The credit channel of monetary policy: Solving the causality challenge by using the impossible trinity

Jiandong Ju
Tsinghua University and University of Oklahoma

Shu Lin
Fudan University

Shang-Jin Wei
Columbia University

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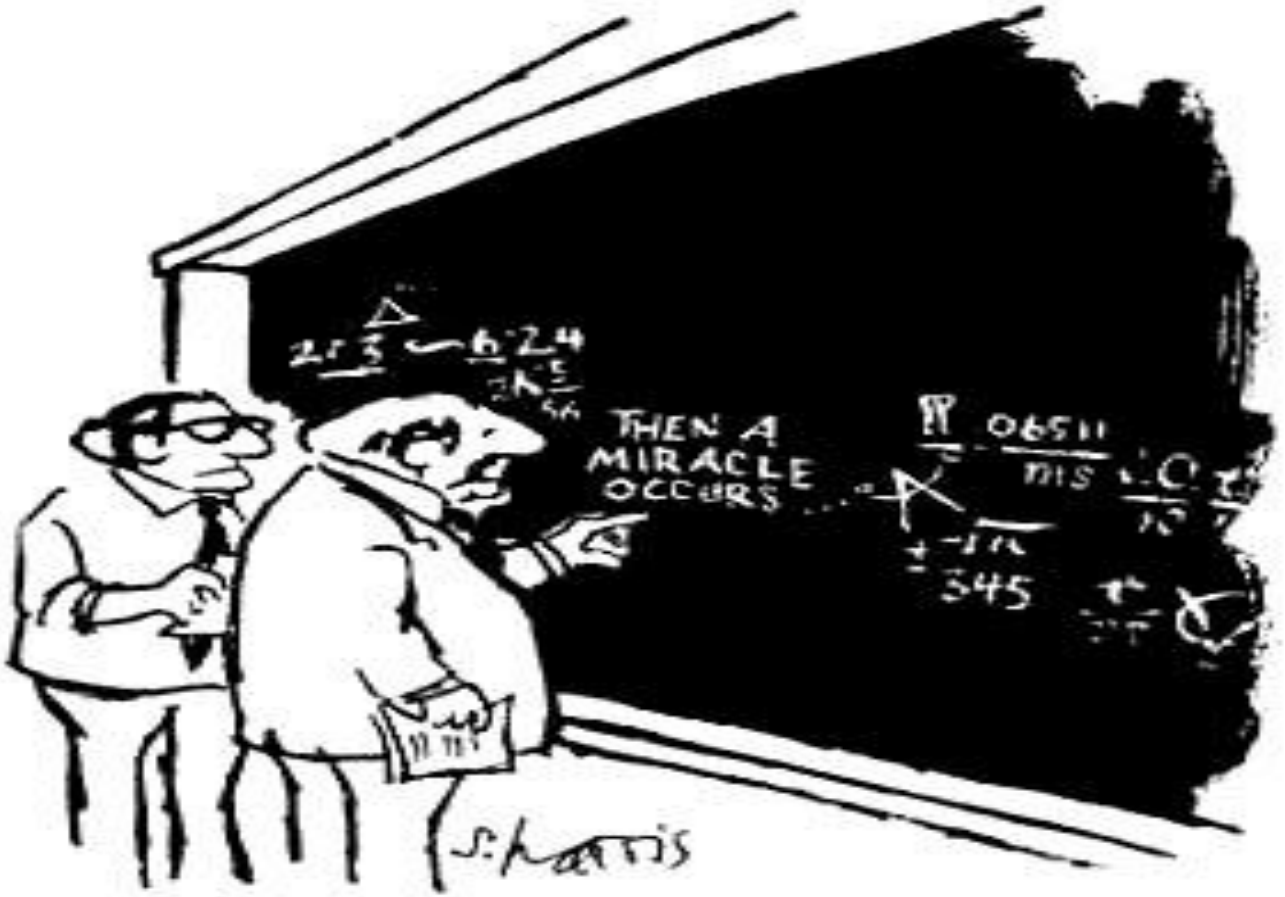
Outline

- Motivations and Related Literatures
- Empirical design and models
- Data and identification
- Results
- Contributions and conclusions

Motivations

- We combine the credit channel of monetary policy transmission literature and credit constraints and trade literature to examine how monetary policy affects trade through a credit channel.

- Our study makes several contributions to the relevant literatures, chief among which is to use the "impossible trinity" (or the "trilemma") theorem in international macroeconomics to sort out the causal effects of monetary policy.



"I THINK YOU SHOULD BE MORE EXPLICIT HERE IN STEP TWO."

Literatures: the credit channel of monetary policy transmission

- Credit market frictions often worsen during tight-money periods, and the resulting increase in the external finance premium amplifies the effects of tight monetary policy on the real economy.

- Empirical studies have examined the effects on bank lending behavior and firm financing and investment activities (Bernanke et al., 1996; Gertler and Gilchrist, 1994; Kashyap et al., 1993, 1994; Kashyap and Stein, 1995; Oliner and Rudebusch, 1996a, b; Cetorelli and Goldberg, 2008)

Literatures: the credit channel of monetary policy transmission

- A challenge for empirical studies in this literature (and the more general monetary policy literature) is to identify the causal effects of monetary policy.

- Previous studies have attempted to solve this identification problem by examining asymmetric responses of small and large firms (Gertler and Gilchrist, 1994; Bernanke et al., 1996) or relative movements in firms' bank loans and commercial papers (Kashyap et al., 1993) after monetary policy changes.

Literatures: the credit channel of monetary policy transmission

- Neither method is completely satisfactory. Large firms can have more influences on policy which may lead to the asymmetry. On the other hand, Kashyap et al.'s (1993) method is also challenged by Oliner and Rudebusch (1996a) who point out only the very largest firms issue commercial papers in their sample.

- To date, the literature has yet been able to find a way to identify an exogenous component of monetary policy *per se*.

Literatures: the credit channel of monetary policy transmission

- For the first time in this literature, we study the effects on exports, which are particularly credit dependent.
- By focusing on exports and using cross-country data, we are able to use the "impossible trinity" to solve the causality challenge.

Literatures: credit constraints and trade literature

- Exporting is more dependent on external financing than domestic production due to additional sunk and fixed costs associated with making market-specific investments and products and higher variable costs associated with international shipping, duties and freight insurance

- The effects of credit constraints on firm exporting activities (Manova, 2008; Muûls, 2008; Minetti and Zhu, 2010; Amiti and Weinstein, 2011; Manova, Wei and Zhang, 2011; Chor and Manova, 2012; Manova, forthcoming).

LITERATURES: THE IMPOSSIBLE TRINITY

- It is impossible for a country to have an independent monetary policy while maintaining a fixed exchange rate and an open capital account.

- The trilemma is not just a theoretical curiosity but supported by recent empirical studies (e.g., Obstfeld and Taylor, 1997; 2003; 2004; Obstfeld, Shambaugh and Taylor, 2004; 2005; Aizenman, Chinn and Ito, 2008).

Hypothesis and empirical design

- Since exporting is particularly dependent on external financing, monetary policy should have an impact on exports through a credit channel.
- Identify exogenous monetary tightening events based on the trilemma and also employ sector variations in technologically determined financial constraints and country variations in financial development to test the hypothesis.
- The export-reducing effect is stronger in financially more constrained sectors; financial development alleviates the impact of credit constraints

Empirical models: gravity model of Anderson and van Wincoop (2003)

$$\log Exports_{ijkt} = \beta_0 + \beta_1 Tight_{it} + \beta_2 Tight_{it} * Fv_k + \beta_3 \log Ergdp_{it} + \beta_4 \log Irgdp_{jt} + \beta_5 \log Ergdppc_{it} + \beta_6 \log Irgdppc_{jt} + \beta_7 \log RER_{ijt} + Z(i,j)\gamma + \varphi_i + \varphi_j + \varphi_k + \varphi_t + \varepsilon_{ijkt} \quad (1)$$

$$\log Exports_{ijkt} = \beta_0 + \beta_1 Tight_{it} + \beta_2 Fd_{it} + \beta_3 Tight_{it} * Fv_k + \beta_4 Tight_{it} * Fd_{it} + \beta_5 Tight_{it} * Fv_k * Fd_{it} + \beta_6 \log Ergdp_{it} + \beta_7 \log Irgdp_{jt} + \beta_8 \log Ergdppc_{it} + \beta_9 \log Irgdppc_{jt} + \beta_{10} \log RER_{ijt} + Z(i,j)\gamma + \varphi_i + \varphi_j + \varphi_k + \varphi_t + \varepsilon_{ijkt} \quad (2)$$

Empirical models

- *Dependent variable*: exports from country i to j in sector k and year t

- *Variables of interest*: a tightening dummy, *Tight,* and its interaction with sector financial constraints, *Tight*Fv,* (and the triple interaction term in Equation (2), *Tight*Fv*Fd*).

- *Controls*: exporter and importer real GDP, real per capita GDP, real exchange rate, a set of standard country-pair variables such as distance, common language, legal system, borders, FTA, colonial ties, etc., along with exporter, importer, sector and year fixed effects

Data

- *Trade data*: Sector bilateral trade date for 137 countries for the years 1970-2000 (NBER-United Nations Trade data), match SITC 4-digit products to ISIC 3-digit categories

- *Control variables*: mainly drawn from the IFS, the WDI, and Helpman, Melitz and Rubinstein (2008)

- *Measures of sector financial vulnerability*: external finance dependence, asset tangibility, R&D intensity, and inventories ratio are from Krosner, Laeven, and Klingebiel (2007)

- *Financial development*: Beck and Demirgüç-Kunt (2009)

Identify exogenous tightening events

- Previous studies often identify monetary tightening events based on large increases in the short-tem nominal interest rate, such as the federal funds rate, or the term spread between the short and the long rates (e.g., Laurent, 1988; Bernanke and Blinder, 1992; Goodfriend, 1991; Oliner and Rudebusch, 1996b)

- The concern of endogeneity

Identify exogenous tightening events

- We identify exogenous tightening events in an exporting country based on the "impossible trinity" (or the "trilemma") theorem in international macroeconomics.

- Our identification follows 3 steps.

Identify exogenous tightening events

1. restrict exporters in our sample to countries that have a fixed exchange rate and a sufficiently open capital account and use anchor countries' tightening dates as exogenous tightening events

2. for the years 1999 and 2000, we exclude further exporters that adopted the Euro from our sample

3. for each exporter, we also exclude its exports to its anchor country as well as exports to countries that peg their currencies to the same anchor country

Identify exogenous tightening events

- A fixed exchange rate is defined as a hard peg according to Reinhart and Rogoff (2004)

- Capital account openness is measured by Chinn and Ito's (2006) index. "Open" is defined as above the 75th percentile index value in the benchmark regressions.

- Using Ilzetzki, Reinhart and Rogoff's (2011) country chronologies of exchange rate arrangements, we identify a total of six anchor countries, Australia, France, Germany, the U.K., the U.S., and the Euro area (for the years 1999 and 2000) in the sample.

Identify exogenous tightening events

- In the benchmark case, define exogenous monetary tightening dates (*Tight*) for each exporter as years in which its corresponding anchor country's money market rate rose at least 2.5 percentage points

- For robustness, also use other definitions of monetary policy, such as an alternative threshold value (1.5 percentage points) or at least a 2 percentage point increase in an anchor country's term spreads between money market rates and long-term government bond rates or the Romer dates for a dollar-pegging exporter subsample.

Danchorrate>2.5 (benchmark)	Danchorrate>1.5	Danchortsp>2
AUSTRALIA1981	AUSTRALIA1981	AUSTRALIA1985
AUSTRALIA1985	AUSTRALIA1982	AUSTRALIA1989
AUSTRALIA1989	AUSTRALIA1985	AUSTRALIA1995
FRANCE1973	AUSTRALIA1989	FRANCE1973
FRANCE1974	AUSTRALIA1995	GERMANY1970
FRANCE1980	FRANCE1973	GERMANY1973
FRANCE1981	FRANCE1974	GERMANY1980
GERMANY1970	FRANCE1980	GERMANY1989
GERMANY1973	FRANCE1981	UNITED KINGDOM1972
GERMANY1979	FRANCE1989	UNITED KINGDOM1978
GERMANY1980	GERMANY1970	UNITED KINGDOM1979
GERMANY1989	GERMANY1973	UNITED KINGDOM1980
UNITED KINGDOM1974	GERMANY1979	UNITED STATES1973
UNITED KINGDOM1978	GERMANY1980	UNITED STATES1979
UNITED KINGDOM1979	GERMANY1981	UNITED STATES1989
UNITED KINGDOM1980	GERMANY1989	UNITED STATES1995
UNITED STATES1973	UNITED KINGDOM1972	
UNITED STATES1979	UNITED KINGDOM1974	
UNITED STATES1981	UNITED KINGDOM1978	
	UNITED KINGDOM1979	
	UNITED KINGDOM1980	
	UNITED STATES1973	
	UNITED STATES1974	
	UNITED STATES1978	
	UNITED STATES1979	
	UNITED STATES1980	
	UNITED STATES1981	
	UNITED STATES1989	
	UNITED STATES1995	

A COMPARISON WITH PREVIOUS STUDIES IN THE CREDIT CHANNEL LITERATURE

	Previous studies	Our study
Outcome variable	Firm investment or bank lending behavior	Exports (particularly dependent on external financing)
Empirical strategy	Rely on variations in firm size : large v.s. small firms	Rely on sector variations in technologically determined financial constraints and country variations in financial development
Identification of monetary tightening events	Large increases in own rate or term spread	Based on the trilemma and use anchor countries' tightening dates as exogenous tightening events for exporters
Results	Do not have implications for other literatures	Have important implications for the credit constraints and trade literature and the international transmission of monetary policy literature

Table 3 Benchmark regressions

	Level	Ext. Fin.	Asset Tang.	R&D Int.	Inv. Ratio
Tight	-0.131	-0.144	-0.995	0.097	0.643
	(0.048)***	(0.048)***	(0.111)***	(0.052)*	(0.104)***
Tight*Fv		-0.124	2.738	-11.719	-4.956
		(0.072)*	(0.296)***	(1.169)***	(0.632)***
R^2	0.63	0.63	0.63	0.63	0.63
N	144055	144055	144055	144055	144055

Benchmark results

- A monetary tightening in anchor country leads to a 12.3% reduction in exports on average.

- Colum (2) suggests that a monetary tightening lowers exports by 20.8% in the professional and scientific equipment sector (which is most dependent on external finance) but only 0.3% in the tobacco sector (which is least dependent on external finance).

Robustness checks

- Alternative measures of monetary policy
- Alternative samples
- Alternative threshold values of capital account openness and to Aizenman, Chinn and Ito's (2008) index
- Additional controls
- Alternative estimation methods

Table 4 Robustness to alternative measures of monetary policy

Panel A: Tight2	Level	Ext. Fin.	Asset Tang.	R&D Int.	Inv. Ratios
Tight2	-0.076	-0.103	-0.583	0.127	0.495
	(0.031)**	(0.031)***	(0.089)***	(0.038)***	(0.090)***
Tight2*Fv		-0.244	1.662	-10.150	-3.608
		(0.061)***	(0.259)***	(1.012)***	(0.560)***
Panel B: Tighttsp					
Tighttsp	-0.056	-0.076	-0.342	0.089	0.186
	(0.034)*	(0.034)**	(0.078)***	(0.038)**	(0.077)**
Tighttsp*Fv		-0.174	0.937	-7.109	-1.521
		(0.051)***	(0.213)***	(0.924)***	(0.472)***
Panel C: Romer dates (dollar-pegging exporters)					
Romer dates*Fv	---	-0.158	1.918	-7.166	-3.802
		(0.083)*	(0.358)***	(1.313)***	(0.792)***
Panel D: Allow for lags in effects					
Tightlag	-0.163	-0.169	-1.070	0.050	0.642
	(0.047)***	(0.047)***	(0.105)***	(0.050)	(0.096)***
Tightlag*Fv		-0.065	2.837	-10.921	-5.197
		(0.068)	(0.276)***	(1.050)***	(0.572)***
Panel E: Loose					
Loose	0.113	0.126	-0.010	0.108	0.124
	(0.027)***	(0.027)***	(0.045)	(0.029)***	(0.054)**
Loose*Fv		0.122	0.403	0.222	-0.071
		(0.031)***	(0.120)***	(0.500)	(0.289)
Panel F: Danchorrate					
Danchorrate	-0.023	-0.027	-0.021	-0.008	-0.012
	(0.007)***	(0.007)***	(0.012)*	(0.008)	(0.012)
Danchorrate*Fv		-0.036	-0.006	-0.748	-0.072
		(0.008)***	(0.026)	(0.124)***	(0.062)

Table 5 Robustness to alternative samples

Panel A: Exclude Euro exporters for all years	Level	Ext. Fin.	Asset Tang.	R&D Int.	Inv. Ratios
Tight	0.038	0.010	-0.873	0.262	1.224
	(0.138)	(0.139)	(0.217)***	(0.136)*	(0.241)***
Tight*Fv		-0.241	3.357	-12.248	-7.131
		(0.121)**	(0.612)***	(2.041)***	(1.247)***
Panel B: year<1990					
Tight	-0.075	-0.092	-0.450	0.042	0.177
	(0.054)	(0.055)*	(0.110)***	(0.056)	(0.104)*
Tight*Fv		-0.155	1.185	-6.087	-1.617
		(0.059)***	(0.283)***	(1.003)***	(0.612)***
Panel C: year>1975					
Tight	-0.085	-0.104	-0.800	0.093	0.754
	(0.048)*	(0.049)**	(0.145)***	(0.056)*	(0.142)***
Tight*Fv		-0.186	2.245	-9.049	-5.403
		(0.100)*	(0.413)***	(1.593)***	(0.886)***

Table 6 Robustness to alternative threshold values of financial openness and to the independent monetary policy index

Panel A: openness> 90th percentile	Level	Ext. Fin.	Asset Tang.	R&D Int.	Inv. Ratios
Tight	-0.111	-0.112	-0.805	0.061	0.518
	(0.030)***	(0.030)***	(0.068)***	(0.033)*	(0.076)***
Tight*Fv		-0.006	2.275	-8.758	-3.977
		(0.054)	(0.200)***	(0.843)***	(0.445)***
Panel B: openness>median					
Tight	-0.044	-0.075	-0.883	0.187	0.937
	(0.047)	(0.049)	(0.145)***	(0.054)***	(0.139)***
Tight*Fv		-0.301	2.647	-11.859	-6.303
		(0.094)***	(0.415)***	(1.534)***	(0.867)***
Panel C: independent monetary policy index					
Tight	-0.014	-0.029	-0.624	0.188	0.714
	(0.041)	(0.042)	(0.089)***	(0.047)***	(0.106)***
Tight*Fv		-0.143	2.034	-10.292	-4.573
		(0.064)**	(0.262)***	(1.020)***	(0.638)***

Table 7 Robustness to additional controls

Panel A: Control for importer growth	Ext. Fin.	Asset Tang.	R&D Int.	Inv. Rati
Tight	-0.088	-0.880	0.142	0.786
	(0.057)	(0.125)***	(0.059)**	(0.116)*
Tight*Fv	-0.151	2.543	-11.061	-5.519
	(0.078)*	(0.327)***	(1.259)***	(0.685)*
Importer real GDP growth	4.635	4.804	4.630	4.749
	(4.354)	(4.347)	(4.349)	(4.349)
Tight*Importer real GDP growth	1.026	3.105	2.229	1.884
	(19.405)	(19.535)	(19.313)	(19.658)
Panel B: Control for sector physical and human capital intensities				
Tight	-0.690	-1.103	-0.651	-0.106
	(0.126)***	(0.157)***	(0.127)***	(0.159)
Tight*Fv	-0.250	3.026	-12.060	-2.809
	(0.071)***	(0.416)***	(1.165)***	(0.622)**
Tight*Pkinten	7.663	-1.452	4.610	5.073
	(1.098)***	(1.477)	(1.054)***	(1.159)**
Tight*Hkinten	-0.010	0.151	0.418	0.063
	(0.130)	(0.136)	(0.136)***	(0.134)

Table 8 Robustness to alternative estimation methods

Panel A: Country-pair fixed effects	Level	Ext. Fin.	Asset Tang.	R&D Int.	Inv. Ratios
Tight	0.038	0.027	-0.786	0.254	0.771
	(0.048)	(0.048)	(0.111)***	(0.052)***	(0.104)***
Tight*Fv		-0.108	2.604	-11.185	-4.699
		(0.072)	(0.297)***	(1.136)***	(0.620)***
Panel B: Country-pair random effects and exporter and importer fixed effects					
Tight	-0.064	-0.076	-0.895	0.155	0.680
	(0.042)	(0.042)*	(0.109)***	(0.047)***	(0.100)***
Tight*Fv		-0.152	2.630	-11.323	-4.768
		(0.063)**	(0.298)***	(1.127)***	(0.618)***
Panel C: Time-varying exporter and importer fixed effects					
Tight*Fv		-0.116	2.726	-11.547	-4.986
		(0.074)	(0.308)***	(1.195)***	(0.641)***
Panel D: Include zero-trade flows					
Tight	-0.040	-0.037	-0.973	0.143	0.765
	(0.045)	(0.046)	(0.112)***	(0.050)***	(0.104)***
Tight*Fv		-0.010	2.957	-9.107	-5.155
		(0.078)	(0.314)***	(1.513)***	(0.630)**

Table 9 The role of financial development

	Ext. Fin.	Asset Tang.	R&D Int.	Inv. Ratios
(1) Benchmark	0.164	-2.745	15.980	2.239
	(0.138)	(0.463)***	(2.449)***	(1.127)**
(2) Tight2	0.337	-5.894	20.904	9.681
	(0.113)***	(0.579)***	(1.947)***	(1.262)***
(3) Tighttsp	0.403	-5.421	20.687	8.133
	(0.108)***	(0.534)***	(1.848)***	(1.179)***
(4) Romer dates (dollar-pegging exporters only)	-0.747	-6.796	22.497	15.353
	(0.597)	(2.205)***	(8.046)***	(4.889)***
(5) Allow for lags in effects	0.018	-3.140	15.624	3.082
	(0.131)	(0.425)***	(2.248)***	(1.042)***
(6) Exclude Euro countries	0.409	-2.570	17.192	4.374
	(0.184)**	(0.769)***	(3.293)***	(1.623)***
(7) year<1990	0.229	-2.666	17.307	2.117
	(0.130)*	(0.470)***	(2.389)***	(1.129)*
(8) year>1975	0.423	-2.426	15.985	3.486
	(0.176)**	(0.826)***	(3.330)***	(1.769)**
(9) Financial openness value>90th percentile	0.409	-2.570	17.192	4.374
	(0.184)**	(0.769)***	(3.293)***	(1.623)***
(10) Financial openness value>median	0.049	-3.135	15.336	4.850
	(0.130)	(0.432)***	(2.240)***	(1.120)***
(11) Independent monetary policy index<25the percentile	0.446	-4.919	15.659	17.591
	(0.306)	(1.088)***	(5.056)***	(3.048)***
(12) Control for importer real GDP growth	0.273	-2.533	15.417	3.353
	(0.138)**	(0.497)***	(2.471)***	(1.142)***
(13) Control for physical and human capital intensities	0.104	-2.964	15.689	2.752
	(0.133)	(0.467)***	(2.425)***	(1.136)**
(14) Country-pair fixed effects	0.124	-2.616	15.301	1.956
	(0.135)	(0.471)***	(2.352)***	(1.089)*
(15) Country-pair random effects and export and importer fixed effects	0.135	-2.527	15.464	1.915
	(0.131)	(0.464)***	(2.338)***	(1.087)*
(16) Time-varying importer-exporter fixed effects	0.148	-2.775	16.320	2.457
	(0.141)	(0.481)***	(2.463)***	(1.242)**
(17) Include zero-trade flows	-0.174	-4.099	11.297	4.385
	(0.146)	(0.735)***	(2.560)***	(1.517)***

Summary of key empirical findings:

1. *The export-reducing effect is significantly stronger in financially more constrained sectors.*

2. *Financial development helps alleviate the impact of credit constraints on exports*

Implications for the international transmission of monetary policy

Results also have important implications for the international transmission of monetary policy literature (e.g., Kim, 2001; Canova 2005; Neumeyer and Perri, 2005; Catorelli and Goldberg, 2008).

Particularly to those focusing on role of exchange rate regimes in the transmission mechanism (Frankel, Schmukler and Serven, 2004; Obstfeld, Shambaugh, and Taylor 2005; Di Giovanni and Shambaugh, 2008)

Future work: can the spillover effects even go beyond the exchange rate regime link?

Thank You !