

**Internet Appendix for
“Stock Market Liberalization and Innovation”
(Not to be published)**

This Internet Appendix provides supplemental analyses and robustness tests to the main results presented in “Stock Market Liberalization and Innovation”. Section A provides a comparison of the Orbis database with the NBER Patent and Citation database. Section B presents the results of numerous robustness checks conducted using different samples, alternative model specifications, and alternative variable definitions. Section C describes the estimation of the growth of industry capital stock and the growth of industry TFP. The tables in Section B are organized as follows:

Figure IA1: The number of patents in the Orbis database vs. that in the NBER database

Table IA1: Robustness checks using alternative liberalization dates

Table IA2: Robustness checks excluding Japan from the sample

Table IA3: Robustness checks excluding firms cross-listed in the U.S.

Table IA4: Robustness checks including liberalized and non-liberalized countries

Table IA5: Robustness checks conducting an analysis at the technology class level

Table IA6: Robustness checks clustering standard errors in two dimensions

Table IA7: Robustness checks using patents/citations of an average (median) firm as dependent variables

Table IA8: Robustness checks lagging liberalization year for five years

Table IA9: Robustness checks mitigating the impact of highly skewed dependent variables

Section A: A comparison of the Orbis database and the NBER database

To obtain further insights into the quality of the Orbis database, we compare the number of U.S. patents owned by publicly-traded firms included in the Orbis database with that included in the NBER Patent and Citation database. Given that the coverage of the NBER database extends until 2006, we plot the number of U.S. patents between 1980 and 2006 in Figure IA1. The numbers of U.S. patents for the two databases are comparable. The only noticeable difference is the large decline in the number of U.S. patents in the NBER database over the 2002-2006 period. This difference exists because the lag between a patent's application year and its grant year is significant (about two years on average) and many patent applications filed during these years were still under review and had not been granted by 2006, at which point the NBER database ends. However, the Orbis database does not suffer from this problem as of 2006 because it continues to include granted patents after 2006 and has coverage up until 2013. Apart from this difference, the two lines in Figure IA1 are very close to each other and exhibit an identical time trend. Therefore, the quality of the Orbis database for U.S. patents is at least as good as that of the NBER database.

Section B: Robustness checks

In this section, we run several tests to check the robustness of our baseline results. First, we use de facto liberalization dates estimated by Bekaert, Harvey, and Lundblad (2003) as alternative liberalization dates. In particular, these de facto liberalization dates are identified as structural breaks in the ownership when foreign presence significantly increases. We replace the official liberalization dates with these dates, and re-estimate the baseline model. The results are presented in Panel A of Table IA1. Apart from using the de facto liberalization dates, we also conduct additional robustness tests using several alternative de jure liberalization dates as in Bekaert, Harvey, and Lundblad (2005), such as the first American Depositary Receipt (ADR) dates, the first country fund dates, and the first sign dates defined as the year associated with the earliest of the three dates: official liberalization, first ADR announcement, and first country fund launch. The results are presented in Panels B-D of Table IA1. We find that the coefficient estimates of $Lib \times Intensity$ are positive and significant in all panels, suggesting that our results are robust to alternative definitions of liberalization dates.

Second, we test the robustness of our results to several additional sampling criteria. Given that Japan has the largest number of patents, patent citations, and innovative firms among all countries in our sample, it is plausible that our inferences from the main analysis are driven by Japan. We thus

exclude Japan from the sample.¹ Moreover, because firms cross-listed on foreign exchanges can be affected by both the liberalization of domestic stock markets and the conditions of foreign stock markets, we exclude firms cross-listed in the U.S., the largest capital market in the world, to mitigate the impact of cross-listing. Finally, as industrial patenting activities increase over time in response to strengthened patent rights and national policies that encourage patenting activities (Lerner and Seru, 2017), it is possible that our results merely reflect such an upward time trend in certain countries. We hence include both the liberalized sample and the non-liberalized sample to control for the trend.² We estimate the baseline model using the above sampling criteria and report the regression results in Tables IA2-IA4, respectively. The coefficient estimates of $Lib \times Intensity$ in all columns are positive and significant, suggesting that our baseline results are not driven by either the inclusion of Japan and firms cross-listed in the U.S. or the exclusion of liberalized and non-liberalized economies.

Third, following Hsu, Tian, and Xu (2014), we conduct an analysis at the technology-class level. Specifically, we aggregate all variables at the 3-digit International Patent Classification (IPC) class and re-estimate the baseline model. We present the regression results in Table IA5 and find that our results do not change qualitatively.

Fourth, to further mitigate the concern on the presence of residual correlation in both country-industry and year dimensions, we employ a two-way clustering by clustering standard errors at both country-year and year following the suggestion of Petersen (2009). We present the regression results in Table IA6 and find that our baseline results are robust to the two-way clustering as the coefficient estimates of $Lib \times Intensity$ are all positive and significant at the 1% level.

Fifth, similar to Acharya and Subramanian (2009), we replace the dependent variables in the baseline model with the logarithm of one plus the number of patents ($Ln(1+Pat_ave)$) and the logarithm of one plus the number of patent citations ($Ln(1+Tcite_ave)$) of an average firm as proxies for the innovation output of an average firm in an industry. We then estimate the baseline model with these two dependent variables and report the regression results in columns (1)-(2) of Table IA7. We find that the results remain because the coefficient estimates of $Lib \times Intensity$ are both positive and significant. In columns (3)-(4), we use the number of patents ($Ln(1+Pat_mdn)$) and patent citations ($Ln(1+Tcite_mdn)$) of a median firm and find qualitatively similar results.

Sixth, to further capture the long-term nature of the innovation process (Manso, 2011), we

¹ In an untabulated test, we further exclude Korea and Taiwan, which have the second and third largest number of patents, and find similar results.

² The official liberalization year of Jordan is 1995. However, we cannot find complete information about major listed firms in manufacturing industries in Jordan prior to 2000 from Datastream. Hence, we remove it from this analysis. Our results are not affected if we include it.

measure the liberalization indicator in year $t-5$ (Lib_lag5) instead of year $t-3$ in the baseline regressions. Hence, we are essentially estimating the effect of stock market liberalization on a country's 5-year-ahead innovation output. We then re-estimate the regressions and present the results in Table IA8. We find that the results are robust to this model specification that takes into account the delayed effect of liberalization on innovation output. The coefficient estimates of $Lib_lag5 \times Intensity$ are all positive and significant at the 1% level, suggesting that the effect of stock market liberalization is long lasting.

Last, to further mitigate the concern that the frequent observations of zero in the dependent variables could drive our results, we conduct three tests as follows. First, we follow Acharya and Subramanian (2009) and remove countries with the total number of patents less than 100. Second, we follow Levine, Lin, and Wei (2017) and remove industries with no patent at all during the entire sample period. Third, we focus on industries in the U.S. with the number of patents granted above the sample median. Specifically, we follow Levine, Lin, and Wei (2017) and calculate the time-series average of the total number of patents granted in each industry in the U.S. We then rank the observations in our sample according to this measure and keep industries that rank above the median. We re-estimate the baseline model based on the three sample filtering criteria above and present the regression results in Table IA9 of the Internet Appendix. We find that although the sample size is substantially reduced due to these additional sampling restrictions, our main findings are not affected, suggesting that the results are unlikely to be driven by the highly skewed dependent variables in the regression model.

Section C: The estimation of industry capital stock growth and industry TFP growth

According to the log-transformed Cobb-Douglas production function in Eq. (IA1) (country, industry, and time subscripts are omitted for brevity), the capital input (the log of industry capital stock, $Ln(\$K)$) and the labor input (the log of industry employment, $Ln(\#Emp)$) with a level of productivity (the log of industry TFP, $Ln(TFP)$) produce the output (the log of industry value added, $Ln(\$VA)$):

$$Ln(\$VA) = \alpha Ln(\$K) + (1 - \alpha) Ln(\#Emp) + Ln(TFP), \quad (IA1)$$

where α and $1 - \alpha$ are capital and labor shares in the output. Assuming standard values of 0.3 and 0.7 for capital share (α) and labor shares ($1 - \alpha$) in the production function (Caselli, 2005), we compute the annual industry TFP growth ($\Delta Ln(TFP)$) according to Eq. (IA2) below:

$$\Delta Ln(TFP) = \Delta Ln(\$VA) - 0.3 \Delta Ln(\$K) - 0.7 \Delta Ln(\#Emp), \quad (IA2)$$

where $\Delta Ln(\$VA)$, $\Delta Ln(\$K)$, and $\Delta Ln(\#Emp)$ are the annual industry value-added growth, the annual industry capital stock growth, and the annual industry employment growth, respectively. The data on $\$VA$ and $\#Emp$ can be directly obtained from the UNIDO database, while the data on $\$K$ are not available. We thus follow Caselli (2005) and construct a series of capital stocks for each industry each

country using the perpetual inventory method by assuming that the economy under consideration is in its steady state. Specifically, according to Harberger (1978), the initial capital stock K_0 is defined in Eq. (IA3) as follows:

$$K_0 = \frac{I_0}{g+\delta}, \quad (\text{IA3})$$

where I_0 represents the gross fixed capital formation of a given industry for the first year when data are available, g corresponds to the average annual growth rate of industry value added in that industry for the period 1963-2008, and δ represents the depreciation rate of physical capital that is set equal to 6%.³ After determining the initial capital stock K_0 , we then compute capital stocks for subsequent years according to Eq. (IA4) below:

$$K_t = (1 - \delta) \times K_{t-1} + I_{t-1}. \quad (\text{IA4})$$

Using the above approach, we are able to compute the industry capital stock growth ($\Delta \ln(\$K)$) and the industry TFP growth ($\Delta \ln(TFP)$).

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³ In the UNIDO database, the first year when data on industry value added are available is 1963. Previous studies, e.g., Nehru and Dharehwar (1993) and Caselli (2005), recommend calculating the average growth from the first year.

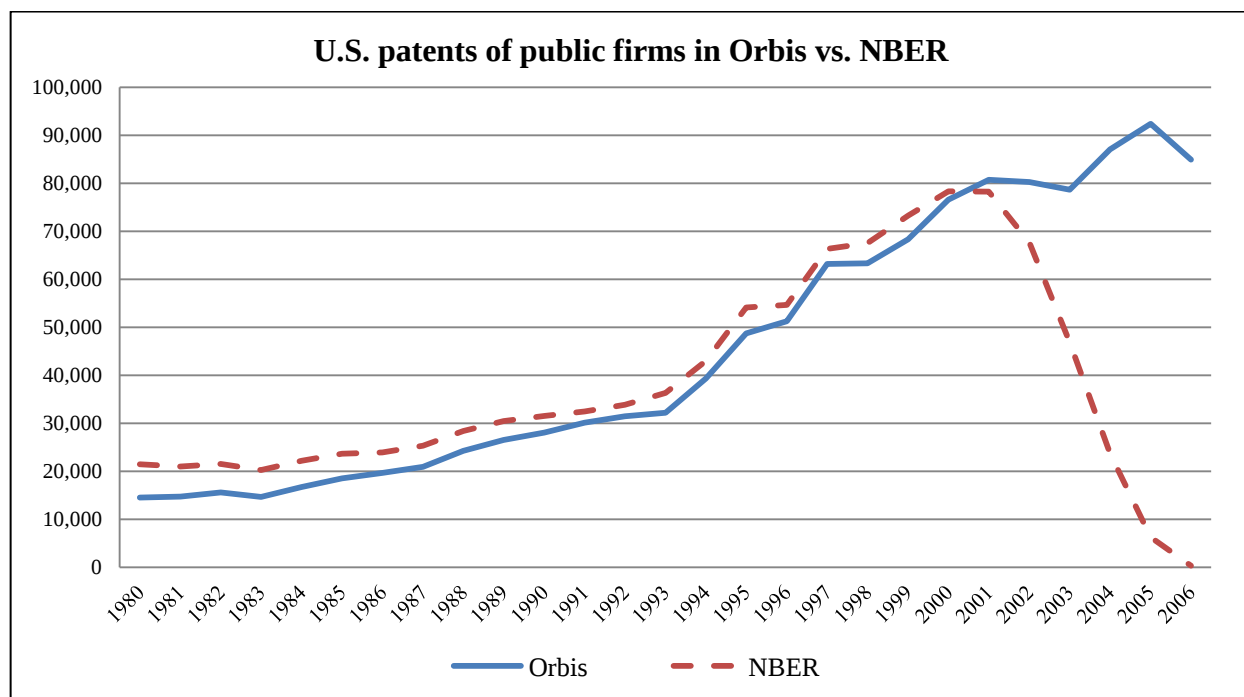


Fig. IA1. The number of patents in the Orbis database vs. that in the NBER database. This figure compares the number of U.S. patents produced by publicly-traded firms included in the Orbis database with that included in the NBER Patent and Citation database between 1980 and 2006. The solid line depicts the number of patents recorded in the Orbis database and the dashed line depicts the number of patents recorded in the NBER patent database.

Table IA1**Using alternative liberalization dates**

The sample includes public firms of manufacturing industries in countries experiencing stock market liberalization, which are jointly covered by the Orbis, the UNIDO, and the PWT 8.0 databases from 1981-2008. *Pat*, *Tcite*, and *Nfirm* are the total number of patents, the total number of citations adjusted for time-technology class fixed effects, and the total number of innovative firms in each industry for each country each year, respectively, which are measured in year *t*. *Lib_{df}* is a binary variable that takes the value of one if the observation is in a country's de facto liberalization year, estimated by Bekaert, Harvey, and Lundblad (2003), and zero otherwise, measured in year *t*-3. *Lib_{adr}* is a binary variable that takes the value of one if the observation is in the year when a country announces the first American Depositary Receipt (ADR) and onwards, and zero otherwise, measured in year *t*-3. *Lib_{cf}* is a binary variable that takes the value of one if the observation is in the year when a country launches the first country fund and onwards, and zero otherwise, measured in year *t*-3. *Lib_{fs}* is a binary variable that takes the value of one on and after the First Sign year, and zero otherwise, measured in year *t*-3. "First Sign" stock market liberalization dates denote the year associated with the earliest of the three dates: official liberalization, first ADR announcement, and first country fund launch. *VA* is the ratio of the value-added in a 2-digit SIC over the total value-added for each country each year, measured in year *t*-1. *GDP* is the log of GDP per capita for each country each year, measured in year *t*-1. *VGDP* is the sample standard deviation of the annual GDP per capita growth estimated using a five-year moving window for each country each year, measured in year *t*. *HumCap* is the log of human capital index from PWT 8.0, measured in year *t*-1. *Trade* is a country's exports and imports as a fraction of GDP, measured in year *t*-1. *Gov* is a country's government spending as a fraction of GDP, measured in year *t*-1. *Intensity* is the log of one plus the average number of patents held by a U.S. firm in a 2-digit SIC industry each year, measured in year *t*-1. Variables in dollars are computed in real terms at constant national prices in 2005 U.S. dollars. Control variables and their interactions with industry innovation intensity are included in all regressions but are not tabulated. Robust standard errors in parentheses are clustered by country-industry. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	<i>Ln(1+Pat)</i> (1)	<i>Ln(1+Tcite)</i> (2)	<i>Ln(1+Nfirm)</i> (3)
<i>Panel A: Using de facto liberalization dates as alternative liberalization dates (N = 6,190)</i>			
<i>Lib_{df} × Intensity</i>	0.107*** (0.04)	0.114*** (0.04)	0.071*** (0.02)
<i>Lib_{df}</i>	-0.175* (0.10)	-0.206** (0.10)	-0.100* (0.05)
<i>Intensity</i>	-0.539** (0.22)	-0.569** (0.24)	-0.346*** (0.13)
R-squared	0.27	0.22	0.32
<i>Panel B: Using first ADR dates as alternative liberalization dates (N = 7,440)</i>			
<i>Lib_{adr} × Intensity</i>	0.098*** (0.03)	0.124*** (0.03)	0.057*** (0.01)
<i>Lib_{adr}</i>	-0.271*** (0.08)	-0.342*** (0.09)	-0.157*** (0.04)
<i>Intensity</i>	-0.264* (0.16)	-0.264 (0.18)	-0.202** (0.09)
R-squared	0.22	0.17	0.26
<i>Panel C: Using first country fund dates as alternative liberalization dates (N = 7,160)</i>			
<i>Lib_{cf} × Intensity</i>	0.114*** (0.03)	0.121*** (0.04)	0.057*** (0.01)
<i>Lib_{cf}</i>	-0.271*** (0.08)	-0.313*** (0.10)	-0.165*** (0.04)
<i>Intensity</i>	-0.322** (0.16)	-0.341* (0.18)	-0.232** (0.09)
R-squared	0.23	0.18	0.27
<i>Panel D: Using first sign dates as alternative liberalization dates (N = 8,675)</i>			
<i>Lib_{fs} × Intensity</i>	0.129*** (0.03)	0.139*** (0.04)	0.071*** (0.02)
<i>Lib_{fs}</i>	-0.162* (0.09)	-0.206** (0.10)	-0.118*** (0.04)
<i>Intensity</i>	-0.350** (0.17)	-0.342* (0.19)	-0.276*** (0.10)
R-squared	0.26	0.17	0.30

Table IA2

Excluding Japan from the sample

The sample includes public firms of manufacturing industries in countries experiencing stock market liberalization except Japan, which are jointly covered by the Orbis, the UNIDO, and the PWT 8.0 databases from 1981-2008. *Pat*, *Tcite*, and *Nfirm* are the total number of patents, the total number of citations adjusted for time-technology class fixed effects, and the total number of innovative firms in each 2-digit SIC industry for each country each year, respectively, which are measured in year *t*. *Lib* is a binary variable that takes the value of one if the observation is in the year since a country's official liberalization, and zero otherwise, measured in year *t*-3. The definitions of other variables are in the legend of Table IA1. Robust standard errors in parentheses are clustered by country-industry. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	<i>Ln</i> (1+ <i>Pat</i>) (1)	<i>Ln</i> (1+ <i>Tcite</i>) (2)	<i>Ln</i> (1+ <i>Nfirm</i>) (3)
<i>Lib</i> × <i>Intensity</i>	0.133*** (0.03)	0.154*** (0.04)	0.076*** (0.02)
<i>Lib</i>	-0.196** (0.08)	-0.241*** (0.08)	-0.107*** (0.04)
<i>VA</i>	0.488 (1.45)	-0.219 (1.61)	0.067 (0.79)
<i>GDP</i>	1.218*** (0.16)	1.181*** (0.17)	0.686*** (0.09)
<i>VGDP</i>	2.713* (1.40)	2.248* (1.30)	1.241* (0.71)
<i>HumCap</i>	0.714 (0.50)	0.373 (0.53)	0.428 (0.26)
<i>Trade</i>	-1.076*** (0.30)	-0.913*** (0.28)	-0.612*** (0.15)
<i>Gov</i>	0.544 (0.73)	0.942 (0.80)	0.158 (0.30)
<i>Intensity</i>	-0.362** (0.17)	-0.357* (0.18)	-0.263*** (0.10)
<i>VA</i> × <i>Intensity</i>	0.529 (0.65)	0.915 (0.71)	0.420 (0.36)
<i>GDP</i> × <i>Intensity</i>	0.078** (0.04)	0.089** (0.04)	0.053*** (0.02)
<i>VGDP</i> × <i>Intensity</i>	-0.826 (0.62)	-0.711 (0.59)	-0.292 (0.31)
<i>HumCap</i> × <i>Intensity</i>	0.183 (0.13)	0.157 (0.13)	0.090 (0.07)
<i>Trade</i> × <i>Intensity</i>	-0.146 (0.10)	-0.185** (0.09)	-0.076 (0.05)
<i>Gov</i> × <i>Intensity</i>	-0.395 (0.33)	-0.500 (0.39)	-0.073 (0.12)
Year FE	Yes	Yes	Yes
Country-industry FE	Yes	Yes	Yes
Observations	8,516	8,516	8,516
R-squared	0.24	0.18	0.28

Table IA3

Excluding firms cross-listed in the U.S.

The sample includes public firms of manufacturing industries in countries experiencing stock market liberalization, which are jointly covered by the Orbis, the UNIDO, and the PWT 8.0 databases from 1981-2008. *Pat_ecl*, *Tcite_ecl*, and *Nfirm_ecl* are the total number of patents, the total number of citations adjusted for time-technology class fixed effects, and the total number of innovative firms for a sample of firms excluding firms cross-listed in the U.S. in each industry for each country each year, respectively, which are measured in year *t*. *Lib* is a binary variable that takes the value of one if the observation is in the year since a country's official liberalization, and zero otherwise, measured in year *t*-3. The definitions of other variables are in the legend of Table IA1. Robust standard errors in parentheses are clustered by country-industry. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	<i>Ln(1+Pat_ecl)</i> (1)	<i>Ln(1+Tcite_ecl)</i> (2)	<i>Ln(1+Nfirm_ecl)</i> (3)
<i>Lib</i> × <i>Intensity</i>	0.101*** (0.03)	0.111*** (0.03)	0.066*** (0.02)
<i>Lib</i>	-0.141* (0.08)	-0.134 (0.08)	-0.093** (0.04)
<i>VA</i>	0.265 (1.42)	-0.688 (1.55)	0.109 (0.77)
<i>GDP</i>	1.264*** (0.15)	1.235*** (0.17)	0.717*** (0.09)
<i>VGDP</i>	2.883** (1.34)	1.347 (1.24)	1.393** (0.69)
<i>HumCap</i>	0.363 (0.47)	0.770 (0.49)	0.284 (0.25)
<i>Trade</i>	-1.254*** (0.30)	-1.133*** (0.30)	-0.692*** (0.15)
<i>Gov</i>	0.639 (0.60)	0.039 (0.54)	0.211 (0.27)
<i>Intensity</i>	-0.343** (0.15)	-0.356** (0.16)	-0.250*** (0.09)
<i>VA</i> × <i>Intensity</i>	0.611 (0.61)	1.000 (0.66)	0.455 (0.34)
<i>GDP</i> × <i>Intensity</i>	0.065* (0.03)	0.070* (0.04)	0.049*** (0.02)
<i>VGDP</i> × <i>Intensity</i>	-0.667 (0.60)	-0.499 (0.58)	-0.260 (0.30)
<i>HumCap</i> × <i>Intensity</i>	0.148 (0.12)	0.118 (0.13)	0.070 (0.06)
<i>Trade</i> × <i>Intensity</i>	-0.078 (0.09)	-0.070 (0.09)	-0.055 (0.04)
<i>Gov</i> × <i>Intensity</i>	-0.212 (0.22)	-0.164 (0.20)	-0.028 (0.10)
Year FE	Yes	Yes	Yes
Country-industry FE	Yes	Yes	Yes
Observations	9,071	9,071	9,071
R-squared	0.25	0.16	0.30

Table IA4

Including liberalized and non-liberalized countries

The sample includes public firms of manufacturing industries in countries that are experiencing, have experienced, and have never experienced stock market liberalization, which are jointly covered by the Orbis, the UNIDO, and the PWT 8.0 databases from 1981-2008. *Pat*, *Tcite*, and *Nfirm* are the total number of patents, the total number of citations adjusted for time-technology class fixed effects, and the total number of innovative firms in each 2-digit SIC industry for each country each year, respectively, which are measured in year *t*. *Lib* is a binary variable that takes the value of one if the observation is in the year since a country's official liberalization, and zero otherwise, measured in year *t*-3. The definitions of other variables are in the legend of Table IA1. Robust standard errors in parentheses are clustered by country-industry. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	<i>Ln(1+Pat)</i> (1)	<i>Ln(1+Tcite)</i> (2)	<i>Ln(1+Nfirm)</i> (3)
<i>Lib</i> × <i>Intensity</i>	0.060** (0.03)	0.103*** (0.03)	0.035** (0.01)
<i>Lib</i>	-0.091 (0.07)	-0.146** (0.07)	-0.047 (0.03)
<i>VA</i>	0.169 (1.07)	-0.987 (1.24)	-0.017 (0.53)
<i>GDP</i>	1.194*** (0.15)	1.029*** (0.16)	0.666*** (0.08)
<i>VGDP</i>	0.063 (1.46)	-1.161 (1.47)	0.361 (0.71)
<i>HumCap</i>	-0.132 (0.43)	0.395 (0.49)	0.030 (0.21)
<i>Trade</i>	-0.517*** (0.10)	-0.408*** (0.10)	-0.311*** (0.05)
<i>Gov</i>	2.601*** (0.58)	1.404** (0.62)	1.234*** (0.25)
<i>Intensity</i>	-0.405*** (0.14)	-0.423*** (0.14)	-0.264*** (0.08)
<i>VA</i> × <i>Intensity</i>	0.394 (0.43)	0.771 (0.51)	0.299 (0.22)
<i>GDP</i> × <i>Intensity</i>	0.044 (0.03)	0.096*** (0.03)	0.033* (0.02)
<i>VGDP</i> × <i>Intensity</i>	-0.040 (0.71)	0.084 (0.76)	-0.240 (0.31)
<i>HumCap</i> × <i>Intensity</i>	0.298*** (0.10)	0.097 (0.11)	0.152*** (0.05)
<i>Trade</i> × <i>Intensity</i>	0.008 (0.03)	0.004 (0.03)	0.006 (0.02)
<i>Gov</i> × <i>Intensity</i>	-0.602** (0.24)	-0.415 (0.27)	-0.225** (0.09)
Year FE	Yes	Yes	Yes
Country-industry FE	Yes	Yes	Yes
Observations	21,103	21,103	21,103
R-squared	0.17	0.08	0.21

Table IA5**Technology-class level analysis**

The sample includes public firms of manufacturing industries in countries experiencing stock market liberalization, which are jointly covered by the Orbis, the UNIDO, and the PWT 8.0 databases from 1981-2008. *Pat*, *Tcite*, and *Nfirm* are the total number of patents, the total number of citations adjusted for time-technology class fixed effects, and the total number of innovative firms in each 3-digit IPC class for each country each year, respectively, which are measured in year *t*. *Lib* is a binary variable that takes the value of one if the observation is in the year since a country's official liberalization, and zero otherwise, measured in year *t*-3. *VA* is the ratio of the value-added in a 3-digit IPC class over the total value-added for each country each year, measured in year *t*-1. *GDP* is the log of GDP per capita for each country each year, measured in year *t*-1. *VGDP* is the sample standard deviation of the annual GDP per capita growth estimated using a five-year moving window for each country each year, measured in year *t*. *HumCap* is the log of human capital index from PWT 8.0, measured in year *t*-1. *Trade* is a country's exports and imports as a fraction of GDP, measured in year *t*-1. *Gov* is a country's government spending as a fraction of GDP, measured in year *t*-1. *Intensity* is the log of one plus the average number of patents held by a U.S. firm in a 3-digit IPC industry each year, measured in year *t*-1. Variables in dollars are computed in real terms at constant national prices in 2005 U.S. dollars. Robust standard errors in parentheses are clustered by country-industry. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	<i>Ln</i> (1+ <i>Pat</i>) (1)	<i>Ln</i> (1+ <i>Tcite</i>) (2)	<i>Ln</i> (1+ <i>Nfirm</i>) (3)
<i>Lib</i> × <i>Intensity</i>	0.129*** (0.04)	0.147*** (0.04)	0.091*** (0.02)
<i>Lib</i>	-0.057 (0.05)	-0.144*** (0.05)	-0.019 (0.03)
<i>VA</i>	-0.422 (1.89)	-1.398 (1.97)	-1.592 (1.39)
<i>GDP</i>	0.758*** (0.07)	0.766*** (0.08)	0.654*** (0.05)
<i>VGDP</i>	1.083 (0.73)	0.586 (0.84)	1.311*** (0.49)
<i>HumCap</i>	-0.137 (0.23)	-0.740*** (0.27)	-0.036 (0.17)
<i>Trade</i>	-0.726*** (0.13)	-0.728*** (0.15)	-0.646*** (0.09)
<i>Gov</i>	0.662* (0.35)	1.246*** (0.41)	0.508*** (0.19)
<i>Intensity</i>	-0.341** (0.17)	-0.385** (0.19)	-0.280** (0.11)
<i>VA</i> × <i>Intensity</i>	-1.743* (1.04)	-1.217 (1.05)	-0.433 (0.74)
<i>GDP</i> × <i>Intensity</i>	0.130*** (0.04)	0.158*** (0.04)	0.099*** (0.03)
<i>VGDP</i> × <i>Intensity</i>	-0.573 (0.55)	-0.547 (0.65)	-0.277 (0.36)
<i>HumCap</i> × <i>Intensity</i>	0.012 (0.12)	0.054 (0.14)	-0.039 (0.08)
<i>Trade</i> × <i>Intensity</i>	-0.145 (0.09)	-0.218** (0.11)	-0.064 (0.06)
<i>Gov</i> × <i>Intensity</i>	-0.600** (0.29)	-0.925*** (0.35)	-0.277* (0.14)
Year FE	Yes	Yes	Yes
Country-tech class FE	Yes	Yes	Yes
Observations	30,115	30,115	30,115
R-squared	0.16	0.13	0.21

Table IA6

Clustering standard errors in two dimensions

The sample includes public firms of manufacturing industries in countries experiencing stock market liberalization, which are jointly covered by the Orbis, the UNIDO, and the PWT 8.0 databases from 1981-2008. *Pat*, *Tcite*, and *Nfirm* are the total number of patents, the total number of citations adjusted for time-technology class fixed effects, and the total number of innovative firms in each 2-digit SIC industry for each country each year, respectively, which are measured in year *t*. *Lib* is a binary variable that takes the value of one if the observation is in the year since a country's official liberalization, and zero otherwise, measured in year *t*-3. The definitions of all variables are in the legend of Table IA1. Robust standard errors in parentheses are clustered by country-industry and year. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	<i>Ln</i> (1+ <i>Pat</i>) (1)	<i>Ln</i> (1+ <i>Tcite</i>) (2)	<i>Ln</i> (1+ <i>Nfirm</i>) (3)
<i>Lib</i> × <i>Intensity</i>	0.118*** (0.03)	0.135*** (0.04)	0.070*** (0.02)
<i>Lib</i>	-0.171* (0.09)	-0.179* (0.09)	-0.098** (0.04)
<i>VA</i>	0.803 (1.44)	-0.190 (1.61)	0.139 (0.77)
<i>GDP</i>	1.264*** (0.19)	1.246*** (0.19)	0.708*** (0.11)
<i>VGDP</i>	2.953* (1.51)	1.476 (1.43)	1.417* (0.76)
<i>HumCap</i>	0.383 (0.56)	0.879* (0.53)	0.273 (0.29)
<i>Trade</i>	-1.309*** (0.32)	-1.212*** (0.32)	-0.715*** (0.16)
<i>Gov</i>	0.855 (0.82)	0.380 (0.85)	0.218 (0.33)
<i>Intensity</i>	-0.295* (0.16)	-0.277 (0.17)	-0.243*** (0.09)
<i>VA</i> × <i>Intensity</i>	0.450 (0.65)	0.932 (0.73)	0.381 (0.35)
<i>GDP</i> × <i>Intensity</i>	0.065* (0.04)	0.071* (0.04)	0.048** (0.02)
<i>VGDP</i> × <i>Intensity</i>	-0.714 (0.66)	-0.549 (0.66)	-0.272 (0.32)
<i>HumCap</i> × <i>Intensity</i>	0.121 (0.12)	0.057 (0.13)	0.070 (0.06)
<i>Trade</i> × <i>Intensity</i>	-0.081 (0.10)	-0.070 (0.10)	-0.050 (0.05)
<i>Gov</i> × <i>Intensity</i>	-0.396 (0.33)	-0.447 (0.39)	-0.058 (0.11)
Year FE	Yes	Yes	Yes
Country-industry FE	Yes	Yes	Yes
Observations	9,071	9,071	9,071
R-squared	0.25	0.17	0.30

Table IA7

Using patents/citations of an average (median) firm as dependent variables

The sample includes public firms of manufacturing industries in countries experiencing stock market liberalization, which are jointly covered by the Orbis, the UNIDO, and the PWT 8.0 databases from 1981-2008. *Pat_ave* (*Pat_mdn*) and *Tcite_ave* (*Tcite_mdn*) are the number of patents and the number of citations adjusted for time-technology class fixed effects of an average (median) innovative firm in an industry for each country each year, respectively, which are measured in year *t*. *Lib* is a binary variable that takes the value of one if the observation is in the year since a country's official liberalization, and zero otherwise, measured in year *t*-3. The definitions of other variables are in the legend of Table IA1. Robust standard errors in parentheses are clustered by country-industry and year. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	<i>Ln</i> (1+ <i>Pat_ave</i>) (1)	<i>Ln</i> (1+ <i>Tcite_ave</i>) (2)	<i>Ln</i> (1+ <i>Pat_mdn</i>) (3)	<i>Ln</i> (1+ <i>Tcite_mdn</i>) (4)
<i>Lib</i> × <i>Intensity</i>	0.062*** (0.02)	0.077*** (0.02)	0.034* (0.02)	0.045** (0.02)
<i>Lib</i>	-0.095 (0.06)	-0.102 (0.07)	-0.046 (0.06)	-0.038 (0.06)
<i>VA</i>	0.281 (0.90)	-0.557 (1.10)	0.233 (0.84)	-1.373 (1.00)
<i>GDP</i>	0.723*** (0.09)	0.732*** (0.10)	0.504*** (0.08)	0.434*** (0.09)
<i>VGDP</i>	1.557 (0.97)	0.261 (0.94)	0.997 (0.87)	-1.047 (0.92)
<i>HumCap</i>	0.219 (0.34)	0.707* (0.39)	0.281 (0.30)	1.037** (0.41)
<i>Trade</i>	-0.718*** (0.18)	-0.639*** (0.19)	-0.491*** (0.15)	-0.252 (0.19)
<i>Gov</i>	0.758 (0.64)	0.383 (0.70)	0.605 (0.60)	-0.045 (0.64)
<i>Intensity</i>	-0.095 (0.09)	-0.073 (0.10)	-0.035 (0.08)	0.034 (0.08)
<i>VA</i> × <i>Intensity</i>	0.156 (0.36)	0.526 (0.46)	0.011 (0.32)	0.439 (0.41)
<i>GDP</i> × <i>Intensity</i>	0.009 (0.02)	0.015 (0.02)	-0.012 (0.02)	-0.016 (0.02)
<i>VGDP</i> × <i>Intensity</i>	-0.470 (0.40)	-0.284 (0.40)	-0.295 (0.34)	-0.177 (0.37)
<i>HumCap</i> × <i>Intensity</i>	0.121 (0.09)	0.071 (0.09)	0.146* (0.08)	0.080 (0.09)
<i>Trade</i> × <i>Intensity</i>	-0.044 (0.06)	-0.047 (0.06)	-0.028 (0.05)	-0.033 (0.06)
<i>Gov</i> × <i>Intensity</i>	-0.361 (0.28)	-0.449 (0.34)	-0.366 (0.25)	-0.431 (0.29)
Year FE	Yes	Yes	Yes	Yes
Country-industry FE	Yes	Yes	Yes	Yes
Observations	9,071	9,071	9,071	9,071
R-squared	0.17	0.09	0.10	0.03

Table IA8

Lagging liberalization year for five years

The sample includes public firms of manufacturing industries in countries experiencing stock market liberalization, which are jointly covered by the Orbis, the UNIDO, and the PWT 8.0 databases from 1981-2008. *Pat*, *Tcite*, and *Nfirm* are the total number of patents, the total number of citations adjusted for time-technology class fixed effects, and the total number of innovative firms in each 2-digit SIC industry for each country each year, respectively, which are measured in year *t*. *Lib_lag5* is a binary variable that takes the value of one if the observation is in the year since a country's official liberalization, and zero otherwise, measured in year *t*-5. The definitions of other variables are in the legend of Table IA1. Robust standard errors in parentheses are clustered by country-industry and year. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	<i>Ln</i> (1+ <i>Pat</i>) (1)	<i>Ln</i> (1+ <i>Tcite</i>) (2)	<i>Ln</i> (1+ <i>Nfirm</i>) (3)
<i>Lib_lag5</i> × <i>Intensity</i>	0.106*** (0.03)	0.109*** (0.04)	0.075*** (0.02)
<i>Lib_lag5</i>	-0.172* (0.09)	-0.136 (0.10)	-0.118*** (0.04)
<i>VA</i>	0.816 (1.45)	-0.176 (1.62)	0.123 (0.78)
<i>GDP</i>	1.265*** (0.16)	1.243*** (0.17)	0.706*** (0.09)
<i>VGDP</i>	3.190** (1.38)	1.746 (1.31)	1.487** (0.70)
<i>HumCap</i>	0.345 (0.52)	0.822 (0.55)	0.293 (0.27)
<i>Trade</i>	-1.270*** (0.31)	-1.199*** (0.30)	-0.676*** (0.15)
<i>Gov</i>	0.976 (0.81)	0.531 (0.86)	0.249 (0.30)
<i>Intensity</i>	-0.271 (0.17)	-0.258 (0.18)	-0.225** (0.09)
<i>VA</i> × <i>Intensity</i>	0.470 (0.64)	0.961 (0.71)	0.399 (0.35)
<i>GDP</i> × <i>Intensity</i>	0.064* (0.03)	0.069* (0.04)	0.048** (0.02)
<i>VGDP</i> × <i>Intensity</i>	-0.835 (0.61)	-0.706 (0.60)	-0.321 (0.31)
<i>HumCap</i> × <i>Intensity</i>	0.140 (0.13)	0.092 (0.13)	0.069 (0.06)
<i>Trade</i> × <i>Intensity</i>	-0.095 (0.09)	-0.079 (0.09)	-0.066 (0.05)
<i>Gov</i> × <i>Intensity</i>	-0.467 (0.35)	-0.540 (0.40)	-0.086 (0.12)
Year FE	Yes	Yes	Yes
Country-industry FE	Yes	Yes	Yes
Observations	9,071	9,071	9,071
R-squared	0.25	0.17	0.30

Table IA9**Mitigating the impact of highly skewed dependent variables**

The sample includes public firms of manufacturing industries in countries experiencing stock market liberalization, which are jointly covered by the Orbis, the UNIDO, and the PWT 8.0 databases from 1981-2008. *Pat*, *Tcite*, and *Nfirm* are the total number of patents, the total number of citations adjusted for time-technology class fixed effects, and the total number of innovative firms in each 2-digit SIC industry for each country each year, respectively, which are measured in year *t*. *Lib* is a binary variable that takes the value of one if the observation is in the year since a country's official liberalization, and zero otherwise, measured in year *t*-3. The definitions of other variables are in the legend of Table IA1. Robust standard errors in parentheses are clustered by country-industry and year. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variables	<i>Ln</i> (1+ <i>Pat</i>) (1)	<i>Ln</i> (1+ <i>Tcite</i>) (2)	<i>Ln</i> (1+ <i>Nfirm</i>) (3)
<i>Panel A: Removing countries with the number of patents less than 100 (N = 4,799)</i>			
<i>Lib</i> × <i>Intensity</i>	0.202*** (0.05)	0.222*** (0.06)	0.120*** (0.03)
<i>Lib</i>	-0.415*** (0.15)	-0.404*** (0.16)	-0.239*** (0.07)
<i>Intensity</i>	-0.253 (0.31)	-0.257 (0.31)	-0.276 (0.17)
R-squared	0.33	0.23	0.39
<i>Panel B: Removing industries with no patent during the sample period (N = 3,847)</i>			
<i>Lib</i> × <i>Intensity</i>	0.208*** (0.06)	0.247*** (0.07)	0.119*** (0.03)
<i>Lib</i>	-0.425** (0.20)	-0.497** (0.21)	-0.236** (0.09)
<i>Intensity</i>	-0.002 (0.32)	-0.021 (0.32)	-0.163 (0.18)
R-squared	0.34	0.23	0.41
<i>Panel C: Focusing on industries with innovativeness above the sample median (N = 4,105)</i>			
<i>Lib</i> × <i>Intensity</i>	0.166** (0.07)	0.181** (0.08)	0.083** (0.03)
<i>Lib</i>	-0.366 (0.22)	-0.362 (0.25)	-0.179 (0.11)
<i>Intensity</i>	-0.021 (0.33)	-0.070 (0.37)	-0.135 (0.18)
R-squared	0.32	0.22	0.38