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Risk-Based Capital Requirements & International Trade: Evidence from Basel II Implementation in Turkey

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Basel II and the real economy

- During the Great Recession, international trade decreased approx. 30%.

- Some, such as Robert Zoellick, the World Bank president, suggested that 10% to 15% of the observed decrease may be due to Basel II (FT, March 31, 2009).

- "the feedback … on Basel II … [suggests] that most banks are facing tougher capital requirements for their trade assets" (ICC Report, March 31, 2009, p.40).

- Surveys indicate that (i) Basel II negatively affected banks' provision of trade finance and that (ii) for a non-negligible proportion banks the increase in the cost of trade finance products (such as commercial letters of credit or trade-related lending) is linked with higher capital requirements (Asmundson et al., 2011).

- We examine if exports (a component of GDP) may have been affected by Basel II for a given country (Turkey) for which we have clear identification schemes as of July 1, 2012.

International trade payment methods

- International Trade Payment terms can be regrouped under three general categories (and form the basis of our data):
  - Open Account (OA): the exporter bears the risk of the transaction
  - Cash In Advance (CIA): the importer bears the risk of the transaction
  - Commercial Letter of Credit (CLC): the importer in the destination country asks its bank a CLC, which it sends to the exporter in Turkey, which in turn presents it to its Turkish bank. If the Turkish bank accepts the CLC, it holds it until its remaining maturity as an off-B/S item.
- Our focus: CLCs that finance 10%-15% of international trade
  - Under Basel rules, CLCs held by by exporters' banks requires setting aside capital based on the risk of the counterparty bank that issued them.
  - The data at our disposal are disaggregated by CIA, CLC and OA categories, but provide no further detail: such aggregation makes it harder for us to find any effect.

Preview of our results

- We find that Turkey's CLC-based exports were affected by risk-weight changes that affect the capital charges for these instruments.

- Exports to A1 to Baa3 (A+ to BBB-) rated OECD countries drop as the corresponding risk-weight increases.

- Exports to investment-grade rated non-OECD countries typically go up as the related risk-weights decrease.

- We find no such effects for OA- or CIA-based exports.

- The risk-weight elasticity of CLC-based exports ranges from -0.32 to -1.25 depending on counterparty rating and the remaining CLC-maturity assumed.

- The overall impact on total exports is small for Turkey is small (RW-change elasticity of exports between roughly -0.032 to -0.125) but would be higher if CLCs are used in higher proportions.

Turkey's implementation of Basel I, II, and III

- Basel I was implemented in Turkey in 1993.
- Basel II on July 1, 2012
- Basel III's gradual implementation started on January 1, 2014

- In general Basel II's treatment of CLCs depends on the approach adopted by the bank:
  - **The Standardized Approach (SA):** mostly similar to Basel I, but typically with different CCFs and/or risk-weights (RWs).
  - **Internal Ratings Based Approach (IRB) or Advanced-IRB (AIRB):** counterparty risk is evaluated based on internal (non-public, proprietary) risk-assessment models.

Brief literature review

- Capital requirements & banks' lending:
  - Peek and Rosengren (1995a and 1995b)
  - Berger and Udell (1994)
  - Berger (2006)
  - Liebig et al. (2007)
  - Brun, Fraisse and Thesmar (2013)
- Methods of payment and int'l trade:
  - Antras and Foley (2013)
  - Schmidt-Eisenlohr (2013)
  - Glady and Potin (2011)
  - Ahn (2013)
- Financial intermediation and trade:
  - Michalski and Örs (2012, 2013)
  - Hale et al. (2013)
  - Amiti and Weinstein (2011)
  - Peek (2013)
  - Paravisini et al. (2013)
  - Minetti and Zhu (2011)
  - Berman and Héricourt (2010)
  - Chor and Manova (2009)
  - Levchenko et al. (2010)
  - Eaton et al. (2011)

Why look at the Turkey's adoption of Basel II?

- In Turkey Basel II was implemented uniformly as of July 1, 2012
  - All the banks had to use only the SA whose components are publicly known.

- Manufactured goods, which we focus on, form 94% of Turkish exports in 2012.

- Turkey (a member of OECD, WTO and G-20) is the world's:
  - 17th largest economy,
  - 22nd largest exporter by value,
  - 15th largest exporter in manufactured goods that we examine.

- Since 1996 Turkey is in a customs union with the EU for manufactured goods:
  - It is the 5th largest exporter to the EU (6th largest exporter in manufactured goods),
  - It is the 7th largest importer from the EU

- We have quarterly country-industry data covering all Turkish exports:
  - 2011Q3 – 2013Q2 data are used to create annual data prior to and after July 1, 2012

Identification

- CLC (issued or held) capital charge = CLC-Notional Amount × CCF × **RW**
- In Turkey the same CCF applied between 2006 and 2013.
- On July 1, 2012, the CLC-related RWs changed as follows (Table 2):

Basel I		Basel II			
Risk-Weights		Risk-Weights		Agency Rating Categories	
A	B	C	D	E	F
OECD	Non-OECD	CLC maturity < 3 months	CLC maturity > 3 months	Moody's	S&P or Fitch's
0.20	1.00	0.20	0.20	Aaa to Aa3	AAA to AA-
			0.50	A1 to Baa3	A+ to BBB-
		0.50	1.00	Ba1 to B3	BB+ to B-
		1.50	1.50	Caa1 and below	CCC+ and below
		0.20	0.50	Non-rated (NR)	Non-rated (NR)

- In fact, we have 3 identification schemes, depending on the assumption made.

Identification scheme 1

- For the sample of OECD counterparties, assuming that CLCs have a remaining maturity of more than 3 months, for A1 to Baa3 (A+ to BBB-) rated counterparties the RW **increases** from **0.20** to **0.50**:

Basel I		Basel II			
Risk-Weights		Risk-Weights		Agency Rating Categories	
A	B	C	D	E	F
OECD	Non-OECD	CLC maturity < 3 months	CLC maturity > 3 months	Moody's	S&P or Fitch's
0.20	1.00	0.20	0.20	Aaa to Aa3	AAA to AA-
			0.50	A1 to Baa3	A+ to BBB-
		0.50	1.00	Ba1 to B3	BB+ to B-
		1.50	1.50	Caa1 and below	CCC+ and below
		0.20	0.50	Non-rated (NR)	Non-rated (NR)

- We have no OECD country that stayed constantly Ba1-to-B3 or Caa1-and-below categories between July 1, 2011 and June 30, 2013.

Identification scheme 2

- For the non-OECD sample, assuming that CLCs have a remaining maturity of more than 3 months, for Aaa to Aa3 (AAA to AA-) rated counterparties the RW **decreases** from **1.00** to **0.20**, and for A1 to Baa3 (A+ to BBB-) rated or non-rated (NR) counterparties, the RW **decreases** from **1.00** to **0.50**:

Basel I		Basel II			
Risk-Weights		Risk-Weights		Agency Rating Categories	
A	B	C	D	E	F
OECD	Non-OECD	CLC maturity < 3 months	CLC maturity > 3 months	Moody's	S&P or Fitch's
0.20	1.00	0.20	0.20	Aaa to Aa3	AAA to AA-
			0.50	A1 to Baa3	A+ to BBB-
		0.50	1.00	Ba1 to B3	BB+ to B-
		1.50	1.50	Caa1 and below	CCC+ and below
		0.20	0.50	Non-rated (NR)	Non-rated (NR)

Identification scheme 3

- For the non-OECD sample, assuming that CLCs have a remaining maturity of less than 3 months, for Aaa to Baa3 (AAA to BBB-) rated or non-rated counterparties, the RWs **decrease** from 1.00 to **0.20** :

Basel I		Basel II			
Risk-Weights		Risk-Weights		Agency Rating Categories	
A	B	C	D	E	F
OECD	Non-OECD	CLC maturity < 3 months	CLC maturity > 3 months	Moody's	S&P or Fitch's
0.20	1.00	0.20	0.20	Aaa to Aa3	AAA to AA-
			0.50	A1 to Baa3	A+ to BBB-
		0.50	1.00	Ba1 to B3	BB+ to B-
		1.50	1.50	Caa1 and below	CCC+ and below
		0.20	0.50	Non-rated (NR)	Non-rated (NR)

A simple example

Consider a CLC-settled steel export with a value of $ 1 million (≅ 1.8 million TL as of July 2, 2012) with a remaining maturity > 3 months to a non-OECD country:

- Prior to July 1, 2012, under Basel I, holding this CLC would cost the Turkish bank a capital charge of $ 24,000 (= $ 1,000,000 × 0.20 × 1.00 × 0.12)

- After July 1, 2012, under Basel II, the same CLC's capital cost to the Turkish bank would change depending the counterparty bank L/T FX-denominated debt rating:

Moody's	S&P or Fitch	Turkish bank's capital charge for CLC	% change
Aaa to Aa3	AAA to AA-	$ 4,800 = $1,000,000 × 0.20 × **0.20** × 0.12	–80%
A1 to Baa3	A+ to BBB-	$ 12,000 = $1,000,000 × 0.20 × **0.50** × 0.12	–50%
Non-Rated	Non-Rated		
Ba1 to B3	BB+ to B-	$ 24,000 = $1,000,000 × 0.20 × **1.00** × 0.12	0%
Caa1 & below	CCC+ & below	$ 36,000 = $1,000,000 × 0.20 × **1.50** × 0.12	+50%

Empirical challenges

We have inherently weak empirical tests:

- Instead of transactions data, we have disaggregated data by country, 2-digit ISIC industry, payment type.

- We do not observe the actual or average counterparty-bank ratings:
  - We use the sovereign (long-term FX-denominated debt) rating as a proxy,
  - The "sovereign floor" is binding in Turkey's case (despite BIS directive of Oct., 2011),
  - Actual CLCs are potentially riskier on average.

-We do not have data on CLC maturity structure:
  - We repeat the tests for L/T (>3 months) and S/T (<3 months) Basel II weights

- It may well be that the Turkish banks do not reflect the changes in CLC clearing costs (i.e., the associated capital charges) to their customers:
  - Turkish banks' average Tier 1+Tier 2 capital ratio was 16.47% as of July 1, 2012, i.e., more than twice 8% required under Basel II and higher than the 12% required by Turkish regulators.

Empirical specifications

To explain our specification, let us start with a log-linear "pseudo" gravity equation for Turkey's exports to countries (c) in 2-digit ISIC industry segment (i) in period (t):

$$ln(EXPORTS_{c,i,t}) = \alpha_0 + \alpha_1\, ln(IMPORTS\_EX\_TUR_{c,t}) + \alpha_2\, ln(DISTANCE_c) + \alpha_3\, D\_ADJACENT_c + \delta_i + \varepsilon_{c,i,t} \quad (1)$$

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Into which we insert a difference-in-differences model (here for the OECD sample: H_0: $\beta_3 < 0$ since RW for A1 to Baa3 increased from 0.20 to 0.50)

$$ln(EXPORTS_{c,i,t}) = \alpha_0 + \alpha_1 ln(IMPORTS\_EX\_TUR_{c,t}) + \alpha_2 ln(DISTANCE_c) + \alpha_3 D\_ADJACENT_c$$
$$+ \beta_1 D\_A1\text{-}Baa3_c + \beta_2 D\_BASELII_t + \beta_3 D\_A1\text{-}Baa3_c \times D\_BASELII_t + \delta_i + \varepsilon_{c,i,t} \quad (2)$$

Basel I		Basel II			
Risk-Weights		Risk-Weights		Agency Rating Categories	
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$$ln(EXPORTS_{c,i,t}) = \alpha_0 + \alpha_1 ln(IMPORTS\_EX\_TUR_{c,t}) + \alpha_2 ln(DISTANCE_c) + \alpha_3 D\_ADJACENT_c + \beta_1 D\_A1\text{-}Baa3_c + \beta_2 D\_BASELII_t + \beta_3 D\_A1\text{-}Baa3_c \times D\_BASELII_t + \delta_i + \varepsilon_{c,i,t} \quad (2)$$

But we have three payment terms:

$$\begin{aligned} ln(EXPORTS_{c,i,t}) = {} & \alpha_0 + \alpha_1 ln(IMPORTS\_EX\_TUR_{c,t}) + \alpha_2 ln(DISTANCE_c) + \alpha_3 D\_ADJACENT_c \\ & + \gamma_1 D\_A1\text{-}Baa3_c + \gamma_2 D\_BASELII_t + \gamma_3 D\_A1\text{-}Baa3_c \times D\_BASELII_t \\ & + [\beta_1 D\_A1\text{-}Baa3_c + \beta_2 D\_BASELII_t + \beta_3 D\_A1\text{-}Baa3_c \times D\_BASELII_t] \times D\_CLC_{c,i,t} \\ & + [\lambda_1 D\_A1\text{-}Baa3_c + \lambda_2 D\_BASELII_t + \lambda_3 D\_A1\text{-}Baa3_c \times D\_BASELII_t] \times D\_CIA_{c,i,t} + \delta_i + \varepsilon_{c,i,t} \quad (3) \end{aligned}$$

Empirical specifications

- To understand the impact of RW-changes in % change, we need to calculate incidence ratios for the change in CLC-based exports:

$$e^{\beta} - 1$$

- Based on which we can also calculate an elasticity:

$$\varepsilon = (e^{\beta} - 1) \,/\, (RW_{BASEL\ II} / RW_{BASEL\ I} - 1)$$

- Finally, Santos-Silva and Tenreyro (2006, 2011) show that log-linear gravity models, which are estimated with heteroskedastic trade data and by construction *exclude* zero trade flows, yield biased and potentially inconsistent estimates.

- We follow their suggestion and use the Poisson Pseudo Maximum Likelihood (PPML) estimator:

$$\begin{aligned} EXPORTS_{c,i,t} = exp\{ & \alpha_0 + \alpha_1 ln(IMPORTS\_EX\_TUR_{c,t}) + \alpha_2 ln(DISTANCE_c) + \alpha_3 D\_ADJACENT_c \\ & + \gamma_1 D\_A1\text{-}Baa3_c + \gamma_2 D\_BASELII_t + \gamma_3 D\_A1\text{-}Baa3_c \times D\_BASELII_t \\ & + [\beta_1 D\_A1\text{-}Baa3_c + \beta_2 D\_BASELII_t + \beta_3 D\_A1\text{-}Baa3_c \times D\_BASELII_t] \times D\_CLC_{c,i,t} \\ & + [\lambda_1 D\_A1\text{-}Baa3_c + \lambda_2 D\_BASELII_t + \lambda_3 D\_A1\text{-}Baa3_c \times D\_BASELII_t] \times D\_CIA_{c,i,t}\} + \delta_i + \varepsilon_{c,i,t} \end{aligned} \quad (4)$$

Data

- Exports data from Turkish Ministry of Customs and Commerce, aggregated at the country of destination, 2 digit ISIC, quarterly between 2011Q3 & 2013Q2.

- Country L/T sovereign debt ratings from Moody, S&P and Fitch:
  - Only countries in a constant Basel II risk-weight group retained (e.g., Greece drops),
  - In any quarter, if multiple ratings: (i) worst of 2 ratings, or (ii) second best of 3 ratings (as stipulated by the BDDK, the Turkish banking regulator).

- Quarterly country-industry level imports data from IMF DOTS database:
  - limiting the dataset to originally 155 countries
  - we drop few countries: Bangladesh, Cuba, Iran, Syria, UAE
  - Others are dropped because they change between the larger rating categories (for ex., Greece)

- Distance between Ankara and country capitals is from CEPII database.

Data – Summary Statistics

PANEL A: OECD SAMPLE

(Number of observations =3,168 =24 countries×22 industries×3 payment terms×2 annual periods)

	Risk-Weight	N	Mean	Median	Std. Dev.	Min.	Max.
EXPORTS		3,168	32.523	0.741	149.976	0	2,561.948
IMPORTS_EX_TUR		3,168	383,334.600	18,4790.400	49,7551.400	4,672.757	2,325,581.000
DISTANCE		3,168	4,390.966	2,175.960	4,488.212	1,123.008	17,234.530
D_ADJACENT		3,168	0	0	0	0	0
D_CIA		3,168	0.333	0	0.472	0	1
D_CLC		3,168	0.333	0	0.472	0	1
D_OA		3,168	0.333	0	0.472	0	1
For CLC maturity > 3 months							
D_Aaa-Aa3	0.20	3,168	0.708	1	0.455	0	1
D_A1-Baa3	0.50	3,168	0.292	0	0.455	0	1

PANEL B: Non-OECD SAMPLE

(Number of observations =17,688 =134 countries×22 industries×3 payment terms×2 annual periods)

	Risk-Weight	N	Mean	Median	Std. Dev.	Min.	Max.
EXPORTS		17,688	5.347	0.015	40.953	0	2,132.603
IMPORTS_EX_TUR		15,840	49,932.860	8,404.347	183,699.800	100.739	1,873,147.000
DISTANCE		17,688	6,318.443	5,512.077	3,814.190	502.329	16,859.540
D_ADJACENT		17,688	0.030	0	0.171	0	1
D_CIA		17,688	0.333	0	0.471	0	1
D_CLC		17,688	0.333	0	0.471	0	1
D_OA		17,688	0.333	0	0.471	0	1
For CLC maturity < 3 months							
D_Aaa-Baa3_&_NR	0.20	17,688	0.669	1	0.470	0	1
D_Ba1-B3	0.50	17,688	0.331	0	0.470	0	1
For CLC maturity > 3 months							
D_Aaa-Aa3	0.20	17,688	0.045	0	0.208	0	1
D_A1-Baa3&NR	0.50	17,688	0.624	1	0.484	0	1
D_Ba1-B3	1.00	17,688	0.331	0	0.470	0	1

Table 4 (part 1): OECD sample

	(1) *ln(EXPORTS)* [OLS]		(2) *ln(EXPORTS)* [OLS]		(3) *EXPORTS* [PPML]		(4) *EXPORTS* [PPML]		(5) *EXPORTS* [PPML]	(6) *EXPORTS* [PPML]
ln(IMPORTS_EX_TUR)	0.999	***	1.156		1.088	***	5.409	*		
	(0.135)		(2.175)		(0.133)		(2.841)			
ln(DISTANCE)	-0.908	***			-1.017	***				
	(0.253)				(0.227)					
D_A1-Baa3	-0.0295				-0.235					
	(0.447)				(0.284)					
D_BASELII	0.267	***	0.261	**	0.0685	**	0.215	**		
	(0.0743)		(0.109)		(0.0290)		(0.109)			
D_A1-Baa3×D_BASELII	-0.222	*	-0.204		0.00783		0.0519			
	(0.114)		(0.123)		(0.0414)		(0.0514)			
Number of observations	2643		2643		3168		3168		3168	3168
R^2	0.637		0.698							
Clustered Std. Errs. (country-level)	yes		yes		yes		yes		yes	yes
Fixed-Effects										
Industry	yes		yes		yes		yes		no	no
Country	no		yes		no		yes		no	no
Industry×time	no		no		no		no		no	yes
Country×time	no		no		no		no		yes	yes

Table 4 (part 2): OECD sample

	(1) *ln(EXPORTS)* [OLS]		(2) *ln(EXPORTS)* [OLS]		(3) *EXPORTS* [PPML]		(4) *EXPORTS* [PPML]		(5) *EXPORTS* [PPML]		(6) *EXPORTS* [PPML]	
D_CLC	-3.931	***	-4.107	***	-2.970	***	-2.970	***	-2.970	***	-2.970	***
	(0.279)		(0.258)		(0.345)		(0.345)		(0.345)		(0.345)	
D_CLC×D_A1-Baa3	0.241		0.255		1.040		1.040		1.040		1.040	
	(0.504)		(0.430)		(0.758)		(0.758)		(0.758)		(0.758)	
D_CLC×D_BASELII	-0.143		-0.0762		0.540		0.540		0.540		0.540	
	(0.243)		(0.256)		(0.367)		(0.367)		(0.367)		(0.367)	
D_CLC×D_A1-Baa3×D_BASELII	0.210		0.119		-0.654	*	-0.654	*	-0.654	*	-0.654	*
	(0.295)		(0.303)		(0.370)		(0.370)		(0.370)		(0.370)	
D_CIA	-2.807	***	-2.835	***	-2.958	***	-2.958	***	-2.958	***	-2.958	***
	(0.128)		(0.123)		(0.334)		(0.334)		(0.334)		(0.334)	
D_CIA×D_A1-Baa3	0.119		0.132		0.311		0.311		0.311		0.311	
	(0.307)		(0.307)		(0.385)		(0.385)		(0.385)		(0.385)	
D_CIA×D_BASELII	-0.109	*	-0.101		0.0260		0.0260		0.0260		0.0260	
	(0.0604)		(0.0614)		(0.229)		(0.229)		(0.229)		(0.229)	
D_CIA×D_A1-Baa3×D_BASELII	0.00543		-0.000748		0.0470		0.0470		0.0470		0.0470	
	(0.193)		(0.196)		(0.243)		(0.243)		(0.243)		(0.243)	
Number of observations	2643		2643		3168		3168		3168		3168	
R^2	0.637		0.698									
Clustered Std. Errs. (country-level)	yes		yes		yes		yes		yes		yes	
Fixed-Effects												
Industry	yes		yes		yes		yes		no		no	
Country	no		yes		no		yes		no		no	
Industry×time	no		no		no		no		no		yes	
Country×time	no		no		no		no		yes		yes	

OECD sample – interpretation of the results

We focus on the triple interaction $D\_CLC_{c,i,t} \times D\_A1\text{-}Baa3_{c} \times D\_BASELII_{t}$:

$$\beta_3 = -0.654$$

- This estimate suggests that as CLC-related RW increases from 0.20 to 0.50 (a 150% increase) for A1 to Baa3 rated counterparties, the incidence of exports to these destinations decreases by 48% ($= e^{-0.654} - 1 = -0.48$).

- The associated RW-change elasticity of CLC-exports to A1 to Baa3 rated OECD destinations is equal to – 0.32 (= – 0.48 / +1.50)

- i.e., a 10% increase in (RW-related) cost of CLCs leads to a 3.2% drop in exports.

- These results are robust: we obtain similar results when we change the frequency of the data (annual or quarterly), use different sub-samples (high vs low CLC-usage industries in 2010, left-winsorized data), and a placebo test using two years of data around July 1, 2011.

Non-OECD results & Interpretations

- We obtain similar (but somewhat weaker) results with the non-OECD sample:
  - if we assume CLC maturities < 3 months as RW drops the related exports increase
  - results are weaker when we assume CLC maturities > 3 months:
    - We have no statistically significant result for the highest drop in RW (but this group is 4.5% of the sample, including zero observations)
  - elasticity estimates range between -0.8 to -1.25

- Basel II brings a trade punishment (reward) channel for sovereign downgrades (upgrades) if importer-country banks all lose investment grade status:
  - If a non-OECD country is downgraded from Baa3 to Ba1 (and sovereign-floor holds) then our estimates imply roughly 1/3rd fall in CLC-based trade.
  - 13.6% of CLC-financed trade in non-OECD A1 to A3 rating category: implied fall of 4.5% of exports

- Is trade finance responsible for exports' dramatic drop during Great Recession?
  - Eaton et al. (2011): this was about the fall in the demand for durable goods
  - Amiti and Weinstein (2011), Chor and Manova (2012): bank provided trade finance
  - Both sides could be right if CLC-trade is important for durable goods.

Conclusion

- We examine whether Basel II related changes in RWs have an impact on the real economy through exports in a case where we have clear identification schemes.

- Although our tests are inherently weak, we find that Turkish CLC-based exports were affected by risk-weight changes, i.e., their capital charges (implicit costs).

- For OECD (non-OECD) countries, as risk-weight increases (decreases), exports to lower-investment grade countries drop (tend to go up).

- We find no such effects for OA- or CIA-based export flows.

- RW-change elasticity of CLC-exports ranges between -0.32 to -1.25.

- The overall impact on total (aggregate) exports depends on the prevalence of CLCs in a country's trade:
  - In Turkey roughly 12%, so the overall impact is economically small.
  - For countries that have higher CLC usage, the effect can be important.