ONLINE APPENDIX

Preliminary analysis results

Presented in Table A1 are summary statistics and a detailed description of the sample period, particularly in terms of the number of observations for the monthly and the annual frequencies. The first layer of the table presents summary statistics on monthly stock returns, while the second layer of the table describes the sample period associated with the return series.

Table A1: Summary Statistics

	Canada	**France**	**Germany**	**Italy**	**Japan**	**UK**	**USA**
Stock Returns (SR)							
Mean	0.3915	0.4682	0.2306	0.4364	0.5499	0.2996	0.3751
Std. Dev.	4.4882	4.7652	7.2345	6.7598	6.1166	3.9830	4.0987
Skewness	-1.0557	-0.0535	-4.7702	0.9907	0.3499	-0.0808	-0.4517
Kurtosis	9.0237	5.5906	115.3158	9.4207	10.1096	15.7626	14.4591
Description of sample period for the monthly SR series							
Frequency	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
Start	Feb-1915	Jan-1880	Jan-1880	Jan-1906	Jan-1915	Jan-1880	Jan-1880
End	Dec-2018	Dec-2018	Dec-2018	Dec-2018	Dec-2018	Dec-2018	Dec-2018
No. Obs.	1247	1668	1668	1356	1248	1668	1668
Climate change: Temperature anomalies (TMP)							
Mean	0.1374	0.0362	0.0362	0.0979	0.1374	0.0362	0.0362
Std. Dev.	0.3328	0.3417	0.3417	0.3477	0.3328	0.3417	0.3417
Skewness	0.6653	0.8573	0.8573	0.6171	0.6653	0.8573	0.8573
Kurtosis	2.6105	2.9758	2.9758	2.6298	2.6105	2.9758	2.9758
Frequency	Annual	Annual	Annual	Annual	Annual	Annual	Annual
Start	1915	1880	1880	1906	1915	1880	1880
End	2018	2018	2018	2018	2018	2018	2018
No. Obs.	104	139	139	113	104	139	139
Country specific –based Technology Shock							
Mean	0.0256	0.0164	0.0503	0.0469	0.1374	0.0155	0.0532
Std. Dev.	0.1998	0.3640	0.3654	0.5568	0.3260	0.2555	0.1638
Skewness	0.3047	0.0460	1.1623	-0.3907	-1.3551	0.3019	-0.0929
Kurtosis	2.7097	9.0084	7.2663	6.0162	8.8270	5.0382	3.3585
Frequency	Annual	Annual	Annual	Annual	Annual	Annual	Annual
Start	1915	1880	1880	1906	1915	1880	1880
End	2018	2018	2018	2018	2018	2018	2018
No. Obs.	104	139	139	113	104	139	139
I64 Countries global–based Technology Shock (GST_164)							
Mean	0.0627	0.0711	0.0711	0.0655	0.0627	0.0711	0.0711
Std. Dev.	0.1790	0.1614	0.1614	0.1721	0.1790	0.1614	0.1614
Skewness	-0.2377	-0.4060	-0.4060	-0.2922	-0.2377	-0.4060	-0.4060
Kurtosis	2.9878	3.6779	3.6779	3.2325	2.9878	3.6779	3.6779
Frequency	Annual	Annual	Annual	Annual	Annual	Annual	Annual
Start	1915	1880	1880	1906	1915	1880	1880
End	2018	2018	2018	2018	2018	2018	2018
No. Obs.	104	130	130	113	104	130	130

Source: Authors' own creation/work.

Starting with the mean statistic, the average stock return for the G7 economies appears to have hovered around 0.23% and 0.55%, with Japan being the country with the highest stock return and Germany the country with the lowest stock return. The standard deviation statistic reveals Germany, Italy, and Japan as being among the G7 countries with the most volatile returns. In contrast, the UK has historically had the least volatile stock returns, followed by the US, Canada, and France. The historical nature of these results indicates that we have a sample of economies where stock markets exhibit different potential risk-return relationships. The distribution statistics show that the returns are predominantly negatively skewed and mainly leptokurtic for the return series. This evidence of non-zero skewness and right-tail kurtosis statistics indicates that the return series are not normally distributed.

Reported in the third layer of Table A1 are the summary statistics of the annual global mean temperature anomalies, a measure of climate change in the context of this study. The fact that the mean values are positive for all the countries, irrespective of the varying start dates, can be interpreted as evidence of high temperatures in each of the G7 countries under investigation. In the final two layers of the table are summary statistics on technological innovations, both from local and global perspectives, respectively. However, while the global technology shock (GTS_164) is homogenous, the mean statistic associated with the local technological shock shows that Japan is the country with the highest average annual technological innovations, followed by the USA and Germany, with France and the UK, having the least average annual technological shock.

Further presented in Table A2 are additional preliminary results of particular importance to our choice of estimation techniques in this study. The statistical tests in this regard include the autoregressive conditional heteroscedasticity (ARCH) and the Ljung-Box autocorrelation tests (Q and Q^2 statistics). For robustness and consistency, these tests are performed at varying lags. We discover that, regardless of the lag used, there is overwhelming evidence of conditional heteroscedasticity and autocorrelations in all the variables of interest. This, among other things, further ascertains the appropriateness of the choice of our estimation technique in the following immediate section.

Table A2: Conditional heteroscedasticity and autocorrelation results

	Canada	France	Germany	Italy	Japan	UK	USA
Stock returns							
ARCH(6)	9.8888***	27.2312***	2.3063***	28.1790***	32.3260***	25.0959***	34.0851***
ARCH(12)	11.5255***	14.1975***	1.5991*	21.7575***	25.3963***	17.0882***	24.7981***
ARCH(24)	6.5766***	7.9171***	1.0477	12.1797***	14.0308***	9.0401***	13.4810***
Q(6)	48.060***	39.121***	81.589***	52.330***	24.302***	38.431***	145.68***
Q(12)	54.892***	62.849***	88.103***	63.292***	37.116***	50.982***	154.66***
Q(24)	87.614***	84.857***	140.87***	99.777***	42.013***	75.549***	216.83***
$Q^2(6)$	83.615***	260.17***	16.654**	258.46***	253.65***	231.12***	255.69***
$Q^2(12)$	218.45***	351.11***	26.834***	552.58***	533.04***	351.52***	491.46***
$Q^2(24)$	299.63***	485.43***	39.900***	771.14***	653.68***	435.04***	602.11
Climate change: Temperature anomalies (TEMP)							
ARCH(6)	643.51***	1091.42***	1091.42***	803.7***	643.51***	1091.42***	1091.42***
ARCH(12)	337.31***	571.90***	571.90***	421.26***	337.31***	571.90***	571.90***
ARCH(24)	182.137***	293.32***	293.32***	218.97***	182.137***	293.32***	293.32***
Q(6)	6081.7***	8207.9***	8207.9***	6715.2***	6081.7***	8207.9***	8207.9***
Q(12)	11482.0***	15554.0***	15554.0***	12720.0***	11482.0***	15554.0***	15554.0***
Q(24)	21102.0***	28786.0***	28786.0***	23552.0***	21102.0***	28786.0***	28786.0***
$Q^2(6)$	4175.7***	6224.6***	6224.6***	4832.6***	4175.7***	6224.6***	6224.6***
$Q^2(12)$	7303.0***	11152.0***	11152.0***	8503.5***	7303.0***	11152.0***	11152.0***
$Q^2(24)$	11875.0***	18887.0***	18887.0***	14250.0***	11875.0***	18887.0***	18887.0***
Country specific –based Technology Shock (TS)							
ARCH(6)	3.5196***	23.5660***	37.7724***	0.8416	4.4895***	7.4196***	11.5822***
ARCH(12)	2.2886**	11.9914***	17.0873***	0.6829	2.0803**	3.2383***	6.0349***
ARCH(24)	0.9771	5.3188***	7.1772***	0.3563	0.8431	1.6059*	2.7063***
Q(6)	75.886***	129.11***	98.080***	43.775***	59.062***	86.211***	98.514***
Q(12)	101.75***	139.28***	104.15***	48.604***	65.823***	86.676***	109.15***
Q(24)	150.22***	161.09***	141.73***	51.305***	81.962***	101.06***	122.73***
$Q^2(6)$	25.337***	121.77***	126.02***	5.7475	32.011***	23.592***	83.656***
$Q^2(12)$	32.100***	126.25***	132.68***	9.5393	37.435***	26.724***	87.084***
$Q^2(24)$	34.036***	133.38***	139.81***	14.193	40.511**	38.532**	101.91***
I64 Countries global –based Technology Shock (GST_164)							
ARCH(6)	7.7128***	12.0639***	12.0639***	8.9754***	7.7128***	12.0639***	12.0639***
ARCH(12)	3.7915***	5.7557***	5.7557***	4.5676***	3.7915***	5.7557***	5.7557***
ARCH(24)	1.6115*	2.3349***	2.3349***	1.8192**	1.6115*	2.3349***	2.3349***
Q(6)	118.92***	146.54***	146.54***	128.26***	118.92***	146.54***	146.54***
Q(12)	120.51***	148.45***	148.45***	129.96***	120.51***	148.45***	148.45***
Q(24)	178.48***	211.82***	211.82***	188.46***	178.48***	211.82***	211.82***
$Q^2(6)$	66.155***	96.118***	96.118***	68.615***	66.155***	96.118***	96.118***
$Q^2(12)$	73.183***	104.15***	104.15***	77.882***	73.183***	104.15***	104.15***
$Q^2(24)$	82.970***	114.17***	114.17***	85.635***	82.970***	114.17***	114.17****

Source: Authors' own creation/work.

Note: The reported figures are F-statistics for the ARCH test and Ljung–Box Q-statistics for the autocorrelation test, considered at three different lag lengths (k = 6, 12, and 24). The null hypotheses of no conditional heteroscedasticity and serial correlation are tested for ARCH and autocorrelation tests, respectively. Statistical significance of tests at 1%, 5%, and 10% levels, denoted by ***, **, and *, respectively, indicates the rejection of the null hypotheses.

The non-MIDAS modelling approach

Here, our empirical strategy is based on the bivariate predictive model of Westerlund and Narayan (2015) due to its ability, among others, to account for some of the inherent statistical features earlier reported in the preliminary analysis. In the absence of such statistical concern, our linear bivariate model is usually as represented in equation (1), where stock returns (r_t) captured individually for each of the G7 member countries are computed using realized volatility is expressed as the square root of annualized realized variance: $r\_rvol_t = \sqrt{12 * d_t^2}$ where *d* is the difference between stock return values in successive months. The stock return volatility is then regressed on climate change (clc_t), which will be captured singly across the two alternatives under comnsideration

$$r_t = \alpha_0 + \beta clc_{t-1} + \varepsilon_t \tag{1}$$

where r_t is the stock returns realized volatility and clc_t is the climate change factor. For $\beta > 0$, the climate change induces volatility in the stock market and the reverse holds for $\beta < 0$.

However, there is likely a tendency towards a correlation between the error term and predictor series in equation (1), could consequently lead to endogeneity bias and the potential effect of persistence as evident in our preliminary results. Therefore, the question of how to estimate the model in equation (1) arises. The conventional way would have been to ignore the issues of bias and inefficiency altogether and run OLS. However, our preliminary finding shows that our variables exhibit some statistical features that make the OLS approach suboptimal for some of the biases that may arise. To counter one of such biases, Lewellen (2004) developed a bias-adjusted estimator "adjusted that deals in particular with the endogeneity issue. Thus, equation (2) is the adjusted variant of the bivariate predictive model in equation (1).

$$r_t = \alpha_0 + \beta'_{adj} clc_{t-1} + \delta(clc_t - \rho clc_{t-1}) + \varepsilon_t \tag{2}$$

The OLS estimator that is adjusted for potential bias in equation (2) is denoted by $\beta_{adj} = \hat{\beta} - \delta(\hat{\rho} - \rho)$, while the endogeneity bias caused by the correlation of ε_t and clc_t is corrected by the inclusion of the additional term $\delta(clc_t - \rho clc_{t-1})$ while ρ and $\hat{\rho}$ are fitted coefficients of one period-lagged (clc_{t-1}). To further account for the probable effect of conditional heteroscedasticity, which is a feature common with time-series data, Narayan and Westerlund (2015) suggest pre-weighting all of the data by $1/\sigma_v$ and then estimate the resulting equation with OLS. Hence, the Feasible Quasi Generalized Least Square (FQGLS) is given as:

$$\beta_{adj}^{FQGLS} = \frac{\sum_{t-qm+2}^{T} \gamma_t^2 p_t^d tmp_{t-1}^d}{\sum_{t-qm+2}^{T} \gamma_t^2 (tmp_{t-1}^d)^2} \quad (3)$$

where $\gamma_t = 1/\sigma_{v,t}$ is used to weigh all the data in the bias-adjusted predictive model in equation (2), while $p_t^d = p - \sum_{p=2}^{T} p_t / T$ and $clc_t^d = clc_t - \sum_{clc=2}^{T} clc_t / T$.

Regression Result -based on the Non-MIDAS Model

Presented in Table B1 are the regression estimates obtained from the estimation of the non-MIDAS model, and the essence is to determine the robustness of the alternative measures of climate change considered in this study.

Table B1: Regression results on stock return volatility and climate change

	Canada	France	Germany	Italy	Japan	UK	USA
Table A1: Climate Change (Temperature Anomalies)							
Without Control	-0.0241*** (0.0085)	0.0079*** (0.0022)	-0.0788*** (0.0150)	0.0327*** (0.0136)	-0.0269*** (0.0042)	0.0421*** (0.0091)	0.0208** (0.0095)
With Control	-0.0203** (0.0078)	0.0134*** (0.0041)	0.0125*** (0.0041)	0.0086** (0.0035)	0.0016 (0.0050)	0.0483*** (0.0104)	0.0087*** (0.0025)
Table A2: Climate Change (Precipitation)							
Without Control	-0.0003** (0.0001)	0.0001*** (3.00E-05)	0.0024*** (0.0002)	4.60E-05 (5.10E-05)	-0.0001*** (2.96E-05)	0.0002*** (2.57E-05)	0.0003** (0.0001)
With Control	-0.0003*** (0.0001)	0.0001*** (3.91E-05)	0.0002** (4.98E-05)	9.32E-05*** (3.02E-05)	6.89E-05*** (2.10E-05)	0.0002*** (2.81E-05)	-6.68E-05 (7.97E-05)

Source: Authors' own creation/work.

Note: "Without Control" implies the original model with the climate change factor only as predictor of stock return volatility while "With Control" is an extension of the original model to include relevant control variables (i.e. inflation). Values in parentheses - ( ) are the standard errors of the coefficients, ***, ** & * indicate statistical significance at 1%, 5% and 10% levels respectively.

Additional Results

One of the main innovations and additional contributions of this study to the literature on the subject matter relates to whether the extent to which climate change matters in the volatility dynamics of stock returns varies for different degrees of climate change (temperature levels). As a result, we innovatively construct different percentiles of high temperature, namely the 25^{th}, 50^{th}, and 75^{th} percentiles of high temperature. This additional analysis is considered for the climate change-stock return volatility nexus with and without the role of technological shock and across the full sample of our data set and the restricted sample of the post-Great Depression period.

Additional results without the role of technology using full-sample

In Table B2, we present additional results, where we further subject our findings to a robustness check across different levels of high temperature based on the full sample of our historical data. Like our earlier findings, we find that the coefficients on the exogenous variable (X), for instance, climate change, are predominantly negative for all of the G7 countries and across all three levels of high temperature considered. However, in what appears to confirm the validity of our innovation of considering different levels of high temperature, we find that the lower the percentile of the level of high temperature (i.e., 25^{th} percentile), the greater the magnitude at which the climate change reduces volatility in the stock returns of five of the G7 countries. This seems consistent with the widespread assumption that increasing climate change will lead to high disruption of the stock market and increased volatility in stock returns. For instance, despite the predominant negative sign on the coefficients of the exogenous regressors, the magnitude is consistently lower for the highest temperature level (i.e., 75^{th} percentile). This indicates that the higher the degree of warming, the more disruptive climate change will be to the stock market, which reduces the potential of climate change to reduce volatility in stock returns.

Additional results without the role of technology using PGD-sample

Here, the additional analysis of the stock returns and climate change nexus is examined from the viewpoint of the post-Great Depression sample, with the empirical estimates presented in Table B3 largely supporting the assertion that high temperature can cause disruption in the stock market and thus increase volatility in stock returns. Unlike what is obtainable in Table B2, where the coefficients on the exogenous variables (X) are virtually negative for all the G7 countries, the reverse appears to be the case in Table B3. This aligns with the underlying intuition that increasing economic activity will increase environmental degradation, carbon emissions, and stock market disruption. However, the fact that the extent to which these transmissions manifest themselves in increasing volatility in the stock returns is larger when the temperature is 25^{th} percentile compared to when it is 50^{th} percentile or 75^{th} percentile seems to be suggesting that the potential of climate change to raise stock return volatility with increasing activities after the great Depression reduces with rising temperature. For example, the post-Great Depression phase of the global business cycle generally implies recovery from a slow economic system and increasing economic activity, which is synonymous with increasing energy consumption and, by implication, increasing carbon emissions and climate change risk. This, among others, indicates that while recovering from the Great Depression episode of the 1930s, some level of climate change was allowed and considered equitable to increasing economic activity, which is a prerequisite in the recovery phase. The trade-off in this regard would be to accommodate some level of environmental degradation, which might be responsible for the overwhelming and significant evidence of increasing volatility in stock returns when climate change is measured as a 25^{th} percentile compared to the 50^{th} or 75^{th} percentile increases in the level of temperature. Thus, the increasing but decreasing rate at which climate change induces volatility in stock returns with temperature rises of about 50^{th} percentile to 75 percentile is an indication that the investigated economies (i.e., the G7) might have preferred a more stringent low-carbon transition, such as carbon pricing or the adoption of renewable energy technologies for a rise in temperature levels above 25^{th} percentile.

Table B2: Stock return volatility response to different degrees of high temperature based on full-sample

		μ	α	β	θ	w	m
Canada	h-25%-TEMP	0.0049***	0.1025***	0.8732***	-3.6081**	5.0941	0.0050***
		(0.0012)	(0.0135)	(0.0149)	(1.8576)	(4.3734)	(0.0015)
	h-50%-TEMP	0.0056***	0.1053***	0.8603***	-11.577***	1.0026***	0.0063***
		(0.0011)	(0.0134)	(0.0134)	(3.3547)	(0.0800)	(0.0013)
	h-75%-TEMP	0.0055***	0.1017***	0.8627***	-2.5093***	1.4706***	0.0046***
		(0.0011)	(0.1017)	(0.0149)	(0.7471)	(0.3822)	(0.0008)
France	h-25%-TEMP	-0.0007***	0.0512***	0.9472***	-1.2034***	5.0613***	0.0002***
		(0.0003)	(0.0046)	(0.0040)	(0.0553)	(1.7165)	(6.69e-07)
	h-50%-TEMP	0.0054***	0.0546***	0.9364***	-1.6280***	48.827	0.0021***
		(0.0008)	(0.0064)	(0.0065)	(0.3092)	(32.654)	(0.0003)
	h-75%-TEMP	0.0034***	0.0515***	0.9421***	2.1137***	2.4082***	0.0025***
		(0.0007)	(0.0059)	(0.0058)	(0.4980)	(0.1950)	(0.0006)
Germany	h-25%-TEMP	0.0040*	0.1497***	0.6173***	-24.714***	3.0480**	0.0066***
		(0.0022)	(0.0203)	(0.0388)	(2.7162)	(1.4877)	(0.0003)
	h-50%-TEMP	0.0034*	0.1417***	0.6075***	-21.301***	1.0525***	0.0112***
		(0.0018)	(0.0188)	(0.0385)	(2.2855)	(0.1055)	(0.0007)
	h-75%-TEMP	0.0025	0.1554***	0.6039***	-7.6458***	1.1478***	0.0114***
		(0.0020)	(0.0215)	(0.0401)	(0.4414)	(0.0625)	(0.0005)
Italy	h-25%-TEMP	0.0022	0.1072***	0.8494***	-43.035**	1.0010***	0.0070***
		(0.0014)	(0.0128)	(0.0176)	(4.9837)	(0.0440)	(0.0007)
	h-50%-TEMP	0.0025	0.1033***	0.8532***	-7.6250***	3.8032*	0.0066***
		(0.0016)	(0.0126)	(0.0180)	(3.2383)	(2.2044)	(0.0012)
	h-75%-TEMP	0.0031**	0.1045***	0.8576***	-1.2903***	49.968	0.0052***
		(0.0015)	(0.0119)	(0.0167)	(0.2456)	(135.99)	(0.0006)
Japan	h-25%-TEMP	0.0042***	0.1649***	0.8069***	-18.436***	47.137***	0.0056***
		(0.0010)	(0.0191)	(0.0203)	(4.8696)	(17.205)	(0.0014)
	h-50%-TEMP	0.0041***	0.1760***	0.7994***	-4.6495***	8.2520	0.0067***
		(0.0010)	(0.0189)	(0.0205)	(1.8460)	(11.601)	(0.0022)
	h-75%-TEMP	0.0042***	0.1410***	0.8320***	-8.7083***	1.1228***	0.0122***
		(0.0011)	(0.0192)	(0.0220)	(1.9366)	(0.0800)	(0.0026)
UK	h-25%-TEMP	0.0021***	0.1420***	0.8447***	-4.3199***	49.436	0.0017***
		(0.0006)	(0.0141)	(0.0141)	(2.1134)	(241.68)	(0.0005)
	h-50%-TEMP	0.0019***	0.1388***	0.8480***	-1.2348***	20.401	0.0017***
		(0.0006)	(0.0138)	(0.0138)	(0.4739)	(33.956)	(0.0005)
	h-75%-TEMP	0.0019***	0.1498***	0.8434***	3.4309	1.1015	2.22e-05***
		(0.0006)	(0.0149)	(0.0144)	(2.2455)	(0.7847)	(5.22e-05)
USA	h-25%-TEMP	0.0066***	0.1530***	0.8086***	-21.650*	4.3140	0.0032***
		(0.0009)	(0.0119)	(0.0144)	(11.679)	(12.154)	(0.0008)
	h-50%-TEMP	0.0067***	0.1525***	0.8093***	-0.6331	49.870	0.0021***
		(0.0009)	(0.0119)	(0.0144)	(1.4656)	(553.91)	(0.0005)
	h-75%-TEMP	0.0064***	0.1554***	0.8091***	-0.2543	9.0535	0.0022***
		(0.0008)	(0.0122)	(0.0144)	(0.5369)	(51.120)	(0.0005)

Source: Authors' own creation/work.

Note: The high temperature (h-TEMPT) is derived as the positive values of temperature anomalies (TEMP). Thus, the 25^{th}, 50^{th}, and 75^{th} percentiles are of the high temperature to test whether varying degrees of intensity of high-temperature matter in the climate change-stock return volatility nexus.

Table B3: Stock return volatility response to different degrees of high temperature based on PGD-sample

		μ	α	β	θ	w	m
Canada	h-25%-TEMP	0.0052***	0.1300***	0.8052***	31.921*	49.987	0.0006
		(0.0016)	(0.0261)	(0.0445)	(13.579)	(279.93)	(0.0006)
	h-50%-TEMP	0.0052***	0.1300***	0.8051***	3.5359**	49.952	0.0006
		(0.0016)	(0.0261)	(0.0446)	(1.5080)	(263.75)	(0.0006)
	h-75%-TEMP	0.0053***	0.1343***	0.7979***	-2.1289	1.7588**	0.0055**
		(0.0016)	(0.0271)	(0.0462)	(1.6677)	(0.7210)	(0.0026)
France	h-25%-TEMP	0.0052***	0.1248***	0.7531***	43.052*	1.9026	0.0007
		(0.0020)	(0.0456)	(0.0988)	(23.973)	(1.7219)	(0.0011)
	h-50%-TEMP	0.0062***	0.1378***	0.7340***	7.4739	2.8300	-0.0003
		(0.0020)	(0.0486	(0.1000)	(8.5307)	(3.1263)	(0.0038)
	h-75%-TEMP	0.0049**	0.1289***	0.7627***	-0.6081	49.976	0.0038***
		(0.0019)	(0.0836)	(0.0836)	(0.8201)	(880.24)	(0.0013)
Germany	h-25%-TEMP	0.0034**	0.1201***	0.8236***	42.768***	1.0678	0.0006
		(0.0017)	(0.0246)	(0.0312)	(13.565)	(0.8356)	(0.0005)
	h-50%-TEMP	0.0033*	0.1263***	0.8174***	5,7191*	6.1769	0.0002
		(0.0017)	(0.0259)	(0.0318)	(3.3514)	(6.3459)	(0.0014)
	h-75%-TEMP	0.0037**	0.1239***	0.8235***	-2.4757**	1.0013***	0.0065***
		(0.0018)	(0.0250)	(0.0299)	(1.0903)	(0.1658)	(0.0018)
Italy	h-25%-TEMP	0.0055**	0.1159***	0.8659***	-58.406	49.979	0.0054**
		(0.0020)	(0.0196)	(0.0219)	(99.824)	(2066.3)	(0.0028)
	h-50%-TEMP	0.0055***	0.1159***	0.8659***	-3.5293	48.894	0.0054**
		(0.0020)	(0.0196)	(0.0219)	(6.0321)	(2059.0)	(0.0028)
	h-75%-TEMP	0.0055***	0.1163***	0.8664***	-1.0167	49.849	0.0055
		(0.0020)	(0.0196)	(0.0218)	(2.5260)	(1613.3)	(0.0042)
Japan	h-25%-TEMP	0.0056***	0.0981***	0.8829***	22.848	49.919	0.0023
		(0.0018)	(0.0165)	(0.0199)	(45.857)	(967.93)	(0.0022)
	h-50%-TEMP	0.0056***	0.0982***	0.8829***	2.2660	49.892	0.0023
		(0.0018)	(0.0165)	(0.0199)	(5.1428)	(785.58)	(0.0022)
	h-75%-TEMP	0.0054***	0.0903***	0.8891***	0.7741	49.789	0.0019
		(0.0017)	(0.0151)	(0.0193)	(0.8144)	(1066.2)	(0.0014)
UK	h-25%-TEMP	0.0047***	0.1440***	0.8349***	57.399**	6.3249	0.0010
		(0.0015)	(0.0263)	(0.0303)	(24.055)	(10.423)	(0.0007)
	h-50%-TEMP	0.0048***	0.1464***	0.8297***	5.4886*	18.601	0.0011
		(0.0016)	(0.0270)	(0.0316)	(3.1439)	(60.832)	(0.0010)
	h-75%-TEMP	0.0051***	0.1519***	0.8284***	-1.8255***	6.3416	0.0070***
		(0.0015)	(0.0278)	(0.0304)	(0.6981)	(8.4425)	(0.0024)
USA	h-25%-TEMP	0.0074***	0.1657***	0.7683***	24.468****	29.468	0.0003
		(0.0012)	(0.0312)	(0.0532)	(6.8973)	(70691)	(0.0002)

h-50%-TEMP	0.0073***	0.1647***	0.7692***	2.6897***	39.401	0.0003
	(0.0012)	(0.0309)	(0.0529)	(0.7176)	(116.66)	(0.0002)
h-75%-TEMP	0.0077***	0.1773***	0.7616***	-1.5380**	2.2707***	0.0040***
	(0.0012)	(0.0322)	(0.0517)	(0.6664)	(0.7473)	(0.0012)

Source: Authors' own creation/work.

Note: The high temperature (h-TEMPT) is derived as the positive values of temperature anomalies (TEMP). Thus, the 25th, 50th, and 75th percentiles are of the high temperature to test whether varying degrees of intensity of high-temperature matter in the climate change-stock return volatility nexus.

Additional results controlling for the role of technology

This section completes our experiment with different percentile rises in the temperature level, and the innovation herein is to test whether technology matters in the nexus. Starting with the full sample of our dataset, the empirical estimates reported in Table B4 reveal the coefficients on the exogenous variables as largely positive irrespective of the scope of the technological shock or the varying degrees of climate change. The only exception in this regard is Canada, where the sign on the coefficient of interest is negative in all of the alternative scenarios considered. Essentially, we find the moderating effect of technological shock in reducing the increasing volatility dynamic of climate change on the stock return, varying for different temperature levels and being sensitive to the spread or scope of the technological shock under consideration. However, when we restrict our sample to the post-Great Depression only, our finding, as reported in Table B5, seems to validate our earlier position that, in the course of recovering from the slow economic activity that defined the Great Depression episode, certain levels of environmental degradation become inevitable in the pursuit of increasing economic activity, which on the other hand, defines the recovery process. That said, deducible from the empirical estimates in Table 7b, where the sign on the coefficients of exogenous variables is mostly positive, is the moderating role of the technological shock. For example, in some of the G7 countries (i.e., Italy, Japan, the UK, and the USA), where climate change consistently increases volatility in stock returns in the post-Great Depression, the magnitude of the effect is relatively larger when the temperature is of the 25th percentile compared to when it increases by 50th percentile and/or 75th percentile. This, among other things, indicates that the post-Great Depression moderating role of technological shock in the nexus between stock return volatility and climate change depends on the degree of the temperature. Experimenting with the 25th, 50th, and 75th percentiles in the temperature level, we find the stringency of the technological shock to curb excessive climate change from aggravating the volatility in stock returns relatively more pronounced when the temperature rises above the 25^{th} percentile.

Table B4: The role of TS in the stock return volatility responses to different degrees of high temperature based on full-sample

	h-TEMP-TS			h-TEMP-GTS-OECD			h-TEMP-GTS-164		
	25%-TEMP	**50%-TEMP**	**75%-TEMP**	**25%-TEMP**	**50%-TEMP**	**75%-TEMP**	**25%-TEMP**	**50%-TEMP**	**75%-TEMP**
Canada									
μ	0.0048***	0.0048***	0.0046***	0.0055***	0.0051***	0.0052***	0.0050***	0.0054***	0.0049***
	(0.0010)	(0.0010)	(0.0009)	(0.0011)	(0.0011)	(0.0011)	(0.0010)	(0.0011)	(0.0011)
α	0.1081***	0.1093***	0.1131***	0.1070***	0.1057***	0.1017***	0.1199***	0.1065***	0.1046***
	(0.0123)	(0.0125)	(0.0129)	(0.0124)	(0.0127)	(0.0126)	(0.0134)	(0.0123)	(0.0124)
β	0.8736***	0.8721***	0.8657***	0.8702***	0.8678***	0.8655***	0.8632***	0.8722***	0.8729***
	(0.0127)	(0.0129)	(0.0133)	(0.0130)	(0.0137)	(0.0141)	(0.0136)	(0.0128)	(0.0132)
θ	-0.6095***	-0.5540***	-0.5079***	-0.8278**	-2.6962**	-0.9933***	-2.5431***	-0.3921***	-0.8330***
	(0.1408)	(0.1242)	(0.1106)	(0.3326)	(1.2707)	(0.2266)	(0.6601)	(0.0942)	(0.2840)
w	8.9485**	9.8404***	8.0238**	11.753	3.3914***	1.6082***	3.3657***	41.854	4.7720***
	(4.0456)	(3.5625)	(3.2106)	(12.103)	(1.1386)	(0.2428)	(0.3344)	(84.122)	(1.2615)
m	0.0030***	0.0027***	0.0024***	0.0022***	-0.0004	0.0020***	0.0032***	0.0019***	0.0016***
	(0.0006)	(0.0006)	(0.0005)	(0.0004)	(0.0012)	(0.0002)	(0.0009)	(0.0003)	(0.0003)
France									
μ	0.0004	0.0035***	0.0011**	0.0021***	0.0028***	-0.0015***	0.0012**	4.05e-05	0.0041***
	(0.0005)	(0.0003)	(0.0005)	(0.0005)	(0.0007)	(0.0003)	(0.0005)	(0.0003)	(0.0009)
α	0.0385***	0.0387***	0.0382***	0.0297***	0.0514***	0.0505***	0.0277***	0.0564***	0.0562***
	(0.0039)	(0.0041)	(0.0040)	(0.0031)	(0.0051)	(0.0034)	(0.0029)	(0.0049)	(0.0067)
β	0.9585***	0.9612***	0.9617***	0.9702***	0.9422***	0.9474***	0.9722***	0.9427***	0.9355***
	(0.0039)	(0.0038)	(0.0037)	(0.0030)	(0.0049)	(0.0032)	(0.0029)	(0.0041)	(0.0066)
θ	0.7601***	0.2729**	0.2406***	-0.3224**	0.1881***	0.0175***	0.0925***	-0.1708**	0.1556*
	(0.0014)	(0.1401)	(0.0644)	(0.1264)	(0.0422)	(0.0061)	(0.0206)	(0.0692)	(0.0812)
w	1.3061***	1.2888***	1.3378***	2.3833***	43.335	7.6989***	2.0779***	2.3266***	49.954
	(0.0049)	(0.0521)	(0.0198)	(0.5160)	(48.360)	(1.5341)	(0.5381)	(0.1549)	(233.11)
m	0.0006***	0.0003**	0.0003***	0.0001***	0.0011***	8.52e-05***	0.0001***	4.50e-05***	0.0020***
	(1.19e-06)	(0.0002)	(9.50e-05)	(3.25e-05)	(0.0002)	(2.97e-05)	(3.54e-05)	(1.17e-05)	(0.0004)
Germany									
μ	0.0040***	0.0037*	0.0039*	0.0036	0.0034	0.0042*	0.0039*	0.0035*	0.0014
	(0.0005)	(0.0022)	(0.0022)	(0.0023)	(0.0021)	(0.0022)	(0.0023)	(0.0028)	(0.0023)
α	0.1651***	0.1479***	0.1481***	0.1490***	0.1476***	0.1500**	0.1487***	0.1538***	0.1412***
	(0.0237)	(0.0201)	(0.0201)	(0.0203)	(0.0202)	(0.0205)	(0.0203)	(0.0211)	(0.0191)
β	0.6133***	0.6175***	0.6131***	0.6189***	0.6191***	0.6164***	0.6200***	0.6059***	0.6230***
	(0.0411)	(0.0390)	(0.0391)	(0.0391)	(0.0392)	(0.0393)	(0.0391)	(0.0396)	(0.0385)
θ	-1.2852***	5.7547***	6.6954***	10.753***	5.2300***	2.5487***	5.522***	4.8135***	1.9425***
	(0.2731)	(0.3131)	(0.3042)	(2.1987)	(0.2813)	(0.3423)	(1.4827)	(0.3921)	(0.4658)

w	13.829*	1.7633***	2.2139***	1.0010***	1.0510***	1.5907***	1.0020***	1.2718***	5.4631***
	(7.9686)	(0.1574)	(0.1575)	(0.0806)	(0.0707)	(0.4674)	(0.1740)	(0.0557)	(1.6942)
m	0.0058***	0.0064***	0.0064***	0.0069***	0.0096***	0.00054***	0.0053***	0.0104***	0.0069***
	(0.000)	(0.0002)	(0.0002)	(0.0004)	(0.0004)	(0.0002)	(0.0002)	(0.0005)	(0.0004)
Italy									
μ	0.0029*	0.0019	0.0020	0.0032**	0.0022	0.0021	0.0034**	0.0034**	0.0034**
	(0.0015)	(0.0015)	(0.0014)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
α	0.1076***	0.1056***	0.1063***	0.1048***	0.1047***	0.1084***	0.1038***	0.1077***	0.1096***
	(0.0132)	(0.0126)	(0.0125)	(0.0118)	(0.0125)	(0.0126)	(0.0120)	(0.0125)	(0.0125)
β	0.8504***	0.8538***	0.8539***	0.8598***	0.8536***	0.8535***	0.8575***	0.8569***	0.8561***
	(0.0178)	(0.0170)	(0.0168)	(0.0160)	(0.0174)	(0.0166)	(0.0166)	(0.0165)	(0.0164)
θ	2.3381***	1.3371***	1.1883***	-1.0359**	3.1081***	2.0429***	-1.6377**	1.4798***	2.6594***
	(0.3642)	(0.1665)	(0.1388)	(0.4648)	(0.9274)	(0.2508)	(0.6441)	(0.4695)	(0.7110)
w	2.9130***	1.7689***	1.2797***	49.981	2.254***	1.2053***	6.5477***	2.9329***	1.5261***
	(0.4415)	(0.4383)	(0.2654)	(104.63)	(0.9082)	(0.0232)	(2.4925)	(0.8416)	(0.2199)
m	0.0070***	0.0068***	0.0060***	0.0039***	0.0070***	0.0042***	0.0041***	0.0060***	0.0068***
	(0.0008)	(0.0007)	(0.0006)	(0.0004)	(0.0011)	(0.0004)	(0.0004)	(0.0009)	(0.0011)
Japan									
μ	0.0045***	0.0041***	0.0041***	0.0042***	0.0040***	0.0044***	0.0041***	0.0040***	0.0040***
	(0.0011)	(0.0011)	(0.0011)	(0.0010)	(0.0010)	(0.0011)	(0.0010)	(0.0010)	(0.0010)
α	0.1438***	0.1621***	0.1602***	0.1511***	0.1614***	0.1399***	0.1590***	0.1625***	0.1649***
	(0.0195)	(0.0204)	(0.0204)	(0.0186)	(0.0195)	(0.0193)	(0.0194)	(0.0200)	(0.0202)
β	0.8201***	0.8114***	0.8131***	0.8196***	0.8160***	0.8244***	0.8188***	0.8140***	0.8126***
	(0.0225)	(0.0216)	(0.0204)	(0.0202)	(0.0203)	(0.0225)	(0.0204)	(0.0208)	(0.0208)
θ	16.3360***	2.6534**	2.9516**	-2.0842*	1.9638**	-5.0097***	2.3721***	1.4611***	1.1219**
	(5.8047)	(1.3382)	(1.4925)	(1.1631)	(0.7735)	(1.3719)	(0.8351)	(0.5328)	(0.4511)
w	2.0929***	2.4639**	2.0711**	2.5505**	1.0010***	1.5690***	1.0010***	1.0018***	1.0010***
	(0.2354)	(1.0166)	(0.8921)	(1.2589)	(0.0838)	(0.1481)	(0.1344)	(0.0991)	(0.1240)
m	-0.0041***	0.0041***	0.0036***	0.0034***	0.0068***	0.0034***	0.0049***	0.0067***	0.0061***
	(0.0024)	(0.0012)	(0.0012)	(0.0008)	(0.0023)	(0.0006)	(0.0016)	(0.0021)	(0.0021)
UK									
μ	0.0022***	0.0018***	0.0016**	0.0019***	0.0016***	0.0018***	0.0018***	0.0016***	0.0017***
	(0.0006)	(0.0006)	(0.0006)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0005)
α	0.1351***	0.1332***	0.1362***	0.1347***	0.1350***	0.1370***	0.1372***	0.1350***	0.1370***
	(0.0135)	(0.0134)	(0.0141)	(0.0125)	(0.0129)	(0.0131)	(0.0131)	(0.0140)	(0.0131)
β	0.8523***	0.8544***	0.8517***	0.8538***	0.8539***	0.8521***	0.8514***	0.8532***	0.8518***
	(0.0136)	(0.0136)	(0.0142)	(0.0125)	(0.0129)	(0.0130)	(0.0131)	(0.0141)	(0.0130)
θ	0.3839***	0.2368**	0.2595***	-0.4047***	0.3614**	0.3495**	0.5249***	0.3203**	0.1518**
	(0.1177)	(0.0924)	(0.0992)	(0.1378)	(0.1711)	(0.1500)	(0.1796)	(0.1264)	(0.0607)

w	7.0269***	7.6272*	14.411*	4.6084***	2.2282**	1.2638**	1.4649***	8.1017***	22.524
	(1.8565)	(4.4502)	(7.9002)	(1.9844)	(1.1582)	(0.5569)	(0.2744)	(3.0957)	(37.888)
m	0.0015***	0.0017***	0.0021***	0.0010***	0.0015***	0.0013***	0.0012***	0.0019***	0.0014***
	(0.0004)	(0.0005)	(0.0007)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0006)	(0.0004)
USA									
μ	0.0064***	0.0064***	0.0064***	0.0063***	0.0064***	0.0064***	0.0064***	0.0064***	0.0064***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
α	0.1553***	0.1543***	0.1551***	0.1535***	0.1535***	0.1553***	0.1524***	0.1494***	0.1538***
	(0.0121)	(0.0121)	(0.0121)	(0.0120)	(0.0119)	(0.0121)	(0.0145)	(0.0117)	(0.0119)
β	0.8100***	0.8110***	0.8100***	0.8110***	0.8033***	0.8007***	0.8043***	0.8111***	0.8031***
	(0.0144)	(0.0143)	(0.0144)	(0.0144)	(0.0145)	(0.0121)	(0.0145)	(0.0144)	(0.0145)
θ	0.7144	0.6140	0.4591	1.4900	0.4274	0.2492	0.6067	0.3079	0.2838
	(1.5756)	(0.8306)	(0.9112)	(2.1895)	(0.3503)	(0.2744)	(0.5325)	(0.7453)	(0.2247)
w	1.9173	1.5973	1.5021	1.5006	1.0021***	1.0299**	1.0014***	3.5371	1.0043***
	(4.1972)	(1.1403)	(2.1402)	(2.0899)	(0.2307)	(0.5035)	(0.2971)	(8.0542)	(0.2930)
m	0.0020***	0.0023***	0.0020***	0.0023***	0.0022***	0.0018***	0.0018***	0.0022***	0.0021***
	(0.0003)	(0.0005)	(0.0003)	(0.0004)	(0.0004)	(0.0002)	(0.0002)	(0.0008)	(0.0003)

Source: Authors' own creation/work.

Note: TEMP denoting temperature anomalies measures climate change, while h-TEMP is high temperature derived as the positive values of TEMP. The interactive terms h-TEMP-TS, h-TEMP-GTS-OECD, and h-TEMP-GTS-164 are derived as the interaction of the high-temperature dummy (where one is assigned to positive values of TEMP and zero otherwise) with the respective technology shock proxies. The 25^{th}, 50^{th}, and 75^{th} percentiles are of high temperature, and their interactions with the respective technology shock proxies are done the same way as the h-TEMP. ***, ** & * represent significance at 1%, 5% and 10% levels, respectively.

Table B5: The role of TS in the stock return volatility response to different degrees of high temperature based on PGD-sample

	h-TEMP-TS			h-TEMP-GTS-OECD			h-TEMP-GTS-164		
	25%-TEMP	**50%-TEMP**	**75%-TEMP**	**25%-TEMP**	**50%-TEMP**	**75%-TEMP**	**25%-TEMP**	**50%-TEMP**	**75%-TEMP**
Canada									
μ	0.0052***	0.0052***	0.00052***	0.0052***	0.0053***	0.0052***	0.0048***	0.0055***	0.0052***
	(0.0016)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0016)	(0.0015)	(0.0015)	(0.0016)
α	0.1300***	0.1256***	0.1290***	0.1305***	0.1234***	0.1320***	0.1308***	0.1367***	0.1315***
	(0.0261)	(0.0255)	(0.0256)	(0.0263)	(0.0246)	(0.0269)	(0.0249)	(0.0268)	(0.0266)
β	0.8052***	0.8089***	0.8040***	0.7996***	0.8049***	0.7990***	0.8124***	0.7984***	0.7999***
	(0.0445)	(0.0444)	(0.0440)	(0.0459)	(0.0447)	(0.0465)	(0.0398)	(0.0448)	(0.0461)
θ	1.6411**	1.3950**	0.4459**	-5.2450*	-1.2245**	-0.6167	-0.3098	1.2138*	-0.5990
	(0.6980)	(0.6680)	(0.2842)	(3.1476)	(0.5162)	(0.4761)	(2.6604)	(0.6983)	(0.4291)
w	49.936	1.9284	1.0014***	45.064	12.883	2.7985**	27.833	1.0849***	8.5525
	(279.40)	(1.2367)	(0.2239)	(287.40)	(15.491)	(1.3316)	(3776.6)	(0.3644)	(5.5557)
m	0.0006	0.0011**	0.0022***	0.0011**	0.0007	0.0025***	0.0022***	0.0040***	0.0016***
	(0.0006)	(0.0004)	(0.0002)	(0.0005)	(0.0005)	(0.0004)	(0.0004)	(0.0011)	(0.0004)
France									
μ	0.0053***	0.0049**	0.0053***	0.0047**	0.0053***	0.0052***	0.0039**	0.0052***	0.0053***
	(0.0020)	(0.0019)	(0.0020)	(0.0019)	(0.0020)	(0.0020)	(0.0018)	(0.0020)	(0.0020)
α	0.1282***	0.1342***	0.1276***	0.1306***	0.1276***	0.1276***	0.1307***	0.1302***	0.1275***
	(0.0458)	(0.0462)	(0.0459)	(0.0458)	(0.0458)	(0.0458)	(0.0457)	(0.0466)	(0.0457)
β	0.7515***	0.7472***	0.7515***	0.7541***	0.7517***	0.7503***	0.7521***	0.7462***	0.7515***
	(0.0966)	(0.0929)	(0.0978)	(0.0928)	(0.0970)	(0.0984)	(0.0929)	(0.0985)	(0.0967)
θ	-39.776	-3.5380	-7.5917*	-8.2407	-2.0585	-1.2396*	12.439**	-2.5124	-1.3906
	(26.051)	(5.1996)	(4.5559)	(6.0027)	(1.3131)	(0.6585)	(4.9035)	(1.8770)	(0.9563)
w	3.2138	16.125	2.0550**	19.415	3.2363	1.5980*	3.6170	4.2600	3.4447
	(2.5776)	(79.686)	(1.0525)	(162.55)	(2.5444)	(0.9071)	(5.3887)	(2.8695)	(2.1642)
m	0.0008	0.0014	0.0020***	0.0013	0.0006	0.0036***	0.0012**	-0.0007	0.0015
	(0.0013)	(0.0020)	(0.0005)	(0.0011)	(0.0014)	(0.0005)	(0.0006)	(0.0027)	(0.0009)
Germany									
μ	0.0037**	0.0036**	0.0033*	0.0038**	0.0033*	0.0035**	0.0040**	0.0029*	0.0033*
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0018)
α	0.1222***	0.1233***	0.1262***	0.1227***	0.1262***	0.1241***	0.1311***	0.1370***	0.1325***
	(0.0252)	(0.0251)	(0.0260)	(0.0252)	(0.0260)	(0.0250)	(0.0267)	(0.0273)	(0.0274)
β	0.8231***	0.8198***	0.8176***	0.8214***	0.8187***	0.8226***	0.8180***	0.8219***	0.8138***
	(0.0311)	(0.0310)	(0.0318)	(0.0252)	(0.0317)	(0.0302)	(0.0307)	(0.0286)	(0.0321)
θ	-7.1569***	-2.5561**	-4.3085*	-10.907***	-2.2833**	-0.5123*	12.552*	11.308**	-1.5243**
	(2.4436)	(1.0645)	(2.4516)	(3.9756)	(1.1274)	(0.2701)	(7.4889)	(4.9788)	(0.7251)

w	2.2920*	4.6603	4.9331	3.5526*	4.3923	1.0010***	11.840	1.7603***	7.2205
	(1.2940)	(5.5244)	(6.2369)	(2.0223)	(3.4582)	(0.2097)	(30.973)	(0.3859)	(9.2941)
m	0.0006	0.0005	-0.0006	0.0007	0.0002	0.0030***	0.0012	0.0197**	0.0014**
	(0.0006)	(0.0008)	(0.0018)	(0.0006)	(0.0011)	(0.0005)	(0.0008)	(0.0078)	(0.0006)
Italy									
μ	0.0060***	0.0055***	0.0055***	0.0055***	0.0061***	0.0061***	0.0055***	0.0055***	0.0055***
	(0.0020)	(0.0020)	(0.0020)	(0.0020)	(0.0020)	(0.0019)	(0.0020)	(0.0020)	(0.0020)
α	0.1155***	0.1160***	0.1158***	0.1160***	0.1123***	0.1086***	0.1159***	0.1160***	0.1156***
	(0.0193)	(0.0196)	(0.0195)	(0.0196)	(0.0186)	(0.0182)	(0.0196)	(0.0196)	(0.0195)
β	0.8640***	0.8659***	0.8648***	0.8659***	0.8744***	0.8767***	0.8659***	0.8659***	0.8654***
	(0.0219)	(0.0219)	(0.0220)	(0.0219)	(0.0204)	(0.0202)	(0.0219)	(0.0219)	(0.0220)
θ	69.138	3.0644	5.9973	5.8905	1.0342	0.3589	30.069	0.9225	1.0975
	(80.623)	(5.2733)	(12.000)	(10.136)	(1.7209)	(0.4312)	(51.383)	(1.5615)	(1.6456)
w	9.249	47.673	48.349	47.673	17.204	48.323	49.979	49.480	49.983
	(22.153)	(1896.8)	(318.22)	(1896.7)	(175.26)	(1260.7)	(2065.7	(2028.2)	(1232.0)
m	-0.0026	0.0054**	0.0055	0.0054**	0.0058**	0.0037*	0.0054**	0.0054**	0.0051**
	(0.0066)	(0.0027)	(0.0040)	(0.0027)	(0.0028)	(0.0020)	(0.0028)	(0.0028)	(0.0023)
Japan									
μ	0.0054***	0.0058***	0.0057***	0.0054***	0.0053***	0.0055***	0.0052***	0.0057***	0.0059***
	(0.0018)	(0.0018)	(0.0017)	(0.0017)	(0.0017)	(0.0018)	(0.0017)	(0.0018)	(0.0019)
α	0.0988***	0.0948***	(0.0945)***	0.0935***	0.0972***	0.0935***	0.0973***	0.0955***	0.0906***
	(0.0159)	(0.0159)	(0.0158)	(0.0157)	(0.0163)	(0.0159)	(0.1613)	(0.0153)	(0.0149)
β	0.8966***	0.8832***	0.8871***	0.8869***	0.8843***	0.8886***	0.8870***	0.8986***	0.8879***
	(0.0162)	(0.0199)	(0.0195)	(0.0196)	(0.0199)	(0.0192)	(0.0191)	(0.0160)	(0.0187)
θ	44.210	12.281	1.2198**	3.6524*	0.6355	-1.7284**	6.2615**	18.082*	-8.9854***
	(38.439)	(30.130)	(0.6117)	(2.1055)	(0.4314)	(0.8361)	(3.2509)	(9.5646)	(2.5171)
w	1.7261***	17.446	16.382	4.3680	49.989	1.0979***	48.854	2.6106***	2.8550***
	(0.2303)	(109.11)	(29.136)	(9.3877)	(426.38)	(0.2491)	(451.47)	(0.1492)	(0.3456)
m	-0.0065	0.0059	0.0034***	0.0040***	0.0042***	0.0043***	0.0030**	-0.0201*	-0.0062***
	(0.0059)	(0.0070)	(0.0012)	(0.0012)	(0.0015)	(0.0015)	(0.0013)	(0.0110)	(0.0019)
UK									
μ	0.0053***	0.0048***	0.0040***	0.0048***	0.0048***	0.0051***	0.0051***	0.0046***	0.0047***
	(0.0016)	(0.0016)	(0.0015)	(0.0015)83	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
α	0.1454***	0.1463***	0.1454***	0.1413***	0.1475***	0.1451***	0.1485***	0.1581***	0.1670***
	(0.0269)	(0.0270)	(0.0266)	(0.0260)	(0.0272)	(0.0267)	(0.0275)	(0.0288)	(0.0299)
β	0.8329***	0.8301***	0.8354***	0.8329***	0.8322***	0.8296***	0.8267***	0.8249***	0.8158***
	(0.0310)	(0.0315)	(0.0301)	(0.0312)	(0.0307)	(0.0308)	(0.0322)	(0.0309)	(0.0315)
θ	18.861*	-2.2114*	-2.3724**	-12.087**	-2.6043*	-0.3875***	15.362***	-4.4260*	-4.6138*
	(10.111)	(1.2490)	(0.9745)	(4.9489)	(1.5044)	(0.1305)	(5.5519)	(2.4903)	(2.7339)

w	6.9482	16.438	27.506*	7.7471	9.5950	14.625	3.8020	6.8420***	3.8312***
	(45.885)	(50.896)	(14.790)	(9.6986)	(20.097)	(16.560)	(2.3695)	(0.8910)	(0.1879)
m	0.0004	0.0015	-0.0021**	0.0010	0.0011	0.0036***	0.0016***	-0.0017	0.0003
	(0.0014)	(0.0009)	(0.0010)	(0.0007)	(0.0009)	(0.0010)	(0.0005)	(0.0011)	(0.0003)
USA									
μ	0.0073***	0.0074***	0.0081***	0.0073***	0.0074***	0.0075***	0.0077***	0.0073***	0.0078***
	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)
α	0.1647***	0.1651***	0.1670***	0.1647***	0.1551***	0.1667***	0.1658***	0.1824***	0.1803***
	(0.0310)	(0.0309)	(0.0291)	(0.0310)	(0.0287)	(0.0312)	(0.0312)	(0.0033)	(0.0326)
β	0.7693***	0.7684***	0.7507***	0.7693***	0.7740***	0.7674***	0.7659***	0.7454***	0.7495***
	(0.0531)	(0.0530)	(0.0514)	(0.0531)	(0.0517)	(0.0532)	(0.0536)	(0.0529)	(0.0540)
θ	-6.2324***	-0.9123***	-0.5232***	-6.2642***	-0.9863**	-0.5828*	8.6665***	-1.3053***	-0.4154**
	(1.7881)	(0.2697)	(0.1986)	(1.7976)	(0.4810)	(0.3338)	(2.8171)	(0.2542)	(0.1659)
w	35.113	43.119	3.0690***	35.334	7.7228	2.6711***	30.983	8.1896***	6.0987**
	(104.95)	(159.62)	(0.9368)	(106.46)	(7.5923)	(0.7827)	(115.26)	(1.6836)	(3.1222)
m	0.0003	0.0003	0.0013***	0.0003	0.0003	0.0018***	0.0003	-0.0003	0.0011***
	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0005)	(0.0003)	(0.0003)	(0.0002)	(0.0002)

Source: Authors' own creation/work.

Note: TEMP denoting temperature anomalies measures climate change, while h-TEMP is high temperature derived as the positive values of TEMP. The interactive terms h-TEMP-TS, h-TEMP-GTS-OECD, and h-TEMP-GTS-164 are derived as the interaction of the high-temperature dummy (where one is assigned to positive values of TEMP and zero otherwise) with the respective technology shock proxies. The 25th, 50th, and 75th percentiles are of high temperature, and their interactions with the respective technology shock proxies are done the same way as the h-TEMP. ***, ** & * represent significance at 1%, 5% and 10% levels, respectively.