DISTANCE TO FRONTIER, MANAGER TURNOVER, AND ECONOMIC GROWTH

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Abstract: We apply a dictionary method to Standard & Poor's Capital IQ microdata on CEO changes, in order to construct a country-level manager turnover index. Next, we study the relation between manager turnover, distance to the technology frontier and economic growth in a panel of countries. Our findings give empirical support to Acemoglu, Aghion and Zilibotti's (2006) theoretical model: low manager turnover rates become negatively correlated with growth as countries get closer to the technology frontier. Our results are robust to different (mild or strict) definitions of manager change motive, as well as to a weighted (by firm size) version of the turnover index. We also address endogeneity issues by instrumenting our manager turnover index with the Doing Business "number of procedures to open a new business" variable.

Keywords: manager turnover ; conditional convergence ; appropriate institutions ; barriers to entry and competition

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1 - introduction

Appearing perhaps for the first time in Gerschenkron (1962), the idea of "appropriate institutions" or "second best institutions" is nowadays familiar to development economists. Basically, the idea is that certain institutional arrangements which block unfettered competition and stimulate rents formation and appropriation may nevertheless be good for countries at their early stages of economic growth. Rodrik (2008) illustrates how this can be true in four areas: contract enforcement, entrepreneurship, trade openness and macroeconomic stability. In particular, the entrepreneurship or, more generally, the firm-manager relationship is one of the most important aspects of the appropriate institutions story.

Post-World War II Japanese and Korean firms used to display much slower manager turnovers than, say, post-1990s Silicon Valley firms. This variability in manager turnover rates is rationalized by Acemoglu, Aghion and Zilibotti (2006): at early stages of economic development, when investment is important, firms tend to renew their contracts with managers who reveal to be low-skilled/untalented because these managers have accumulated rents and good connections with financial institutions. Conversely, when the economy gets closer to the technology frontier, firms will fire those old managers and hire new ones that may be high-skilled/talented and more able to conduct innovation.[1] As is known, Japan and Korea promoted long manager tenures and big firm size through institutions and cultural practices that amounted to "barriers to entry and competition".

In spite of their elegant modelling and clear economic mechanism, all Acemoglu, Aghion and Zilibotti (2006) offer as empirical motivation is showing that high barriers to entry and competition (proxied by the "number of procedures to open a new business" variable from Djankov et al. 2002) become negatively correlated with GDP per worker growth as countries get closer to the technology frontier. That empirical motivation leaves manager turnover rates aside, notwithstanding this being the variable through which most of the action takes place in their model. In this paper, we seek to fill this gap in the

[1] Bereskin and Hsu (2014) find empirical evidence that CEO turnover is associated with significantly greater quantity and quality of future innovation.

literature by showing that low manager turnover rates become negatively correlated with growth as countries get closer to the technology frontier.

To show that, we first construct a country-level index of manager turnover from the S&P Capital IQ Financials database. This is a qualitative database which reports "key developments" for listed companies around the globe, including "Executive Change" (CEO) announcements. Because Capital IQ does not classify those changes by their motive, we have to apply the dictionary method to individual announcements. This, in turn, is quite involved because words like "fired", "dismissed" or "discharged" seldom or never appear on the text, whilst it is precisely in such cases that we are interested, in the spirit of Acemoglu, Aghion and Zilibotti's model.

In the face of this, like other studies in empirical corporate finance[2] we proceed by removing those cases of top manager change that stand out as voluntary or *force majeure* (such as disease and death), with the residual cases being then taken as the desired *forced turnovers*, that is, when the manager was fired. In order to feed our dictionary with the keywords that identify the types of manager turnover, we have manually inspected over 1000 Capital IQ Executive Change announcements. The resulting index of manager turnover displays some coherent features such as a negative, albeit small, cross-country correlation with the "number of procedures to open a new business" variable from Djankov et al. (2002). Also, the developed, closer to the technology frontier countries have, on average, higher manager turnover rates than the emerging economies in our sample.

Based on a panel of 70 countries and covering the 2002-2017 period, our results give some support to the "microfoundation" mechanism envisaged by Acemoglu, Aghion and Zilibotti (2006). In our output per worker growth regressions, the coefficient associated to the interaction between the manager turnover index and the proximity to the technology frontier is positive and statistically significant when proximity is proxied by the number of patents per habitant, but not when it is proxied by relative to the U.S. productivity. Our results are robust to different (mild or strict) definitions of manager change motive, as well as to a weighted (by firm size) version of the turnover index.

We also replicate Acemoglu, Aghion and Zilibotti (2006)'s results, using our more recent data and the "number of procedures to open a new business" variable from the

[2] See, for example, Jenter and Kanaan (2015).

Doing Business database - which, unlike the original from Djankov et al. (2002), is time variant. We confirm that high "barriers to entry and competition" are accompanied by slower growth for countries near the technology frontier. However, we cannot go as far as saying that the growth effects of barriers operate through the turnover of managers: in our two-stage exercise we find that the more exogenous and institutional Doing Business variable is a weak instrument for the manager turnover index.

The remainder of the paper is organized as follows: In section 2, we replicate Acemoglu, Aghion and Zilibotti (2006)'s growth regressions; section 3 details the construction of the manager turnover index using the dictionary method; section 4 brings our main results, together with some robustness exercises; section 5 concludes.

2 – distance to frontier, barriers to entry and competition, and economic growth

The conditional (on distance to frontier) effect of barriers to entry and competition on growth will be tested using the following specification:

$$g_{y_{i,t}} = \beta_0 + \beta_1 . a_{i,t,initial} + \beta_2 . Barriers_{i,t,initial} + \beta_3 . a_{i,t,initial} . Barriers_{i,t,initial} + \tilde{\beta}_4 . \tilde{C}_{i,t,initial} + \alpha_t + \gamma_i + \varepsilon_{i,t} \qquad (1)$$

Where $g_{y_{i,t}}$ is the growth rate of output per worker for country *i* during time *t*; $a_{i,t,initial}$ is the initial value (calculated at the beginning of time *t*) of a proxy for country *i*'s proximity to the world technology frontier; $Barriers_{i,t\ initial}$ is the initial value of the "number of procedures to open a new business" variable from the Doing Business database; $\tilde{C}$ is a vector of controls including the investment to GDP ratio and a human capital index; α_t is a time fixed-effect and γ_i is a country fixed-effect. The time unit *t* is a quinquennium.[3]

[3] Initial values refer to the last year of the previous quinquennium (that is, the last year of $t - 1$). See appendix A for the list of variables used in equation (1) and their data sources.

We estimate (1) in a sample of 70 countries, covering the three quinquennia between 2002 and 2017.[4] Acemoglu, Aghion and Zilibotti (2006) run their corresponding regression using a sample of 42 countries, covering the seven quinquennia between 1960 and 1995. Whereas we can explore the full panel dimension of the data, when Acemoglu, Aghion and Zilibotti (2006) estimate (1) they either omit the term where *Barriers* appears alone or omit the country fixed-effect. This is because the Doing Business variable is time variant in our sample, but in their sample it is fixed for the year 1999.

The results from estimating (1) in our sample, with the proximity to the world technology frontier (a_i) proxied by country i's GDP per worker relative to the U.S., are shown in Table 1 below:

Table 1: Acemoglu, Aghion and Zilibotti's growth regression (first version)

	dep = growth rate of output per worker		
GDP per worker relative to the U.S.	-205.7913***	-150.2138***	-157.0926***
	(64.4484)	(34.8292)	(32.4401)
Number of procedures to open a new business (DB)	1.2880	2.9168**	2.9396**
	(1.8626)	(1.4563)	(1.3073)
GDP per worker relative to the U.S. x DB	-1.3994	-6.9358**	-6.5507**
	(5.4933)	(3.0770)	(2.8709)
Human Capital		-5.1800	0.9296
		(17.4491)	(17.2677)
Savings			0.3850*
			(0.1992)
Quinq. 2008-2012	-0.0580	1.1978	1.3116
	(2.0899)	(2.4112)	(2.3583)
Quinq. 2013-2017	-5.2966*	-3.4559	-2.3949
	(2.8081)	(3.7209)	(3.4971)
Constant	102.6430***	94.8379*	69.4755
	(26.1027)	(52.3490)	(50.9785)
Observations	190	182	179
R-squared (within)	0.6379	0.6569	0.6977
Number of countries	70	67	67
F-Statistic	29.01	19.86	20.04
p-value (F-statistic)	0.000	0.000	0.000

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

[4] See appendix B for our country list, including the last quinquennium's initial (2012) values of the Doing Business variable, proximity to frontier, and turnover of CEOs (this latter variable to be used in section 4). Countries identified as tax havens or oil exporters (OPEC members) were removed from our database.

The pattern of coefficients in Table 1 broadly confirms the "appropriate institutions" hypothesis as spelled out in Acemoglu, Aghion and Zilibotti (2006). While β_2, the coefficient associated to "barriers" is positive, the coefficient β_3 associated to the interaction between "barriers" and "proximity to frontier" is negative. Indeed, that β_3 be negative is the main empirical prediction of their theoretical model.

For countries far from the frontier, that is, with small a_i, the derivative of the growth rate with respect to the barriers ($\beta_2 + \beta_3 . a_{i,t,initial}$) may well be positive. However, as a country approaches the frontier, that is, as a_i gets higher, this derivative becomes negative. Taking our estimates from column 3 as benchmark, we calculate a threshold a^* = 2.93/6.55 ≅ 0.45 (of the U.S. GDP per worker) such that, for $a_i > a^*$ it is harmful for country i's growth rate to increase its barriers.[5]

Inspecting our country list in Appendix B, we see that 36 out of 70 countries had $a_i < a^*$ in the last quinquennium's initial year 2012, with the cutoff occurring between Lebanon and Chile. Concordant with the theory, all countries with $a_i < a^*$ were classified as "emerging economies" by the IMF's World Economic Outlook 2002, while 27 out of the 34 countries with $a_i > a^*$ were classified as "advanced economies".

The trouble with Table 1's results is that they may suffer from the so-called Nickell (1981) bias, inasmuch as we have country i's initial output per worker both on the left side (growth rate) and on the right side (a_i) of the equation. According to Islam (1995), this renders the LSDV estimator asymptotically inconsistent, unless the T (number of periods) dimension of the panel is large, which is certainly not our case with T = 3 (three quinquennia). To circumvent this problem, in Table 2 we present the results from estimating (1) when the proximity to the technology frontier (a_i) is proxied by country i's (relative to the country with the maximum) number of patents per habitant, from the World Bank Indicators database.

[5] Using the Stata program "*nlcom*" command, we get a 0.082 standard deviation for a^*..

Table 2: Acemoglu, Aghion and Zilibotti's growth regression (second version)

	dep = growth rate of output per worker		
Number of patents per habitant	57.5031	63.1286	67.0122
	(47.4940)	(46.8216)	(50.3043)
Number of procedures to open a new business (DB)	2.5298**	2.3695*	2.7472**
	(1.2250)	(1.2659)	(1.1505)
Number of patents per habitant x DB	-7.7413***	-8.0725***	-7.7946***
	(2.4110)	(2.4980)	(2.5179)
Human Capital		-32.3789	-28.1627
		(19.8194)	(20.4679)
Savings			0.2244
			(0.4100)
Quinq. 2008-2012	-6.5112**	-3.4705	-2.6848
	(2.6815)	(2.8478)	(2.8192)
Quinq. 2013-2017	-15.6334***	-9.4715**	-7.6643*
	(3.6884)	(4.4905)	(4.2691)
Constant	1.8095	93.1109	70.5129
	(12.6869)	(59.1683)	(65.6049)
Observations	163	162	159
R-squared (within)	0.4131	0.4257	0.4359
Number of countries	64	63	63
F-Statistic	10.68	8.896	8.286
p-value (F-statistic)	0.000	0.000	0.000

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The pattern of coefficients in Table 2 is the same as in Table 1, being that we now have significance for the barriers×proximity term in all three specifications. Taking the results from column 3, we calculate a threshold $a^* = 2.75/7.79 = 0.35$ (relative number of patents per habitant) such that, for $a_i > a^*$ it is harmful for country i's growth rate to increase its barriers.[6] This threshold value may look small, but going back to our country list in Appendix B we find that it places only 4 (out of 61) countries in the region $a_i > a^*$.

[6] Using the Stata program "*nlcom*" command, we now get a 0.14 standard deviation for a^*.

3 – the manager turnover index

The data regarding manager turnover events was based on Standard & Poor's Capital IQ, which compiles all news regarding CEO/Executive changes by individual companies, worldwide. The main concern during the data extraction process was filtering each piece of news in order to consider only "forced" dismissals (i.e., cases in which the departure of a CEO was caused by a decision from her/his superiors, rather than voluntarily or by *force majeure*).

Capital IQ does not provide a straightforward classification of each CEO's reason for dismissal, only a news excerpt announcing such occurrence. To overcome this problem, we implement the "keyword dictionary" method, which consists of an automated mapping of pieces of news into occurrence types, according to specific "keywords" identified in the excerpt. For example, if the keywords "redesignated", "relocated", "remain", "will continue", etc., appear on the text, the corresponding turnover will be classified as a "switching positions" (a type that should not be viewed as a "forced turnover").

Figure 1 illustrates how data is displayed in Capital IQ:

Figure 1: Capital IQ display of information regarding CEO turnover

Viewing 1-50 of 1 to 10000 [View 1-50 | 51-100 | 101-150 | 151-200 | 201-250 | > >>] [View 250 Per Page]

Key Developments By Date	Key Developments by Type	Company Name(s)	Key Development Headline	Key Development Situation	Key Development Sources	Headquarters - Country/Region
May-22-2020	Executive Changes - CEO	Timber Pharmaceuticals, Inc. (AMEX:TMBR)	Timber Pharmaceuticals, Inc. Appoints John Koconis as Chief Executive Officer in Place of Steven M. Bosacki	Timber Pharmaceuticals, Inc. announced in accordance with the Amended Merger Agreement, on May 18, 2020, at the Effective Time, Steven M. Bosacki was terminated as Chief Executive Officer. In accordance with the Amended Merger Agreement, on May 18, 2020, the Board appointed John Koconis as Chief Executive Officer.	SEC Form 8k	United States
May-22-2020	Executive Changes - CEO	Delcath Systems, Inc. (NasdaqCM:DCTH)	Delcath Systems, Inc. Announces Executive Changes, Effective on June 1, 2020	Delcath Systems, Inc. announced that on May 18, 2020, Jennifer K. Simpson submitted her resignation as the Chief Executive Officer of the company. Ms. Simpson's resignation of her employment as the Chief Executive Officer of the Company, to be effective on June 1, 2020, was not because of any disagreement with the Company on any matter relating to the Company's operations, policies or practices. On... More >>	SEC Form 8k	United States
May-22-2020	Executive Changes - CEO; Executive Changes - CFO	Golden Grain Energy, LLC	Golden Grain Energy, LLC Announces Executive Changes	On May 18, 2020, the board of directors of Golden Grain Energy, LLC appointed Chad Kuhlers as the company's interim Chief Executive Officer and the company appointed Brooke Peters as the company's interim Chief Financial Officer. In addition, effective May 18, 2020, Christine Marchand resigned as the Company's Chief Financial Officer.	SEC Form 8k	United States
May-22-2020	Executive Changes - CEO	PurLucid Treatment Solutions, Inc.	PurLucid Treatment Solutions, Inc. Announces Resignation of Preston McEachern as Chief Executive Officer	Preston McEachern has offered his resignation as Chief Executive Officer of PurLucid Treatment Solutions (Canada) Inc. The Company expects PurLucid to appoint a new CEO shortly.	SEDAR	Canada

Source: Capital IQ

In order to feed our dictionary with the keywords that identify the types of manager turnover, we have manually inspected 1069 news excerpts from the "Key Development Situation" column above. In the end, we devised a classification system with twelve types of occurrences:[7]

- **Resignation:** CEO voluntarily resigns from her/his position
- **Health issues:** CEO leaves his position due to health-related issues
- **Switching positions:** CEO is switched to another position of similar importance in the same company (ex: Board of Directors)
- **Bankruptcy:** CEO leaves his position due to his firm going bankrupt
- **Death:** CEO dies in office
- **Corporate Scandal:** CEO leaves office due to a corporate scandal
- **Arrest:** CEO is arrested while in office
- **M&A:** CEO is removed from his position due to a "Mergers and Acquisitions" takeover in his company during his mandate
- **Planned:** CEO is substituted from his position due to a pre-established succession-plan in the company
- **Interim:** CEO is temporarily removed from his office, or a new interim CEO is sworn in temporarily
- **Retirement:** CEO retires from office
- **Creation of a new business:** The CEO office is established for the first time in a newly-created company

Inspecting this list, none of the twelve types stands out as a "forced turnover". Indeed, the trouble with relying on a dictionary method is that the news writers never make themselves clear when announcing a forced turnover event. DeFond and Park (1999) argue that many turnover events announced as "retirements" by the press are, in fact, forced occurrences. Fee *et al.* (2018) believe that a considerable part of the cases classified as "voluntary" by the previous literature should be viewed as "forced"

[7] In Appendix C, we present a table linking keywords to each type of turnover.

occurrences instead. From that, we can conclude it is impossible to construct an ideal, "noise-absent" measure of CEO turnover.

Here we offer three different definitions of manager turnover, as a way of accommodating for different types of "omission errors":

Our first metric keeps all the turnover occurrences identified in the Capital IQ database, excluding only those associated with *force majeure* ("death", "health issues", "M&As", "start of a business", "bankruptcy", "corporate scandals", and "arrests"). We call this the "inclusive" definition, which is less susceptible to filtering out forced dismissals hidden by the press.[8]

The second metric is based on ruling out all the events that fit in any of the twelve types of turnover identified by our "dictionary". We call this the "strict" definition, which is less susceptible to wrongly including voluntary occurrences.

At last, our third metric considers the sum of the events identified in the second metric with the "retirement" occurrences, therefore considering only the limitation pointed by DeFond and Park (1999). This last definition of turnover is called "intermediate".[9]

Table 3 summarizes the results from our turnover filtering applied on Capital IQ excerpts from 2002 to 2017:

[8] Basically, our "inclusive" definition coincides with the liberal ("FIRE 1") definition in Fee *et al.* (2018). In order to identify forced turnovers, Jenter and Kanaan (2015) also discard "*force majeure*" cases.

[9] This metric could be refined by applying the so-called Parrino (1997) algorithm, which recommends classifying the departures of 60-year or older CEOs as voluntary turnovers; but Fee *et al.* (2018) cast a series of objections to this criterion.

Table 3: Turnover classification in the Capital IQ database

Type	**Quantity**	**Percentage**
Resignation	37627	43.17%
Switching positions	28241	32.40%
Interim	10684	12.26%
Retirement	9900	11.36%
M&A	5351	6.14%
Planned	1707	1.96%
Creation of new business	1480	1.70%
Death	1002	1.15%
Health Issues	193	0.22%
Bankruptcy	144	0.17%
Corporate Scandal	142	0.16%
Arrest	13	0.01%
"Strict" turnover	**24786**	28.44%
"Intermediate" turnover	**34686**	39.80%
"Inclusive" turnover	**79172**	90.84%
Total	**87157**	100,00%

In Table 3, notice that the sum of percentages across the types is higher than 100%. This happens because by our dictionary method the same turnover occurrence may be classified as being more than one type. Regarding the three turnover definitions, as expected the number of occurrences increases as we move from the "strict" to the "inclusive" definition.

After the filtering detailed above, we proceed to calculate a country-level "manager turnover index" as follows:

$$TI_{i,t} = \frac{\#(events)_{i,t}}{\#(firms)_{i,t}} \qquad (2)$$

Where $\#(events)_{i,t}$ is the number of manager turnovers in country i at time t, as obtained from applying our dictionary method on the Capital IQ database; $\#(firms)_{i,t}$ represents the number of all listed domestic companies in country i, time t.[10]

"$\#(firms)_{i,t}$" comes from the "Listed domestic companies, total" variable from the World Bank. It is described as:

"Listed domestic companies, including foreign companies which are exclusively listed, are those which have shares listed on an exchange at the end of the year. Investment funds, unit trusts, and companies whose only business goal is to hold shares of other listed companies, such as holding companies and investment companies, regardless of their legal status, are excluded. A company with several classes of shares is counted once. Only companies admitted to listing on the exchange are included."[11] (**Source:** World Bank Open Data)

We apply these same restrictions to the Capital IQ database, removing any of the foreign firms related to "cross-listing" (i.e., when a company is listed beyond its central Stock Market), or those firms exclusively associated with "share-holding" practices as well. [12] More generally, we have good reasons to expect the variables $\#(events)_{i,t}$ and $\#(firms)_{i,t}$ to be compatible in the sense that every turnover occurrence is taking place in a firm that is part of the "Listed domestic companies" universe from the World Bank. This is so because the World Bank data are (at least until 2013) sourced from Standard & Poor's, just like the Capital IQ data.

By considering only the firms which concord with the criteria stated above, we seek to remain faithful to the original conception of Acemoglu, Aghion and Zilibotti

[10] Because for each country-time pair (*i, t*) the variable #(events) may assume a different value depending on the turnover definition ("strict", "intermediate" or "inclusive"), so does the turnover index TI for each pair (*i , t*).

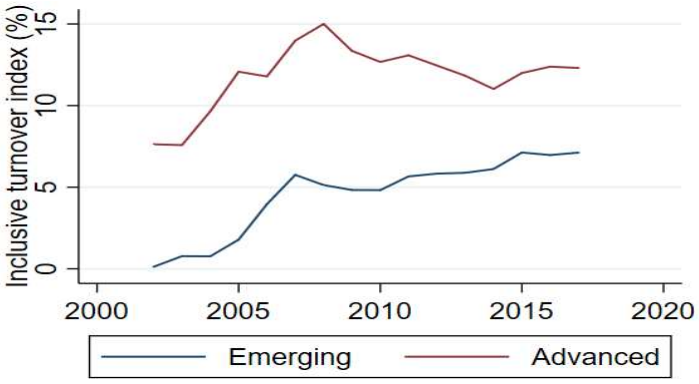
[11] Such description can be found in the "Details" section of the variable, in the following link: https://data.worldbank.org/indicator/CM.MKT.LDOM.NO?end=2020&start=1975&view=chart

[12] For that, all the firms listed as "REITs", "Holding Companies", "Trusts", "Investment Funds" and/or "Investment Companies" in the "Industry Classifications" filter options were removed (considering "Primary" activities only). A second "Equity Security Features" for "Primary Listing" categories filtering was applied as well, since it excludes cases of "cross-listing".

(2006), in that their theoretical model has neither a financial sector nor multinational firms.

In section 4 below we present some descriptive statistics of the country-level turnover index as defined in (2). Here, instead, we would like to call attention to a cross-country clubs difference. Figure 2 plots the evolution, from 2002 to 2017, of the average turnover index for the "advanced economies" (in red) and for the "emerging economies" (in blue) that compose our sample of countries.[13]

FIGURE 2: turnover index evolution for emerging and advanced economies



Inspecting Figure 2, we can see that on average the "advanced economies" club displays a higher turnover rate than the "emerging economies club".[14] This pattern is as predicted by Acemoglu, Aghion and Zilibotti (2006): countries closer to the technology frontier will benefit more from innovation, which in turn is favored by higher turnover rates.

[13] The "advanced" or "emerging" economy definition comes from the IMF "World Economic Outlook". The averages are calculated by first summing the *TI* indicator across the countries in a club, and then dividing it by the sum of *n* across the countries in that club. The turnover definition used in figure XX is the "inclusive" one.

[14] Such difference is also present in the empirical finance literature: DeFond and Hung (2004) conclude that countries with "strong law enforcement institutions" (a common feature in the developed world) present a significant relationship between CEO turnover and poor firm performance, while those with "weak enforcement" do not. Burns et al. (2023) broaden the analysis by finding that turnover is more sensitive to firm performance in countries that culturally value hard work and competition over network connections, have higher investor protection and have more flexible labor markets. Gibson (2003) points out that firms in emerging markets do present a significant link between turnovers and performance; but for a subset of companies with "large domestic shareholders" such relationship does not hold, suggesting some degree of "inefficiency" in corporate governance for emerging countries.

With regard to differences between advanced and emerging economies, there may be a problem of underrepresentation of the latter in the Capital IQ database. Indeed, when Burns et al. (2023) trim their data by considering only those countries with at least 100 firm-year observations, their sample is reduced to 27 countries (half as much as we have in Table 5 below), most of which developed ones.[15] The main reason for our not adopting this trimming, nor worrying much about the potential problem of underrepresentation, is that both the numerator and the denominator in equation (2) come from the same S&P's universe of firms: if underrepresentation affects equally both the reported number of turnovers and the number of listed companies, then it will not bias our turnover index.

4 – results

In Table 4 we present descriptive statistics of all the variables used in this paper, for the last quinquennium of our sample:

Table 4: Summary statistics (2013-2017 quinquennium)

VARIABLE	min	max	Mean	Std. Dev.	Median	1st Perc.	99th Perc.	t-value
Growth rate of output per worker (%)	-57.18	258.77	16.81	27.36	12.39	-50.50	96.59	9.81
Number of procedures to open a new business (DB)	1.00	20.00	8.81	3.63	9.00	2.00	19.00	36.45
Manager Turnover Index (%)	0.04	45.24	6.76	7.60	4.13	0.12	40.00	11.36
Number of patents per habitant (relative to frontier)	0.00	1.00	0.11	0.19	0.03	0.00	1.00	8.17
GDP per worker relative to the U.S.	0.27	1.39	0.75	0.22	0.75	0.33	1.26	51.98
Weighted Manager Turnover Index (%)	0.00	70.35	10.82	12.44	7.21	0.00	56.26	10.29
Human Capital Index	1.52	3.72	2.79	0.53	2.81	1.66	3.67	81.57
Savings/GDP (%)	-4.60	60.33	24.44	10.27	23.25	1.95	57.25	37.03

Note: all variables except the growth rate are at initial values. See equations (1) and (3).

[15] Like us, Burns et al. (2023) use S&P's Capital IQ to compute CEO turnovers at the country level. For S&P's coverage (number of company profiles by country), see https://www.spglobal.com/marketintelligence/en/solutions/privatecompanydata?utm_medium=cpc&utm_source=google&utm_campaign=Latam_Portuguese_Search_Google&utm_term=capital&iq&utm_content=554179681871&gclid=Cj0KCQjwwtWgBhDhARIsAEMcxeC1uysdc9TWQ62vHaKUHREpDRE8ULH7QQSawUKPVoxIv36AokJT14QaAvPsEALw_wcB

In this section, we study the conditional (on distance to frontier) effect of manager turnover on growth. This is done by replacing the "barriers" variable from (1) with the turnover index defined in (2):

$$g_{y_{i,t}} = \beta_0 + \beta_1 . a_{i,t,initial} + \beta_2 . TI_{i,t,initial} + \beta_3 . a_{i,t,initial} . TI_{i,t,initial} + \tilde{\beta}_4 . \tilde{C}_{i,t,initial} + \alpha_t + \gamma_i + \varepsilon_{i,t} \quad (3)$$

Where $g_{y_{i,t}}$ is the growth rate of output per worker for country *i* at time *t*; $a_{i,t,initial}$ is the initial value (calculated at the beginning of time *t*) of a proxy for country *i*'s proximity to the world technology frontier; $TI_{i,t\ initial}$ is the initial value of the manager turnover index; $\tilde{C}$ is a vector of controls including the investment to GDP ratio and a human capital index; α_t is a time fixed-effect and γ_i is a country fixed-effect. The time unit *t* is a quinquennium.[16]

In Table 5 we present the results from estimating (3) when: i) the proximity to the world technology frontier a_i is proxied by country *i*'s (relative to the country with the maximum) number of patents per habitant; and ii) *TI* is constructed using the "inclusive" definition of turnover from section 3.

[16] As in (1), initial values refer to the last year of the previous quinquennium (that is, the last year of *t* – 1).

Table 5: growth regressions with the manager turnover index

	dep = growth rate of output per worker		
Patents per habitant	-18.2756	-7.8458	-7.5868
	(34.5315)	(36.7039)	(40.0260)
Manager Turnover Index (TI)	-1.2012***	-1.1299***	-1.1283***
	(0.3853)	(0.3888)	(0.3945)
Patents per habitant x TI	2.6450***	1.8477**	1.8304*
	(0.7098)	(0.8486)	(0.9780)
Human Capital		-43.2696**	-43.4998*
		(21.0435)	(22.0615)
Savings			-0.0141
			(0.5097)
Quinq. 2008-2012	-0.0588	4.3853	4.5013
	(3.6489)	(3.8513)	(4.1503)
Quinq. 2013-2017	-10.7719***	-2.2534	-2.1345
	(2.9904)	(4.0317)	(4.4035)
Constant	25.2943***	146.3134**	147.1413**
	(3.8898)	(57.0870)	(65.4224)
Observations	126	126	125
R-squared (within)	0.3911	0.4141	0.4112
Number of countries	54	54	54
F-Statistic	11.23	9.978	8.286
p-value (F-statistic)	0.000	0.000	0.000

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Comparing the patterns in Table 5 with those in Table 2, we see that the signal of the coefficients associated to *TI* (Manager Turnover Index) is the opposite of the signal of the coefficients associated to the DB (Doing Business) variable, which stands for barriers to entry and competition. Recalling the brief description of Acemoglu, Aghion and Zilibotti's (2006) model we make in the introduction, this is as predicted: having high manager turnovers is bad for countries at early stages of development (hence the negative β_2 coefficient associated to *TI* alone), and good as they approach the technology frontier (hence the positive β_3 coefficient associated to the interaction *TI* × Patents per habitant).[17]

Analogous to what we did in section 2, now we consider the derivative of the growth rate with respect to the manager turnover index ($\beta_2 + \beta_3 . a_{i,t,initial}$) and, taking the estimates from column 3 as benchmark, calculate a threshold a^* = 1.1283/1.8304 ≅

[17] It is important to emphasize that this changing effect (conditional on proximity to the technology frontier) on productivity growth applies to the turnover of top managers only, and not to the turnover of workers in general. This latter is seen as universally harmful to productivity in that it represents an interruption in the "learning by doing" process, although the empirical evidence is not conclusive. See Thompson (2012).

0.61 (relative number of patents per habitant) such that, for $a_i > a^*$ it is beneficial for country *i*'s growth rate to increase its turnover of managers. [18]

Holding the proximity to the technology frontier proxied by patents, we get results similar to those reported in Table 5 when we reestimate (3) using the other ("strict" and "intermediate") definitions of turnover from section 3.[19] However, we do not get any statistically significant results (for any turnover definition) when (3) is reestimated proxying the proximity to frontier with country *i*'s GDP per worker relative to the U.S.. Recalling the results from section 2, we must therefore conclude that we find less support to Acemoglu, Aghion and Zilibotti's (2006) theory when we use our country-level turnover index instead of the "barriers to entry and competition" original variable.

Notwithstanding, our results from estimating (3) with the patents proxy for the proximity to frontier prove to be robust to using a "weighted by firm size" version of the manager turnover index. This weighted turnover index is defined as follows:

$$WTI_{i,t} = \frac{\widehat{M}_{it}}{\overline{M}_{it}} \qquad (4)$$

Where $\widehat{M}_{it}$ is the sum of the "market caps" of the firms that had a CEO change in country *i*, period *t*, according to S&P's Capital IQ; and $\overline{M}_{it}$ is the country-level "Market capitalization of listed domestic companies (current US$)" World Bank variable.[20]

The trade-off we incur in using this new turnover index, compared to the old one defined in (2), is a substantial reduction in our sample size, given that fewer companies present their individual market value in the Capital IQ database. The same thing can be

[18] Using the Stata program "*nlcom*" command, we now get a 0.23 standard deviation for a^*.

[19] Actually, we lose statistical significance for the β_3 coefficient in the specification corresponding to Table 5's column (3), where we control for both the country's investment rate and its human capital index. Regression results using alternative turnover definitions, as well as using alternative proxies for proximity to frontier, are available at the reader's request.

[20] To account for the difference between data sources, we once again had to make adaptions. All the "market cap" values from Capital IQ were collected from the 31st day of December for each year of the series, in current US$. Such methodology is in line with the data collected from the World Bank total sum of market capitalizations, which were collected at "end of year values". This information can be found in the "Details" section of the Variable, in the following link: <https://data.worldbank.org/indicator/CM.MKT.LCAP.CD>.

said of the World Bank $\bar{M}_{it}$ variable, since fewer countries have the complete series of their annual market value data, compared to the "$\#(firms)_{i,t}$" variable in (2).

Table 6 displays the results from estimating (3) just as in Table 5, but using the "weighted by firm size" version of the turnover index:

Table 6: growth regressions with the weighted manager turnover index

	dep = growth rate of output per worker		
Patents per habitant	0.6876	8.5719	8.8429
	(45.0779)	(44.8734)	(45.3432)
Weighted Manager Turnover Index (WTI)	-0.1078	-0.0698	-0.0728
	(0.1792)	(0.1755)	(0.1768)
Patents per habitant x WTI	0.7058*	0.6842*	0.6786*
	(0.3973)	(0.3629)	(0.3651)
Human Capital		-48.3372**	-48.4360**
		(19.4823)	(19.5478)
Savings			-0.1029
			(0.8675)
Quinq. 2008-2012	-5.3141	-0.8855	-0.6012
	(3.1969)	(2.9793)	(3.3650)
Quinq. 2013-2017	-16.3575***	-6.8821*	-6.7773
	(3.3349)	(3.9474)	(4.0984)
Constant	21.2901***	156.6296***	159.1284**
	(6.1882)	(53.0553)	(62.9016)
Observations	110	110	109
R-squared (within)	0.3179	0.3531	0.3494
Number of countries	51	51	51
F-Statistic	5.239	5.042	4.367
p-value (F-statistic)	0.000	0.000	0.000

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Inspecting Table 6, we find a positive coefficient associated to the interaction *WTI* × proximity to the technology frontier, recalling that this latter is proxied by the number of patents per habitant. The interpretation is the same as in Table 5: having high (now weighted by firm size) manager turnovers is bad for countries at early stages of development, and good as they approach the technology frontier.

So far, we have tested Acemoglu, Aghion and Zilibotti's (2006) theory by replacing their original "barriers to entry and competition" variable with our manager

turnover index in the output per worker growth regression. As we argued in the introduction, the motivation to do so was that the turnover of managers is the central piece of their model's *mechanism*. However, it can also be argued that the turnover is something endogenous. Indeed, there is a strand of literature that studies how the turnover of managers is determined by institutional variables.[21]

Bearing this in mind, here we conduct one last, two-stage exercise: first we use the DB ("number of procedures to open a new business") variable from section 2 as an instrument for *WTI* (the weighted manager turnover index); next, we use the *WTI* estimate from the first-stage as a regressor in the output per worker growth equation (3). Table 7 displays our first-stage results:

Table 7: first-stage results

	(1.1)	(1.2)	(2.1)	(2.2)	(3.1)	(3.2)
	dep = WTI	dep = WTI x Patents per habitant	dep = WTI	dep = WTI x Patents per habitant	dep = WTI	dep = WTI x Patents per habitant
Number of procedures to open a new business (DB)	-1.5116	0.1286	-1.2519	0.1467	-0.9699	0.2198
	(1.2287)	(0.1762)	(1.1860)	(0.1693)	(1.2381)	(0.1798)
DB x Patents per habitant	-2.4888	-4.0106***	-2.4850	-4.0104***	-3.0016	-4.1514***
	(2.0962)	(0.9171)	(2.0847)	(0.9212)	(2.3175)	(0.9645)
Patents per habitant	25.5159	44.6803***	24.3688	44.6004***	27.9775	45.5458***
	(19.0308)	(11.1562)	(19.2669)	(11.2219)	(19.8871)	(11.8440)
Quinq. 2008-2012	9.1955***	1.3985**	7.8922**	1.3077	9.2187**	1.6555
	(3.0650)	(0.6488)	(3.7745)	(0.9373)	(4.0566)	(1.0174)
Quinq. 2013-2017	4.4118	1.4351*	1.8531	1.2567	2.5939	1.4361
	(3.3066)	(0.7993)	(5.6085)	(1.4558)	(5.6865)	(1.4342)
Human Capital			15.7137	1.0956	15.0039	0.9061
			(20.6139)	(5.6906)	(20.4440)	(5.4829)
Savings					-0.4995	-0.1374
					(0.5200)	(0.1420)
Observations	91	91	91	91	90	90
Number of countries	36	36	36	36	36	36
F test of excluded instruments	2.59	9.67	2.13	9.53	1.93	9.26
Prob(F)	0.081	0.000	0.129	0.000	0.157	0.000

Notice that Table 7 comprises three blocks of results, corresponding to the three second-stage models from Table 6. Each block, in turn, has two columns because we have to instrument both the *WTI* (alone) and the *WTI* × *proximity to frontier* variables. The negative but nonsignificant coefficient associated to DB in (1.1), (2.1) and (3.1) reflects the small -0.18 correlation between *DB* and *WTI* in our pooled sample[22]. As we move to

[21] Burns et al. (2023) examine how countries' cultural and legal environment, in addition to firm-level governance mechanisms, affects firms' retention and termination decision of the CEO.

[22] "Pooled" means that each (country , time) pair counts as an observation.

(1.2), (2.2) and (3.2), we get statistical significance for the coefficient associated to *DB* × *Patents*, which looks promising when we recall that our chief variable of interest in the second-stage is precisely the *WTI* × *Patents* interaction. Furthermore, in the lower panel of Table 7 we observe a considerable increase in the F-statistics of excluded instruments as we move from the first to the second column in each of the three blocks of results. Even so, these F-statistics all lie below the critical value 10 used in the Stock-Yogo (2005) weak ID test, and therefore we must conclude that the Doing Business variable is a weak instrument for our weighted turnover index. Table 8 displays our second stage results:

Table 8: second-stage results

	dep = growth rate of output per worker		
	(1)	(2)	(3)
Patents per habitant	-20.0571	-16.1014	-24.3475
	(67.7432)	(60.6825)	(64.2926)
Weighted Manager Turnover Index (WTI)	-1.8616	-1.4210	-1.8624
	(1.5168)	(1.7213)	(2.3270)
Patents per habitant X WTI	3.0107*	2.7399	3.3563
	(1.7988)	(1.7393)	(2.3546)
Quinq. 2008-2012	7.6621	7.5062	13.3153
	(13.4725)	(12.2414)	(18.5921)
Quinq. 2013-2017	-9.4054	-4.0564	-2.6820
	(10.6630)	(7.1811)	(9.7691)
Human Capital		-42.4005	-37.9105
		(53.5309)	(61.6628)
Savings			-1.3606
			(1.3565)
Observations	91	91	90
R-squared	-0.6751	-0.1867	-0.6136
Number of countries	36	36	36

Inspecting Table 8, we find the right positive signal, with statistical significance (at 10%) for the *WTI* × *proximity to frontier* interaction variable, which is the main empirical prediction of Acemoglu, Aghion and Zilibotti's (2006) model. However, we get this favorable result only for the specification without controls (i.e., without human capital and without the savings rate). Furthermore, the favorable result does not obtain in any other version of our growth regressions (for example, using other definitions of turnover that not the "inclusive" one, using the non-weighted turnover index, etc.).

Together with the weak instrument evidence from Table 7, this is why we affirm in the introduction that we cannot go as far as saying that the growth effects of barriers to entry and competition *operate through* the turnover of managers. Of course, there remains open for future research to test different institutional variables (that not the Doing Business) in the hope of finding a non-endogenous, conditional on proximity to the technology frontier, effect of manager turnover on growth.

5 – conclusions

This paper's motivation came from Acemoglu, Aghion and Zilibotti (2006) and their model of "appropriate institutions". In that model, when an economy gets close to the technology frontier, having high barriers to entry and competition becomes detrimental to productivity growth. This happens because high barriers give firms an incentive to keep old managers that have revealed to be unskilled/untalented, and therefore less likely to conduct innovation. Given this mechanism, it seems natural to look at cross-country differences in manager turnover rates, which Acemoglu, Aghion and Zilibotti (2006) do not do when they empirically motivate their model.

In this paper, we seek to fill this gap in the literature by showing that low manager turnover rates become negatively correlated with growth as countries get closer to the technology frontier. To show that, we applied a dictionary method to Standard & Poor's Capital IQ microdata on CEO changes, in order to construct a country-level manager turnover index. We got best regression results using the "inclusive" (mild) definition of turnover, and proxying the proximity to the technology frontier with the number of patents per habitant. We showed that these results are robust to using a weighted (by firm size) version of the turnover index, but we could not satisfactorily treat the potential endogeneity of the turnover index by instrumenting it with the Doing Business variable.

In our research, we tapped into two strands of the empirical corporate finance literature: the first (like Jenter and Kanaan 2015) seeks to relate manager turnovers to firm (bad previous) performance; the second (like Burns et al. 2023) seeks to explain variability in country-level turnover rates by institutional and cultural factors. Both strands can be used in future extensions of this paper: the first, to refine our turnover

index by selecting the occurrences of CEO change *after* bad firm performance, in the spirit of Acemoglu, Aghion and Zilibotti's model; the second suggests that different institutional variables (like measures of investor protection and of labor rigidity) could produce better two-stage regression results than the one we got using the Doing Business variable.

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APPENDIX A – Variables and data sources

Variable	Source
Output-side Real GDP *per worker* at chained PPPs (for the growth rate $g_{y,t}$)	Penn World Table 9.1
Patent applications of residents and nonresidents, divided by inhabitants (Proxy for a_t)	World Bank & PWT 9.1
Ratio of the country's real GDP *per worker* to the U.S. real GDP *per worker* (Proxy for a_t)	PWT 9.1
Human Capital Index (Control)	PWT 9.1
Gross savings as % of GDP (Control)	World Bank
Number of procedures to open a new business (Proxy for "barriers to entry and competition")	Doing Business/World Bank
CEO turnover ratio (% of companies in the country)	Capital IQ, World Bank

Source: self-elaborated.

The growth rate $g_{y,t}$ is calculated as

$$g_{y,t} = \frac{y_{t,final} - y_{t,initial}}{y_{t,initial}}$$

where *t* is a quinquennium (for example, the one beginning in 2003 and ending in 2007); $y_{t,final}$ is the output per worker in the last year of *t* (2007, for the given example); and $y_{t,initial}$ is *t*'s initial output per worker, which we assume to be equal to $y_{t-1,final}$, that is, the output per worker in the last year of the previous quinquennium (2002, in our example).[23]

Our patents proxy for a_t was calculating by summing the number of patents applications filled by residents with those made by non-residents (being two distinct variables from the World Bank), and diving it by the population variable from PWT:

$$a_t^{Patents} = \frac{Patents_t^{residents} + Patents_t^{non-residents}}{POP_t}$$

[23] Due to the lack of data on the "number of procedures" variable from Doing Business/World Bank, we exceptionally use 2003 data as the initial value for this variable in our first quinquennium (2003-2007).

APPENDIX B – Country list and selected variables (last quinquennium, 2013-2017)

Country	Growth rate	DB	TI (inclusve)	Patents per habitat (relative)	GDP per worker relative to USA	Human capital index	savings rate	WEO classification (2012)
Argentina	0.89%	14	4.95%	3.02%	33.56%	2.89	16.21%	emerging
Australia	5.42%	3	16.59%	30.54%	83.77%	3.46	24.31%	advanced
Austria	3.55%	8	3.57%	7.92%	79.11%	3.30	25.78%	advanced
Bangladesh	26.31%	9	1.10%	0.06%	6.52%	1.92	40.60%	emerging
Barbados	-2.50%	8	0.00%		23.49%	2.81	4.52%	emerging
Belgium	2.27%	5	6.12%	2.10%	86.10%	3.11	24.73%	advanced
Botswana	3.48%	9	0.00%	0.18%	31.84%	2.76	43.32%	emerging
Brazil	-5.78%	12	4.53%	4.01%	27.17%	2.62	17.68%	emerging
Bulgaria	13.69%	7	1.03%	0.94%	30.29%	3.11	22.34%	emerging
Canada	5.70%	2	12.63%	26.70%	75.66%	3.67	20.97%	advanced
Chile	0.23%	8	2.22%	4.61%	45.69%	3.02	22.47%	emerging
China	26.75%	14	4.13%	12.55%	16.95%	2.40	49.47%	emerging
Colombia	9.54%	9	2.63%	1.16%	24.05%	2.44	18.50%	emerging
Costa Rica	14.69%	12	0.00%	3.47%	27.78%	2.57	14.37%	emerging
Croatia	9.14%	8	0.00%	1.53%	51.61%	3.31	16.51%	emerging
Cyprus	4.20%	6	7.92%	0.37%	64.10%	2.76	12.33%	advanced
Czech Republic	9.79%	8	17.65%	2.54%	50.26%	3.64	24.12%	advanced
Denmark	5.14%	5	0.00%	7.71%	79.98%	3.47	25.74%	advanced
Egypt	11.04%	9.5	2.14%	0.67%	30.69%	2.44	12.87%	emerging
Finland	4.47%	3	0.00%	8.92%	74.90%	3.37	21.48%	advanced
France	3.84%	5	6.58%	6.68%	79.78%	3.09	21.46%	advanced
Germany	5.40%	9	6.17%	20.01%	74.94%	3.66	26.80%	advanced
Ghana	8.74%	7	0.00%		8.80%	2.32	5.17%	emerging
Greece	-3.93%	11	3.05%	1.52%	54.08%	2.98	8.52%	advanced
Hungary	3.80%	5	9.80%	2.03%	47.74%	3.31	20.93%	emerging
Iceland	9.22%	5	0.00%	3.57%	67.09%	3.10	8.82%	advanced
India	30.92%	15	6.36%	0.92%	11.47%	2.01	35.26%	emerging
Israel	6.23%	5	5.26%	23.33%	58.06%	3.61	21.81%	advanced
Italy	3.10%	8	4.62%	4.12%	77.13%	3.03	17.55%	advanced
Jamaica	-1.89%	6	4.00%	1.00%	16.01%	2.56	11.01%	emerging
Japan	2.72%	8	1.44%	70.58%	64.72%	3.52	23.56%	advanced
Jordan	-2.68%	7.5	0.82%	1.30%	38.20%	2.81	10.86%	emerging
Kazakhstan	14.58%	7	10.81%		40.64%	3.20	29.76%	emerging
Kenya	8.14%	14	5.00%	0.16%	6.61%	2.20	12.54%	emerging
Lebanon	-15.79%	8	0.00%		44.54%		1.95%	emerging
Lithuania	9.29%	6	0.00%	1.08%	46.75%	3.18	18.13%	emerging
Malaysia	13.53%	6.5	10.43%	6.29%	42.21%	2.93	30.92%	emerging
Malta	20.93%	10	13.64%	1.07%	52.09%	3.03	20.44%	advanced
Mauritius	12.54%	5.5	3.33%	0.38%	36.62%	2.52	17.17%	emerging
Mexico	4.34%	7	6.11%	3.35%	33.76%	2.64	23.28%	emerging
Montenegro	12.98%	8	0.00%	3.29%	41.56%		5.13%	emerging
Morocco	16.21%	7	0.00%	0.82%	18.34%	1.79	25.25%	emerging
Namibia	10.15%	10	0.00%		27.04%	2.16	18.35%	emerging
Netherlands	6.94%	6	14.81%	4.27%	78.20%	3.30	28.82%	advanced
New Zealand	4.05%	1	12.77%	42.01%	57.56%	3.25	17.25%	advanced
Norway	3.58%	5	17.39%	8.25%	142.18%	3.59	39.20%	advanced
Pakistan	12.16%	13	5.41%	0.13%	13.61%	1.79	20.51%	emerging
Palestinian Authority	-3.64%		0.00%		23.39%		5.34%	emerging
Panama	15.86%	6	15.00%		37.08%	2.78	29.65%	emerging
Peru	11.64%	8	0.47%	1.04%	18.27%	2.72	22.30%	emerging
Philippines	26.35%	17	7.54%	0.82%	14.61%	2.62	43.25%	emerging
Poland	11.84%	7	2.13%	3.21%	52.53%	3.28	16.78%	emerging
Portugal	-4.55%	6	2.04%	1.62%	51.21%	2.39	13.79%	advanced
Romania	24.80%		7.79%	1.41%	42.38%	3.14	22.13%	emerging
Russia	-0.25%	8	25.34%	8.15%	49.98%	3.33	27.86%	emerging
Slovakia	8.39%	8	1.45%	0.99%	51.36%	3.66	21.83%	advanced
Slovenia	6.47%	2	4.92%		52.28%	3.43	20.39%	advanced
South Africa	-5.14%	6	13.91%	3.71%	35.65%	2.60	15.10%	emerging
South Korea	8.25%	6	1.13%	100.00%	58.68%	3.53	34.37%	advanced
Spain	3.87%	10	0.28%	1.96%	72.56%	2.84	18.52%	advanced
Sri Lanka	16.83%	9	9.41%		27.09%	2.88	33.30%	emerging
Sweden	6.84%	3	0.00%	6.75%	79.09%	3.37	27.71%	advanced
Thailand	20.08%	8	7.53%	2.63%	21.61%	2.61	29.24%	emerging
Tunisia	5.20%	11	1.69%	1.52%	32.67%	2.33	16.00%	emerging
Turkey	11.78%	10	0.83%	1.65%	62.79%	2.28	22.81%	emerging
Ukraine	10.66%	10	0.00%	2.89%	20.78%	3.23	13.07%	emerging
United Kingdom	3.85%	6	11.12%	9.56%	69.35%	3.72	12.41%	advanced
United States	4.24%	6	25.72%	45.81%	100.00%	3.71	18.84%	advanced
Vietnam	29.79%	9	3.44%	1.11%	7.89%	2.53	30.83%	emerging
Zambia	1.68%	7	0.00%	0.07%	10.68%	2.33	35.86%	emerging

APPENDIX C – The turnover dictionary

Here we present a table linking each type of turnover from section 3 to its corresponding "keyword" indicators:

Classification	Keywords
Resignation	[administrative leave], [severance payment], free up, give up, intends to leave, other interests, other investment opportunities, other opportunities, personal decision, personal interest, personal reason, personal reasons, private reasons, pursue his personal interests, pursue new opportunities, pursue other business opportunities, pursue other entrepreneurial ventures, pursue other interests, pursue other opportunities, pursue other ventures, pursuing his own business, pursue another opportunity, pursue other career opportunities, quit, quitting, relinquished, resign, resignation, resigned, resigning, spend more time with his family, stand down, step aside, step away, step down, step-down, stepped aside, stepped down, stepping down, steps down, voluntarily resigned, voluntary personal leave
Health issues	condition of his health, health and personal reasons, health concerns, health considerations, medical leave
Switching positions	continue, redesignated, re-designated, redesignation, re-designation, relocate, relocated, remain, remaining, remains, retained, still a member of the board, transition, will be staying, will continue, will maintain, will remain, will resume, will retain
Bankruptcy	bankruptcy, insolvency
Death	death, deceased, demise, died, fatal heart attack, greatly missed, natural causes, passed away, passed on, passing, stricken, suicide
Corporate Scandal	[fraud management], bribe, bribery, bribe-taking, cheating, corporate governance problems, corruption, fake audit, false accounting, federal investigations, illegal, improper, improper expenses, instability, irregularities, lobbying, misconduct, mismanagement, racket, racketeering, scam, scandal, securities fraud, unconventional accounting methods, unlawful
Arrest	arrest warrant, arrested, jailed
M&A	[merger & acquisitions], [mergers and acquisitions], acquire, acquired, acquired majority ownership, buyout, full ownership, has new owners, merge, merger, merger agreement, new majority shareholder, plan of merger, purchase, spin-off, spinout, spins off, spun off, spun-off, transaction, transactions, transfer of ownership
Planned	fixed term, liable to retire by rotation, phased leadership transition plan, planned transition, planning process, retirement by rotation, rotation policy, rotational requirement, scheduled, succession plan, succession planning, transition planning
Interim	acting, interim, serve temporarily
Retirement	retire, retired, retirement, retires, retiring, superannuate, superannuating, superannuation
Creation of a new business	created, newly created, newly founded, newly-created

Source: self-elaborated.

Besides the keywords which were used to identify the corresponding classification, we also have certain words and phrases that are listed between "[.]" brackets, which works as a "negation" to the classification. For example, suppose a "bracket-keyword" has been identified in the text after an initial filtering. In that case, it will automatically identify such turnover as not belonging to the corresponding classification in the table above.

Another limitation is that some of the news excerpts on the platform are known for detailing other types of turnover besides CEO changes. Such cases may happen when a company announces more than one employee change at the same time. For example, we may find news explaining that a CFO of the company has retired from office while the CEO has been dismissed for another reason that is unrelated to "retirement" at the same time. Since the dictionary method will identify the corresponding keyword to the "retirement" category, it may happen that a CEO turnover that was originally caused by a "non-retirement" factor is wrongfully classified as a "retirement". However, such types of news have been found to be uncommon in the Capital IQ database, representing a negligible noise in the construction of the variable.