp	2	-2
Newsprint	2	-25 ^{**}
Printing and writing paper	0.3	-10 ^{**}
Other paper and paperboard	-0.5	-14 ^{***}

Italy

SRM on Price SRM on Quantity

Italy

Chemical semi-chemical woodpulp	-19	-219***
Other paper and paperboard	-79**	-387***
Sawnwood	88***	-182***

Spain and U.K.

	SRM on Price	SRM on Quantity
Spain		
Sawnwood	-4	-47
Chemical semi-chemical woodpulp	-83 [*]	-202 ^{**}
Other paper and paperboard	-87 ^{***}	-130
U.K.		
Sawnwood	-6	6
Chemical semi-chemical woodpulp	-31 ^{**}	1
Printing and writing paper	-16	-3.7
Other paper and paperboard	-16	-13

Conclusion

- Negative effect
 - currency fluctuation
 - Poorly developed currency forward exchange market
- Positive effect for exports to Canada
- Negligible effect if country has a history of stable currency
- Future work
 - Apply methods to more disaggregated data
 - U.S. imports from Canada
 - Characterize long term effect



Thank you!

Questions?