



The transnational effects of temperature realizations on remittances

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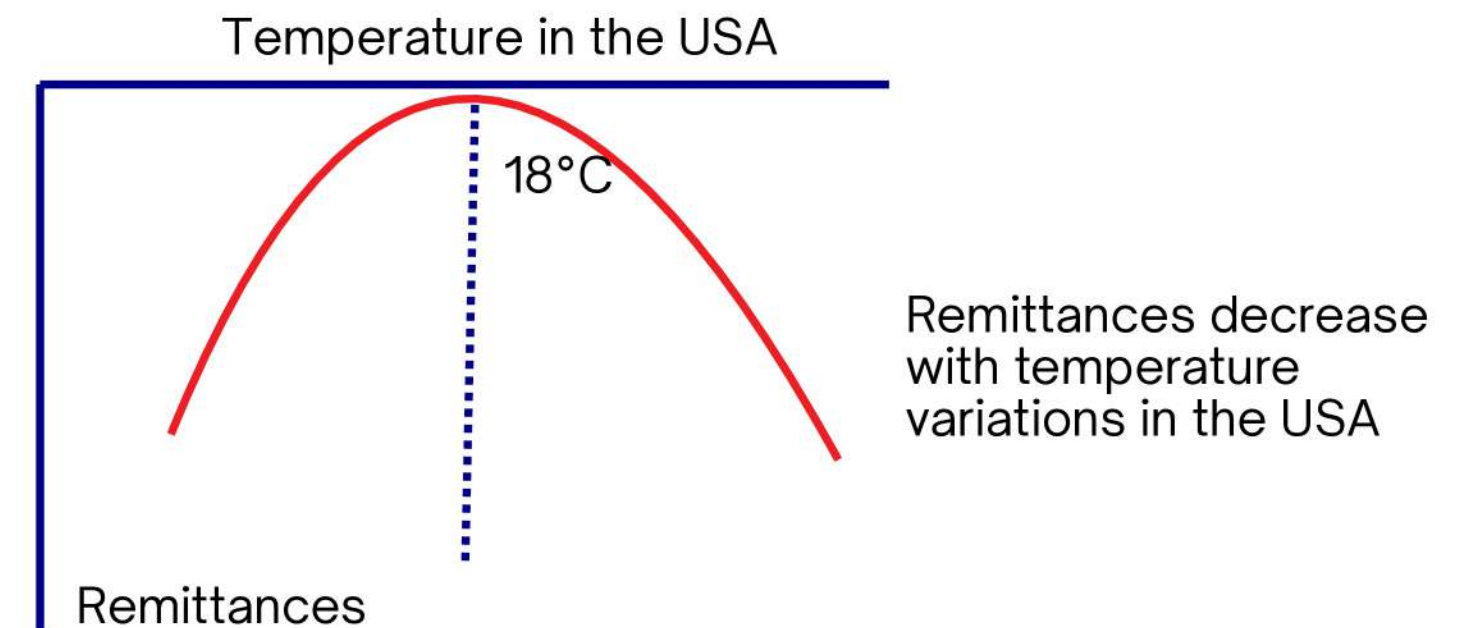
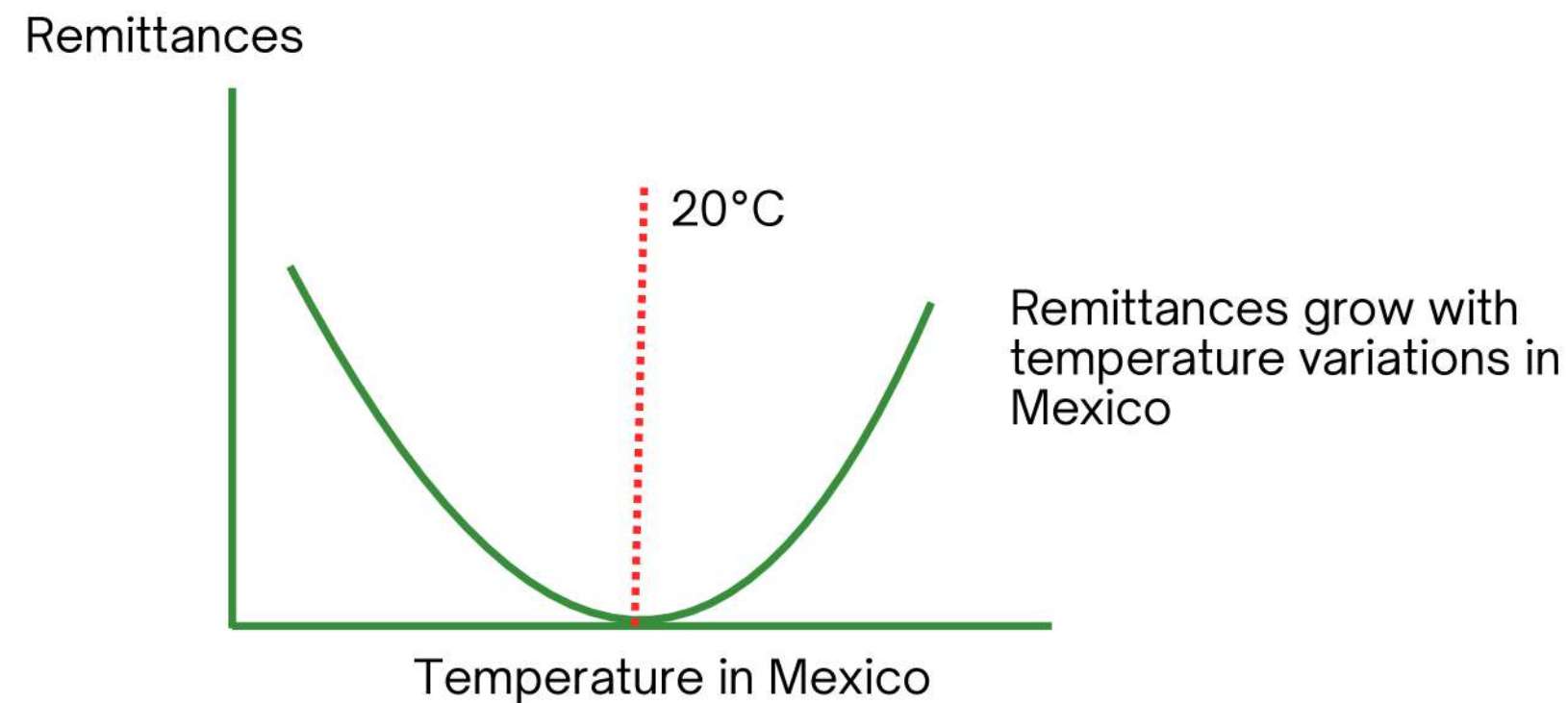
Research Questions



- How is the demand for remittances affected by temperature realisations in Mexico?
- How is the supply of remittances affected by temperature realisations in the USA?
- Do they act in opposite directions?
- What are the main mechanisms behind this effect?

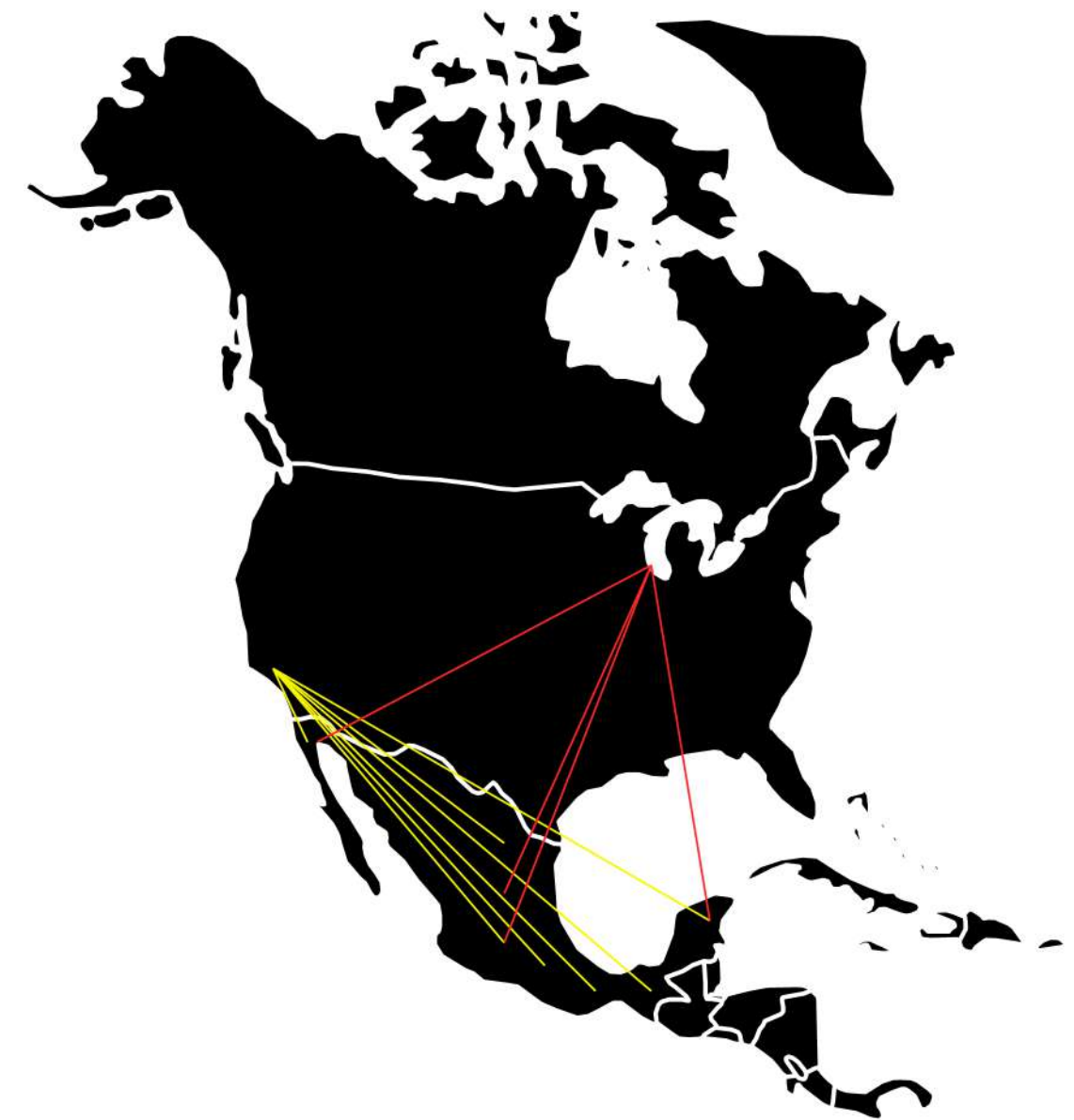
Temperature and remittances

- Assume there is an optimal temperature ($t^* \sim 20^\circ$) such that deviations lead to changes in remittances.
- Demand: In Mexico, temperature deviations lead to less income, resulting in a higher need for remittances.
- Offer: In the USA, temperature deviations lead to less income for workers, resulting in fewer remittances.



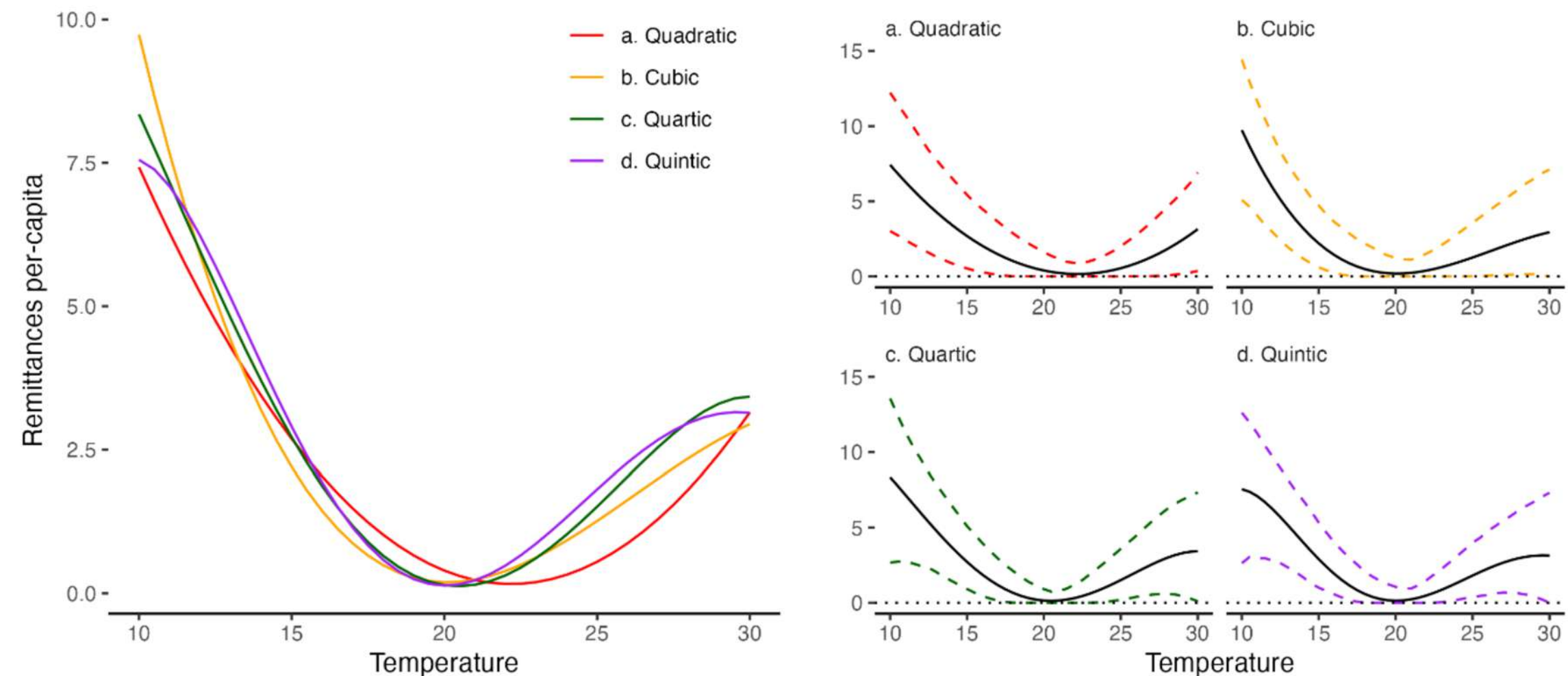
Data

- **Remittances:** Quarterly report for each Mexican municipality from the Bank of Mexico between 2013 and 2023.
- **Temperature and weather:** ERA5 – Population weighted daily averages for Mexico and the USA.
- **Migrant network:** Matrículas Consulares de Alta Seguridad (MCAS) — they link each origin municipality with the county of residence.



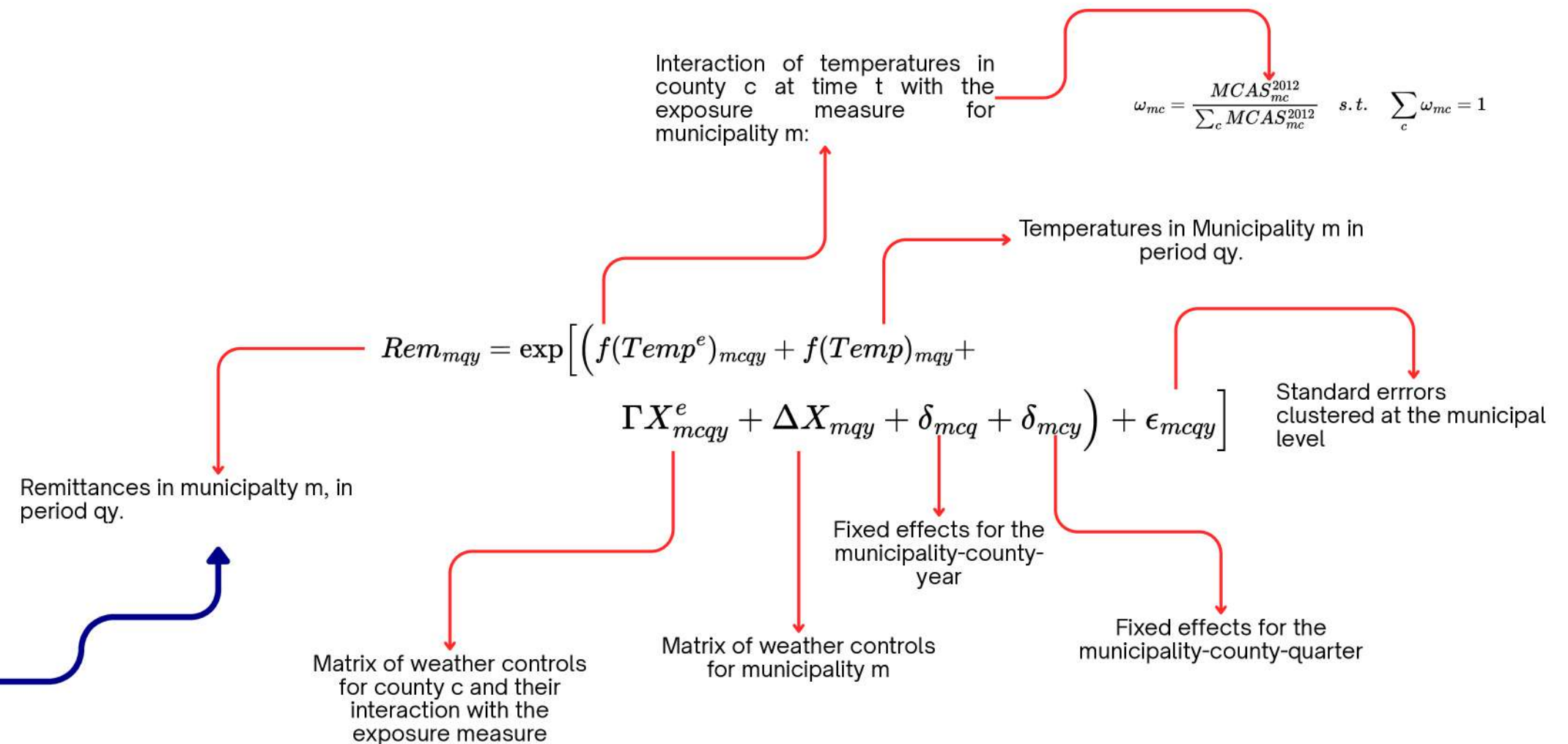
Effects of temperature changes in Mexico:

- We estimate the effect with a high-dimensional PMLE (my, mq) panel model using different polynomials as well as non-parametric indicators.
- The coefficients imply a U-shaped relationship between remittances and local temperatures.



How to estimate the supply effect

- While we know the total remittances received per municipality per quarter, we do not know where they are coming from.
- Instead, we know the share of migrants from each municipality in each county – Exposure.
- We use this exposure measure as exogenous variation to estimate the impact of temperatures in the US on remittances sent to Mexico.
- In the first step, we can start with a stacked panel



Non-parametrik stacked panel

Temperature bin	Specification			
	(1)	(2)	(3)	(4)
(-45-0] °C	-0.01660*** (0.00162)	-0.01474*** (0.00162)	-0.01514*** (0.00160)	-0.01390*** (0.00153)
(0-5] °C	-0.01751*** (0.00171)	-0.01718*** (0.00171)	-0.01833*** (0.00171)	-0.01980*** (0.00172)
(5-10] °C	-0.00719*** (0.00097)	-0.00435*** (0.00095)	-0.00356*** (0.00093)	-0.00523*** (0.00094)
(20-25] °C	-0.00893*** (0.00072)	-0.00594*** (0.00079)	-0.00474*** (0.00080)	-0.00502*** (0.00080)
(25-30] °C	-0.01182*** (0.00075)	-0.01079*** (0.00085)	-0.00987*** (0.00085)	-0.01037*** (0.00085)
(30-45] °C	-0.01408*** (0.00093)	-0.01158*** (0.00112)	-0.01097*** (0.00112)	-0.01167*** (0.00110)
Controls				
Exp. × Weather US		✓	✓	✓
Temperatures MX			✓	✓
Weather MX				✓
County-Mun-Year	✓	✓	✓	✓
County-Mun-Month	✓	✓	✓	✓
Summary Statistics				
N Obs	16398557	16398557	16398557	16398557
Avg. population	143618	143618	143618	143618
Avg. remittances PC	129.57	129.57	129.57	129.57
Days per quarter	18.57	18.57	18.57	18.57
Days per quarter (SD)	17.84	17.84	17.84	17.84

Nice! But what are we estimating?

Network size weighted average treatment effect

Solution

Re-weight each municipality by the inverse of the network size: 1/C

Non parametrik stacked panel with weights

	(1)	(2)	(3)	(4)
(-45-0] °C	-0.01341*** (0.00137)	-0.00848*** (0.00134)	-0.00923*** (0.00132)	-0.00894*** (0.00118)
(0-5] °C	-0.01252*** (0.00171)	-0.01101*** (0.00166)	-0.01251*** (0.00165)	-0.01519*** (0.00146)
(5-10] °C	-0.00501*** (0.00077)	-0.00183* (0.00103)	-0.00171* (0.00104)	-0.00322*** (0.00099)
(20-25] °C	-0.00620*** (0.00038)	-0.00711*** (0.00051)	-0.00621*** (0.00051)	-0.00612*** (0.00050)
(25-30] °C	-0.00120** (0.00056)	-0.00412*** (0.00057)	-0.00339*** (0.00057)	-0.00354*** (0.00056)
(30-45] °C	-0.00438*** (0.00044)	-0.00964*** (0.00057)	-0.00914*** (0.00057)	-0.00934*** (0.00055)
Controls				
Exp. × temperature intervals in C	✓	✓	✓	✓
Exp. × weather in C		✓	✓	✓
Temperatures MX			✓	✓
Weather MX				✓
Fixed-effects				
Municipality-county-year	✓	✓	✓	✓
Municipality-county-quarter	✓	✓	✓	✓
Fit statistics				
Observations	16,398,557	16,398,557	16,398,557	16,398,557
Avg Remittances PC	129.57	129.57	129.57	129.57
Avg Population	143,618.0	143,618.0	143,618.0	143,618.0

- As we can see, our stacked panel is very similar to a shift-share design.
- As such, we also estimate the effect by collapsing the stacked panel to (m, q, y) as follows:

$$f(Temp^e)_{mqy} = \sum_{c \in C} f(Temp^e)_{cqy} \times \frac{MCAS^m_c}{MCAS^c}$$

↓

Temperature exposure in municipality m during period qy.

↓

Temperature realisation at county c at period qy.

↓

Share of MCAS from m in c as a share of all MCAS in c.

$$Rem_{mqy} = \exp \left[\left(f(Temp^e)_{mqy} + f(Temp)_{mqy} + \Gamma X^e_{mqy} + U_{mqy} + \Delta X_{mqy} + \delta_{mq} + \delta_{my} \right) + \epsilon_{mqy} \right]$$

↙

Average weather in the municipality's m network at period qy

January 2026

Malmsten Workshop on Sustainability Economics

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Non-parametric Bartik Model

	(1)	(2)	(3)	(4)
30 to 45 C	-0.00510*** (0.00007)	-0.00353*** (0.00011)	-0.00224*** (0.00011)	-0.00260*** (0.00011)
25 to 30 C	-0.00473*** (0.00006)	-0.00309*** (0.00007)	-0.00217*** (0.00007)	-0.00235*** (0.00006)
20 to 25 C	-0.00276*** (0.00007)	-0.00139*** (0.00008)	-0.00062*** (0.00008)	-0.00068*** (0.00008)
5 to 10 C	-0.00181*** (0.00021)	-0.00121*** (0.00020)	-0.00122*** (0.00020)	-0.00152*** (0.00019)
0 to 5 C	-0.00539*** (0.00022)	-0.00538*** (0.00020)	-0.00627*** (0.00019)	-0.00663*** (0.00018)
-45 to 0 C	-0.00504*** (0.00017)	-0.00450*** (0.00017)	-0.00533*** (0.00016)	-0.00499*** (0.00016)
Controls				
Exp. × temperature intervals in C (Z)	✓	✓	✓	✓
Average temperature intervals in C (U)	✓	✓	✓	✓
Exp. × weather in C		✓	✓	✓
Average weather in C		✓	✓	✓
Temperatures MX			✓	✓
Weather MX				✓
Fixed-effects				
Municipality-year	✓	✓	✓	✓
Municipality-quarter	✓	✓	✓	✓
Fit statistics				
Observations	93,789	93,789	93,789	93,789
Avg Remittances	4.0400	4.0400	4.0400	4.0400
Avg Population	143,618.0	143,618.0	143,618.0	143,618.0

- The non-parametric shift-share à la Bartik is consistent with the stacked panel.
- One additional weighted day with temperatures above 30 or under 0 decreases remittances by 0.26% and 0.49%, respectively.
- This is equivalent to a reduction in remittances of 10,504 and 19,797 USD for the average municipality.

Another option: Residualize first to end-up with a series of weighted idiosyncratic temperature shocks.

$$\tilde{Z}_{mt}^{(b)} := \eta_{mt}^{(b)} = Z_{mt}^{(b)} - \hat{\Pi}_b' W_{mt}^{FWL}.$$

Concluussions

- Temperature realisations in the USA and Mexico have asymmetric effects on remittances.
- We provide evidence that temperature (environmental) shocks can affect the efficacy of migration as an insurance mechanism.
- Temperature realisations do not only affect where we live, but also the resources we send back home.



Appendix: Demand for remittances



Non-parametric Bartiik Model (residualized)

	(1)	(2)	(3)	(4)
30 to 45 C	-0.00589*** (0.00049)	-0.00430*** (0.00056)	-0.00324*** (0.00058)	-0.00367*** (0.00055)
25 to 30 C	-0.00626*** (0.00046)	-0.00430*** (0.00049)	-0.00365*** (0.00049)	-0.00356*** (0.00049)
20 to 25 C	-0.00364*** (0.00037)	-0.00206*** (0.00039)	-0.00157*** (0.00040)	-0.00164*** (0.00042)
5 to 10 C	-0.00157*** (0.00035)	-0.00043 (0.00038)	-0.00032 (0.00036)	-0.00094*** (0.00030)
0 to 5 C	-0.00382*** (0.00053)	-0.00248*** (0.00049)	-0.00270*** (0.00050)	-0.00431*** (0.00044)
-45 to 0 C	-0.00383*** (0.00047)	-0.00266*** (0.00050)	-0.00278*** (0.00050)	-0.00265*** (0.00048)
Fixed effects				
Municipality-Year	Yes	Yes	Yes	Yes
Municipality-Quarter	Yes	Yes	Yes	Yes
S.E. type	Custom	Custom	Custom	Custom
Observations	93,789	93,789	93,789	93,789
Squared Cor.	0.99310	0.99321	0.99326	0.99330
Pseudo R^2	0.86875	0.86879	0.86880	0.86882
BIC	573,988.1	574,017.0	574,063.4	574,103.8

**Residualization
also works well!**

Demand: Poisson estimates by clustering specification

	Municipality	State	(Conley)			
			25 km	50 km	100 km	200 km
Non-Parametric Model						
< 10 °C	0.002462*** (0.000696)	0.002462** (0.001114)	0.002462** (0.001013)	0.002462** (0.001199)	0.002462* (0.001345)	0.002462* (0.001432)
(10, 15]°C	0.000496* (0.000296)	0.000496 (0.000597)	0.000496 (0.000461)	0.000496 (0.000507)	0.000496 (0.000527)	0.000496 (0.000502)
(25, 30]°C	0.000447*** (0.000120)	0.000447** (0.000205)	0.000447*** (0.000134)	0.000447*** (0.000156)	0.000447** (0.000179)	0.000447** (0.000181)
> 30°C	0.000484* (0.000255)	0.000484 (0.000359)	0.000484* (0.000270)	0.000484* (0.000290)	0.000484 (0.000327)	0.000484 (0.000346)
Parametric Model						
Linear term	-0.02741*** (0.00609)	-0.02741** (0.01267)	-0.02741*** (0.00633)	-0.02741*** (0.00787)	-0.02741** (0.01128)	-0.02741* (0.01507)
Quadratic term	0.00062*** (0.00014)	0.00062** (0.00027)	0.00062*** (0.00014)	0.00062*** (0.00018)	0.00062** (0.00025)	0.00062* (0.00034)
Observations (N)	94 444	94 444	94 444	94 444	94 444	94 444
Outcome mean	79.9842	79.9842	79.9842	79.9842	79.9842	79.9842
Population (mean)	49 756.05	49 756.05	49 756.05	49 756.05	49 756.05	49 756.05

Demand: The effect of temperature in Mexican municipalities on quarterly remittances with four and two-degree intervals

	(-15:10]	(10:14]	(14:18]	(22:26]	(26:30]	(30:42]
λ_b from Eq. 1 and 3	0.00246*** (0.00073)	0.00030 (0.00042)	0.00019 (0.00013)	0.00015 (0.00015)	0.00065*** (0.00019)	0.00063** (0.00032)
Fitted Stat.						
N.Obs	94,444	94,444	94,444	94,444	94,444	94,444
Avg population	49,756	49,756	49,756	49,756	49,756	49,756
Days per quarter (SD)	5.22	13.40	25.30	23.90	23.30	8.37
Days per quarter (Cell-SD)	0.83	2.36	5.23	5.64	3.20	1.23

	(-15:10]	(10:12]	(12:14]	(14:16]	(16:18]	(22:24]	(24:26]	(26:28]	(28:30]	(30:42]
	0.00246*** (0.00073)	0.00030 (0.00042)	0.00030 (0.00042)	0.00019 (0.00013)	0.00019 (0.00013)	0.00015 (0.00015)	0.00015 (0.00015)	0.00065*** (0.00019)	0.00065*** (0.00019)	0.00063** (0.00032)
Fitted Stat.										
N.Obs	94,444	94,444	94,444	94,444	94,444	94,444	94,444	94,444	94,444	94,444
Avg population	49,756	49,756	49,756	49,756	49,756	49,756	49,756	49,756	49,756	49,756
Days/PQ (SD)	5.22	5.50	8.84	13.00	16.60	14.50	14.10	14.50	11.80	8.37
Days/PQ (Cell-SD)	0.83	1.14	1.87	2.99	4.37	4.09	3.38	2.88	1.90	1.23

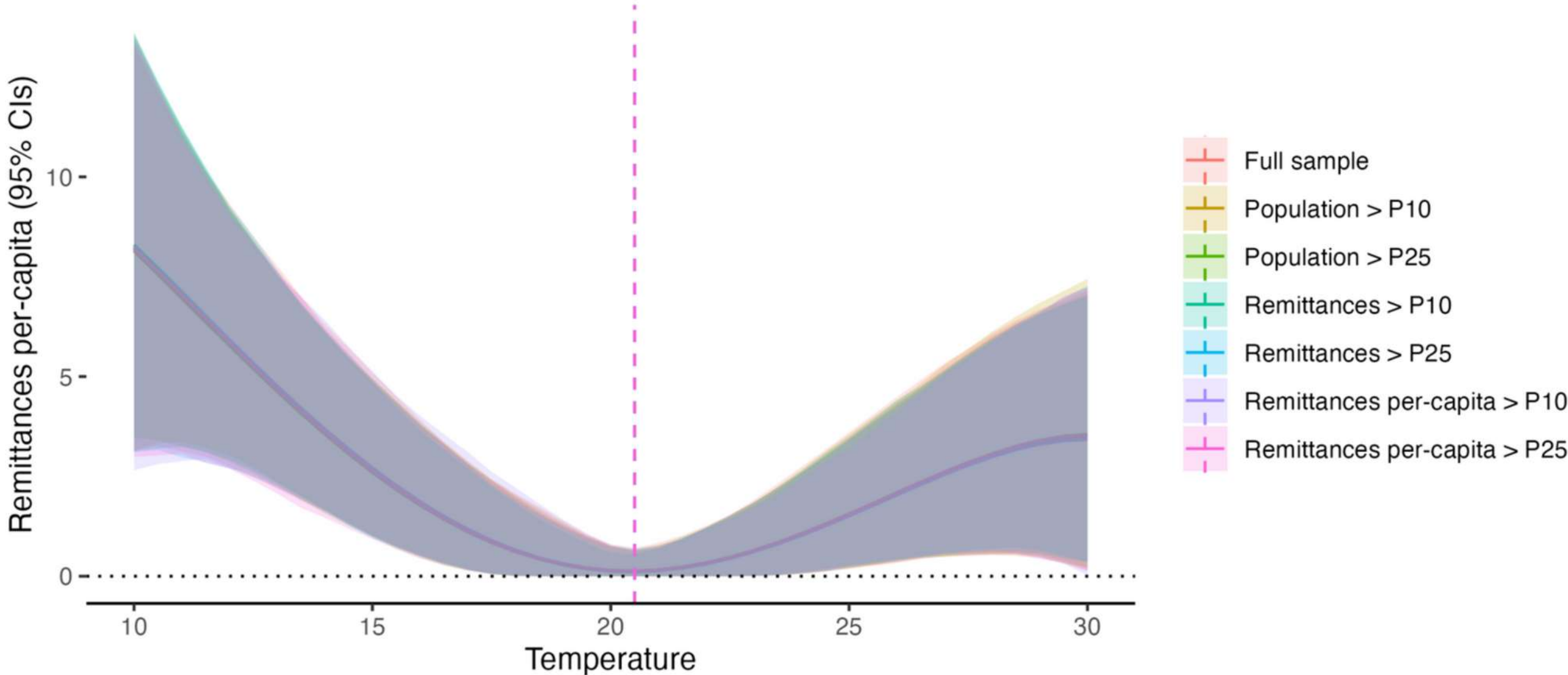
Demand: Poisson-IV estimates across different fixed effects controls

	(1)	(2)	(3)	(4)	(5)	(6)
< -15 °C	-0.01202*** (0.00326)	0.00098** (0.00043)	0.00057 (0.00044)	-0.00029 (0.00058)	0.00068 (0.00050)	0.00246*** (0.00070)
(10, 15] °C	-0.00781*** (0.00141)	-0.00065*** (0.00021)	-0.00078*** (0.00021)	-0.00027 (0.00026)	-0.00012 (0.00018)	0.00050* (0.00030)
(25, 30] °C	-0.00492*** (0.00120)	0.00048*** (0.00015)	0.00036** (0.00017)	0.00015 (0.00022)	0.00025 (0.00016)	0.00045*** (0.00012)
> 30 °C	-0.00581*** (0.00179)	-0.00070** (0.00029)	-0.00093*** (0.00032)	-0.00041 (0.00036)	-0.00023 (0.00025)	0.00048* (0.00026)
Fixed-effects						
agem		✓	✓	✓	✓	
quarter		✓				
year		✓				
quarter-year			✓			
state-quarter-year				✓		
state-quarter					✓	
state-year					✓	
agem-year						✓
agem-quarter						✓
Fitted Stat.						
Squared Correlation	0.02180	0.69409	0.69398	0.70472	0.70366	0.93145
Observations (N)	115,291	115,103	115,103	115,103	115,103	94,444
Outcome mean	79.9842	79.9842	79.9842	79.9842	79.9842	79.9842
Population (mean)	49,756.05	49,756.05	49,756.05	49,756.05	49,756.05	49,756.05

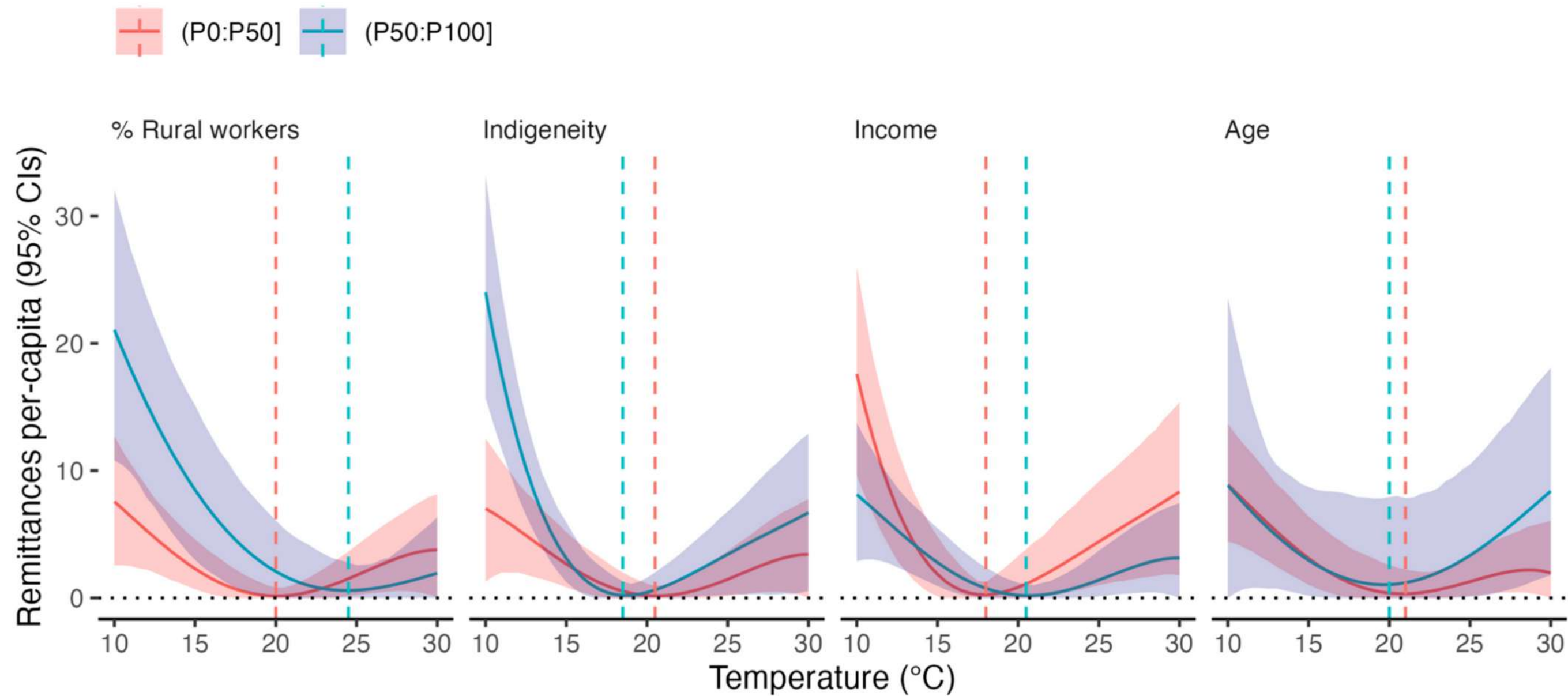
Demand: Poisson-IV estimates across different Weather controls

	(1)	(2)	(3)	(4)
< -15 °C	0.00209*** (0.00073)	0.00217*** (0.00072)	0.00209*** (0.00071)	0.00246*** (0.00070)
(10, 15] °C	0.00059** (0.00028)	0.00063** (0.00029)	0.00054* (0.00030)	0.00050* (0.00030)
(25, 30] °C	0.00033*** (0.00012)	0.00022* (0.00012)	0.00038*** (0.00012)	0.00045*** (0.00012)
> 30 °C	0.00027 (0.00023)	0.00005 (0.00024)	0.00043* (0.00025)	0.00048* (0.00026)
Weather controls				
Rain (2nd degree polynomial)		✓	✓	
Mean wind speed			✓	
Mean relative humidity			✓	
Mean Atmospheric pressure			✓	
Rain (Non-parametric)				✓
Wind speed (Non-parametric)				✓
Relative humidity (Non-parametric)				✓
Atmospheric pressure (Non-parametric)				✓
Fitted Stat.				
Squared Correlation	0.93152	0.93169	0.93162	0.93145
Observations (N)	94,444	94,444	94,444	94,444
Outcome mean	79.9842	79.9842	79.9842	79.9842
Population (mean)	49 756.05	49 756.05	49 756.05	49 756.05

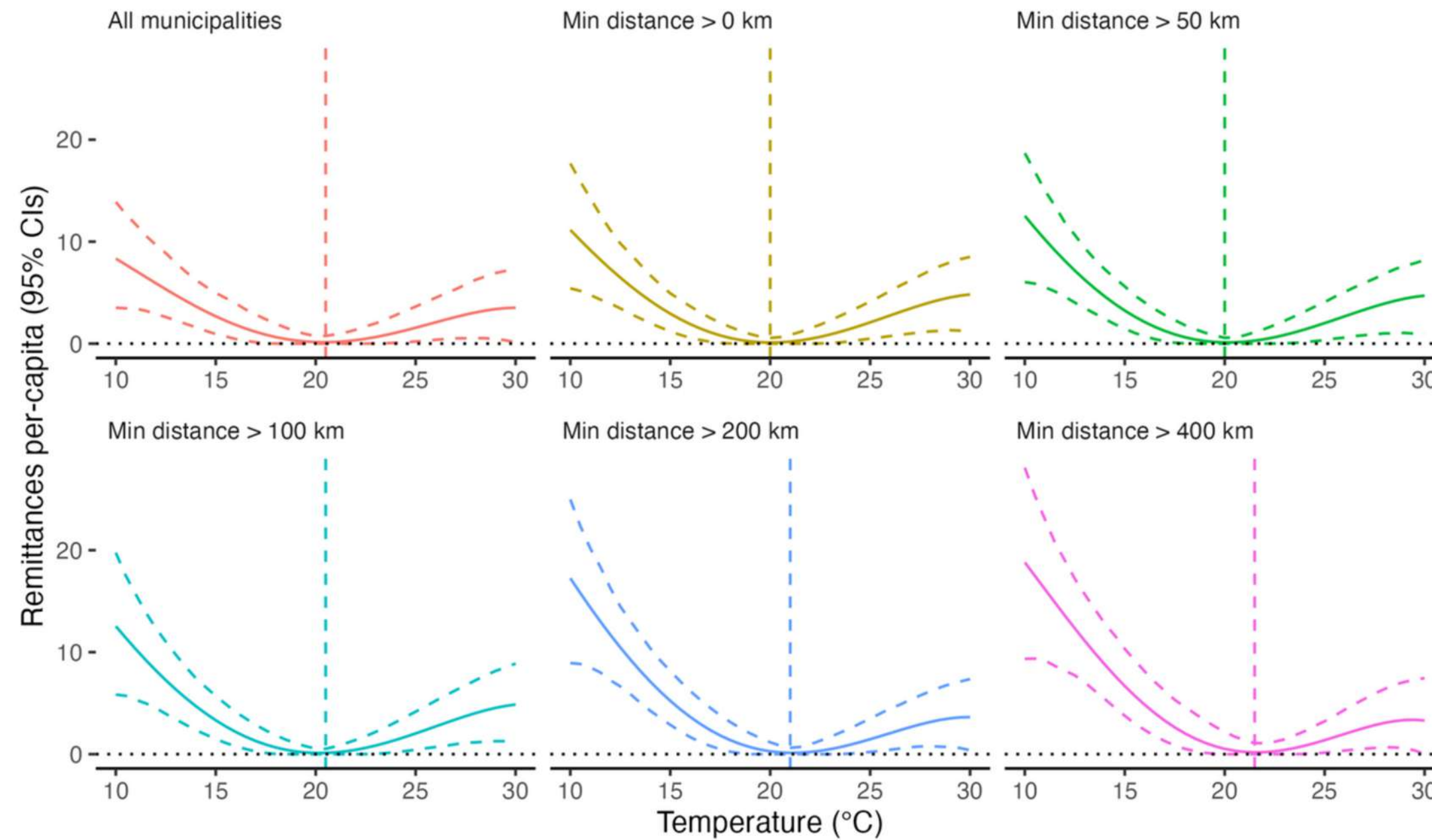
Demand: Simulated effect across different samples (quartic polynomial)



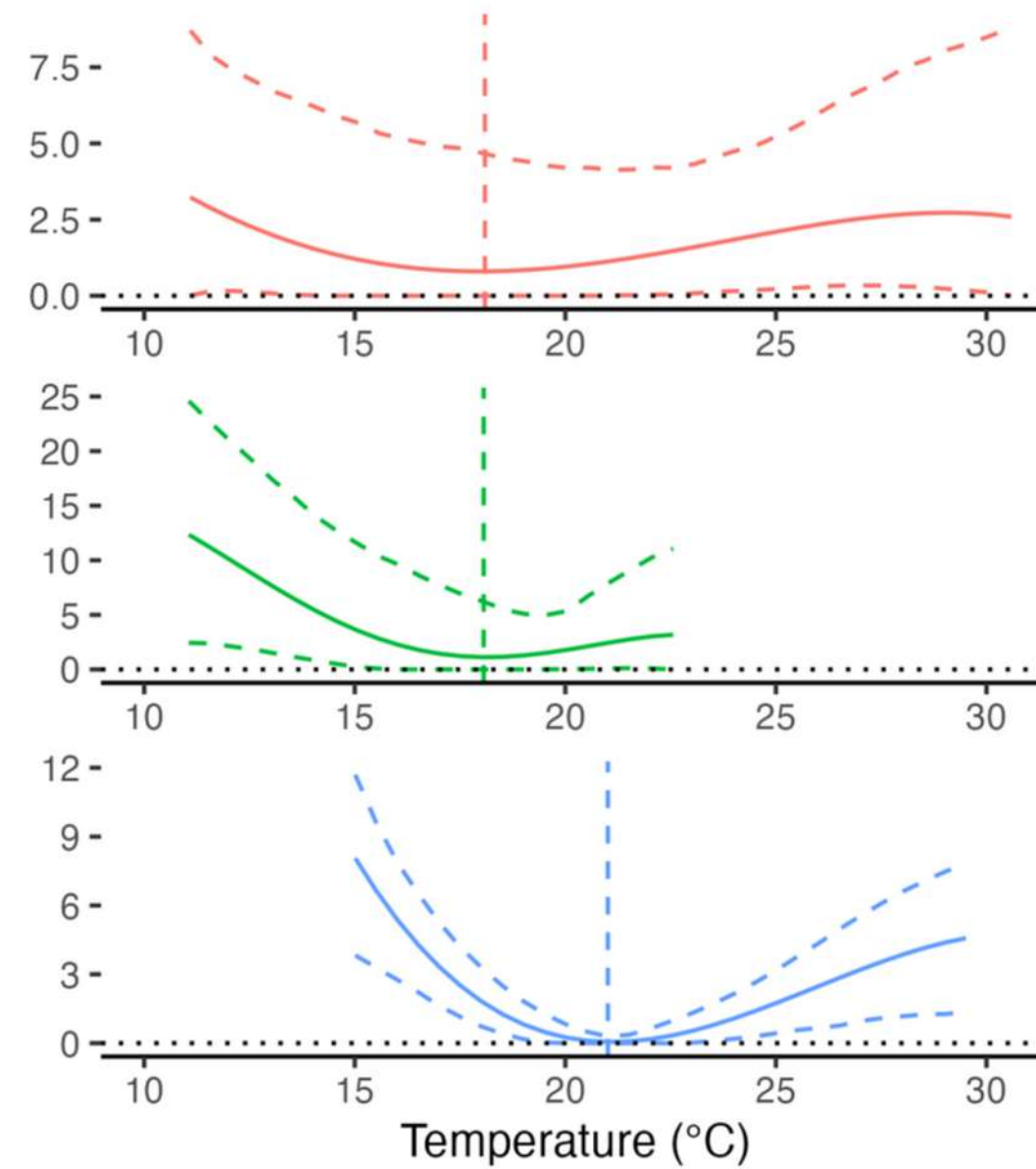
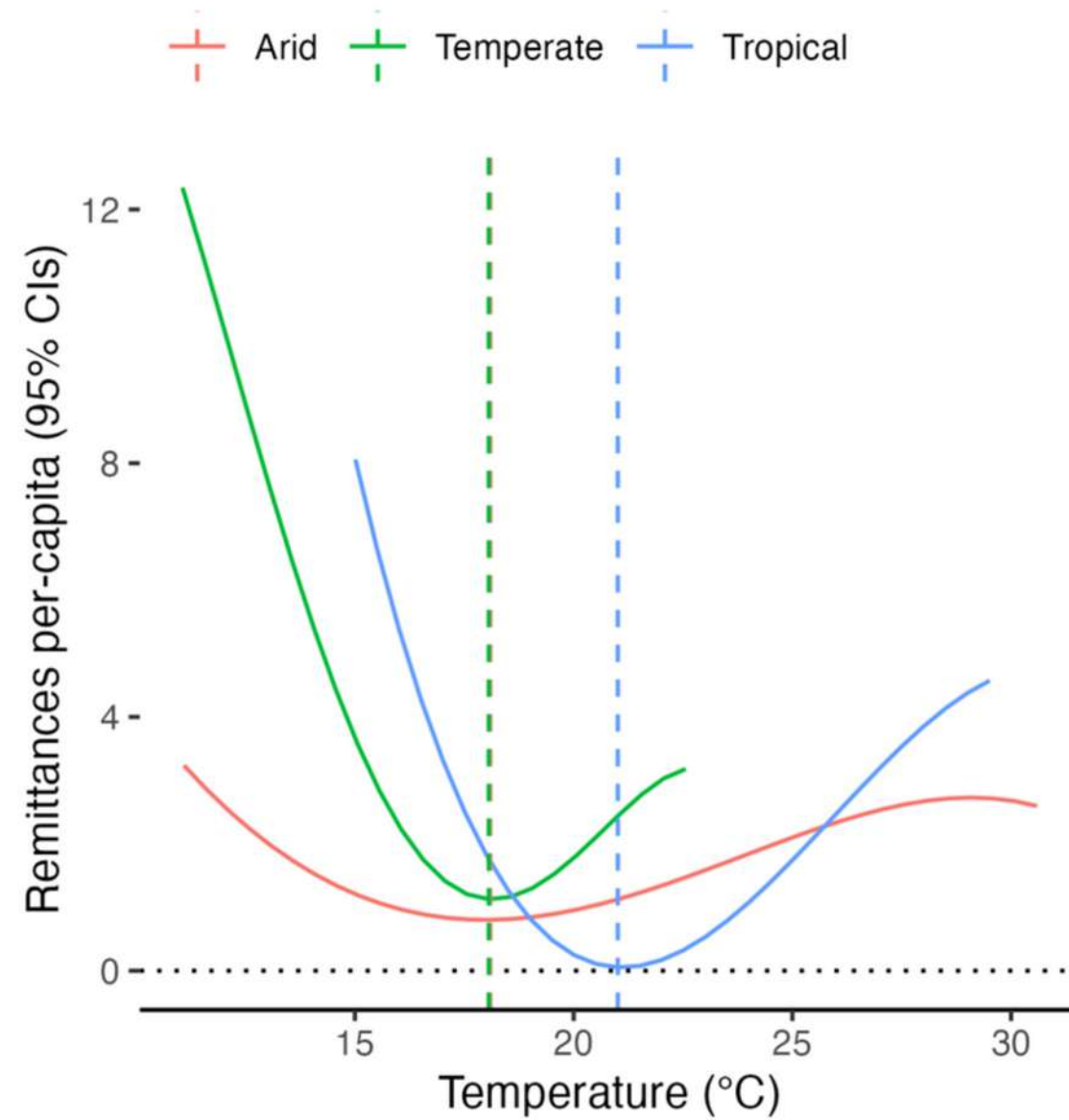
Demand: Exposure-response curve across median sample splits



Demand: Exposure-response curve for different subsamples of municipalities based on their distance to the border



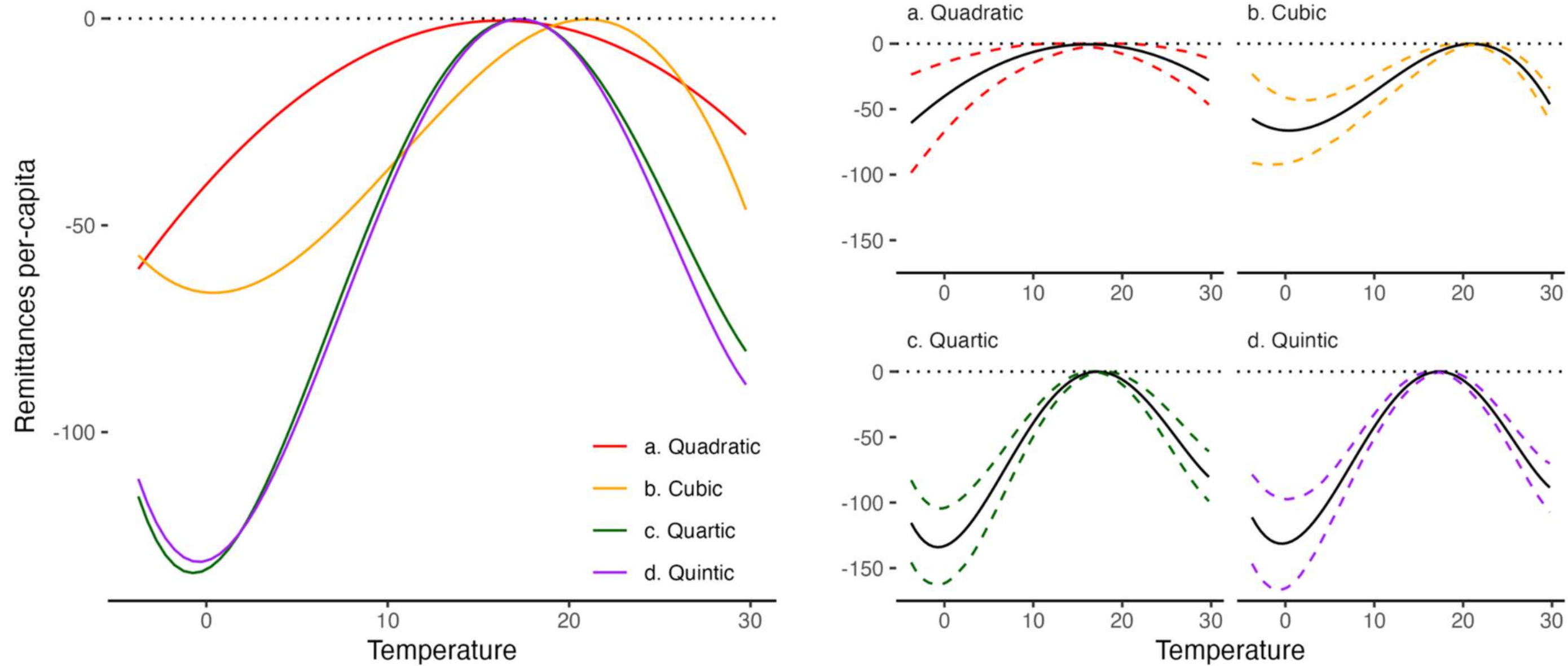
Demand: Exposure-response curve for different climate zones



Appendix: Stacked Pannel



Stacked Pannel: Parametric estimates across different polynomials



Stacked Pannel: The effect of temperature in US counties on quarterly remittances to Mexican municipalities (two-degree intervals)

	(-45:0]	(0:2]	(2:4]	(4:6]	(6:8]	(8:10]	(20:22]	(22:24]	(24:26]	(26:28]	(28:30]	(30:42]
	-0.013 [§] (0.002)	-0.022 [§] (0.003)	-0.025 [§] (0.003)	-0.006 [‡] (0.003)	-0.004 [†] (0.002)	-0.004 [§] (0.001)	-0.003 [§] (0.001)	-0.004 [§] (0.001)	-0.014 [§] (0.001)	-0.008 [§] (0.001)	-0.012 [§] (0.001)	-0.011 [§] (0.001)
Fitted Stat.												
N.Obs (000s)	16,399	16,399	16,399	16,399	16,399	16,399	16,399	16,399	16,399	16,399	16,399	16,399
Avg population	143,618	143,618	143,618	143,618	143,618	143,618	143,618	143,618	143,618	143,618	143,618	143,618
Days/PQ (SD)	6.149	2.705	3.402	3.865	4.462	5.014	7.145	7.554	7.679	6.968	4.108	2.112
Days/PQ (Cell-SD)	2.472	1.318	1.582	1.724	1.964	2.170	2.768	2.766	2.753	2.512	1.876	1.246

he effect of temperature in US counties on quarterly remittances to Mexican municipalities (Different clustering)

	Node	FIPS	State	(Conley-Fips)			
				25 km	50 km	100 km	200 km
Non-Parametric Model							
< 0°C	-0.014*** (0.002)	-0.014*** (0.005)	-0.014* (0.007)	-0.014*** (0.005)	-0.014** (0.006)	-0.014** (0.007)	-0.014** (0.007)
(0, 5]°C	-0.020*** (0.002)	-0.020*** (0.006)	-0.020*** (0.008)	-0.020*** (0.006)	-0.020*** (0.007)	-0.020*** (0.007)	-0.020*** (0.007)
(5, 10]°C	-0.005*** (0.001)	-0.005** (0.002)	-0.005 (0.004)	-0.005** (0.002)	-0.005** (0.002)	-0.005** (0.002)	-0.005** (0.003)
(20, 25]°C	-0.005*** (0.001)	-0.005** (0.002)	-0.005** (0.002)	-0.005** (0.002)	-0.005** (0.002)	-0.005** (0.002)	-0.005* (0.003)
(25, 30]°C	-0.010*** (0.001)	-0.010*** (0.002)	-0.010*** (0.003)	-0.010*** (0.002)	-0.010*** (0.002)	-0.010*** (0.002)	-0.010*** (0.003)
> 30°C	-0.012*** (0.001)	-0.012*** (0.002)	-0.012** (0.005)	-0.012*** (0.002)	-0.012*** (0.003)	-0.012*** (0.004)	-0.012*** (0.004)
Parametric Model							
Linear Term	0.03779*** (0.00975)	0.03779 (0.02945)	0.03779 (0.03803)	0.03779 (0.02964)	0.03779 (0.03452)	0.03779 (0.03651)	0.03779 (0.03752)
Quadratic Term	-0.00114*** (0.00026)	-0.00114 (0.00084)	-0.00114 (0.00111)	-0.00114 (0.00084)	-0.00114 (0.00096)	-0.00114 (0.00106)	-0.00114 (0.00110)
Observations (N, thousands)	16 399	16 399	16 399	16 399	16 399	16 399	16 399
Outcome mean	129.6	129.6	129.6	129.6	129.6	129.6	129.6
Population (mean)	143 618	143 618	143 618	143 618	143 618	143 618	143 618

Stacked pannel: The effect of temperature in US counties on quarterly remittances to Mexican municipalities (Different FEs)

	(1)	(2)	(3)	(4)	(5)
Non-Parametric Model					
< 0°C	-0.02683 (0.02315)	-0.00918*** (0.00158)	-0.00002 (0.00060)	-0.00091 (0.00062)	-0.01390*** (0.00487)
(0, 5]°C	-0.01031 (0.07202)	-0.00143 (0.00478)	-0.00264** (0.00130)	-0.00257** (0.00110)	-0.01980*** (0.00622)
(5, 10]°C	-0.03075* (0.01828)	-0.00836*** (0.00246)	-0.00189** (0.00086)	-0.00236** (0.00101)	-0.00523** (0.00225)
(20, 25]°C	-0.01415** (0.00613)	-0.00635*** (0.00190)	-0.00198*** (0.00031)	-0.00247*** (0.00048)	-0.00502*** (0.00158)
(25, 30]°C	-0.03666*** (0.00796)	-0.00345* (0.00193)	-0.00112*** (0.00037)	-0.00069** (0.00034)	-0.01037*** (0.00161)
> 30°C	-0.02086** (0.00926)	-0.00503*** (0.00194)	-0.00054 (0.00045)	-0.00051 (0.00065)	-0.01167*** (0.00232)
Parametric Model					
Linear	6.1930* (3.6293)	0.01937 (0.01662)	0.00117 (0.00326)	0.00317 (0.00214)	0.03779 (0.02945)
Quadratic	-0.14639 (0.09242)	-0.00025 (0.00039)	-0.00008 (0.00009)	-0.00009 (0.00006)	-0.00114 (0.00084)
<i>Fixed-effects</i>					
Node		✓	✓	✓	
Year		✓			
Quarter		✓			
year-agem			✓	✓	
quarter-agem			✓	✓	
year-fips				✓	
quarter-fips				✓	
id-year					✓
id-quarter					✓
Observations (N, thousands)	17,322,696	17,321,709	16,398,557	16,398,557	16,398,557
Outcome mean	129.57	129.57	129.57	129.57	129.57
Population (mean)	143,618.0	143,618.0	143,618.0	143,618.0	143,618.0

Appendix: Bartik Shift Share



Bartik SS: he effect of temperature in US counties on quarterly remittances to Mexican municipalities: Non-parametric Bartik model with different clustering assumptions

<i>Clustering:</i>	AKM	Municipality	Mun. + Period	State
30 to 45 C	-0.00260*** (0.00011)	-0.00260*** (0.00094)	-0.00260 (0.00208)	-0.00260** (0.00130)
25 to 30 C	-0.00235*** (0.00006)	-0.00235*** (0.00084)	-0.00235 (0.00182)	-0.00235** (0.00111)
20 to 25 C	-0.00068*** (0.00008)	-0.00068 (0.00060)	-0.00068 (0.00187)	-0.00068 (0.00105)
5 to 10 C	-0.00152*** (0.00019)	-0.00152*** (0.00053)	-0.00152 (0.00110)	-0.00152** (0.00069)
0 to 5 C	-0.00663*** (0.00018)	-0.00663*** (0.00128)	-0.00663*** (0.00189)	-0.00663*** (0.00174)
-45 to 0 C	-0.00499*** (0.00016)	-0.00499*** (0.00099)	-0.00499** (0.00206)	-0.00499*** (0.00157)
Controls				
Exp. × temperature intervals in <i>C</i> (Z)	✓	✓	✓	✓
Average temperature intervals in <i>C</i> (U)	✓	✓	✓	✓
Exp. × weather in <i>C</i>	✓	✓	✓	✓
Average weather in <i>C</i>	✓	✓	✓	✓
Temperatures MX	✓	✓	✓	✓
Weather MX	✓	✓	✓	✓
Fixed-effects				
Municipality-year	✓	✓	✓	✓
Municipality-quarter	✓	✓	✓	✓
<i>Fit statistics</i>				
Observations	93,789	93,789	93,789	93,789
Avg Remittances	4.0400	4.0400	4.0400	4.0400
Avg Population	143,618.0	143,618.0	143,618.0	143,618.0

Bartik SS: The effect of temperature in US counties on quarterly remittances to Mexican municipalities: Non-parametric Bartik model with inverted shares

	(1)	(2)	(3)	(4)
30 to 45 C	0.0006105*** (0.0000683)	-0.0001503** (0.0000735)	0.0001646** (0.0000725)	-0.0003957*** (0.0000780)
25 to 30 C	0.0003274*** (0.0000314)	-0.0001120*** (0.0000420)	0.0000706** (0.0000337)	-0.0002709*** (0.0000409)
20 to 25 C	0.0005807*** (0.0000517)	-0.0000443 (0.0000606)	0.0001702*** (0.0000540)	-0.0002695*** (0.0000627)
5 to 10 C	-0.0001486 (0.0001150)	-0.0005108*** (0.0001343)	-0.0001025 (0.0001188)	-0.0004184*** (0.0001360)
0 to 5 C	0.0001166 (0.0000835)	-0.0001531* (0.0000888)	0.0003447*** (0.0000858)	-0.0000259 (0.0000930)
-45 to 0 C	0.0000890* (0.0000497)	0.0000758 (0.0000657)	0.0000023 (0.0000496)	-0.0000318 (0.0000643)
Controls				
Exp. × temperature intervals in C (Z)	✓	✓	✓	✓
Average temperature intervals in C (U)			✓	✓
Exp. × weather in C	✓	✓	✓	✓
Average weather in C	✓	✓	✓	✓
Temperatures MX	✓	✓	✓	✓
Weather MX	✓	✓	✓	✓
$\sum Share \times period$		✓		✓
Fixed-effects				
Municipality-year	✓	✓	✓	✓
Municipality-quarter	✓	✓	✓	✓
<i>Fit statistics</i>				
Observations	93,789	93,789	93,789	93,789
Avg Remittances	4.0400	4.0400	4.0400	4.0400
Avg Population	143,618.0	143,618.0	143,618.0	143,618.0

Bartik SS: The effect of temperature in US counties on quarterly remittances to Mexican municipalities: Non-parametric Bartik model with 2°C intervals

	(1)	(2)	(3)	(4)
30 to 42 C	-0.00208*** (0.00007)	-0.00139*** (0.00010)	-0.00040*** (0.00011)	-0.00077*** (0.00011)
28 to 30 C	-0.00339*** (0.00019)	-0.00236*** (0.00018)	-0.00126*** (0.00018)	-0.00154*** (0.00018)
26 to 28 C	-0.00043** (0.00019)	-0.00029 (0.00019)	0.00015 (0.00019)	0.00027 (0.00019)
24 to 26 C	-0.00612*** (0.00026)	-0.00457*** (0.00025)	-0.00374*** (0.00025)	-0.00441*** (0.00024)
22 to 24 C	-0.00107*** (0.00032)	-0.00033 (0.00031)	0.00040 (0.00031)	0.00085*** (0.00030)
20 to 22 C	-0.00005 (0.00032)	0.00063* (0.00036)	0.00100*** (0.00035)	0.00057 (0.00035)
8 to 10 C	-0.00229*** (0.00040)	-0.00288*** (0.00036)	-0.00219*** (0.00034)	-0.00252*** (0.00032)
6 to 8 C	-0.00086* (0.00049)	0.00015 (0.00049)	-0.00111** (0.00047)	-0.00120*** (0.00046)
4 to 6 C	0.00087 (0.00056)	0.00213*** (0.00057)	0.00185*** (0.00056)	0.00108** (0.00054)
2 to 4 C	-0.00207*** (0.00058)	-0.00169*** (0.00054)	-0.00298*** (0.00052)	-0.00357*** (0.00051)
0 to 2 C	-0.01556*** (0.00071)	-0.01627*** (0.00061)	-0.01634*** (0.00057)	-0.01571*** (0.00053)
-45 to 0 C	-0.00454*** (0.00015)	-0.00385*** (0.00014)	-0.00461*** (0.00014)	-0.00423*** (0.00014)
Controls				
Exp. × temperature intervals in <i>C</i> (Z)	✓	✓	✓	✓
Average temperature intervals in <i>C</i> (U)	✓	✓	✓	✓
Exp. × weather in <i>C</i>		✓	✓	✓
Average weather in <i>C</i>		✓	✓	✓
Temperatures MX			✓	✓
Weather MX				✓
Fixed-effects				
Municipality-year	✓	✓	✓	✓
Municipality-quarter	✓	✓	✓	✓
<i>Fit statistics</i>				
Observations	93,789	93,789	93,789	93,789
Avg Remittances	4.0400	4.0400	4.0400	4.0400
Avg Population	143,618.0	143,618.0	143,618.0	143,618.0

Bartik SS: The effect of temperature in US counties on quarterly remittances to Mexican municipalities: Non-parametric Bartik model with different fixed effect specifications

	(1)	(2)	(3)	(4)	(5)
<i>Variables</i>					
30 to 45 C	-0.00863*** (0.00098)	-0.00282*** (0.00090)	-0.01178*** (0.00055)	-0.00260*** (0.00011)	0.00024*** (0.00009)
25 to 30 C	-0.00603*** (0.00072)	-0.00678*** (0.00065)	0.00118*** (0.00036)	-0.00235*** (0.00006)	0.00017*** (0.00005)
20 to 25 C	-0.01021*** (0.00074)	-0.00443*** (0.00065)	-0.00531*** (0.00039)	-0.00068*** (0.00008)	0.00088*** (0.00006)
5 to 10 C	0.00661*** (0.00128)	0.00528*** (0.00125)	0.00391*** (0.00058)	-0.00152*** (0.00019)	-0.00085*** (0.00012)
0 to 5 C	0.00497*** (0.00184)	0.00604*** (0.00177)	-0.00040 (0.00055)	-0.00663*** (0.00018)	-0.00439*** (0.00012)
-45 to 0 C	0.00503*** (0.00152)	0.00675*** (0.00146)	-0.00748*** (0.00055)	-0.00499*** (0.00016)	-0.00372*** (0.00011)
Controls					
Exp. × temperature intervals in C (Z)	✓	✓	✓	✓	✓
Average temperature intervals in C (U)	✓	✓	✓	✓	✓
Exp. × weather in C	✓	✓	✓	✓	✓
Average weather in C	✓	✓	✓	✓	✓
Temperatures MX	✓	✓	✓	✓	✓
Weather MX	✓	✓	✓	✓	✓
<i>Fixed-effects</i>					
Quarter		✓			
Year		✓			
Municipality-Quarter			✓	✓	✓
Municipality-Year				✓	✓
Year-Quarter					✓
<i>Fit statistics</i>					
Observations	114,492	114,492	113,592	93,789	93,789
Avg Remittances	4.0400	4.0400	4.0400	4.0400	4.0400
Avg Population	143,618.0	143,618.0	143,618.0	143,618.0	143,618.0

Bartik SS: The effect of temperature in US counties on quarterly remittances to Mexican municipalities:
Non-parametric Bartik model for different samples of distance to the US- Mexico Border

Model:	All demarcations	> 0 Km	> 50 Km	> 100 Km	> 200 Km	> 400 Km	> 800 Km
30 to 45 C	-0.00260*** (0.00011)	-0.00260*** (0.00011)	-0.00248*** (0.00013)	-0.00289*** (0.00014)	-0.00275*** (0.00018)	-0.00268*** (0.00013)	-0.03075*** (0.00086)
25 to 30 C	-0.00235*** (0.00006)	-0.00235*** (0.00006)	-0.00227*** (0.00006)	-0.00253*** (0.00006)	-0.00212*** (0.00006)	-0.00257*** (0.00006)	-0.00447*** (0.00011)
20 to 25 C	-0.00068*** (0.00008)	-0.00068*** (0.00008)	-0.00117*** (0.00009)	-0.00142*** (0.00010)	-0.00151*** (0.00012)	-0.00124*** (0.00010)	-0.00539*** (0.00015)
5 to 10 C	-0.00152*** (0.00019)	-0.00152*** (0.00019)	-0.00136*** (0.00019)	-0.00156*** (0.00019)	-0.00178*** (0.00020)	-0.00238*** (0.00018)	-0.00518*** (0.00031)
0 to 5 C	-0.00663*** (0.00018)	-0.00663*** (0.00018)	-0.00736*** (0.00017)	-0.00729*** (0.00017)	-0.00694*** (0.00016)	-0.00724*** (0.00013)	-0.00759*** (0.00022)
-45 to 0 C	-0.00499*** (0.00016)	-0.00499*** (0.00016)	-0.00532*** (0.00014)	-0.00525*** (0.00014)	-0.00530*** (0.00014)	-0.00539*** (0.00012)	-0.00588*** (0.00014)
Controls							
Weighted shock (Z)	✓	✓	✓	✓	✓	✓	✓
Avg. network weather (U)	✓	✓	✓	✓	✓	✓	✓
Exp. × weather in C	✓	✓	✓	✓	✓	✓	✓
Average weather in C	✓	✓	✓	✓	✓	✓	✓
Temperatures MX	✓	✓	✓	✓	✓	✓	✓
Weather MX	✓	✓	✓	✓	✓	✓	✓
Fixed-effects							
Mun-Year	✓	✓	✓	✓	✓	✓	✓
Mun-Quarter	✓	✓	✓	✓	✓	✓	✓
Fit statistics							
N. Municipalities	2,453	2,436	2,398	2,365	2,277	2,153	1,197
Observations	93,789	93,789	92,161	90,855	87,242	82,362	42,324
Avg Remittances	4.0400	4.0500	3.9300	3.9500	3.9300	3.9900	2.4200
Avg Population	49,756.1	49,951.4	48,063.9	48,119.4	46,757.4	46,718.3	24,645.2

Appendix: Bartik Shift Share (Residualization)



Bartik SS with Residualization: Construct Z – U by demeaning g before weighting

	(1)	(2)	(3)	(4)
30 to 45 C	-0.00424*** (0.00007)	-0.00239*** (0.00010)	-0.00136*** (0.00010)	-0.00214*** (0.00010)
25 to 30 C	-0.00568*** (0.00008)	-0.00253*** (0.00008)	-0.00208*** (0.00008)	-0.00208*** (0.00007)
20 to 25 C	-0.00268*** (0.00008)	-0.00138*** (0.00008)	-0.00090*** (0.00008)	-0.00091*** (0.00008)
5 to 10 C	-0.00163*** (0.00021)	-0.00083*** (0.00020)	-0.00095*** (0.00019)	-0.00139*** (0.00018)
0 to 5 C	-0.00070*** (0.00023)	-0.00144*** (0.00022)	-0.00099*** (0.00021)	-0.00258*** (0.00019)
-45 to 0 C	-0.00087*** (0.00019)	-0.00098*** (0.00016)	-0.00063*** (0.00015)	-0.00094*** (0.00015)
Observations	94,444	93,789	93,789	93,789
Pseudo R^2	0.86844	0.86881	0.86881	0.86883

Bartik SS with Residualization: Construct Z – U directly at the collapsed level

	(1)	(2)	(3)	(4)
30 to 45 C	-0.00425*** (0.00007)	-0.00239*** (0.00010)	-0.00136*** (0.00010)	-0.00214*** (0.00010)
25 to 30 C	-0.00568*** (0.00008)	-0.00253*** (0.00008)	-0.00209*** (0.00008)	-0.00208*** (0.00007)
20 to 25 C	-0.00268*** (0.00008)	-0.00138*** (0.00008)	-0.00090*** (0.00008)	-0.00091*** (0.00008)
5 to 10 C	-0.00163*** (0.00021)	-0.00083*** (0.00020)	-0.00095*** (0.00019)	-0.00139*** (0.00018)
0 to 5 C	-0.00070*** (0.00023)	-0.00144*** (0.00022)	-0.00099*** (0.00021)	-0.00258*** (0.00019)
-45 to 0 C	-0.00087*** (0.00019)	-0.00097*** (0.00016)	-0.00063*** (0.00015)	-0.00094*** (0.00015)

Bartik SS with Residualization: Residualized Z after weighting

	(1)	(2)	(3)	(4)
30 to 45 C	-0.00589*** (0.00049)	-0.00430*** (0.00056)	-0.00324*** (0.00058)	-0.00367*** (0.00055)
25 to 30 C	-0.00626*** (0.00046)	-0.00430*** (0.00049)	-0.00365*** (0.00049)	-0.00356*** (0.00049)
20 to 25 C	-0.00364*** (0.00037)	-0.00206*** (0.00039)	-0.00157*** (0.00040)	-0.00164*** (0.00042)
5 to 10 C	-0.00157*** (0.00035)	-0.00043 (0.00038)	-0.00032 (0.00036)	-0.00094*** (0.00030)
0 to 5 C	-0.00382*** (0.00053)	-0.00248*** (0.00049)	-0.00270*** (0.00050)	-0.00431*** (0.00044)
-45 to 0 C	-0.00383*** (0.00047)	-0.00266*** (0.00050)	-0.00278*** (0.00050)	-0.00265*** (0.00048)
Fixed effects				
Municipality-Year	Yes	Yes	Yes	Yes
Municipality-Quarter	Yes	Yes	Yes	Yes
S.E. type	Custom	Custom	Custom	Custom
Observations	93,789	93,789	93,789	93,789
Squared Cor.	0.99310	0.99321	0.99326	0.99330
Pseudo R^2	0.86875	0.86879	0.86880	0.86882
BIC	573,988.1	574,017.0	574,063.4	574,103.8

Bartik SS with Residualization: Residualized Z before weighting

Dependent variable:	rem			
	(1)	(2)	(3)	(4)
30 to 45 C	-0.00424*** (7.47e-5)	-0.00239*** (9.54e-5)	-0.00136*** (0.00010)	-0.00214*** (9.77e-5)
25 to 30 C	-0.00568*** (7.63e-5)	-0.00253*** (7.55e-5)	-0.00208*** (7.59e-5)	-0.00208*** (7.26e-5)
20 to 25 C	-0.00268*** (8.42e-5)	-0.00138*** (7.81e-5)	-0.00090*** (7.84e-5)	-0.00091*** (8.41e-5)
5 to 10 C	-0.00163*** (0.00021)	-0.00083*** (0.00020)	-0.00095*** (0.00019)	-0.00139*** (0.00018)
0 to 5 C	-0.00070*** (0.00023)	-0.00144*** (0.00022)	-0.00099*** (0.00021)	-0.00258*** (0.00019)
-45 to 0 C	-0.00087*** (0.00019)	-0.00098*** (0.00016)	-0.00063*** (0.00015)	-0.00094*** (0.00015)
Fixed effects:				
agem-year	Yes	Yes	Yes	Yes
agem-quarter	Yes	Yes	Yes	Yes
S.E. type	Custom	Custom	Custom	Custom
Observations	94,444	93,789	93,789	93,789
Squared Cor.	0.99310	0.99329	0.99333	0.99334
Pseudo R^2	0.86844	0.86881	0.86881	0.86883
BIC	578,147.6	574,070.9	574,119.1	574,175.8

Appendix: MCAS

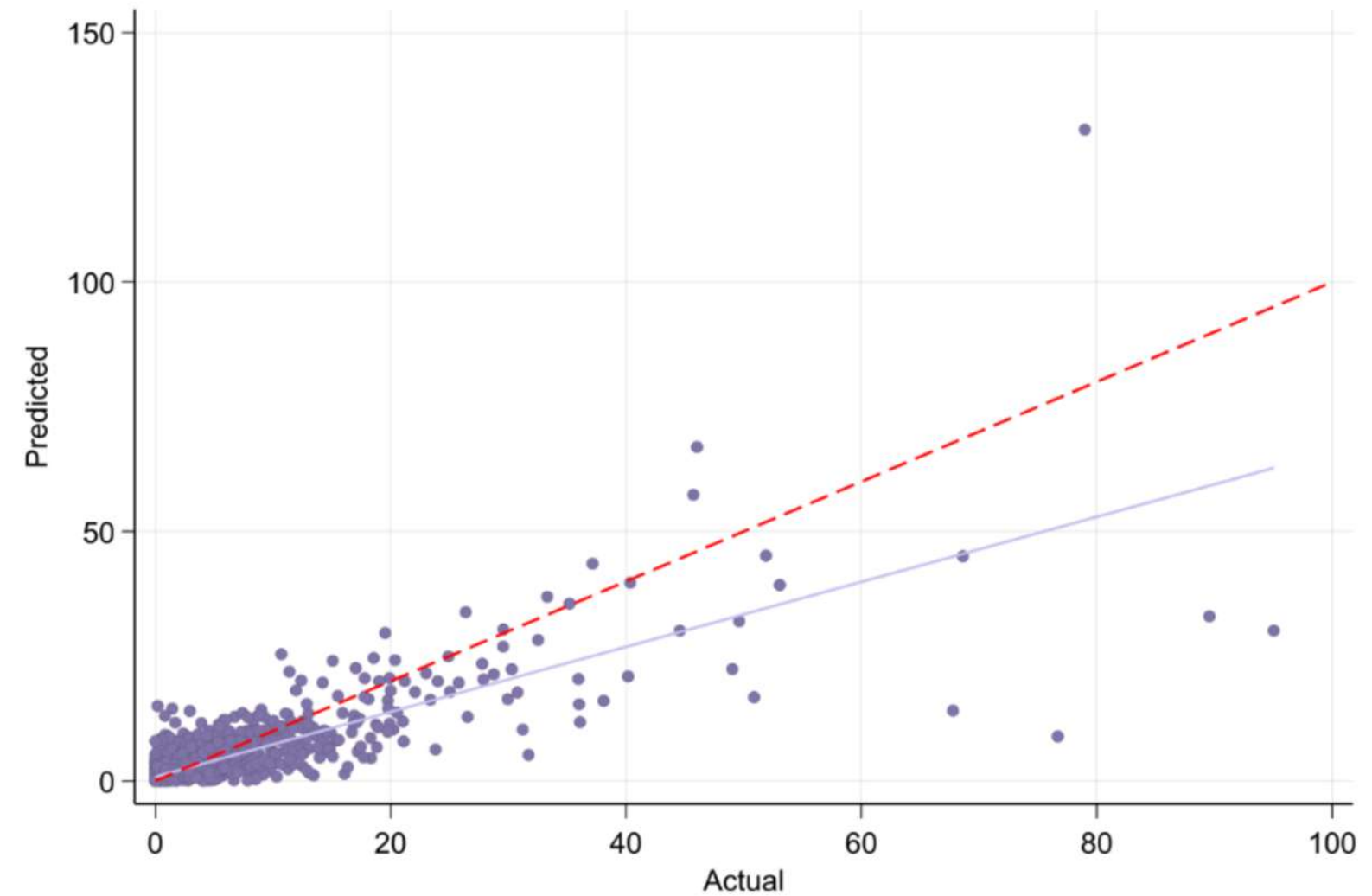
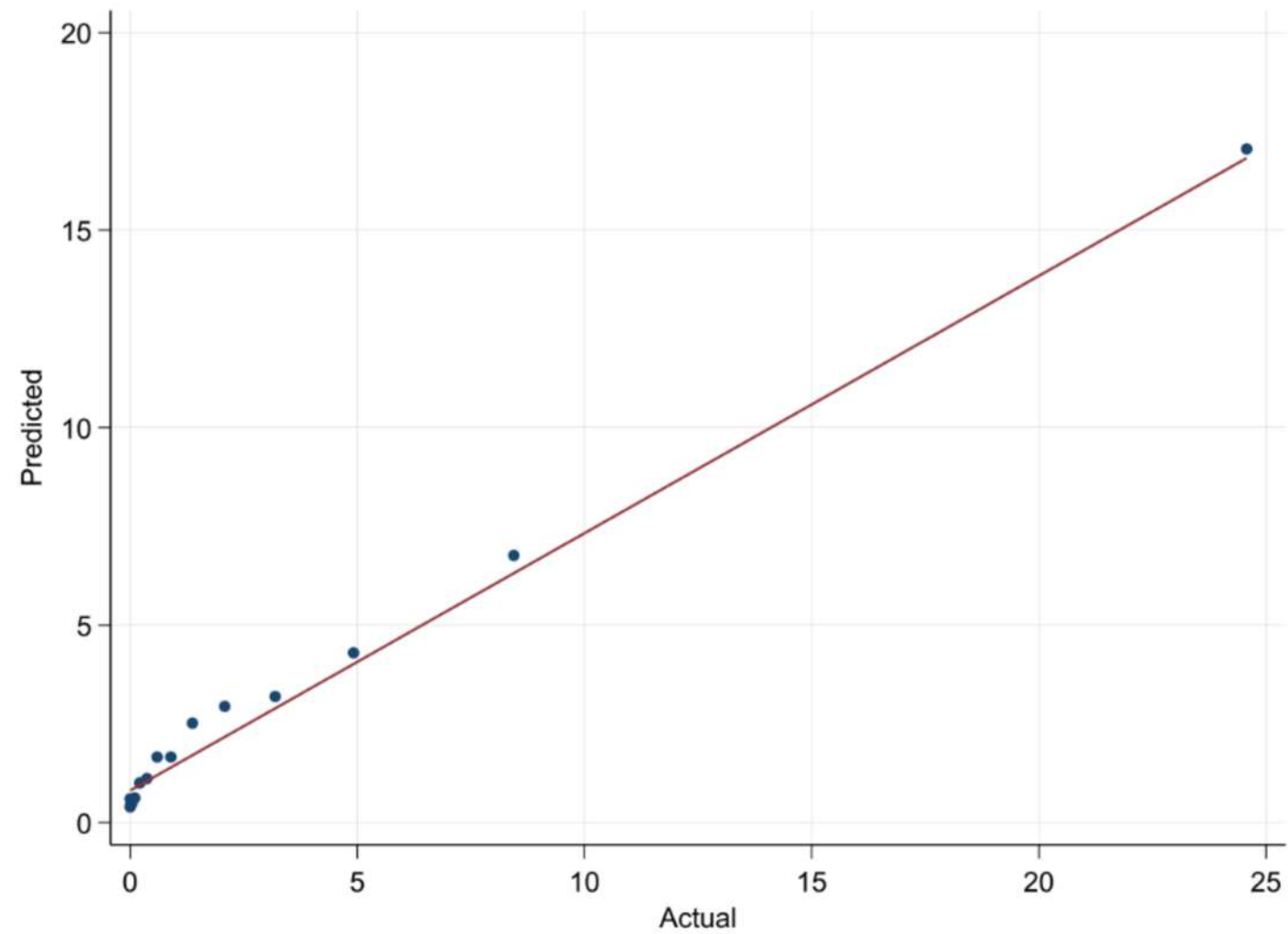


regression of Actual Remittances on Predicted Remittances (2013)

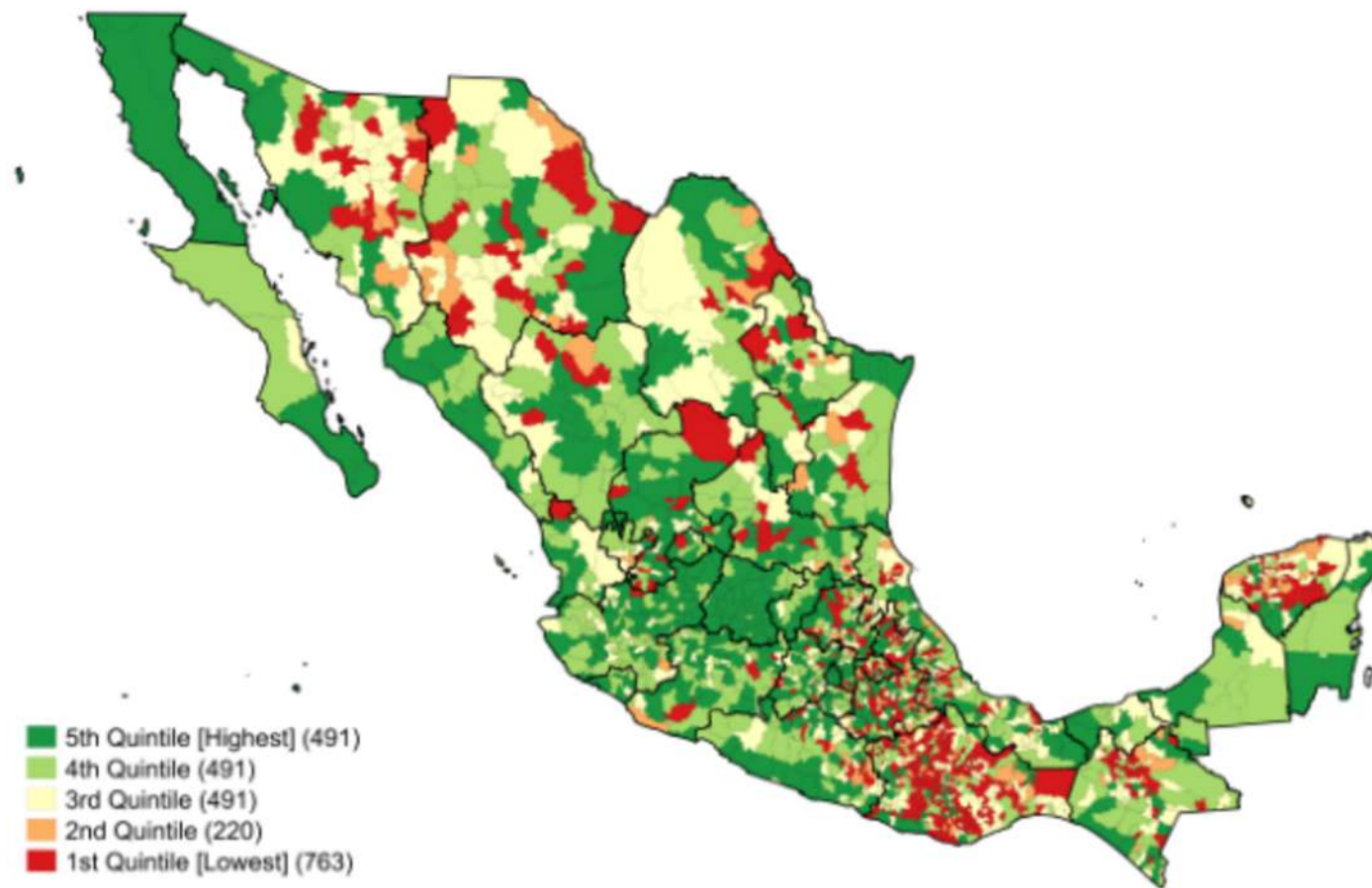
	Actual Remittances	
	(1)	(2)
Predicted Remittances	0.996*** (0.093)	0.996*** (0.107)
Constant		0.010 (0.214)
Observations	2,457	2,457
R^2	0.688	0.649

Robust standard errors in parentheses. *, **, and *** denote $p < 0.05$, $p < 0.01$, and $p < 0.001$.

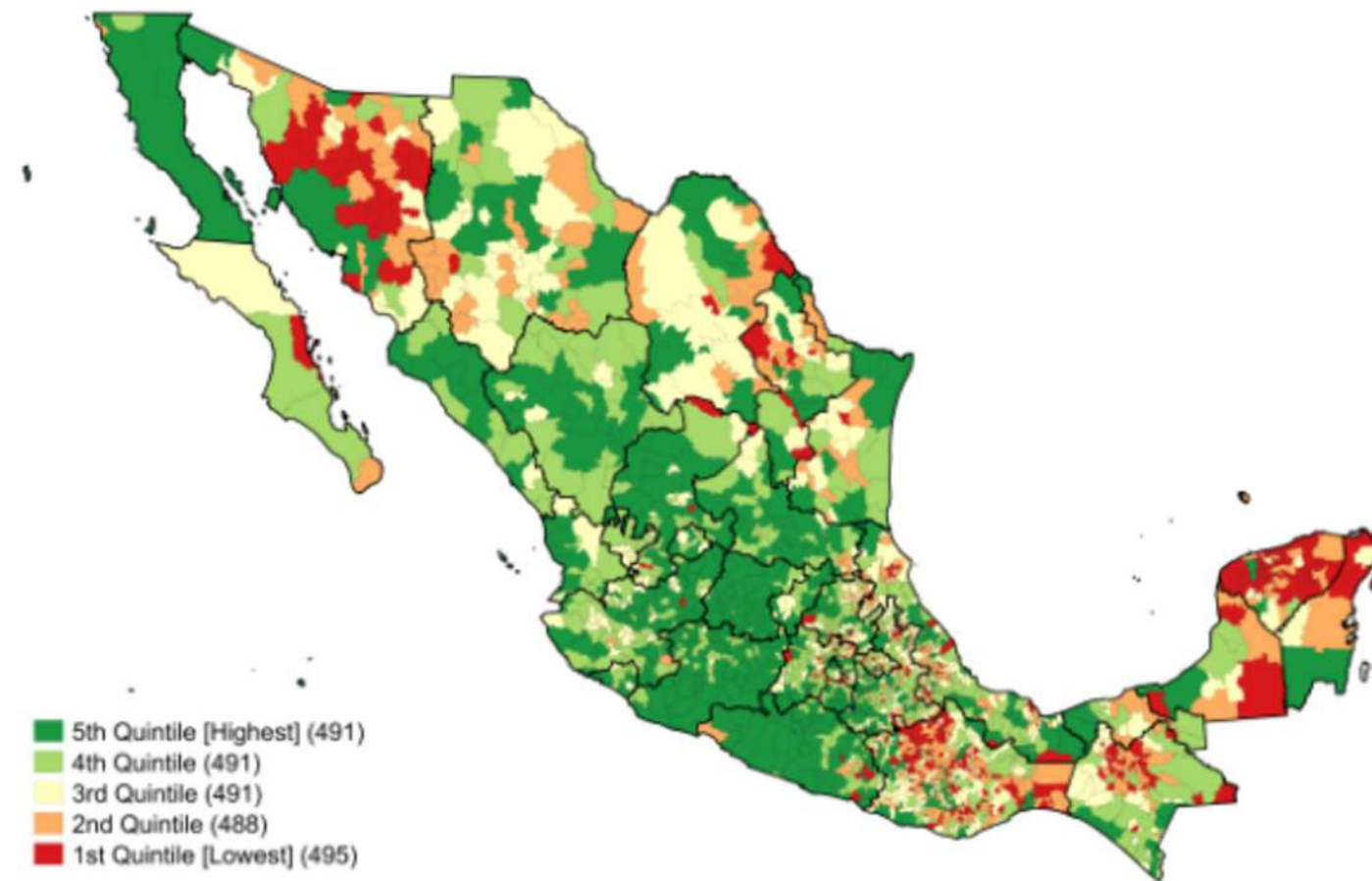
Remsas (observadas vs predicción)



Effects of CR-fires on mortality across different distances



(a) Actual Remittances



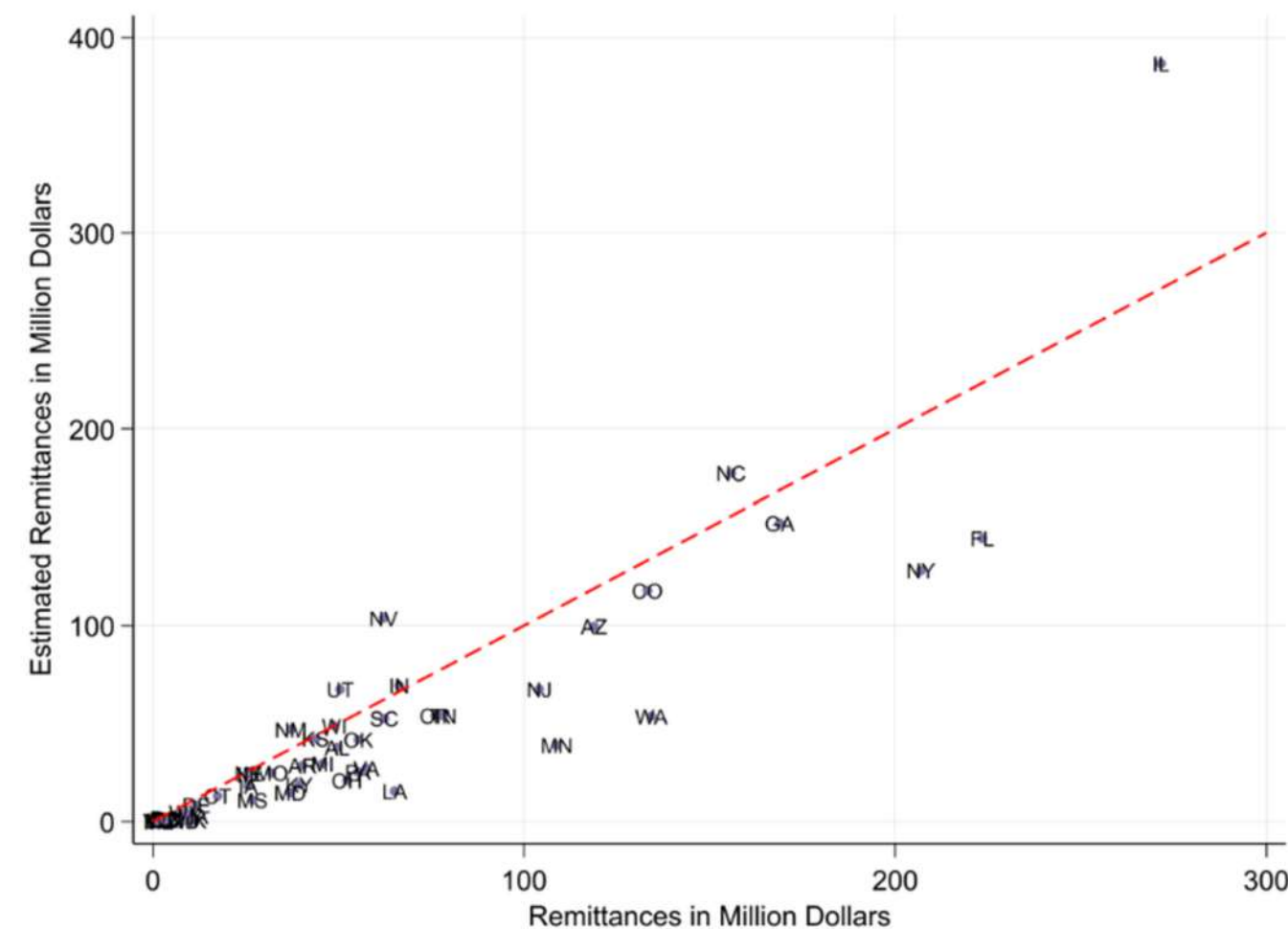
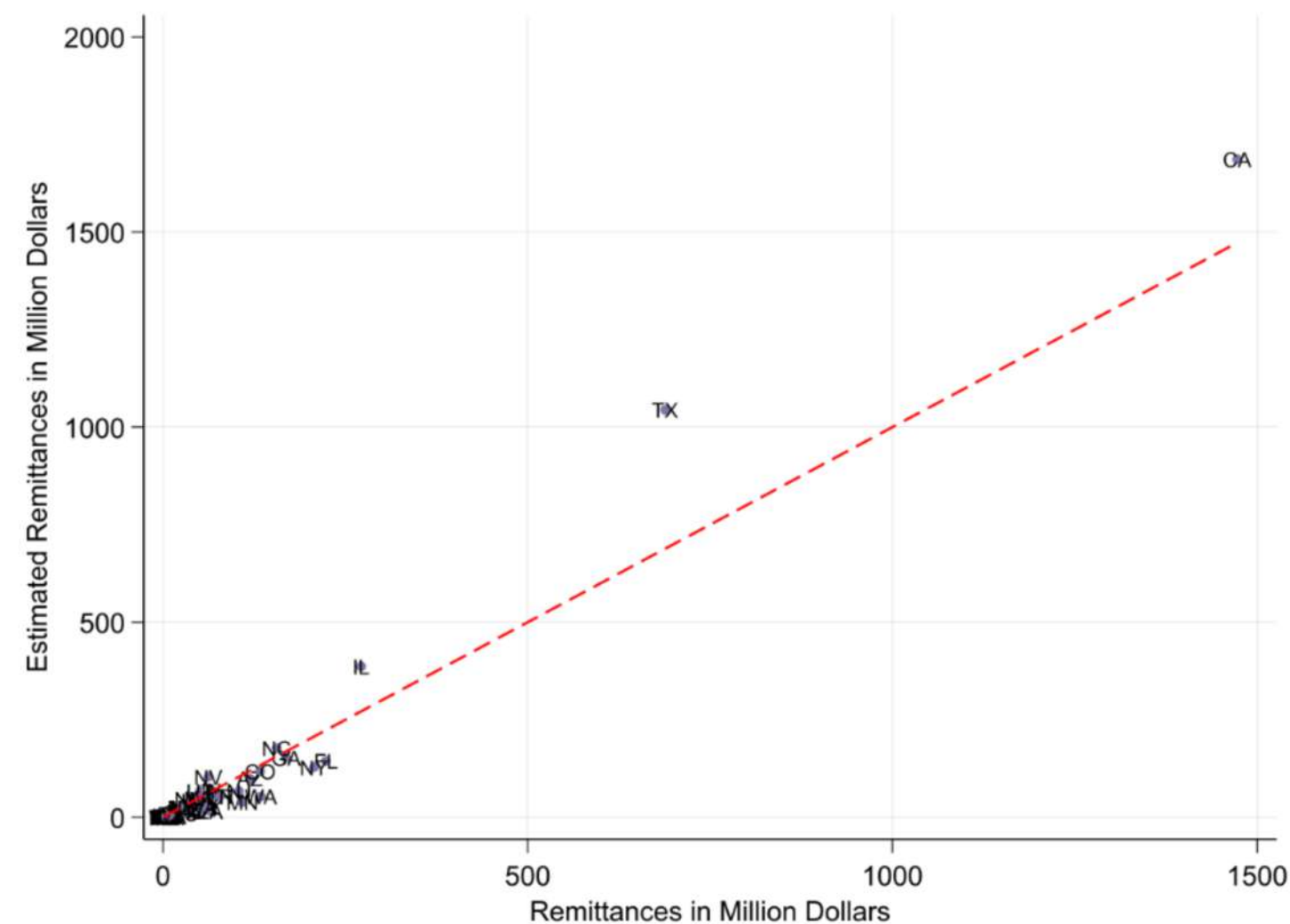
(b) Predicted Remittances
Based on MCAS Shares

Regression of Actual Remittances on Predicted Remittances Sent by US States (2013)

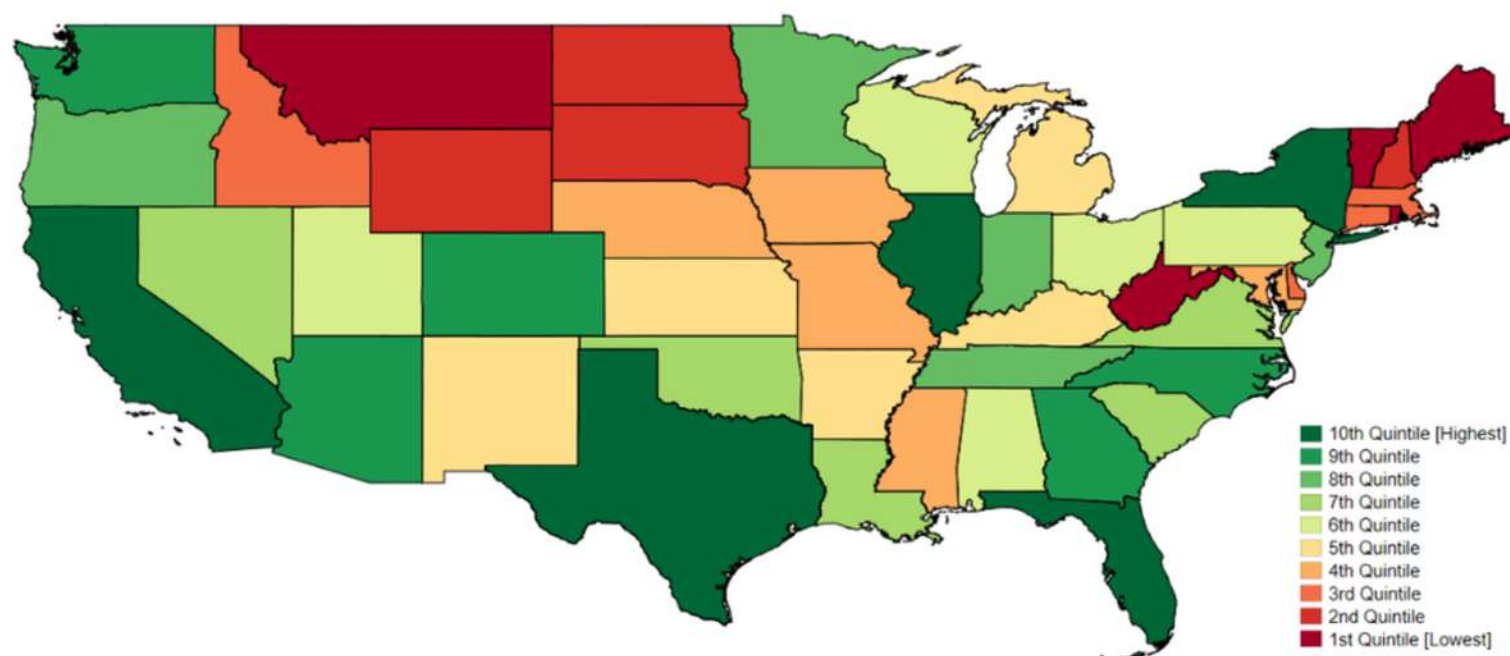
	Actual Remittances	
	(1)	(2)
Predicted Remittances	0.826*** (0.054)	0.803*** (0.061)
Constant		19.459*** (4.583)
Observations	51	51
R^2	0.968	0.969

Robust standard errors in parentheses. *, **, and *** denote $p < 0.05$, $p < 0.01$, and $p < 0.001$.

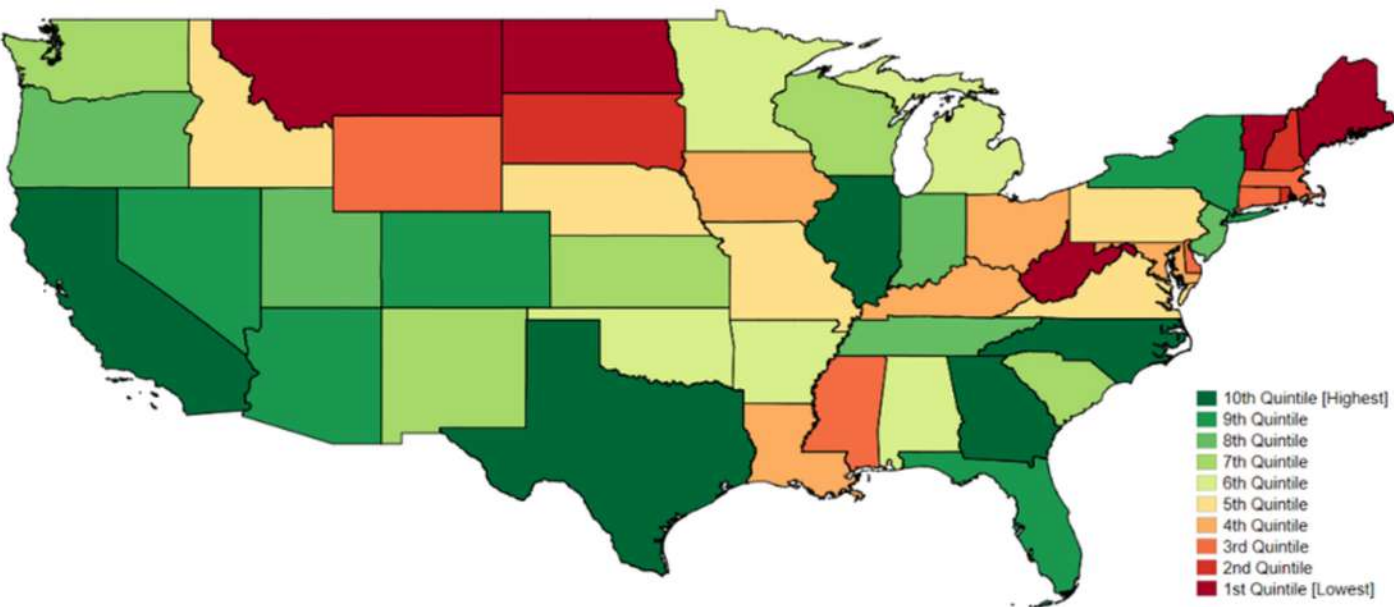
Scatter Plot: Actual vs. Predicted Remittances Sent by US States in 2013 (right hand side excludes California and Texas)



Remesas (observado vs. predicho)



(a) Actual Remittances



(b) Predicted Remittances Based on MCAS Shares