Supplementary Material for

"The Negative Impact of Uncertainty on R&D Investment:

International Evidence"

February 23, 2021

Table S1: List of 109 sample countries and classification of country groups.

Country/Region Name	(a) Level of income per capita	(b) Ratio of R&D Investment to GDP	(c) Degree of uncertainty	(d) Degree of corruption control	(e) Degree of financial openness	(#a) Number of patent per capita	(#b) Global innovation index 2019	(#c) International innovation scorecard 2019
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Albania	Low	Low	Low	Low	Low	Low	Low	Low
Algeria	Low	Low	Low	Low	Low	Low	Low	Low
Angola	Low	Low	Low	Low	Low	High	Low	Low
Argentina	Low	Low	High	High	Low	Low	Low	Low
Armenia	Low	Low	Low	Low	High	High	High	Low
Australia	High	High	High	High	High	High	High	High
Austria	High	High	High	High	High	High	High	High
Belgium	High	High	Low	High	High	High	High	High
Bolivia	Low	Low	High	Low	High	Low	Low	Low
Botswana	Low	Low	High	High	High	Low	Low	Low
Brazil	Low	High	High	High	Low	Low	Low	High
Bulgaria	Low	Low	High	High	High	High	High	High
Burkina Faso	Low	Low	High	High	Low	Low	Low	Low
Burundi	Low	Low	High	Low	Low	Low	Low	Low
Cambodia	Low	Low	High	Low	High	Low	Low	Low
Canada	High	High	High	High	High	High	High	High
Chile	High	Low	Low	High	High	Low	High	High
China	Low	High	Low	High	Low	High	High	High
Colombia	Low	Low	High	High	Low	Low	Low	Low
Congo, Dem. Rep.	Low	Low	High	Low	Low	High	Low	Low
Costa Rica	Low	Low	High	High	High	Low	High	Low
Cote d'Ivoire	Low	Low	High	Low	Low	Low	Low	Low
Croatia	High	High	High	High	High	High	High	High
Czech Republic	High	High	High	High	High	High	High	High
Denmark	High	High	High	High	High	High	High	High
Ecuador	Low	Low	High	Low	High	Low	Low	Low
Egypt, Arab Rep.	Low	Low	High	Low	High	Low	Low	Low
El Salvador	Low	Low	High	High	High	Low	Low	Low
Ethiopia	Low	Low	High	Low	Low	Low	Low	Low
Finland	High	High	Low	High	High	High	High	High
France	High	High	High	High	High	High	High	High
Gabon	Low	Low	Low	Low	Low	High	Low	Low
Gambia, The	Low	Low	Low	Low	High	High	Low	Low
Germany	High	High	High	High	High	High	High	High

Ghana	Low	Low	High	High	Low	Low	Low	Low
Greece	High	High	High	High	High	High	High	High
Guatemala	Low	Low	High	Low	High	Low	Low	Low
Honduras	Low	Low	High	Low	Low	Low	Low	Low
Hong Kong SAR, China	High	High	Low	High	High	Low	High	Low
Hungary	High	High	High	High	High	High	High	High
India	Low	High	Low	High	Low	Low	High	Low
Indonesia	Low	Low	High	Low	High	Low	Low	High
Iran, Islamic Rep.	Low	Low	Low	Low	Low	High	High	Low
Ireland	High	High	High	High	High	Low	High	High
Israel	High	High	High	High	High	High	High	High
Italy	High	High	High	High	High	High	High	High
Jamaica	Low	Low	High	High	High	Low	Low	Low
Japan	High	High	High	High	High	High	High	High
Jordan	Low	Low	Low	High	High	Low	Low	Low
Kazakhstan	Low	Low	High	Low	Low	High	Low	High
Kenya	Low	High	High	Low	High	Low	Low	Low
Korea, Rep.	High	High	High	High	High	High	High	Low
Kuwait	High	Low	Low	High	High	Low	High	Low
Kyrgyz Republic	Low	Low	High	Low	High	Low	Low	Low
Lao PDR	Low	Low	Low	Low	Low	Low	Low	Low
Latvia	High	Low	High	High	High	High	High	High
Lesotho	Low	Low	High	High	Low	Low	Low	Low
Lithuania	High	High	Low	High	High	High	High	High
Madagascar	Low	Low	High	High	Low	Low	Low	Low
Malaysia	Low	High	Low	High	Low	High	High	High
Mali	Low	Low	Low	Low	Low	High	Low	Low
Mexico	Low	Low	High	High	High	Low	High	High
Moldova	Low	Low	High	Low	Low	High	High	Low
Mongolia	Low	Low	High	High	High	High	High	Low
Morocco	Low	High	Low	High	Low	Low	Low	Low
Mozambique	Low	Low	High	Low	Low	Low	Low	Low
Namibia	Low	Low	High	High	Low	Low	Low	Low
Nepal	Low	Low	High	Low	Low	Low	Low	Low
Netherlands	High	High	High	High	High	High	High	High
New Zealand	High	High	High	High	High	High	High	High
Nicaragua	Low	Low	High	Low	High	Low	Low	Low
Nigeria	Low	Low	High	Low	Low	Low	Low	Low
Norway	High	High	High	High	High	High	High	High
Pakistan	Low	Low	Low	Low	Low	Low	Low	Low
Panama	High	Low	High	High	High	Low	Low	Low
Paraguay	Low	Low	High	Low	High	Low	Low	Low
Peru	Low	Low	High	High	High	Low	Low	High

Philippines	Low	Low	High	Low	Low	Low	High	Low
Poland	High	High	High	High	Low	High	High	High
Portugal	High	High	High	High	High	High	High	High
Qatar	High	Low	Low	High	High	Low	High	Low
Romania	Low	Low	High	High	High	High	High	High
Russian Federation	Low	High	High	Low	High	High	High	High
Rwanda	Low	High	Low	High	Low	Low	Low	Low
Saudi Arabia	High	Low	Low	High	High	Low	Low	High
Senegal	Low	Low	High	High	Low	High	Low	Low
Singapore	High	High	Low	High	High	High	High	High
Slovak Republic	High	High	High	High	High	High	High	High
Slovenia	High	High	High	High	High	High	High	High
South Africa	Low	High	High	High	Low	Low	High	High
Spain	High	High	High	High	High	High	High	High
Sri Lanka	Low	Low	Low	High	Low	Low	Low	Low
Sudan	Low	Low	High	Low	Low	Low	Low	Low
Sweden	High	High	High	High	High	High	High	High
Switzerland	High	High	High	High	High	High	High	High
Tajikistan	Low	Low	Low	Low	Low	Low	Low	Low
Tanzania	Low	Low	High	Low	Low	Low	Low	Low
Thailand	Low	Low	High	High	Low	Low	High	Low
Togo	Low	Low	High	Low	Low	High	Low	Low
Tunisia	Low	High	High	High	Low	Low	Low	Low
Turkey	Low	High	High	High	Low	High	High	Low
Uganda	Low	Low	High	Low	High	Low	Low	Low
Ukraine	Low	High	High	Low	Low	High	High	Low
United Arab Emirates	High	High	Low	High	High	Low	High	Low
United Kingdom	High	High	High	High	High	High	High	High
United States	High	High	High	High	High	High	High	High
Uruguay	High	Low	High	High	High	Low	High	Low
Venezuela, RB	Low	Low	High	Low	Low	Low	Low	Low
Vietnam	Low	Low	Low	Low	Low	Low	High	High

Note: Some regions (e.g., the Hong Kong SAR of China) included in our analysis sample are not sovereign states. But in the paper, for convenience, we usually use the term "countries" to refer to all countries and regions.

Table S2: Estimated effect of uncertainty (measured by the index of stock market volatility) on R&D investment.

Independent Variable	Baseline Result (of Table 3)	Uncertainty = Index of stock market volatility
	(i)	(ii)
Uncertainty	−0.156**	−0.0977*
	[0.0770]	[0.0559]
ln(Population)	1.000**	1.516***
	[0.4487]	[0.5360]
ln(GDPPerCapita)	1.160***	1.039***
	[0.2052]	[0.3024]
GDPGrowthRate	−0.00299	0.00168
	[0.0044]	[0.0033]
UnemploymentRate	0.0127	0.0113*
	[0.0080]	[0.0067]
FinancialDevelopment	0.209	0.375
	[0.3661]	[0.4006]
FinancialOpenness	0.0327	−0.0717
	[0.1337]	[0.1201]
TradeOpenness	0.00227*	0.00219*
	[0.0012]	[0.0011]
HumanCapital	0.513*	0.485
	[0.2893]	[0.2955]
GovernmentSize	0.0249*	0.0162
	[0.0141]	[0.0181]
ControlofCorruption	0.258*	0.222*
	[0.1458]	[0.1299]
RuleofLaw	−0.161	−0.294*
	[0.1590]	[0.1747]
Country-fixed effect	Yes	Yes
Time-fixed effect	Yes	Yes
Observations	1497	1101
Countries	109	73
R^2	0.555	0.672

Note: ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively. Robust standard errors are reported in parentheses.

Table S3: Estimated effect of uncertainty on R&D investment after mitigating the endogeneity issue.

Independent Variable	Baseline Result (of Table 3)	Use Alternative Methods to Mitigate Endogeneity Issue			
		Use 1-year-lagged *Uncertainty* as explanatory variable	Use 1-year-lagged *Uncertainty* as instrumental variable	Use Difference GMM estimation	Use System GMM estimation
	(i)	(ii)	(iii)	(iv)	(v)
Uncertainty	−0.156**	−0.188**	−0.616**	−0.112**	−0.153***
	[0.0770]	[0.0843]	[0.2524]	[0.0445]	[0.0409]
ln(Population)	1.000**	0.893*	0.827***	0.257	1.037***
	[0.4487]	[0.4541]	[0.2375]	[0.3056]	[0.2323]
ln(GDPPerCapita)	1.160***	1.141***	1.121***	1.002***	1.182***
	[0.2052]	[0.2038]	[0.0843]	[0.2412]	[0.1642]
GDPGrowthRate	−0.00299	−0.00104	−0.00240	0.000909	0.00522
	[0.0044]	[0.0044]	[0.0039]	[0.0040]	[0.0037]
UnemploymentRate	0.0127	0.0128	0.0130***	0.0238***	0.0236***
	[0.0080]	[0.0080]	[0.0040]	[0.0081]	[0.0064]
FinancialDevelopment	0.209	0.0598	0.0000885	−0.0235	−0.437
	[0.3661]	[0.3895]	[0.2164]	[0.3843]	[0.3141]
FinancialOpenness	0.0327	0.0671	0.0639	−0.288***	−0.176**
	[0.1337]	[0.1342]	[0.0697]	[0.1051]	[0.0882]
TradeOpenness	0.00227*	0.00187*	0.00193***	−0.000255	0.00363***
	[0.0012]	[0.0011]	[0.0006]	[0.0013]	[0.0010]
HumanCapital	0.513*	0.505*	0.572***	0.971***	0.962***
	[0.2893]	[0.2919]	[0.1322]	[0.2210]	[0.1741]
GovernmentSize	0.0249*	0.0228	0.0226***	0.00268	0.0572***
	[0.0141]	[0.0140]	[0.0076]	[0.0107]	[0.0093]
ControlofCorruption	0.258*	0.276*	0.261***	−0.129	−0.100
	[0.1458]	[0.1452]	[0.0798]	[0.0992]	[0.0944]
RuleofLaw	−0.161	−0.176	−0.201**	−0.176*	−0.0250
	[0.1590]	[0.1599]	[0.0785]	[0.1043]	[0.0913]
Country-fixed effect	Yes	Yes	Yes	Yes	Yes
Time-fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	1497	1450	1444	1256	1256
Countries	109	109	103	88	88
R^2	0.555	0.536	0.520	-	-

Note: ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively. Robust standard errors are reported in parentheses.

Table S4: Estimated effect of uncertainty on R&D investment based on the multi-year-average data.

Independent Variable	Baseline Result (of Table 3)	Use Multi-Year-Average Variables			
		Use 2-year-average variables	Use 3-year-average variables	Use 4-year-average variables	Use 5-year-average variables
	(i)	(ii)	(iii)	(iv)	(v)
Uncertainty	−0.156**	−0.200*	−0.258*	−0.128	−0.255
	[0.0770]	[0.1172]	[0.1502]	[0.2416]	[0.2530]
ln(Population)	1.000**	0.823*	1.018**	0.867*	0.760
	[0.4487]	[0.4791]	[0.4286]	[0.4652]	[0.4625]
ln(GDPPerCapita)	1.160***	1.171***	1.104***	1.038***	1.168***
	[0.2052]	[0.2358]	[0.2641]	[0.3013]	[0.2888]
GDPGrowthRate	−0.00299	0.00308	0.00207	0.00401	−0.00582
	[0.0044]	[0.0072]	[0.0085]	[0.0097]	[0.0146]
UnemploymentRate	0.0127	0.0143*	0.00913	0.0115	0.0130
	[0.0080]	[0.0082]	[0.0071]	[0.0080]	[0.0090]
FinancialDevelopment	0.209	0.339	0.300	0.444	0.419
	[0.3661]	[0.4459]	[0.4502]	[0.3878]	[0.5258]
FinancialOpenness	0.0327	0.0248	0.000964	−0.0616	−0.0655
	[0.1337]	[0.1480]	[0.1360]	[0.1406]	[0.1421]
TradeOpenness	0.00227*	0.00249**	0.00248**	0.00275**	0.00279*
	[0.0012]	[0.0012]	[0.0010]	[0.0012]	[0.0015]
HumanCapital	0.513*	0.466	0.346	0.277	0.249
	[0.2893]	[0.3140]	[0.2569]	[0.3098]	[0.3563]
GovernmentSize	0.0249*	0.0286*	0.0207	0.0122	0.0211
	[0.0141]	[0.0169]	[0.0157]	[0.0246]	[0.0235]
ControlofCorruption	0.258*	0.266	0.175	0.0224	−0.0196
	[0.1458]	[0.1713]	[0.1441]	[0.1902]	[0.1794]
RuleofLaw	−0.161	−0.233	−0.296*	−0.132	−0.196
	[0.1590]	[0.1591]	[0.1751]	[0.1741]	[0.1877]
Country-fixed effect	Yes	Yes	Yes	Yes	Yes
Time-fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	1497	643	390	264	208
Countries	109	86	78	71	71
R^2	0.555	0.606	0.692	0.740	0.779

Note: ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively. Robust standard errors are reported in parentheses.

Table S5: Estimated effect of uncertainty on R&D investment based on a model investigating the possible structural change around 2008.

Independent Variable	Baseline Model	Winsorize top and bottom 1% sample	*y* = Logarithmic value of R&D investment per million population	*y* = Logarithmic value of R&D investment per million US$ GDP	*Uncertainty* = Dummy variable for legislative election	*Uncertainty* = Economic policy uncertainty (EPU) index
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Uncertainty	−0.265*	−0.261*	−0.266*	−0.250*	−0.0344**	−0.0976*
	[0.1479]	[0.1515]	[0.1484]	[0.1451]	[0.0137]	[0.0505]
Uncertainty×D^{after2008}	0.173	0.171	0.174	0.144	0.0380	−0.00410
	[0.1968]	[0.2043]	[0.2063]	[0.2005]	[0.0238]	[0.0667]
ln(Population)	1.014**	1.000**	-	-	0.595	0.696
	[0.4442]	[0.4414]	-	-	[0.6545]	[0.5664]
ln(GDPPerCapita)	1.172***	1.188***	1.169***	-	0.939***	1.477***
	[0.2076]	[0.2061]	[0.2034]	-	[0.1757]	[0.2218]
GDPGrowthRate	−0.00338	−0.00114	−0.00341	−0.00278	−0.00174	−0.00437
	[0.0045]	[0.0038]	[0.0048]	[0.0047]	[0.0036]	[0.0026]
UnemploymentRate	0.0130	0.0135*	0.0130	0.0116	0.00565	0.0126
	[0.0079]	[0.0079]	[0.0081]	[0.0074]	[0.0070]	[0.0077]
FinancialDevelopment	0.209	0.234	0.209	0.277	0.220	0.358
	[0.3634]	[0.3629]	[0.3671]	[0.3760]	[0.3599]	[0.3178]
FinancialOpenness	0.0317	0.0294	0.0293	0.0413	0.219	−0.0181
	[0.1331]	[0.1334]	[0.1339]	[0.1319]	[0.1316]	[0.1794]
TradeOpenness	0.00229**	0.00232**	0.00228**	0.00213*	0.00364***	0.00185**
	[0.0012]	[0.0012]	[0.0011]	[0.0011]	[0.0013]	[0.0008]
HumanCapital	0.502*	0.552*	0.501*	0.512*	0.487	0.175
	[0.2908]	[0.2912]	[0.2849]	[0.2851]	[0.3944]	[0.1592]
GovernmentSize	0.0246*	0.0259*	0.0246*	0.0221	0.0333**	0.0143
	[0.0140]	[0.0140]	[0.0143]	[0.0148]	[0.0160]	[0.0128]
ControlofCorruption	0.254*	0.257*	0.254*	0.274*	0.202	−0.0735
	[0.1447]	[0.1443]	[0.1462]	[0.1476]	[0.1666]	[0.1047]
RuleofLaw	−0.156	−0.161	−0.157	−0.138	−0.0933	−0.021
	[0.1567]	[0.1561]	[0.1599]	[0.1586]	[0.1813]	[0.1629]
Country-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Time-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1497	1497	1497	1497	1179	496
Countries	109	109	109	109	76	26
R^2	0.555	0.559	0.490	0.155	0.593	0.892

Note: ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively. Robust standard errors are reported in parentheses.

Table S6: Estimated effect of uncertainty in different country groups with different innovative abilities.

Classification Criterion	Dependent Variable: ln(R&DInvestment)		Dependent Variable: ln(Patent)	
	High-Group (i)	**Low-Group** (ii)	**High-Group** (iii)	**Low-Group** (iv)
(#a) Number of patent per capita	−0.0312	−0.258*	−0.215*	−0.275**
	[0.0855]	[0.1426]	[0.1150]	[0.1171]
(#b) Global innovation index 2019	−0.193**	−0.228	−0.152	−0.462*
	[0.0759]	[0.1584]	[0.0928]	[0.2277]
(#c) International innovation scorecard 2019	−0.213**	−0.173	−0.193**	−0.228
	[0.0917]	[0.1606]	[0.0759]	[0.1584]

Note: (1) ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively. Robust standard errors are reported in parentheses. In order to save space, only the coefficient of *Uncertainty* is reported in the table. The estimated coefficients of control variables are available from the authors upon request. (2) In row (#a), the countries were classified according to the number of annual new patent per capita. If the average value over the sample period of a country was above the sample median, the country was put into the "High-Group". Otherwise, the country was included in the "Low-Group". (3) In row (#b), the countries were grouped according to the ranking of "Global Innovation Index 2019" provided by the World Intellectual Property Organization (WIPO). The data were extracted from the published report "The Global Innovation Index 2019: Creating Healthy Lives—The Future of Medical Innovation" (https://www.wipo.int/global_innovation_index/en/2019/). The countries with rankings above the sample median were grouped into the "High-Group", and into the "Low-Group" otherwise. (3) In row (#c), the countries were classified based on the ranking of "International Innovation Scorecard 2019" constructed by the Consumer Technology Association (CTA) of the US. The data were available from its website (https://cta.tech/Advocacy/Innovation-Scorecard/International-Scorecard/Data). In the scorecard, different countries were labelled as "Innovation Champion", "Innovation Leader", "Innovation Adopter" or "Modest Innovator". In our classification, the countries of "Innovation Champion", "Innovation Leader" and "Innovation Adopter" were grouped into the "High-Group", and other countries were grouped into the "Low-Group". (4) The list of countries in different groups was recorded in columns (vi)—(viii) of Table S1.