Tournament Incentives and Corporate Innovation

March 2021

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Keywords: Wage Differential; Wage Gap; Tournament theory; Innovation; Patents

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Abstract

We find that differences in average wages among firms in the same industry lead to tournament incentives that increase innovation. Firms in high-wage gap country-industries are associated with higher normalized patent counts and patent citations. In addition, a high wage gap between a firm and top-paying firms in immigration destinations can increase the firm's innovation activity if the firm is in an industry pays below-median wages on average within the firm's home country.

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In this paper, we use an international panel of firms to investigate whether differences in pay among competing firms in the same industry can create a de facto tournament among workers that leads to increases in innovation.

The potential for higher future pay, often called “career concerns” in the literature, can be an incentive for employees to exert effort (Fama 1980, and Holmstrom 1999). This extra effort can lead to many desirable outcomes. It is well documented that firms can treat promotions to a fixed number of higher-compensation positions as tournaments to incentivize lower-level employees to exert effort and take risks (Lazear and Rosen, 1981; for a review, see Connelly, Tihanyi, Crook, and Gangloff, 2014). However, internal tournaments are only one kind of tournament incentive. Industry-wide “tournaments” can incentivize senior executives at lower paying firms in the industry. This idea is supported by survey evidence from Graham, Harvey, and Rajgopal (2005), who find that 75% of CEOs say that upward mobility in the labor market has more impact on their decisions than the compensation scheme at the CEO’s own firm. Industry-wide tournaments can lead to higher firm performance (Fee and Hadlock 2003; Kale, Reis, and Venkateswaran 2009; Coles, Li, and Wang 2012) and higher risk taking (Kini and Williams 2012; Coles, Li, and Wang 2012). We take these findings to their logical conclusion by evaluating the effects of industry tournament incentives on an inherently risky activity that can raise firm value: innovation that results in patents.

To measure this effect, we take advantage of the fact that there are large differences in pay for the same job across different industries (Thaler, 1989). These differences are roughly the same regardless of job category (Katz and Summers, 1989). For example, if engineers in the telecommunications industry make 20% more than engineers in the defense industry, then it is likely that the secretary or the accountant in the telecommunications industry also makes 20% more than their counterparts in the defense industry. These wage differences between industries are remarkably persistent, with roughly the same rank order of industries across countries, time periods, and job occupations (Krueger and Summers, 1987). This has also been found at the firm level, where there is contrasting evidence about whether lower-skilled workers gain more (Aghion et al., 2017) or less (Kline et al., 2019) than higher-skilled workers from the firm's innovative activities. We do not take a position in this debate; for our purposes the main point is that firms which pay higher wages tend to pay higher wages across the board. These findings allow us to use the firm's average wage to proxy for the firm's wage premium (Célérier and Vallée, 2019).

We rank-order the firms in each industry by the average wage of the firm. For each industry, we find the Wage Gap between the 90th percentile firm and the 10th percentile firm, and standardize this by the standard deviation of the average wages of firms within the industry. In robustness checks, we also use a measure that varies for each firm within the industry to measure each individual firm's Firm Industry Wage Gap. For this variable, we find the wage gap between the 90th percentile firm in the industry and the firm in question. In sensitivity checks, we vary both the percentile thresholds and the variable used to standardize the Wage Gap measure.

We test if the Wage Gap predicts two measures of innovation activity: patents and patent citations, both scaled by year and the technology class of the firm. On a test of 49,008 firm-year observations across 45 countries from 1991 to 2010, we find that *WageGap* is associated with a statistically significant increase in the number of patents. This effect is robust to including industry fixed effects, year fixed effects, country effects, the own firm's average wage, the firm's research and development expenditures, and a large battery of control variables. Further tests show that it is robust to different lags on the innovation measure, different measures of innovation such as patent citations and the percent of patents that are cited, different definitions of WageGap, and controls for CEO incentives.

To further confirm that tournament incentives are driving our results, we analyze different subsamples of countries where tournament incentives should matter more for innovation outcomes. Past research suggests that firms are more likely to innovate in countries with low creditor rights (Acharaya et al., 2011), high foreign investment (FDI) (Luong et al., 2017 and Bena et al., 2017), high failure tolerance for workers (Manso, 2011; Tian and Wang, 2014), and a more long-term orientation (Flammer and Bansal, 2017 and Bukowski and Rudnicki, 2019). Thus, these countries should be more likely to have innovative firms at the top who are willing to pay top dollar for innovative employees. Consistent with this logic, we find that results are stronger in the subsamples of countries with low creditor rights, high FDI, high employee protections, and longer-term orientation.

Next, we use an instrumental variables approach. We instrument for the *WageGap* in each industry-country with the wage gap of the finance industry within that country. The wage gap of the finance industry is a strong predictor of WageGap in other industries in the country. Results from the instrumental variables approach are actually stronger, both statistically and economically, than results from the baseline OLS test.

We also test to see if there are international effects. There is strong evidence that skilled immigration results in increases in innovation (for a review, see Kerr, Kerr, and Lincoln, 2015) as US and European firms seek to import innovative workers. Although most workers do not emigrate from their home country, it is possible that the incentive effect of high salaries in popular immigration destinations (such as the United States, Germany, the United Kingdom, and France) may motivate workers to innovate. We measure the Wage Gap between the median firm in that industry in the home country and the 90^{th} percentile firm in that industry in the immigration destination. We find that for each immigration destination, this Wage Gap (*Gapto X*) has a positive effect on innovation, but it is only statistically significant in Germany. Interestingly, when we interact this with an indicator variable for below-median wage industries within the country, we find very strong effects for all four immigration destinations. In other words, this indicates that employees in low-paying industries within their country are more likely than employees in high-paying industries within their country to innovate in order to be able to immigrate to higher paying jobs in other countries. To the best of our knowledge, this is a unique finding in the immigration literature.

This is the first paper to document a connection between tournament wages and innovation. As such, this contributes to both sets of literature. It contributes to the literature on economic tournaments by showing a novel outcome of tournaments. It contributes to the literature on innovation by showing a new way by which innovation can be driven.

2. Do Innovators Jump to Higher Wage Firms?

It is widely documented that some firms pay seemingly above-market wages to their employees. Thaler (1989) concludes that, "Either firms are choosing not to maximize profits, or, for some reason, high wage firms find that lowering wages would decrease profits."

There are some reasons why above-market wages may be sub-optimal. Firms may also pay higher than market wages if they have entrenched top managers, who may want to gain the private benefits of good social relations with their employees (Cronqvist et al, 2009). Van Reenaen (1996) finds that firms with higher innovation tend to have higher wages. However, he finds that higher innovation in the industry depresses the wage gains from innovation at a firm, which leads him to conclude that the link between firm-level wages and firm-level innovation is due to employees being able to extract economic rents from innovation. This is supported by Kline et al (2019), who find that senior workers are able to capture economic rents after their firm gains patents.

However, there are many reasons why paying above-market wages may be optimal. Firms may pay higher than market wages in order to reduce turnover (Stiglitz, 1974), or to reduce the threat of union actions (Dickens, 1986). They may also to reduce shirking on the job (Shapiro and Stiglitz, 1984), to increase the quality of the applicant pool and reduce adverse selection of workers (Stiglitz, 1976), to reduce perceptions of unfair wages among workers when such a perception results in lower effort (Solow, 1979). Supporting these reasons related to employee productivity, Gibbons and Katz (1992) find that industries pay higher wages in order to obtain more productive employees. This is supported by Abowd, Kramarz, and Margolis (1999), who study a panel of 1 million French workers. They find that individual effects explain most wage differentials across industries. Abowd et al. also find a similar effect across firms that explains why studies (Oi and Idson, 1999) find a positive relationship between firm size and wages.

Thus, there is some evidence that firms pay higher wages in an attempt to attract better employees. One characteristic that they may be willing to pay for is high innovation. Firms are particularly willing to pay for innovative employees if the firm is in a high risk industry that has high payoffs to innovation (Andersson, Freedman, Haltiwanger, Lane, and Shaw, 2009). Firms may also pay high wages to obtain knowledge that innovators developed at their previous job (Singh and Agrawal, 2011).

But do innovative workers respond to those higher wages by changing jobs? It is well known that other types of star employees change jobs frequently. Football coaches (Fee, Hadlock, and Pierce, 2006) and CEOs (Coles, Li, and Wang, 2018) will leave for higher salaries. Groysberg and Nanda (2001) do not evaluate salaries, but they do find that star stock analysts are more likely to leave if the firm is small or is underperforming (which are both likely linked to the ability to pay higher salaries). There is also evidence specifically related to job mobility of innovative workers. Lenzi (2009) finds that there is a positive association between innovation productivity and job mobility. There is evidence that job mobility is extremely high in the computer industry in Silicon Valley (Saxenian, 1994), which is perhaps the world's most innovative industry cluster. Mobility is higher in the California computer industry than in other computer job clusters, but other industries in California do not have higher job mobility (Fallick et al., 2006). Ganco, Ziedonis, and Agarwal (2014) evaluate the effect of firms' enforcement of their patent rights on whether patent creators leave for another job, and their conclusion on the effect of high litigiousness is in the title of the paper: "More stars stay, but the brightest ones still leave."

Thus, the existing evidence in the literature is consistent with the idea that innovative employees may leave their firm if offered higher salaries elsewhere. This makes it possible that industry-wide tournament incentives may increase the innovative output of a firm's employees. However, the question of whether or not this actually happens is an empirical question that has not been addressed in previous literature.

3. Data and Summary Statistics

3.1 Data Sources and Primary Variable Construction

To carry out our empirical analyses, we collect our datasets from multiple sources. We first obtain patent data from the European Patent and Trademark Office patent database[1]. The patent dataset provides the patent applicant's name, address, affiliation as well as patent numbers, citation information. From raw patent data, we use the patent applicant's affiliated organization names and merge it with firm names listed in the Global Compustat database. After merging, we find unique 5,920 unique gvkey matched to the patent data which are equivalent to about 11% (5920/54111) of firms listed in the Global Compustat database. Our sample period ranges from 1991 to 2010. This presents a potential problem because there was a decline in the number of patents applied or citations received in final five to six years of the sample period. To address this truncation problem, we calculate scaled numbers of patents or citations within each year and country following the spirit of Hall et al. (2001) and Bernstein (2015). Our independent variables are log-transformed value of patents applied (*LnPat*), citations received (*LnCit*), and citations divided by patents (*LnCitpat*). Because the innovation process may be longer than one

[1] https://www.epo.org/searching-for-patents/data/bulk-data-sets.html

year, we investigate 1-year, 2-year, and 3-year forwarded number of patents, citations, and citations divided by patents.

We obtain employee wage information from Worldscope through the Datastream database. More precisely, we first calculate the firm-level employee wage (i.e., wage) as labor expense (or staff costs) plus wages plus benefits paid to all employees, and divide the total by the number of employees. We then estimate wage distribution, with a minimum of four observations, to determine an industry-wide wage disparity within country and year. Our primary measure is *WageGap*, which is constructed as follows:

$$WageGap = (\text{Top 90\% of } Wage_{c,j,t} - \text{Bottom 10\% of } Wage_{c,j,t}) / Std(Wage_{c,j,t}) \quad (1)$$

where *c* represents country, *j* represents industry, and *t* does time. *Wage* is the firm-level average employee wage at year *t*. *Top 90% of Wage* is the 90th percentile of *Wage* in that country-industry *j* during year *t*, and *Bottom 10% of Wage* is the 10th percentile. It is normalized by the standard deviation of *Wage* in the country-industry *j* during year *t*. In a similar way, we develop other wage gap measures as follows;

$$WageGap(P90\text{-}P50) = (\text{Top 90\% of } Wage_{c,j,t} - \text{Meidan } Wage_{c,j,t}) / Std(Wage_{c,j,t}) \quad (2)$$

$$WageGap(P50\text{-}P10) = (\text{Median } Wage_{c,j,t} - \text{Bottom 10\% of } Wage_{c,j,t}) / Std(Wage_{c,j,t}) \quad (3)$$

$$WageGap(P75\text{-}P25) = (\text{Top 75\% of } Wage_{c,j,t} - \text{Bottom 25\% of } Wage_{c,j,t}) / Std(Wage_{c,j,t}) \quad (4)$$

Alternatively, to measure the industry tournament incentives faced by average employees at each individual firm, we develop

$$WageGap(P90\text{-}F) = (\text{Top 90\% of } Wage_{c,j,t} - Wage_{c,j,t}) / Std(Wage_{c,j,t}) \quad (5)$$

where $Wage_{c,I,t}$ is the average wage of the individual firm *i* during year *t*. All relevant definitions of wage variables are listed in Appendix A.

3.2 Control Variables

We collect firm and country characteristics from Worldscope and the WorldBank. First, we control for firm-level variables in line with the extant innovation literature. For instance, economic theory suggest that wage premium is highly correlated with a worker's talent (Murphy and Zabojnik, 2004). Since corporate innovation outputs are heavily influenced by workers' talent, and thus we include the firm level average employee wage (*LnAvgWage*).

Schumpeter (1942) hypothesizes that large firms are likely to have comparative advantage over small firms to engage in innovation due to the economies of scale. Scherer (1991) show that a firm's patent outputs increase as the firm size increases, but at a decreasing rate. Therefore, we include revenue (*LnSale*) as a proxy for firm size.

Fang et al. (2016) raise a question about the validity of R&D expenditure as a proxy for corporate innovation. Bradley et al. (2016) separately use R&D expenditure as innovation inputs and patents as innovation outputs. We proxy for innovation inputs using R&D expenditure scaled by assets (*RnD*)as a proxy of innovation inputs following Bradley et al (2017).

Furthermore, Giebel and Kraft (2019) show that a firm's external financial constraints affect innovation performance. To capture a firm's external financing difficulty, we include a ratio of (interest-bearing) debts to assets (or *Leverage*). Geroski et al. (1991) find a positive relation between a firm's innovation and profitability, and thus we include return on assets (*RoA*) as a proxy variable for profitability. In line with previous literature, we also control for the natural log of the Book-to-Market ratio (*LnBM*).

We also include controls for the external environment that the firm faces. For example, several researchers have examined the effect of product market competition on corporate innovation performance. Most notably, Aghion et al. (2005) show an inverted U-shaped relation between competition and innovation. To control for competition, we include the Herfindahl-Hirschman Index (*HHI*) and the square of the Herfindahl-Hirschman Index (*HHI-sq*).

Since the scope of our research covers international firms, we also include country-level economic development indicators such as GDP per capita (*Ln(PPP)*)and GDP growth (*GDPGrow*) (Ayyagari et al. 2014). In addition, extant literature (Lai 1998; Kanwar and Evenson 2003; Fang et al. 2017) shows that the country-level intellectual property rights protection significantly shapes innovation development. We obtain the country level index measuring the degree of intellectual property rights protection from Park (2008) (*PropertyRight*). MacGarvie (2006) also show that importing products from other countries stimulates the diffusion of technological knowledge across countries, and thus, we include imports minus exports divided by GDP as a control variable (*Trade*).

When reporting the baseline effects, we also run regressions where we drop country level fixed effects and instead control for time-invariant country effects. For example, Brown et al. (2013) find that shareholder protection rights and accessibility to stock market financing are positively associated with corporate R&D investments. Therefore, we include controls for shareholder protection rights index (*SharholderRight*) and a ratio of the market-wide stock market capitalization divided by the total deposit value in banks (*MktDep*). While Brown et al. (2013) show little effect of credit market development on R&D investment, Acharya et al. (2011) present cross-country evidence showing that stronger creditor rights inhibit corporate risk taking, resulting in less innovation. We therefore include the country level creditor right index (*CreditRight*). Lastly, we include a set of cultural value motivated by prior studies documenting the effect of religiosity (Chen et al. 2014; Bénabou et al. 2015; Adihikari and Agrawal 2016) (*Catholic* and *Protestant*) and Hofstede's cultural values such as individualism (*Individualism*) and uncertainty avoidance (*UncertAvoid*) (Li et al 2013) on innovation.

We also control for CEO incentives as additional control variables in some regressions. We use CEO compensation information from S&P Capital IQ data to construct two variables:

$$\textit{CEO-Worker Gap}=(\text{CEO Comp}_{c,i,t}-\text{Wage}_{c,i,t})/\ \text{Wage}_{c,i,t} \quad (6)$$

$$\textit{CEOCompGap}=(\text{Top 90\% of CEO Comp}_{c,j,t}-\text{Bottom 10\% of CEO Comp}_{c,j,t})/\text{Std}(\text{CEO Comp}_{c,j,t}) \quad (7)$$

3.3 Summary Statistics

Summary statistics for each variable are listed in Table 1. Table 2 shows the average wage, wage gap, and number of scaled patents for each industry and country. The industry with the highest average *WageGap* is Local & Interurban Passenger Transit, followed by Hotels & Other Lodging, and Fishing, Hunting & Trapping. The industry with the lowest average *WageGap* is Eating and Drinking Places, followed by Personal Services and Tobacco Products. The country with the highest average *WageGap* is Finland, followed by Germany and Italy. The country with the lowest average *WageGap* gap is Canada, followed by Korea and Russia.

4. Empirical Results

4.1 Baseline Results

Table 3 is our baseline result. Columns 1, 2, and 3 evaluate the impact of *WageGap* on *LnPat* where *LnPat* is constructed as the log of 1 plus the number of patents 1, 2, and 3 years in the future, respectively. We test different time lags for LnPat because it possible that workers are more likely to know the wage gap in their industry with a lag, and because most patents are awarded 2 years after the research on them is completed (Hirshleifer et al. 2013). Columns 1, 2, and 3 also control for all of the time-variant control variables in Section 3.2 as well as year fixed effects, industry fixed effects, and country fixed effects. Columns 4, 5, and 6 do not control for country fixed effects, which allows us to add controls for time-invariant country effects such as *CreditRight, MktDep, ShareholderRight, ComLaw, Catholic, Protestant, Individualism, and UncertAvoid*.

All six tests have a positive coefficient on WageGap. The results are statistically significant at the 5% level for all six tests. This implies that the Industry's wage gap has a positive effect on innovation.

4.2 Alternative Specifications

Table 4 shows some of the many robustness checks that we performed. Panel A uses different proxies for innovation. Where *LnPat* uses the number of patents, Columns 1, 2, and 3 substitute the number of patent citations (*LnCit*), while Columns 4, 5, and 6 substitute the number of patent citations divided by the number of patents (*LnCitPat*). The number of patent citations is statistically significant in Columns 1, 2, and 3. The coefficient on LnCitPat is positive in Columns 4, 5, and 6, although it is only statistically significant in Column 6. This result is consistent with our previous result of a stronger effect when using the 3-year lag of innovation proxies.

Panel B tests alternative specifications for *WageGap*. Our baseline result in Table 3 used the difference in wages between the 90^{th} and 10^{th} percentile firms to measure the wage gap.

Columns 1, 2, and 3 use the difference between the 75th and 25th percentile, while columns 4, 5, and 6 use the difference between the 90th percentile and the firm's own median wage. The results in Panel B show that the effect of *WageGap* on innovation is positive and statistically significant in every regression.

Panel C tests whether the effect of *WageGap* is due to the upside incentive or the downside incentive. In other words, are employees at average firms motivated by the potential gain of gaining employment at higher-paying firms? Or are these employees motivated to avoid the potential loss at lower-paying firms? To test this, we use *WageGap(P90-P50)* as the variable of interest in Columns 1, 2, and 3 and *WageGap(P50-P10)* as the variable of interest in Columns 4, 5, and 6. We find that *WageGap(P90-P50)* is positive and statistically significant in all three regressions. We find that *WageGap(P50-P10)* has no statistically significant effect. This suggests that our earlier results are primarily driven by employees who are motivated by the prospect of employment at higher paying firms.

4.3 Subsample Analyses

In Table 5, we examine the moderating effect of four institutional factors on the relation between wage differential and innovation: creditor rights, foreign direct investment (FDI), employment protection, and long-term orientation. If the theme in our paper is correct, then wage differential should have a larger effect in countries with lower creditor rights, higher FDI, higher employment protections, and higher long term orientation, for the reasons explained below.

Acharya et al. (2011) presents cross-country evidence showing that stronger creditor rights inhibit corporate risk taking, resulting in less innovation. However, Mann (2018) finds that patents are used as collateral to fund innovation activities. He consequently finds that corporate patenting activities increase when creditor rights are enhanced. To test this, we split the sample into firms in countries with high creditor rights (Column 1) and low creditor rights (Column 2). We find that wage differential has a bigger impact on innovation for firms in countries with low creditor rights. This finding supports Acharaya et al. (2011).

Luong et al. (2017) and Bena et al. (2017) find that foreign institutional ownership results in higher corporate innovation activities. This suggests that countries that have high foreign direct investment will have relatively more highly innovative firms that need to pay a premium for innovation talent. Therefore, wage differential should have a bigger impact on innovation for firms in countries with high foreign direct investment. To test this, we split the sample into firms in countries with high FDI (Column 3) and low FDI (Column 4). We find that wage differential has a bigger impact on innovation for firms in countries with higher FDI.

Third, extant literature shows that innovation is crucial for economic growth (Solow 1957; Romer 1986 and 1990), but it is difficult to motivate workers to innovate because the innovation process takes a long time and has high uncertainty. Therefore, Manso (2011) develops a theoretical framework showing how tolerating for early failure and rewarding long-term success are important to motivate workers to be innovative. Similarly, Tian and Wang (2014) find that venture capital-backed firms which are more lenient for failure are more encouraged to engage in innovation. However, protection for failure does not always increase innovation. For instance, Bradley et al. (2017) find that a winning labor union election significantly lowers future patenting outputs. Francis et al. (2018) show that an increase in the strictness of employee firing (measured as the country level employment protection index) significantly reduced corporate innovation activities in an international setting. Altogether, this literature suggests that countries with higher employment protections are more likely to have firms that are willing to pay more for innovative employees. Therefore, we split the sample into firms in countries with a high (Column 5) and a low (Column 6) employee protection index. The results show that wage differential has a bigger impact on innovation for firms in countries with higher employment protections.

Fourth, developing patents is challenging. Bukowski and Rudnicki (2019) show that long-term orientation is positively associated with the country level innovation performance. Flammer and Bansal (2017) show that firm performance increases as the firm invests in innovation when CEO pay is highly tied with long-term incentives.

All four results support the idea that employees are motivated to innovate by a high wage gap in their industry.

4.4 Controlling for CEO Incentives

Table 6 adds different controls for the CEO's incentives. CEO incentives have been shown to influence a firm's innovation output (Balkin et al. 2000). Column 1 adds a control for the industry wage gap of the CEO versus other CEOs in their industry (*CEOGap*). Column 2 adds a control for the wage gap between the CEO and the average worker at the firm (*CEOWorkerGap*). The results show that *IndustryWageGap* is significantly associated with innovation activity even after controlling for CEO incentives.

4.5 Instrumental Variable Regressions

It is possible that our results so far are caused by reverse causality or a confounding factor. In an attempt to rule out such explanations, we run two 2-stage instrumental variables regressions where the wage gap in the country's finance industry is used to predict the *IndustryWageGap* in the the firm's own industry. The results are in Table 7. The first stage regression shows that the wage gap in the finance industry is a strong predictor of the wage gap in the industry. The exclusion restriction, of course, is more difficult to argue. The vast majority of a firm's workers who produce patents would not be able to work in the finance industry. Even if they are, their incentives would be affected not by the industry wage gap within in the finance industry, but by the wage gap between their own industry and the finance industry. If this path of action is truly what causes a positive and significant effect in Table 7, then this argument against the validity of the exclusion restriction also argues in favor of our paper's primary point that a worker's tournament incentives outside the firm are positively associated with innovation output.

The second stage regression shows that the predicted wage gap in the first stage positively and significantly predicts *LnPat* (Column 2).

4.6 Cross-Country Wage Incentive

In this section, we investigate whether and to what extent cross-country wage differentials promote corporate innovation performance. To see this effect, we select the four most developed countries which are mostly targeted as immigration destinations: US, UK, Germany, and France.

In some industries, there is international competition for top employees. It is possible that this may create a tournament incentive for employees who may wish to move to a higher-paying job in another country. We test this theory by creating the variable:

$$Gapto\ X = (\text{Top 90\% of Wage}_{X,j,t} - \text{Median Wage}_{c,j,t}) / \text{Std}(\text{Wage}_{c,j,t}) \quad (8)$$

Where *X* is the immigration destination country (the United States, United Kingdom, German, or France). We interact *Gapto X* with *LowWage*, a dummy variable that takes the value of one if the industry wage in the country of the firm being tested is below the median wage of all industries in that particular country in that year. Thus, if *LowWage* = 1, it may indicate that workers in the industry are relatively underpaid compared to other industries in the country. This may prompt highly talented workers to look for jobs outside the country, rendering the pay at firms in the same industry in countries that are top immigration destinations more important than pay at top domestic firms within their industry.

We test this in Table 8, Columns 2, 4, 6, and 8. The interaction term is positive and statistically significant at the 5% level for all four countries. This indicates that workers in industries that are lower-paid within a country have higher patent outputs if their earning opportunities are higher in top immigration destinations.

4.7 Further Robustness Tests

It is possible that firms employees in countries that are effectively city-states may be more motivated by the wage gap in the country surrounding their city than by the wage gap in the city itself. Appendix B tests this by excluding Singapore and Hong Kong from the regressions in Table 3. The results are essentially the same.

Table 3 is robust to excluding all variables except the variable of interest, as well as excluding each variable one at a time. Table 3 is robust to measuring the effect *WageGap(P75-P25), WageGap(P90-F)*, and *WageGap(P90-P50)* on *LnCit*. We choose not to report these results in table format for the sake of brevity.

5. Discussion & Conclusion

Consistent with prior studies, we find evidence that industry-wide salary tournaments can incentivize workers at lower-paying firms to perform. We provide cross-country evidence that industry-wide tournaments increase innovation within an industry. We find that within an industry, a high wage gap between low-paying and high-paying firms in the same country is associated with higher innovation output. Further, we find evidence that this is driven by the high-end of the pay scale: the difference between the median firm and the 90^{th} percentile firm increases innovation, but the difference between the 10^{th} percentile firm and the median firm does not increase innovation. These results are consistent with a tournament effect.

Further, we find evidence that workers in a country's low-wage industries are likely to be more motivated by the wage gap with firms in the same industry in popular immigrant destinations such as the USA, Germany, France, and the UK. Workers in a country's high-wage industries are not. This is, we believe, a unique finding in the immigration literature. We believe it deserves more study.

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Table 1 - Descriptive Statistics

This table presents descriptive statistics on our sample of 49,008 firm-year observations across 35 countries between 1991 and 2010. All wage (or compensation) variables are winsorized at the top and bottom 5%. Other continuous variables are winsorized at the top and bottom 1%. Detailed definitions of variables are included in Appendix A.

	N	Mean	Std	p25	p50	p75

WageGap	49008	0.255	0.034	0.235	0.257	0.276
WageGap(P90-P50)	49008	0.150	0.042	0.122	0.149	0.178
WageGap(P50-P10)	49008	0.105	0.042	0.076	0.104	0.133
WageGap(P75-P25)	49008	0.167	0.135	0.093	0.132	0.195
WageGap(P90-F)	49008	0.067	0.077	0.019	0.050	0.090
LnPat (t+1)	49008	0.045	0.243	0.000	0.000	0.000
LnCit (t+1)	49008	0.039	0.241	0.000	0.000	0.000
LnCitPat (t+1)	49008	0.038	0.183	0.000	0.000	0.000
LnPat (t+2)	43709	0.044	0.242	0.000	0.000	0.000
LnCit (t+2)	43709	0.038	0.240	0.000	0.000	0.000
LnCitPat (t+2)	43709	0.035	0.175	0.000	0.000	0.000
LnPat (t+3)	38739	0.042	0.241	0.000	0.000	0.000
LnCit (t+3)	38739	0.037	0.239	0.000	0.000	0.000
LnCitPat (t+3)	38739	0.032	0.168	0.000	0.000	0.000
AvgWage (US$)	49008	44245.284	33475.104	16460.792	39393.348	63981.113
LnAvgWage	49008	10.312	1.003	9.709	10.581	11.066
LnSale	49008	4.885	2.174	3.505	4.851	6.265
LnBM	49008	1.365	1.938	0.286	0.577	1.543
ROA	49008	-0.002	0.197	-0.009	0.037	0.078
Leverage	49008	0.192	0.171	0.033	0.165	0.305
Tangibility	49008	0.282	0.226	0.086	0.235	0.424
Capx	49008	0.057	0.063	0.016	0.036	0.072
RnD	49008	0.016	0.049	0.000	0.000	0.003
HHI	49008	0.245	0.194	0.103	0.195	0.310
HHI-sq	49008	0.098	0.167	0.011	0.038	0.096
Ln(PPP)	49008	10.297	0.764	10.333	10.633	10.703
GDPGrow	49008	0.023	0.029	0.012	0.024	0.036
Trade	49008	0.012	0.048	-0.022	-0.005	0.038
PropertyRight	49008	4.241	0.597	4.010	4.540	4.540
RuleRaw	49008	1.225	0.735	0.660	1.590	1.730
CreditRight	49008	2.530	1.290	1.000	3.000	4.000
MktDep	49008	0.645	0.693	0.000	0.470	1.278
ShareholderRight	47134	4.201	0.857	3.500	4.000	5.000
ComLaw	49008	0.590	0.492	0.000	1.000	1.000
Catholic	49008	0.180	0.384	0.000	0.000	0.000
Protestant	49008	0.547	0.498	0.000	1.000	1.000
Individualism	48926	65.437	25.606	48.000	71.000	89.000
UncertAviod	48926	50.204	21.311	35.000	44.000	65.000
FDI	49008	0.043	0.045	0.018	0.030	0.050
EmployProtect	39714	1.858	0.827	1.260	1.600	2.610
LongtermOrien	47945	52.303	17.764	41.000	51.000	62.000
LnCEOComp	19440	13.574	1.538	12.455	13.282	14.621
CEO-Worker Gap	19440	2.912	9.172	0.035	0.115	0.607

CEOCompGap	11542	0.178	0.074	0.108	0.186	0.240
FinWageGap	47792	0.206	0.067	0.165	0.194	0.247
GaptoUS	30066	0.128	0.104	0.071	0.129	0.200
GaptoUK	33809	0.460	0.647	0.042	0.104	0.695
GaptoGER	37251	0.373	0.568	0.038	0.076	0.490
GaptoFRA	38637	0.353	0.552	0.032	0.069	0.435

Table 2 – Average Wage by Industry and Country

This table presents average wage, wage gap, and log-transformed numbers of patents by industry (Panel A) and by country (Panel B). Each industry is defined at the 2-digit SIC code level.

Panel A: Average Wage Gap by Industry

SIC2	Industry	N	*AvgWage (US$)*	*WageGap*	*LnPat*
1	Agricultural Production – Crops	137	23993.106	0.248	0.000
2	Agricultural Production – Livestock	53	7954.779	0.242	0.000
7	Agricultural Services	36	42952.702	0.257	0.007
8	Forestry	15	44476.718	0.240	0.000
9	Fishing, Hunting, & Trapping	14	29813.003	0.268	0.000
10	Metal, Mining	1613	54911.634	0.254	0.001
12	Coal Mining	157	39377.664	0.248	0.000
13	Oil & Gas Extraction	976	72600.179	0.264	0.019
14	Nonmetallic Minerals, Except Fuels	93	45549.811	0.251	0.000
15	General Building Contractors	651	40124.053	0.257	0.001
16	Heavy Construction, Except Building	608	35647.144	0.258	0.014
17	Special Trade Contractors	233	41150.740	0.255	0.001
20	Food & Kindred Products	2688	30943.641	0.258	0.023
21	Tobacco Products	16	10654.304	0.234	0.000
22	Textile Mill Products	578	23543.563	0.243	0.005
23	Apparel & Other Textile Products	558	31369.345	0.247	0.000
24	Lumber & Wood Products	275	28519.506	0.255	0.001
25	Furniture & Fixtures	246	28985.735	0.255	0.074
26	Paper & Allied Products	711	34292.281	0.252	0.012
27	Printing & Publishing	1048	49122.743	0.262	0.017
28	Chemical & Allied Products	4260	47540.026	0.252	0.161
29	Petroleum & Coal Products	184	39955.469	0.254	0.091
30	Rubber & Miscellaneous Plastics Products	894	25268.987	0.252	0.023
31	Leather & Leather Products	113	29737.105	0.257	0.000
32	Stone, Clay, & Glass Products	1292	27509.319	0.247	0.027
33	Primary Metal Industries	1404	23973.725	0.246	0.023
34	Fabricated Metal Products	990	35667.839	0.251	0.033
35	Industrial Machinery & Equipment	2968	47541.280	0.254	0.087
36	Electronic & Other Electric Equipment	3093	41762.283	0.251	0.089
37	Transportation Equipment	1488	37438.549	0.255	0.184
38	Instruments & Related Products	1656	58655.780	0.254	0.118
39	Miscellaneous Manufacturing	393	41876.214	0.255	0.017
40	Railroad Transportation	39	69997.471	0.244	0.000
41	Local & Interurban Passenger Transit	110	33986.080	0.272	0.000
42	Trucking & Warehousing	330	44355.174	0.255	0.000

44	Water Transportation	530	46196.495	0.256	0.002
45	Transportation by Air	321	52236.803	0.264	0.001
47	Transportation Services	565	37258.393	0.261	0.001
48	Communications	1528	47117.176	0.259	0.065
50	Electric, Gas, & Sanitary Services	1643	38744.376	0.254	0.006
51	Wholesale Trade – Nondurable Goods	612	30931.285	0.261	0.002
52	Building Materials & Gardening Supplies	149	32125.248	0.255	0.000
53	General Merchandise Stores	228	18042.255	0.243	0.000
54	Food Stores	163	18948.982	0.259	0.000
55	Automative Dealers	254	37464.161	0.259	0.000
56	Apparel & Accessory	216	27033.935	0.252	0.000
57	Furniture & Homefurnishings	191	34002.904	0.253	0.000
58	Eating & Drinking Places	615	19677.572	0.223	0.002
59	Miscellaneous Retail	578	38749.959	0.260	0.000
70	Hotels & Other Lodging	429	21575.062	0.269	0.000
72	Personal Services	35	23660.928	0.223	0.000
73	Business Services	7402	61709.059	0.260	0.006
75	Auto Repair, Services, & Parking	73	50739.614	0.264	0.000
76	Miscellaneous Repair	23	36331.736	0.266	0.000
78	Motion Pictures	310	60787.398	0.261	0.000
79	Amusement & Recreation Services	644	45057.702	0.260	0.000
80	Health Services	628	37789.046	0.240	0.026
81	Legal Services	18	72209.841	0.259	0.000
82	Educational Services	104	45224.478	0.262	0.000
83	Social Services	9	35921.705	0.252	0.000
84	Museums, Botanical, Zoological Gardens	13	20075.333	0.258	0.000
87	Engineering & Management Services	1412	54896.413	0.258	0.008
89	Services, Not Elsewhere Classified	48	63680.804	0.266	0.000
99	Non-Classifiable Establishments	321	36688.705	0.254	0.120

Panel B: Average Wage Gap by Country

Country	N	*AvgWage (US$)*	*WageGap*	*LnPat*
AUS	2709	66975.983	0.255	0.012
AUT	127	64902.335	0.257	0.126
BEL	265	69292.674	0.248	0.126
BRA	132	21585.550	0.245	0.041
CAN	279	48856.443	0.226	0.001
CHE	989	71739.909	0.25	0.151

CHN	924	6580.177	0.249	0.017
DEU	3321	65285.107	0.267	0.098
DNK	448	72751.029	0.261	0.194
ESP	340	54529.034	0.263	0.055
FIN	616	58551.808	0.267	0.086
FRA	3966	58457.906	0.256	0.077
GBR	13878	49784.126	0.259	0.034
GRC	588	41574.258	0.259	0.001
HKG	534	14978.050	0.245	0.015
IDN	1270	6772.320	0.243	0.000
IND	3062	9608.481	0.247	0.031
IRL	107	81440.494	0.247	0.003
ISR	319	44593.257	0.26	0.021
ITA	739	64423.306	0.266	0.089
KOR	1251	39785.433	0.237	0.017
MYS	2376	8611.519	0.253	0.000
NGA	82	17966.455	0.262	0.000
NLD	763	58381.684	0.259	0.032
NOR	860	85154.988	0.251	0.069
PAK	184	7698.355	0.242	0.000
PHL	267	9837.275	0.243	0.000
POL	803	20112.278	0.254	0.004
RUS	67	13881.524	0.24	0.000
SGP	1194	17614.897	0.256	0.005
SWE	1929	72860.357	0.263	0.116
THA	1182	7415.516	0.25	0.000
TUR	376	21456.350	0.252	0.038
USA	2360	39738.251	0.242	0.062
ZAF	701	23169.607	0.257	0.003

Table 3 – Baseline Effect of Wage Gap on Innovation

This table presents estimates from OLS regressions where the independent variables are $LnPat_{t+N}$ (N=1,2, and 3), which is the natural log of 1 plus the number of patents applied by the firm in year *t+N*. The variable of primary interest is *WageGap*, an industry-wide employees' wage gap within country measured as (top 10% of $wage_{c,j,t}$- bottom 10% of $wage_{c,j,t}$)/ std($wage_{c,j,t}$) [*c* represents country, *j* represents industry, and *t* represents time]. Detailed definitions of other variables are included in Appendix A. Numbers shown below the coefficient are p-values that are clustered at the industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: $LnPat_{(t+N)}$					
	N=1	N=2	N=3	N=1	N=2	N=3
$WageGap_t$	0.086**	0.102***	0.114**	0.092**	0.106**	0.120**
	(0.017)	(0.007)	(0.034)	(0.034)	(0.014)	(0.029)
$LnAvgWage_t$	-0.005	-0.004	-0.001	-0.000	0.001	0.004
	(0.132)	(0.310)	(0.891)	(0.983)	(0.793)	(0.359)
$LnSale_t$	0.037***	0.037***	0.036***	0.036***	0.036***	0.036***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
LnBM	0.001	0.002	0.002	-0.001	-0.001	-0.001
	(0.792)	(0.496)	(0.554)	(0.729)	(0.647)	(0.555)
ROA_t	-0.022**	-0.022*	-0.022*	-0.023**	-0.022*	-0.023*
	(0.044)	(0.054)	(0.054)	(0.040)	(0.054)	(0.059)
$Leverage_t$	-0.057***	-0.058***	-0.061***	-0.056***	-0.058***	-0.062***
	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
$Tangibility_t$	-0.029**	-0.029**	-0.025*	-0.022**	-0.021*	-0.016
	(0.027)	(0.032)	(0.067)	(0.045)	(0.066)	(0.140)
$Capx_t$	0.052**	0.053**	0.049**	0.042	0.042	0.037
	(0.013)	(0.013)	(0.018)	(0.108)	(0.103)	(0.132)
RnD_t	0.596***	0.582***	0.564***	0.588***	0.574***	0.557***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
HHI_t	0.015	0.013	0.008	0.027	0.022	0.027
	(0.700)	(0.760)	(0.844)	(0.544)	(0.624)	(0.548)
$HHI\text{-}sq_t$	0.010	0.011	0.013	-0.003	-0.000	-0.007
	(0.843)	(0.830)	(0.802)	(0.951)	(0.993)	(0.892)
$Ln(PPP)_t$	0.009	0.009	0.010	0.003	0.006	0.003
	(0.472)	(0.482)	(0.546)	(0.861)	(0.767)	(0.855)
$GDPGrow_t$	-0.068*	0.056	0.054	-0.144**	-0.054	-0.147
	(0.095)	(0.129)	(0.289)	(0.020)	(0.228)	(0.115)
$Trade_t$	-0.248*	-0.281**	-0.341**	-0.152	-0.168*	-0.163
	(0.078)	(0.040)	(0.016)	(0.136)	(0.094)	(0.114)
$PropertyRight_t$	-0.000	-0.009	-0.003	-0.025***	-0.028***	-0.029***
	(0.949)	(0.218)	(0.734)	(0.000)	(0.000)	(0.000)
$RuleRaw_t$	-0.002	0.008	0.006	0.029	0.030	0.031
	(0.884)	(0.589)	(0.742)	(0.251)	(0.256)	(0.251)
CreditRight				-0.014**	-0.014**	-0.013**
				(0.035)	(0.038)	(0.040)
MktDep				-0.010	-0.009	-0.009

				(0.100)	(0.136)	(0.152)
ShareholderRight				-0.002	0.001	0.003
				(0.838)	(0.906)	(0.735)
ComLaw				-0.029*	-0.032*	-0.034*
				(0.098)	(0.069)	(0.060)
Catholic				-0.021	-0.018	-0.019
				(0.460)	(0.544)	(0.565)
Protestant				-0.001	0.000	-0.002
				(0.957)	(0.993)	(0.952)
Individualism				0.000	0.000	-0.000
				(0.832)	(0.922)	(0.991)
UncertAviod				-0.001**	-0.001**	-0.001*
				(0.036)	(0.049)	(0.088)
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	NO	NO	NO
Observations	48,982	43,685	38,717	47,026	42,266	37,593
Adj. R-squared	0.152	0.151	0.148	0.151	0.149	0.146

Table 4 – Alternative Specifications

This table presents results of sensitivity analyses. Panel A uses alternative innovation measures as dependent variables: *LnCit* and *LnCitPat*. $LnCit_{t+N}$ is a log-transformed number of citations received for a firm's patents in a given year after adding one (N=1,2, 3). $LnCitPat_{t+N}$ is a log-transformed number of citations divided by patents for a firm in a given year after adding one (N=1,2, 3). Panel B uses alternative measures of wage gap: *WageGap(P75-P25)* and *WageGap(P90-F)*. *WageGap(P75-P25)* is an industry-wide employees' wage gap within country measured as (top 25% of $wage_{c,j,t}$- bottom 25% of $wage_{c,j,t}$)/ std($wage_{c,j,t}$) [c represents country, j does industry, and t does time]. *WageGap(P90-F)* is an industry-wide employees' wage gap within country measured as (top 10% of $wage_{c,j,t}$- a firm's average employee $wage_{c,i,t}$)/ std($wage_{c,j,t}$) [c represents country, j does industry, i does firm, and t does time]. Panel C uses upside or downside wage gap. *WageGap(P90-P50)* is an industry-wide employees' wage gap within country measured as (top 10% of $wage_{c,j,t}$- median $wage_{c,j,t}$)/ std($wage_{c,j,t}$) [c represents country, j does industry, and t does time]. *WageGap(P50-P10)* is an industry-wide employees' wage gap within country measured as (median $wage_{c,j,t}$- bottom 10% $wage_{c,j,t}$)/ std($wage_{c,j,t}$) [c represents country, j does industry, and t does time]. Detailed definitions of all variables are included in Appendix A. Numbers shown below the coefficient are p-values that are clustered at the industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Alternative Innovation Measures

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: $LnCit_{(t+N)}$			*Dependent variable: $LnCitPat_{(t+N)}$*		
	N=1	*N=2*	*N=3*	*N=1*	*N=2*	*N=3*
$WageGap_t$	0.066**	0.088***	0.111**	0.014	0.022	0.056**
	(0.050)	(0.008)	(0.014)	(0.590)	(0.465)	(0.015)
$LnAvgWage_t$	-0.004	-0.003	-0.001	-0.000	0.002	0.002
	(0.142)	(0.347)	(0.734)	(0.860)	(0.257)	(0.257)
$LnSale_t$	0.033***	0.033***	0.033***	0.017***	0.017***	0.017***
	(0.004)	(0.005)	(0.006)	(0.000)	(0.000)	(0.000)
LnBM	0.001	0.001	0.001	-0.002	-0.001	-0.001
	(0.792)	(0.473)	(0.597)	(0.237)	(0.450)	(0.605)
ROA_t	-0.020**	-0.019*	-0.022**	-0.008	-0.003	-0.003
	(0.039)	(0.076)	(0.046)	(0.330)	(0.721)	(0.703)
$Leverage_t$	-0.051***	-0.050***	-0.056***	-0.027***	-0.027***	-0.035***
	(0.005)	(0.004)	(0.004)	(0.000)	(0.001)	(0.002)
$Tangibility_t$	-0.034**	-0.033**	-0.030**	-0.019	-0.017*	-0.014*
	(0.032)	(0.034)	(0.045)	(0.108)	(0.096)	(0.088)
$Capx_t$	0.060***	0.056**	0.050**	0.074***	0.062***	0.057***
	(0.009)	(0.015)	(0.012)	(0.005)	(0.009)	(0.006)
RnD_t	0.542***	0.511***	0.494***	0.549***	0.485***	0.454***
	(0.006)	(0.006)	(0.007)	(0.009)	(0.008)	(0.010)
HHI_t	0.016	0.007	0.004	-0.031	-0.043**	-0.036
	(0.669)	(0.843)	(0.905)	(0.203)	(0.045)	(0.107)
$HHI\text{-}sq_t$	0.004	0.011	0.008	0.029	0.041	0.031
	(0.933)	(0.811)	(0.851)	(0.332)	(0.105)	(0.196)
$Ln(PPP)_t$	0.014	0.015	0.015	0.018*	0.020**	0.030**
	(0.271)	(0.206)	(0.329)	(0.084)	(0.038)	(0.012)
$GDPGrow_t$	-0.093***	0.160**	0.093**	-0.105***	0.163***	0.065
	(0.004)	(0.017)	(0.018)	(0.000)	(0.002)	(0.177)
$Trade_t$	-0.293**	-0.329**	-0.391***	-0.297***	-0.305**	-0.359***
	(0.046)	(0.019)	(0.010)	(0.009)	(0.012)	(0.008)
$PropertyRight_t$	0.003	-0.010*	-0.002	0.006	-0.006	0.002
	(0.669)	(0.071)	(0.798)	(0.343)	(0.136)	(0.725)
$RuleRaw_t$	-0.008	0.005	0.000	-0.011	-0.003	-0.018
	(0.566)	(0.719)	(0.982)	(0.187)	(0.723)	(0.194)
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
Observations	48,982	43,685	38,717	48,982	43,685	38,717
Adj. R-squared	0.132	0.130	0.127	0.132	0.127	0.122

Panel B. Alternative industry Wage Gap Measures

	(1)	(2)	(3)	(4)	(5)	(6)
	WageGap(P75-P25)			*WageGap(P90-F)*		
	Dependent variable: $LnPat_{(t+N)}$					
	N=1	*N=2*	*N=3*	*N=1*	*N=2*	*N=3*
$WageGap_t$	0.074**	0.060**	0.039*	0.087**	0.085**	0.062*
	(0.022)	(0.024)	(0.092)	(0.020)	(0.026)	(0.090)
$LnAvgWage_t$	-0.002	-0.001	0.001	0.004	0.005	0.007
	(0.633)	(0.814)	(0.692)	(0.359)	(0.255)	(0.167)
$LnSale_t$	0.037***	0.037***	0.036***	0.036***	0.036***	0.036***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
LnBM	0.001	0.002	0.002	0.001	0.002	0.002
	(0.777)	(0.481)	(0.536)	(0.776)	(0.486)	(0.541)
ROA_t	-0.022**	-0.021*	-0.022*	-0.020*	-0.019*	-0.020*
	(0.046)	(0.055)	(0.055)	(0.069)	(0.093)	(0.092)
$Leverage_t$	-0.056***	-0.057***	-0.061***	-0.056***	-0.056***	-0.059***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
$Tangibility_t$	-0.029**	-0.028**	-0.024*	-0.027***	-0.027**	-0.024**
	(0.030)	(0.035)	(0.070)	(0.010)	(0.013)	(0.036)
$Capx_t$	0.052**	0.054**	0.049**	0.051**	0.055**	0.053**
	(0.014)	(0.014)	(0.019)	(0.021)	(0.019)	(0.024)
RnD_t	0.592***	0.580***	0.563***	0.591***	0.580***	0.567***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
HHI_t	0.025	0.021	0.015	0.009	0.009	0.009
	(0.525)	(0.605)	(0.719)	(0.811)	(0.835)	(0.836)
$HHI\text{-}sq_t$	0.001	0.002	0.006	0.005	0.003	0.000
	(0.992)	(0.964)	(0.909)	(0.914)	(0.947)	(0.994)
$Ln(PPP)_t$	0.006	0.007	0.010	0.006	0.007	0.009
	(0.628)	(0.573)	(0.541)	(0.653)	(0.602)	(0.559)
$GDPGrow_t$	-0.068*	0.053	0.062	-0.068*	0.055	0.058
	(0.096)	(0.142)	(0.241)	(0.099)	(0.135)	(0.264)
$Trade_t$	-0.256*	-0.289**	-0.347**	-0.261*	-0.293**	-0.352**
	(0.070)	(0.034)	(0.014)	(0.062)	(0.030)	(0.012)
$PropertyRight_t$	-0.002	-0.011	-0.004	-0.002	-0.010	-0.004
	(0.708)	(0.123)	(0.617)	(0.778)	(0.145)	(0.607)
$RuleRaw_t$	-0.003	0.006	0.004	0.001	0.010	0.007
	(0.783)	(0.672)	(0.841)	(0.967)	(0.505)	(0.712)
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
Observations	48,982	43,685	38,717	48,982	43,685	38,717
Adj. R-squared	0.152	0.151	0.148	0.152	0.151	0.149

Panel C. Upside or Downside Incentive

	(1)	(2)	(3)	(4)	(5)	(6)
	WageGap(P90-P50)			*WageGap(P50-P10)*		
	Dependent variable: $LnPat_{(t+N)}$					
	N=1	*N=2*	*N=3*	*N=1*	*N=2*	*N=3*
$WageGap_t$	0.101**	0.102***	0.103***	-0.057	-0.047	-0.038
	(0.013)	(0.006)	(0.002)	(0.225)	(0.293)	(0.345)
$LnAvgWage_t$	-0.004	-0.003	0.000	-0.004	-0.003	0.000
	(0.183)	(0.410)	(0.945)	(0.169)	(0.377)	(0.984)
$LnSale_t$	0.037***	0.037***	0.036***	0.037***	0.037***	0.036***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
LnBM	0.001	0.002	0.001	0.001	0.002	0.002
	(0.815)	(0.512)	(0.565)	(0.805)	(0.500)	(0.549)
ROA_t	-0.022**	-0.021*	-0.022*	-0.022**	-0.021*	-0.022*
	(0.046)	(0.056)	(0.056)	(0.044)	(0.054)	(0.054)
$Leverage_t$	-0.056***	-0.057***	-0.061***	-0.057***	-0.058***	-0.061***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
$Tangibility_t$	-0.030**	-0.029**	-0.025*	-0.029**	-0.028**	-0.024*
	(0.025)	(0.030)	(0.065)	(0.026)	(0.032)	(0.067)
$Capx_t$	0.052**	0.054**	0.049**	0.052**	0.054**	0.049**
	(0.013)	(0.013)	(0.017)	(0.013)	(0.013)	(0.018)
RnD_t	0.596***	0.582***	0.564***	0.596***	0.582***	0.564***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
HHI_t	0.016	0.014	0.009	0.017	0.015	0.011
	(0.686)	(0.742)	(0.820)	(0.661)	(0.712)	(0.790)
$HHI\text{-}sq_t$	0.009	0.010	0.011	0.007	0.008	0.009
	(0.858)	(0.849)	(0.826)	(0.886)	(0.883)	(0.860)
$Ln(PPP)_t$	0.008	0.009	0.010	0.009	0.009	0.010
	(0.509)	(0.511)	(0.540)	(0.485)	(0.473)	(0.514)
$GDPGrow_t$	-0.069*	0.056	0.062	-0.064	0.062*	0.062
	(0.091)	(0.130)	(0.234)	(0.109)	(0.093)	(0.230)
$Trade_t$	-0.246*	-0.281**	-0.343**	-0.253*	-0.289**	-0.350**
	(0.081)	(0.039)	(0.016)	(0.073)	(0.034)	(0.013)
$PropertyRight_t$	-0.001	-0.009	-0.003	-0.001	-0.009	-0.003
	(0.935)	(0.201)	(0.711)	(0.914)	(0.187)	(0.695)
$RuleRaw_t$	-0.002	0.008	0.006	-0.002	0.007	0.005
	(0.899)	(0.581)	(0.757)	(0.877)	(0.601)	(0.775)
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
Observations	48,982	43,685	38,717	48,982	43,685	38,717
Adj. R-squared	0.152	0.151	0.148	0.152	0.150	0.148

Table 5 – Subsample Analyses

This table presents results of subsample analyses. *CreditorRight* is the country-level creditor protection index of 2003 (Djankov, McLiesh, and Shleifer, 2007). *FDI* is foreign direct investment divided by GDP. *EmployProtect* is an index that measures the country's strictness of employment protection against the dismissal of workers. *LongtermOrien* is an index that measures the extent to which society encourages individuals to prepare for the future. High vs. low is determined based on the median value of each variable. Detailed definitions of all variables are included in Appendix A. Numbers shown below the coefficient are p-values that are clustered at the industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: $LnPat_{t+1}$							
	CreditorRight		*FDI*		*EmployProtect*		*LongtermOrien*	
	High	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*
$WageGap_t$	0.029	0.111**	0.114**	0.066*	0.187**	0.008	0.165*	0.004
	(0.453)	(0.045)	(0.027)	(0.071)	(0.014)	(0.899)	(0.097)	(0.925)
$LnAvgWage_t$	0.017***	-0.020***	0.008*	-0.012***	0.006	-0.010	0.011	-0.012**
	(0.008)	(0.000)	(0.069)	(0.008)	(0.516)	(0.227)	(0.346)	(0.021)
$LnSale_t$	0.031**	0.045***	0.034***	0.040***	0.056***	0.030**	0.056***	0.025***
	(0.018)	(0.000)	(0.004)	(0.000)	(0.000)	(0.016)	(0.000)	(0.006)
LnBM	-0.001	0.000	-0.004	0.003	-0.002	-0.010	0.003	-0.005
	(0.819)	(0.992)	(0.323)	(0.205)	(0.565)	(0.141)	(0.266)	(0.264)
ROA_t	-0.010	-0.032*	-0.019*	-0.024*	-0.038**	-0.005	-0.062**	0.002
	(0.433)	(0.092)	(0.071)	(0.066)	(0.038)	(0.694)	(0.037)	(0.866)
$Leverage_t$	-0.070**	-0.043*	-0.059***	-0.050***	-0.072**	-0.082***	-0.077**	-0.049***
	(0.011)	(0.080)	(0.004)	(0.006)	(0.017)	(0.004)	(0.032)	(0.003)
$Tangibility_t$	-0.009	-0.042*	-0.026*	-0.030*	-0.014	-0.034*	-0.012	-0.030**
	(0.387)	(0.057)	(0.056)	(0.057)	(0.512)	(0.057)	(0.593)	(0.018)
$Capx_t$	0.029	0.084**	0.035**	0.068**	0.071*	0.032	0.002	0.043*
	(0.158)	(0.023)	(0.019)	(0.035)	(0.061)	(0.113)	(0.962)	(0.051)
RnD_t	0.427**	0.795***	0.522***	0.661***	0.782**	0.379***	0.713***	0.511**
	(0.014)	(0.007)	(0.006)	(0.003)	(0.018)	(0.001)	(0.003)	(0.013)
HHI_t	-0.019	0.041	-0.015	0.034	0.041	0.023	0.070	0.000
	(0.724)	(0.628)	(0.761)	(0.354)	(0.497)	(0.802)	(0.326)	(0.992)
$HHI\text{-}sq_t$	0.006	0.026	0.050	-0.024	-0.004	-0.024	-0.055	0.048
	(0.906)	(0.806)	(0.441)	(0.601)	(0.956)	(0.794)	(0.500)	(0.457)
$Ln(PPP)_t$	0.059	-0.010	0.016	0.004	0.099	0.238	-0.045	0.054
	(0.252)	(0.607)	(0.226)	(0.816)	(0.135)	(0.218)	(0.396)	(0.130)
$GDPGrow_t$	-0.152	-0.006	0.008	-0.094	-0.278**	-0.402	-0.019	-0.127
	(0.125)	(0.917)	(0.897)	(0.109)	(0.023)	(0.139)	(0.802)	(0.259)
$Trade_t$	-0.096	-0.272	-0.255*	-0.269	-0.131	-0.390	-0.130	-0.223
	(0.423)	(0.269)	(0.094)	(0.283)	(0.553)	(0.157)	(0.479)	(0.193)
$PropertyRight_t$	-0.022	0.004	0.012	-0.006	-0.019	0.064	0.041	-0.009
	(0.117)	(0.529)	(0.406)	(0.347)	(0.677)	(0.472)	(0.124)	(0.176)
$RuleRaw_t$	-0.002	0.015	-0.008	0.011	0.080	0.116**	0.038	0.010
	(0.852)	(0.534)	(0.579)	(0.669)	(0.288)	(0.012)	(0.461)	(0.304)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	27,703	21,276	26,083	22,899	19,050	20,637	16,318	31,600
Adj. R-squared	0.164	0.157	0.153	0.155	0.197	0.150	0.192	0.131

Table 6 – Adding Controls for CEO Incentives

LnCEOComp is the natural log of total CEO compensation including cash and equity-based compensation. *CEO-Worker Gap* is the pay gap between CEO salary and average workers' wage measured as (CEO $Comp_{i,t}$ - workers' $wage_{i,t}$)/ workers' $wage_{i,t}$ [*i* represents firm and *t* represents time]. *CEOCompGap* is the Industry wage gap for the CEO's salary measured as (90^{th} percentile CEO $salary_{j,t}$ – 10^{th} percentile CEO $salary_{j,t}$)/ std(CEO $salary_{j,t}$). Detailed definitions of all variables are included in Appendix A. Numbers shown below the coefficient are p-values that are clustered at the industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)
	Dependent variable: $LnPat_{t+1}$	
$WageGap_t$	0.095*	0.133*
	(0.065)	(0.065)
LnCEOComp	0.011**	0.011*
	(0.012)	(0.069)
CEO-Worker Gap	0.001	0.001
	(0.106)	(0.287)
CEOCompGap		0.045
		(0.711)
$LnAvgWage_t$	-0.004	-0.010
	(0.576)	(0.255)
$LnSale_t$	0.038***	0.040***
	(0.001)	(0.001)
LnBM	0.002	-0.000
	(0.759)	(0.956)
ROA_t	-0.014	-0.014
	(0.296)	(0.495)
$Leverage_t$	-0.069***	-0.026
	(0.009)	(0.479)
$Tangibility_t$	-0.039**	-0.041*
	(0.023)	(0.053)
$Capx_t$	0.086**	0.079*
	(0.037)	(0.058)
RnD_t	0.512***	0.566***
	(0.005)	(0.008)
HHI_t	0.043	0.136
	(0.540)	(0.369)
$HHI\text{-}sq_t$	0.008	-0.054
	(0.935)	(0.812)
$Ln(PPP)_t$	-0.008	-0.006
	(0.742)	(0.818)
$GDPGrow_t$	-0.290	-0.288*
	(0.108)	(0.085)
$Trade_t$	0.001	-0.257
	(0.998)	(0.357)
$PropertyRight_t$	0.017*	0.016
	(0.096)	(0.214)
$RuleRaw_t$	-0.019	-0.023
	(0.533)	(0.519)
Year FE	YES	YES
Industry FE	YES	YES
Country FE	YES	YES
Observations	19,440	11,542
Adj. R-squared	0.174	0.170

Table 7 – Instrumental Variables Regression

FinWageGap is the industry wage gap within the finance industry in the same country, measured as (90th percentile of $Wage_{c,Fin,t}$ – 10th percentile of $Wage_{c,Fin,t}$)/Std ($Wage_{c,Fin,t}$). *Pred_WageGap* is the predicted value of wage gap from the 1st stage regression. Detailed definitions of all variables are included in Appendix A. Numbers shown below the coefficient are p-values that are clustered at the industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)
	1st Stage	2nd Stage
	$WageGap_t$	$LnPat_{t+1}$
$FinWageGap_t$	0.011**	
	(0.009)	
$Pred\_WageGap_t$		3.104*
		(0.004)
$LnAvgWage_t$	0.003	-0.016*
	(0.000)	(0.006)
$LnSale_t$	0.000	0.037**
	(0.179)	(0.001)
LnBM	0.000	0.001
	(0.811)	(0.724)
ROA_t	-0.002	-0.019
	(0.082)	(0.091)
$Leverage_t$	-0.001	-0.052**
	(0.305)	(0.022)
$Tangibility_t$	0.000	-0.031***
	(0.736)	(0.000)
$Capx_t$	-0.002	0.060**
	(0.562)	(0.002)
RnD_t	0.002	0.631**
	(0.587)	(0.009)
HHI_t	0.018	-0.042
	(0.000)	(0.549)
$HHI\text{-}sq_t$	-0.022	0.068
	(0.000)	(0.335)
$Ln(PPP)_t$	-0.001	0.012
	(0.790)	(0.614)
$GDPGrow_t$	0.058	-0.237*
	(0.000)	(0.000)
$Trade_t$	-0.054	-0.097
	(0.000)	(0.375)
$PropertyRight_t$	-0.001	-0.001
	(0.606)	(0.918)
$RuleRaw_t$	-0.001	-0.001
	(0.764)	(0.945)
Year FE	YES	YES
Industry FE	YES	YES
Country FE	YES	YES
Observations	47,792	47,792
Adj. R-squared	0.060	0.155

Table 8 – Cross-Country Wage Gap

This table presents results of OLS regressing cross-country wage gaps on corporate innovation outputs. *Gapto X* is a cross-country wage gap measured as (90th percentile of $wage_{X,j,t}$ - median $wage_{c,j,t}$)/ std($wage_{c,j,t}$), [*X*= US, UK, Germany, and France]. *LowWage* is a dummy variable that takes the value of one if a country's industry median wage is less than median value of industry wage in a given year and zero otherwise. Numbers shown below the coefficient are p-values that are clustered at the country level. Detailed definitions of all variables are included in Appendix A. Numbers shown below the coefficient are p-values that are clustered at the industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: $LnPat_{t+1}$							
X:	US		UK		Germany		France	
Gapto X_t	0.008	-0.064*	0.008	-0.005	0.030**	0.016	0.026	0.011
	(0.780)	(0.099)	(0.504)	(0.724)	(0.030)	(0.257)	(0.110)	(0.529)
Gapto X_t x $LowWage_t$		0.128***		0.019**		0.020**		0.024**
		(0.005)		(0.046)		(0.031)		(0.010)
$LowWage_t$		-0.027***		-0.023***		-0.017***		-0.018***
		(0.001)		(0.001)		(0.001)		(0.006)
$LnAvgWage_t$	0.009	0.003	-0.006	-0.013**	-0.002	-0.007	-0.001	-0.005
	(0.165)	(0.554)	(0.341)	(0.027)	(0.766)	(0.478)	(0.944)	(0.555)
$LnSale_t$	0.043***	0.043***	0.041***	0.041***	0.041***	0.041***	0.036***	0.036***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LnBM	-0.001	-0.001	0.000	0.000	-0.000	-0.000	-0.001	-0.001
	(0.869)	(0.808)	(0.926)	(0.962)	(0.905)	(0.886)	(0.784)	(0.745)
ROA_t	-0.035**	-0.035**	-0.031*	-0.031*	-0.023	-0.023	-0.015*	-0.015*
	(0.018)	(0.018)	(0.067)	(0.067)	(0.111)	(0.116)	(0.062)	(0.065)
$Leverage_t$	-0.075**	-0.073**	-0.050**	-0.048**	-0.055**	-0.054**	-0.052**	-0.051**
	(0.014)	(0.015)	(0.015)	(0.015)	(0.014)	(0.014)	(0.017)	(0.016)
$Tangibility_t$	-0.023	-0.024	-0.013	-0.014	-0.033***	-0.032***	-0.027*	-0.026*
	(0.164)	(0.158)	(0.389)	(0.369)	(0.006)	(0.007)	(0.071)	(0.071)
$Capx_t$	0.068**	0.068**	0.056*	0.059*	0.040	0.041	0.064**	0.064**
	(0.041)	(0.040)	(0.071)	(0.057)	(0.262)	(0.238)	(0.019)	(0.017)
RnD_t	0.496***	0.482***	0.707***	0.689***	0.628***	0.614***	0.582***	0.567***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HHI_t	0.040	0.041	0.025	0.024	0.019	0.019	-0.009	-0.009
	(0.551)	(0.538)	(0.575)	(0.590)	(0.741)	(0.745)	(0.828)	(0.833)
$HHI\text{-}sq_t$	0.012	0.010	0.011	0.013	0.037	0.038	0.040	0.040
	(0.893)	(0.909)	(0.845)	(0.821)	(0.631)	(0.630)	(0.458)	(0.461)
$Ln(PPP)_t$	0.005	0.006	-0.002	-0.002	0.024	0.022	0.021	0.020
	(0.719)	(0.709)	(0.909)	(0.896)	(0.168)	(0.212)	(0.204)	(0.252)
$GDPGrow_t$	-0.089	-0.092	-0.011	-0.012	-0.045	-0.046	-0.056	-0.056
	(0.255)	(0.239)	(0.858)	(0.842)	(0.487)	(0.485)	(0.408)	(0.414)
$Trade_t$	-0.096	-0.099	-0.265**	-0.264**	-0.282*	-0.281*	-0.267*	-0.266*
	(0.440)	(0.426)	(0.022)	(0.024)	(0.063)	(0.069)	(0.067)	(0.072)
$PropertyRight_t$	0.013**	0.013**	0.005	0.005	-0.002	-0.002	-0.003	-0.002
	(0.020)	(0.025)	(0.439)	(0.402)	(0.820)	(0.785)	(0.705)	(0.724)
$RuleRaw_t$	-0.014	-0.014	0.009	0.008	-0.012	-0.012	-0.007	-0.007
	(0.417)	(0.407)	(0.597)	(0.610)	(0.471)	(0.482)	(0.657)	(0.654)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	30,066	30,066	33,808	33,808	37,251	37,251	38,637	38,637
Adj. R-squared	0.166	0.166	0.158	0.159	0.154	0.154	0.153	0.154

Appendix A – Definition of Variables

This table lists definitions of variables.

Variables	Definitions
WageGap	Industry-wide employees' wage gap within country measured as (top 10% of $wage_{c,j,t}$ - bottom 10% of $wage_{c,j,t}$)/ std($wage_{c,j,t}$)
WageGap(P90-P50)	Industry-wide employees' wage gap within country measured as (top 10% of $wage_{c,j,t}$ - median $wage_{c,j,t}$)/ std($wage_{c,j,t}$)
WageGap(P50-P10)	Industry-wide employees' wage gap within country measured as (median $wage_{c,j,t}$ - bottom 10% of $wage_{c,j,t}$)/ std($wage_{c,j,t}$)
WageGap(P75-P25)	Industry-wide employees' wage gap within country measured as (top 25% of $wage_{c,j,t}$ - bottom 25% of $wage_{c,j,t}$)/ std($wage_{c,j,t}$)
WageGap(P90-F)	Wage gap between industry top 10% and employees' own firm measured as (top 90% of $wage_{c,j,t}$ - $wage_{c,i,t}$)/ std($wage_{c,j,t}$)
LnPat (t+1)	Log-transformed number of patents by adding one at year t+1
LnCit (t+1)	Log-transformed number of citations by adding one at year t+1
LnCitPat (t+1)	Log-transformed number of citations divided by patents by adding one at year t+1
LnPat (t+2)	Log-transformed number of patents by adding one at year t+2
LnCit (t+2)	Log-transformed number of citations by adding one at year t+2
LnCitPat (t+2)	Log-transformed number of citations divided by patents by adding one at year t+2
LnPat (t+3)	Log-transformed number of patents by adding one at year t+3
LnCit (t+3)	Log-transformed number of citations by adding one at year t+3
LnCitPat (t+3)	Log-transformed number of citations divided by patents by adding one at year t+3
AvgWage (US$)	Dollar-denominated average workers' wage for firm i at year t
LnAvgWage	Log-transformed value of *AvgWage*
LnSale	Log-transformed sales revenue
LnBM	log-transformed ratio of book value to market value of equities
ROA	Net income divided by assets
Leverage	Total debts divided by assets
Tangibility	Net property, plant, and equipment divided by assets
Capx	Capitial expenditure divided by assets
RnD	Research and development expense divided by assets
HHI	Herfindahl index based on sales across the first two digits of the SIC code
HHI-sq	The square of HHI
Ln(PPP)	Log-transformed gross domestic product (GDP) per capita (World Bank Data)
GDPGrow	Annual growth in GDP per capital (World Bank Data)
Trade	(Export- Import) divided by GDP (World Bank Data)
PropertyRight	Property Right Protection Index (Professor Walter G. Park's website)
RuleRaw	Index that measures the country's quality of laws (https://info.worldbank.org/governance/wgi/)
CreditRight	Credit right index of 2003 (Djankov, McLiesh, and Shleifer, 2007)
MktDep	Total stock market capitalizaton divided by total deposits in banks (World Bank Data)
ShareholderRight	Anti-director right index of 2005 (Spamann, 2009)
ComLaw	Dummy =1 if a country's legal origin follows common law system (Professor Rafael La Porta's website)

Catholic	Dummy =1 if a country's religion is Catholic (Professor Rafael La Porta's website)
Protestant	Dummy =1 if a country's religion is Protestant (Professor Rafael La Porta's website)
Individualism	Individualism index measures the extent to which members of a society can independently choose and decide (Professor Geert Hofstede's website)
UncertAviod	Uncertainty avoidance index measures the extent to which members of a society feel uncomfortable with uncertainty (Professor Geert Hofstede's website)
FDI	Fraction of foreign direct investment in the GDP (World Bank Data Site)
EmployProtect	Index that measures the strictness of employment protection against the dismissal of workers (https://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection.htm)
LongtermOrien	Long-term orientation index measures the extent to which members of a society are encouraged to prepare for the future (Professor Geert Hofstede's website)
LnCEOComp	Log-transformed total CEO compensation
CEO-Worker Gap	CEO to worker wage gap measured as (CEO Comp - workers' wage)/ workers' wage
CEOCompGap	Industry-wide CEO compensation gap within country measured as (top 10% of CEO $Comp_{j,t}$ - bottom 10% of CEO $Comp_{j,t}$)/ std($wage_{j,t}$)
FinWageGap	Finance industry employees' wage gap within country measured as (top 10% of $wage_{F,t}$ - bottom 10% of $wage_{F,t}$)/ std($wage_{F,t}$)
Gapto US	Wage gap to US measured as (top 10% of $wage_{US,j,t}$ - median $wage_{c,j,t}$)/ std($wage_{c,j,t}$)
Gapto UK	Wage gap to UK measured as (top 10% of $wage_{UK,j,t}$ - median $wage_{c,j,t}$)/ std($wage_{c,j,t}$)
Gapto GER	Wage gap to Germany measured as (top 10% of $wage_{GER,j,t}$ - median $wage_{c,j,t}$)/ std($wage_{c,j,t}$)
Gapto FRA	Wage gap to France measured as (top 10% of $wage_{FRA,j,t}$ - median $wage_{c,j,t}$)/ std($wage_{c,j,t}$)

Appendix B – Without Firms in Hong Kong and Singapore

The table presents the replication results of Table 3 without firms in Hong Kong and Singapore. Detailed definitions of all variables are included in Appendix A. Numbers shown below the coefficient are p-values that are clustered at the industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: $LnPat_{(t+N)}$					
	N=1	N=2	N=3	N=1	N=2	N=3
$WageGap_t$	0.088**	0.108***	0.120**	0.095**	0.112**	0.126**
	(0.024)	(0.010)	(0.040)	(0.039)	(0.016)	(0.030)
$LnAvgWage_t$	-0.006	-0.004	-0.001	-0.000	0.001	0.004
	(0.119)	(0.273)	(0.848)	(0.938)	(0.845)	(0.391)
$LnSale_t$	0.038***	0.038***	0.037***	0.037***	0.037***	0.037***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
LnBM	0.001	0.002	0.002	-0.001	-0.001	-0.001
	(0.825)	(0.480)	(0.527)	(0.608)	(0.604)	(0.623)
ROA_t	-0.022*	-0.021*	-0.022*	-0.023**	-0.022*	-0.023*
	(0.052)	(0.064)	(0.062)	(0.042)	(0.060)	(0.065)
$Leverage_t$	-0.059***	-0.060***	-0.064***	-0.060***	-0.061***	-0.066***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
$Tangibility_t$	-0.031**	-0.030**	-0.026*	-0.024*	-0.023*	-0.019
	(0.034)	(0.041)	(0.079)	(0.054)	(0.080)	(0.150)
$Capx_t$	0.059***	0.061***	0.057***	0.053**	0.054**	0.049*
	(0.008)	(0.007)	(0.010)	(0.049)	(0.043)	(0.054)
RnD_t	0.595***	0.581***	0.563***	0.584***	0.570***	0.551***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
HHI_t	0.019	0.017	0.013	0.037	0.032	0.037
	(0.636)	(0.685)	(0.758)	(0.417)	(0.488)	(0.420)
$HHI\text{-}sq_t$	0.008	0.009	0.011	-0.010	-0.006	-0.013
	(0.872)	(0.859)	(0.835)	(0.866)	(0.908)	(0.810)
$Ln(PPP)_t$	0.006	0.007	0.008	0.009	0.012	0.009
	(0.602)	(0.608)	(0.607)	(0.617)	(0.500)	(0.587)
$GDPGrow_t$	-0.091*	0.044	0.040	-0.139**	-0.030	-0.123
	(0.097)	(0.414)	(0.622)	(0.030)	(0.484)	(0.249)
$Trade_t$	-0.268	-0.282*	-0.357**	-0.165	-0.178*	-0.175
	(0.105)	(0.068)	(0.029)	(0.127)	(0.099)	(0.116)
$PropertyRight_t$	0.001	-0.008	-0.002	-0.019***	-0.022***	-0.021***
	(0.842)	(0.311)	(0.845)	(0.005)	(0.004)	(0.008)
$RuleRaw_t$	-0.007	0.006	0.003	0.029	0.030	0.032
	(0.622)	(0.735)	(0.895)	(0.270)	(0.268)	(0.264)
CreditRight				-0.014**	-0.014**	-0.014**
				(0.031)	(0.035)	(0.045)
MktDep				-0.010*	-0.009	-0.009
				(0.078)	(0.112)	(0.153)
ShareholderRight				-0.001	0.001	0.003

				(0.853)	(0.905)	(0.729)
ComLaw				-0.024	-0.026	-0.027
				(0.198)	(0.161)	(0.161)
Catholic				-0.022	-0.020	-0.021
				(0.434)	(0.523)	(0.528)
Protestant				-0.006	-0.005	-0.008
				(0.776)	(0.843)	(0.765)
Individualism				-0.000	-0.000	-0.000
				(0.867)	(0.797)	(0.713)
UncertAviod				-0.001**	-0.001**	-0.001**
				(0.017)	(0.024)	(0.045)
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	NO	NO	NO
Observations	47,254	42,042	37,166	45,356	40,673	36,083
Adj. R-squared	0.154	0.153	0.151	0.153	0.152	0.149