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National treatment, institutions and IP uncertainties: An analytics of compliance, change and comparability

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ABSTRACT

This paper addresses national treatment for IP uncertainties (NTIPU) as to whether it is upheld, its changing nature, and differences between patents and trademarks. Based on the institutional theory, empirical evidence in the US and China, the lagged regression modeling of longitudinal data, and multiple comparison, we find that NTIPU is upheld in the past 12 years for trademarks due to equal or favorable treatment for foreigners in granting for both countries, and in pendency for China, but not upheld against pendency due to shorter duration for US locals. Both countries show progress (pendency and foreign granting in China, US granting) or remain unchanged (local granting in China, and US pendency) when compared with pre-2002 eras. Consistently, patents demonstrate shorter pendency but lower granting than trademarks for both countries. The findings address theoretical and empirical voids of NTIPU and provide implications to handle IP uncertainties in bilateral collaboration.

1. Introduction

Under the global tide of integration, nation-based intellectual property (IP) systems (IPS) face challenges of harmonization to meet the need for cross-border cooperation. A salient example of such a challenge is the global compliance of national treatment (i.e. equal treatment to the local and foreign) in key areas of national interests (e.g. trade, diplomacy, IP). Given the policy significance, countries are willing and sometimes obliged to accord the principle with other countries for mutual benefits. Such an integration in IP is vital for effective global collaboration, but challenging due to IP uncertainties (e.g. those in granting and delay). Therefore, analyzing relevant comparators (e.g. locals vs. foreign; patents vs. trademarks) can aid understanding of global compliance with this principle for policy and practice across countries.

The significance of global compliance in IP urges academic endeavor to address contradictions, understudies and voids through clarity and new evidences. Prior studies are sporadic, but insightful surrounding the legal interpretation and influence of national treatment (e.g. Liddell & Waibel, 2016; Scotchmer, 2004), and economic effects (e.g. Geng & Saggi, 2015; Horn, 2006). They also seem consistent that cross-country variations remain in great degrees when applying national treatment for IP uncertainties (e.g. Kotabe, 1992; Gillespie, Krishna, & Jarvis, 2002; Yang & Sonmez, 2018) given the nation-based nature of IPS (Yang, 2013). Such variations will remain in the detail because global principles are minimum standards for countries to comply with. Therefore, countries pursue consistency rather than identical compliance in national treatment among them. However, one unsettled issue is whether the minimum standard of national treatment is upheld against IP uncertainties and findings are contradictory: compliance (Gillespie et al., 2002; Yang, 2008; Yang and Sonmez, 2018) versus non-compliance (e.g. Kotabe, 1992; Webster, Jensen, & Palangkaraya, 2014). We argue that such variations come from IP itself (e.g. patents vs other IP rights), the empirical data examined (e.g. countries), the period of time examined, and the data analytics adopted (e.g. survival analysis, regression modelling; outcome data versus predictive data). We also recognize the lack of studies in examining the changing global compliance except one recent study revealing that both the US and China have demonstrated mixed changes (progressive granting, but regressive delay) in handling patent uncertainties (Yang & Sonmez, 2018). Moreover, one significant void to fill is to examine how national treatment fares between patents and trademarks. Prior studies put a great emphasis on patents with only sporadic studies on other IPs (Gillespie et al., 2002; Yang, 2007). While this is justifiable given the sophistication of patents among IP (Bosworth & Yang, 2000), other IPs should also be addressed comparatively given the embeddedness of these rights within products and services (e.g. patents and trademarks) and their differences from patents.

To address the contradictions, understudies and voids identified above, we focus on how global compliance in national treatment is for IP uncertainties with three objectives. Firstly, we demonstrate if there is a global compliance of national treatment for IP uncertainties (NTIPU) for trademarks (2003–2014). Secondly, we evidence the changing nature of NTIPU (1985–2002 vs. 2003–2014) to contribute to this new area of study. Thirdly, we focus on the NTIPU between patents and trademarks to identify similarities and differences.

To achieve the objectives, we formulate hypotheses based on theories, empirics, practice and our own logical arguments. We ground our theoretical arguments of the global principle of national treatment based on the institutional theory. We also use the US and China (the top filing and granting countries in IP), as our empirical examples to draw evidence for arguments since the two countries top both the patent and trademark activities in the world[1]. These two countries have also gone through dynamic policy reforms that cause changes of national treatment in IP. Their policy environment matters to foreign owners who file patents and trademarks for protection. Our study thus helps assert whether or not global compliance of national treatment has met the minimum standards in the last decade (i.e. responding Objective 1). We also address how NTIPU has changed for better or worse over the last 30 years (Objective 2). In the end, we demonstrate the similarities and differences of NTIPU between patents and trademarks (Objective 3).

This study contributes to several scholarly endeavors in theories, empirics and methodology. Theoretically, we contribute to using the principle of national treatment and institutions to explain IP uncertainties. Institutions here refer to the rules of the game in society, including formal rules and regulations and informal institutions of value and cultural understanding (North, 1991; Scott, 1995). We demonstrate that the institutional theory (e.g. Bush, 1987; Oliver, 1992; Scott, 2001) is fundamental in interpreting IPS and IP uncertainties. We also enrich the study of the national treatment principle from IP perspectives. Empirically, we study the two most active nations to address spatial and temporal details of IPS changes. The findings fill in a gap of barely studied issue of trademark uncertainties in comparison to patents. The longitudinal comparison helps address the changing nature of the trademark systems and uncertainties between the two countries to reveal progress, issues and predict trends. The comparative understanding is significant for the two large IP filing nations since the IPS plays a deciding role for national economic wellbeing, including actions from foreign countries to trade and invest. A novel contribution is to allow comparison of global compliance between patents and trademarks and conclude holistic findings for IP. This paper seems to be the first study to address national treatment with comparison between the two major IP rights. Methodologically, we enrich comparative studies as a method from the angle of IPS with multiple comparators. We also use lagged regression modeling, which allows us to assess different prior findings with ours in discussions.

The holistic findings for IP have implications for policy makers and IP owners. The results evidence the IP role in countries′ multilateral collaboration through the emphasis of equality for local and foreign owners. The international context was emphasized in the paper due to examining the significance of global principle in two major IP countries, and its global alignment in time and between two key IP rights. Despite the international expectation of global integration, compliance is intricate due to the complexity of IPS, including the difficulty in harmonizing the legal mechanism, administration and enforcement across nations (Yang, 2013). The revelation of changes provides implications that we ought to see compliance in both progressive and regressive forms when dealing with IP rights. The comparative results between patents and trademarks provide new insights as to how these two key IP rights should be treated similarly or differently for cross-border collaboration.

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2. National treatment and IP uncertainties

In this section, we address the three objectives of national treatment based on the institutional theory, empirical evidence and our own logical arguments before formulating hypotheses. The integration of prior work also allows us to identify disagreements, contradictions, inadequacy and voids in detail. Within the arguments of each section, we accordingly propose hypotheses for retesting and for new examinations. 2.1. National treatment for IP uncertainties

Global compliance of national treatment in IP is unsettled and we have varied answers based on the institutional theory. The support of NTIPU is grounded within the understanding of institutional universalism. That is, international institutions exist given the interdependence of nations so that countries can make effort toward universalism - common interest to share and common issues to address (Ruggie, 1992; Eden, 2010). Given this reality, national treatment is a relevant, minimum standard toward global consistency so that countries can oblige toward and benefit from the integration. After all, countries are limited in generating all needed technologies, and broad global integration would allow them to have standards for efficient and effective cooperation and performance (Bosworth & Yang, 2000. From the perspective of IP, given the nation-based nature of IPS (Yang, 2013), international institutions set minimum standards for countries to work together (e.g. handling applications from across the world, and dealing with cross-border IP disputes).

Meanwhile, the institution of functionalism emphasizes that such a universal convergence is an ideal rather than reality. This is because national authority and interests always function to cause resistance toward global integration (Scholte, 2001). Moreover, there is a gap of statue and enforcement. Countries may exacerbate the gap since originneutral legislations tend to have concealed protectionism leading to inconsistency and opacity in the application, and interpretation to mandate the application and national obligation (Pillai, 2002).

Global integration therefore remains a long, enduring domestication (Sgard, 1995; Yang & Sonmez, 2013; Wijk & Ramanna, 2007) since national institutions remain the functionalist to decide what, how and when the country should align with global standards (Yang & Sonmez, 2013). The universalism and functionalism both remain to play their role in the area of IPS (e.g. Legislating laws, administrative policy and judicial enforcement; Yang, 2013). This means that institutional convergence in IP is most complex, and fragmented for cross-national coordination and negotiations (Sgard, 1995). Controversy continues in the global arena due to discrimination and burden of proof on discrimination (Pillai, 2002).

Alongside the theoretical arguments and practice, prior studies generate two opposite empirical answers for NTIPU: compliance vs. non-compliance. One camp of argument confirms that there is an overall compliance of national treatment in IP (e.g. Yang, 2008; Yang &

[1] Based on the WIPO statistics, China has been no. 1 worldwide in ranking for resident patent applications since 2010 and no. 2 in non-resident patent applications since 2004; For trademarks, China ranks no. 1 for both resident and non-resident trademark applications from 2002. Meanwhile, the US has been no. 2 in resident patent applications since 2002, but no. 1 in non-resident patent applications since 2002; For trademarks, the US held no. 2

position for both applications and registrations from 2002 to 2014, but jumped to no. 1 for both in 2015 and 2016.

Sonmez, 2018; Gillespie et al., 2002). Such a compliance is particularly so in dealing with two uncertainties: pendency (i.e. length of time to secure a particular IP right) and granting (i.e. the uncertainties of being granted or not a patent and/or trademark). Regardless of applicants' origins, equal pendency complies between local and foreign owners (e.g. Kotabe, 1992; Popp, Juhl, & Johnson, 2004). Moreover, prior studies also recognize the positive discrimination, that is, foreign applicants endure less uncertainty than their domestic peers for pendency and granting (op cit; Gillespie et al., 2002) since they demonstrate clearer, more valuable applications with no significant differences. In a recent study, the findings on patent uncertainties also confirm that foreigners enjoy equal granting between the US and China, but foreigners are favored more for Chinese patent granting because all foreign applications show higher certainty than locals (Yang & Sonmez, 2018).

The opposite argument, however, emphasizes the non-compliance of NTIPU. Despite the government efforts to accelerate granting, evidence demonstrates inequality due to lower granting to foreign applicants for US patents (Kotabe, 1992), the EU and Japan (Webster et al., 2014; Harhoff & Wagner, 2009) and unequal pendency biased toward locals (Liegsalza & Wagner, 2013). Moreover, China seems to provide higher certainty of granting for domestic applicants than foreign applicants within equality (Yang, 2008), although new data analysis (2003–2014) refuted this assertion (Yang & Sonmez, 2018).

To sum up, given the above two camps of arguments in both theory and empirics, further testing is rationalized to clarify prior answers. Firstly, national treatment is a minimum standard for countries to comply with. Despite this obligation, countries have flexibility to introduce detailed policy in consideration of their national interests. Secondly, the co-existence of institutional convergence and divergence continues to rule, but the global tide of integration obligates policy makers to adjust their IP environments constantly to suit the economic wellbeing of their own country for technology and branded products. Thirdly, countries like the US and China are active in accepting patent and trademark applications from overseas. Therefore, discrimination toward locals would compromise the national objective of innovation. Finally, prior studies have not addressed our topical issues surrounding trademark uncertainties for the two top filing countries in recent years. Given the rationalization for further studies and discussions in this section, accordingly, we hypothesize that

H1. NTIPU is upheld, as a minimum standard.

H1a. Local and foreign applicants enjoy equal treatment of pendency.

H1b. Local and foreign applicants enjoy equal treatment of granting.

2.2. Changes of national treatment for IP uncertainties

The discrepancy of arguments in NTIPU above relates to the changing nature of institutions. Although the institutional theory emphasizes change as a process and cause (e.g. Oliver, 1997; Scott, 1995Townley, 2002; Scott, 1995), it also recognizes changes being progressive/regressive (Ayres, 1944; Bush, 1987; Veblen, 1942), in incremental (North, 1990) or revolutionary (Gersick, 1991) manner. To recognize institutional changes is to evidence the influence (Keohane & Martin, 1995), and to see the result of human actions affecting state behaviors (Keohane, 1989). In this process, state behaviors in the form of policy change and instrumental efficiency (or inefficiency) consequently affects the fundamental changes of society (Ayres, 1944; Bush, 1987). Moreover, state behaviors also respond to the demand of international institutions (Keohane & Martin, 1995) and technological changes (Bush, 1987). Therefore, policy efficiency leads to progressive institutional changes, but inefficient policy may result in regression.

National treatment in IP, as a global standard, has time evolvement to generate outcomes, as evidenced at the national, international and global levels (Yang & Sonmez, 2018). Countries attempt to improve their IP environment under the global tide causing changes of national IP environment. Meanwhile, countries depend on reciprocity of bilateral dialogue and actions to reach compliance causing institutional changes between countries (Scotchmer, 2004). The process also evolves obligatory adjustments to overcome frictions and conflicts across countries. It is a process to prevent future defection, as an iterative political process (Peters & Pierre, 1998). Such a changing process is transformative of political, economic and social conditions to allow a stable structure to have appropriate modifications over time (Op cit). These changes are incremental, cumulative (Veblen, 1942) and sometimes unnoticeable. Accordingly, we argue that national treatment is an external condition that countries are obliged or willing to accommodate, as a policy instrument; thereby leading to changes. The introduction of such a policy instrument imposes on a slow process of change in the country in the form of progress, regress or non-change with time.

In addition to the theoretical argument above, empirical evidence seems sparse to reflect on the changing nature of NTIPU. One recent exception was a comparative study between the US and China to address longitudinal changes of patent granting and delays (Yang & Sonmez, 2018). They find that both the US and China have demonstrated progress, regress and non-change in the past 30 years. As an evidence of progress, applicants for US patents and foreign applicants for Chinese patents all enjoy higher granting than before. Moreover, China demonstrates positive discrimination with time, that is, in 2003–2014, foreign applicants are favored more than local applicants, but it was the other way around in 1985–2002. As an evidence of regress, both countries demonstrate more delays than before in treating patent pendency. For example, applicants endure three and two years respectively in the US and China in 2003–2014, but they had only one year and zero year in 1985–2002. However, locals and foreigners evidence no change in granting for Chinese patents for the two periods. In addition, the authors have recognized some positive discrimination toward foreign applicants. For example, there is a trend that foreign applicants enjoy more certainty against pendency than their foreign peers, and more than before.

In summary, both theoretical and empirical evidence suggests the changing nature of national treatment in IP, but also implies the need to enrich the understudied topic and address voids. The theory of institutional change broadly explains the changing nature of the NTIPU in the form of progress, regress and non-change. However, studies need to take place to see details over time. Aligning with the theory, empirical studies were only conducted for patent uncertainties with no reflection on trademark uncertainty changes. To enrich this topical investigation, based on the above discussions, we hypothesize broadly below and allow the data to refine the result.

H2. Countries change in a mixed form toward the global compliance of NTIPU over time.

H2a. Countries change in a mixed form toward NTIPU in pendency.

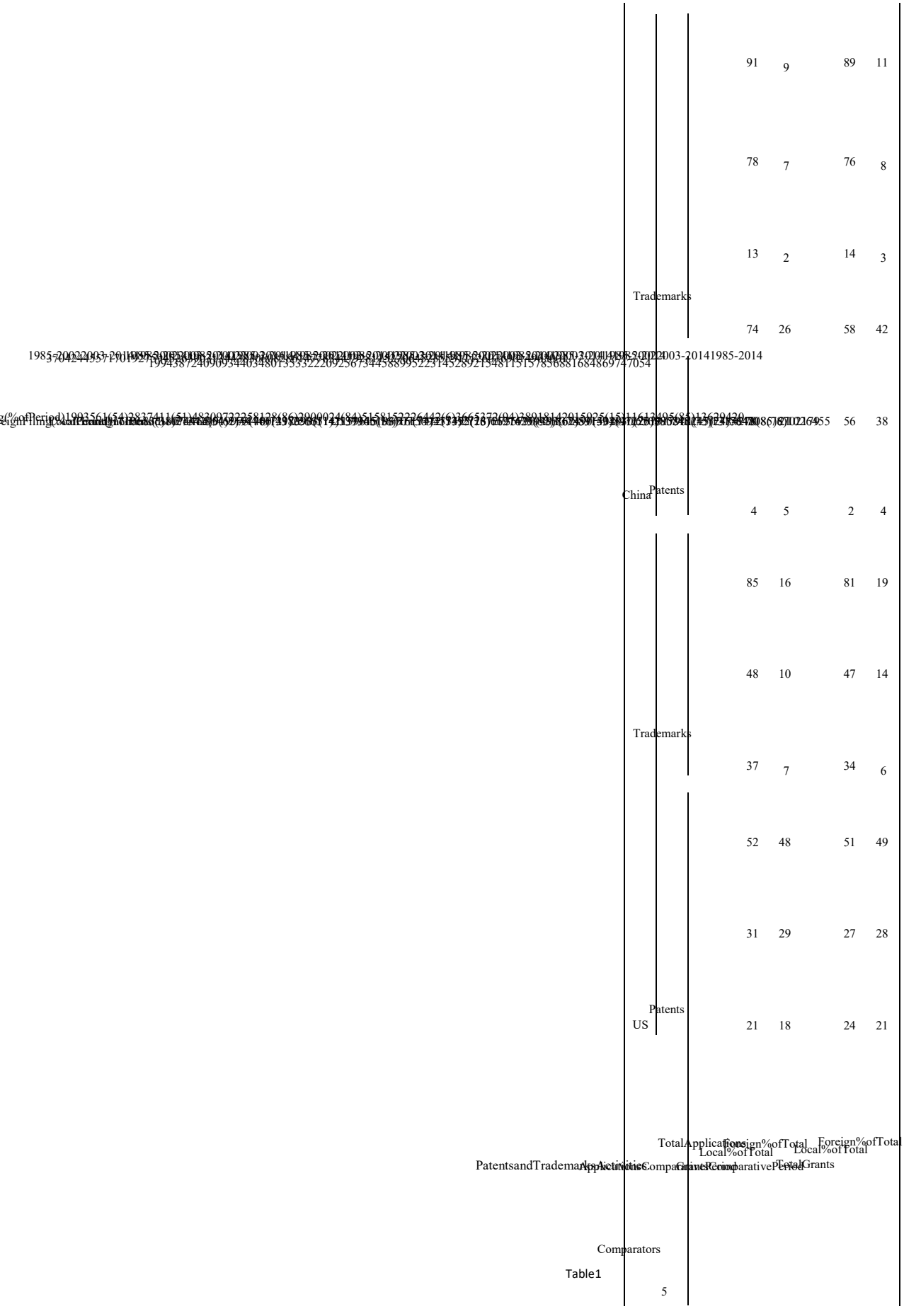
H2b. Countries change in a mixed form toward NTIPU in granting.

2.3. NTIPU between patents and trademarks

Relevant to the above two sections in theory and empirics, studies on IP puts great emphasis on patents, national treatment for trademark uncertainties (NTTU) was addressed little and let alone comparative studies of national treatment between the two distinctive IP rights. However, it is important to understand their similarities and differences from the perspective of national treatment for policy makers and practitioners since patents and trademarks are often embedded in products and services together. Historically, NTTU was an ideal rather than a reality. For example, national consumers should not contribute to foreign brand equity, foreign brand protection would undermine domestic industries (e.g. India in the 1970s–1980s, Hazarika, 1992; Japan in the 1960s) and intrude national cultures (Gillespie et al., 2002). These studies

were culturally insightful, but reflected little on how countries are obliged or willing to comply with national treatment in recent times.

Different from patents, sporadic studies on NTTU seem to have two sets of



findings. Regardless of country groups (i.e. developed, transitional, least developed and newly industrialized countries), one study found that NTTU was pro-foreign (Gillespie et al., 2002). The study also found that developed and transitional economies, to which the US and China respectively belong, do not discriminate in pendency. On the contrary, they found all the groups have reverse bias toward foreigners although the degree of such a behavior varies across the four groups. The results form a stark contrast to the historical treatment that we previously mentioned as well as the national treatment for patents. Specifically, for trademark uncertainties, differences are reflected in pendency across the world rather than granting behaviors. Such variations are probably due to the changing nature of trademark applications (e.g. transitional economy has a surge of 1780% in trademark applications; Gillespie et al., 2002). Positive discrimination is evidenced across all the groups studied to favor foreigners (op cit). They also affirm that longer pendency is expected for both local and foreign trademark owners.

Different from the above findings, Yang′s single-country study of China (2007) resulted in some consistency and disagreement. Focusing on several IP rights (patents, trademarks, utility models and industrial designs), the study affirms that foreign applicants enjoy more certainty than their domestic peers to have trademark registrations within the equal pendency (1983–2003). Differently, this study identifies no discrimination (positive or negative) in both pendency and granting for trademarks. As the first study to compare and contrast national treatment of patent and trademark uncertainties, the findings show that trademark applicants endure the longest pendency while patent owners the shortest in China. They also confirm that equal pendency is evidenced for both trademarks and patents between locals and foreigners. However, trademark applicants expect longer pendency than patent owners although locals and foreigners enjoy equality in pendency (two years) against trademark uncertainties. Meanwhile, prior work also argues that there are more grants in trademarks than patents due to the nature of the IP since more technicality is involved to examine patents than trademarks.

In short, studies on the compliance of NTIPU between patents and trademarks are sporadic warranting our desire to clarify, enrich and fill in a these data in the process of data cleaning, and inconsistency was sought through clarification with the above authorities.

Using this dataset, we generate new findings about national treatment and longitudinal changes, and prepare data for comparison to patent uncertainties. The longitudinal data is from 1985 to 2014 since China only had the patent data available from 1985[2]. We are able to use the raw dataset to generate spatial (China, US) and temporal (overall trend and periodical changes) results. Mentioning about the temporal results, we divide the data into two periods (1985–2002; 2003–2014) for comparative purpose. Such a split-data analysis is logical to examine the changes of NTIPU for three reasons: One is to follow the steps of prior studies that have used this divide (Yang & Sonmez, 2018) or have examined the patent and/or trademark activities until 2002/2003 (e.g. Harhoff et al 2013; Yang, 2007, 2008) to show a continuity of the study. Two is to add comparisons to previous studies using the consistent period of time. Three is the consideration of policy and practice since 2003 serves as a landmark year of policy changes in IP for both countries (Yang & Sonmez, 2018). Examples include China′s priority IP policy for international dialogues to enhance collaboration across countries and US′s policy to promote balanced development of IP and competition. Thus, the trademark studies in a longitudinal manner is timely to address how national treatment for trademark uncertainties have changed since 2003 before we compare the results with patent uncertainties.

For this study, we have focused on aggregated data to serve our purpose. Table 1 provides a characteristic description of the trademark and patent activities to allow understanding and comparison of the background information. Firstly, we study national treatment for three uncertainties: trademark uncertainties between local and foreign owners, longitudinal changes, and comparison between trademark and patent uncertainties. Therefore, aggregated data will help us achieve the purposes to generate holistic void. IPS is changing, from policy improvement, administrative efficiency to dispute resolution. Prior studies generated their findings based on the trademark data before or at the turn of the century, but significant changes in IPS have taken place across countries to obligate global integration. There is also a void to compare and contrast patents and trademarks in the US, which form two important but different IP rights. The only study of such a comparison was for one country based on pre-2002 data. Therefore, there is little reflection of changes and comparison in recent years. Rationalized accordingly and based on the existing findings, we hypothesize:

H3. NTIPU demonstrates varied compliance for patents and trademarks.

H3a. NTIPU demonstrates shorter pendency for patents than for trademarks.

H3b. NTIPU demonstrates lower granting for patents than for trademarks.

3. Method

3.1. Data and organization

We gathered the trademark and patent data (1985–2014) from the USPTO, Trademark Office of China (TOC), WIPO and OECD. Our results were therefore based on the analysis of millions of applications and grants (i.e. approximately 9/4.5 and 6/3.5 millions of patent/trademark applications and grants in the US; 5/1.5 and 15/10 millions in China. See Table 1). These datasets tend to be consistent and similar in terms of applications and registrations in total, and by local and foreign owners. Nonetheless, country data provide rich categories and information to help in-depth comparison and identify any country characteristics meanwhile WIPO and OECD statistics provide uniformity for cross-country data compilation and international dimension (e.g. country relative to the rest of the world). We compared and contrasted

findings. Secondly, our aim in this paper is to advance research in understanding IP administration and provides policy implications. The aggregated data analysis is sufficient to serve intention. Finally, we intend to advance prior studies by examining changes and comparison to patents in the areas of NTIPU. Such a data focus therefore will allow the consistency of multiple comparisons

3.2. Models

We use three models to address the objectives and hypotheses proposed and evaluate comparators. Model 1 is to conduct an analysis to address pendency and granting uncertainties between locals and foreigners resulting in responding hypothesis one and objective one. Prior scholars have adopted this model to conduct IP analysis to generate new findings on, for example, patent uncertainties in Japan, Germany and UK (Kotabe, 1992), in China and the US (Yang, 2008; Yang & Sonmez, 2018); IP uncertainties in China (i.e. patents, trademarks, utility models and industrial designs; Yang, 2007) and trademark activities in four groups – developed, developing least developing and newly industrialized countries (Gillespie et al., 2002). By adopting this model, we discover trademark pendency and grants in a particular year to the applications in lagged years (0, 1, 2, 3....) to allow multiple comparisons.

$$\gamma_t = \alpha_{t\,L-} + \beta_{t\,L-} X_{t\,L-} + \varepsilon_t \quad (1)$$

Here Y_t: the number of trademark/patent grants in year t; t: the year of filing a trademark/patent application; a: Constant

L: the number of years the trademark/patent grant lags behind the application;

B: Patent/trademark grant ratio or percentage of patent/trademark applications

$X_{t\text{-}L}$: the number of trademark/patent applications; and ε: the residual error term.

We use Models 2,3 to conduct cross-applicant, cross-time and crossIP analysis to find out similarities and differences of the findings. As a result, we respond hypotheses 2 and 3 and objectives 2 and 3. Using these two models, we are able to test the correlation coefficients (Bryant, 1966) and slope coefficients (Cohen & Cohen, 2002) of IP data using independent samples.

$$\eta = \frac{0.5\ln\frac{1+r_1}{1-r_1} - 0.5\ln\frac{1+r_2}{1-r_2}}{\sqrt{\frac{1}{n_1-3}+\frac{1}{n_2-3}}} \quad (2)$$

η: the test statistics based on the normal curve;

r: the correlation coefficient; n: the sample size; and

1 or 2: two independent samples.

$$t = \frac{\beta_{(tL-)1} - \beta_{(tL-)2}}{\sqrt{SE._{.2\beta tL(-)1} + SE._{.2\beta tL(-)2}}} \quad (3)$$

t: The year filing a trademark/patent.

$\beta_{(t\text{-}L)1}$ and $\beta_{(t\text{-}L)2}$: Two slope coefficients for local and foreign applications within each trademark/patent office or for applications in different eras.

S.E.: the standard error consistent with the slope coefficients under comparison.

2 It is worth noting that China's database for trademarks and patents starts in different years (i.e. 1982 for trademarks and 1985 for patents). For comparison purpose, we use 1985 as a starting point given the availability of patent data from 1985.

4.1. NTIPU between locals and foreigns (trademarks, 2003–2014)

We use the data evidence from trademarks (2003–2014) in Table 3 to support or refute hypotheses of NTIPU between locals and foreigns.

Table 2
Responses to the Hypotheses.

Hypotheses	Responses	Adjustment or Exposition
H_1: NTIPU is upheld, as a minimum standard		Overall, NTIPU is upheld with the exception of pendency for US trademarks
H_{1a}: Foreign applicants have equal or positive treatment of pendency relative to local applicants	X/V	Foreign applicants have shorter pendency for Chinese trademarks, but longer pendency for US trademarks
H_{1b}: Foreign applicants enjoy equal or positive. treatment in granting relative to local applicants	V	Foreign applicants have higher granting for Chinese trademarks; and locals and foreign applicants have equal grating for US trademarks
H_2: Countries change in a mixed form toward the NTIPU over time		Countries progress or remain unchanged toward the NTIPU over time
H_{2a}: Countries change in a mixed form toward NTIPU in pendency	V	China progresses toward NTIPU in reducing trademark pendency for locals & foreigns; The US remains unchanged toward NTIPU in reducing trademark pendency for locals and foreigns
H_{2b}: Countries change in a mixed form toward NTIPU in grants	V	China is largely unchanged for locals, but progresses for foreigns toward NTIPU in increasing trademark grants; The US progresses toward NTIPU in increasing trademark grants for both locals and foreigns
H_3. NTIPU demonstrates varied for patents and trademarks.		NTIPU demonstrates shorter pendency, but lower granting for patents than for trademarks
H_{3a}. NTIPU demonstrates shorter pendency for patents than for trademarks	V	Both the US and China demonstrate shorter pendency, but lower granting for patents than for trademarks for locals and foreigns
H_{3b}. NTIPU demonstrates lower granting for patents than for trademarks	V	

3.3. Analytical techniques

We adopt two analytical techniques to generate results: lagged regressions and cross-case comparative analysis. Lagged regression was used by prior research in IP to allow simultaneous measuring of variables and factors to establish foundations for comparative studies. Cross-case comparative analysis is also used by prior studies (e.g. Yang, 2007; Gillespie et al., 2002; Yang & Sonmez, 2018) to assess national treatment in IP and add depths to robust results (Yin, 2003). Using multiple comparators, we are able to examine similarities and differences of national treatment for trademark uncertainties between local and foreign applicants, between temporal periods, and between trademarks and patents. Comparisons help generate insightful outcomes that are hard to detect and detail in non-comparative studies. These authors have published in leading journals demonstrating the effectiveness of these two analytical techniques to generate findings. We combine these two analytical methods to complement the analysis, and avoid monmethod biases.

4. Results

Table 2 summarizes the response to all the hypotheses and we discuss these findings with data evidence. As a result, we address the first objective and relevant hypotheses on trademark data in 2003–2014 to fill in the gap of prior studies. The second objective is to address the longitudinal findings between 1985–2002 and 2003–2014 to recognize the changes. Finally, we address objective three examining the whole dataset (1985–2014) to address consistency and incongruences of findings between patents and trademarks.

Table 3
NTIPU between Locals and Foreigners.(2003–2014).

Lagged Year	US Trademarks		Chinese Trademarks	
	Locals	Foreigners	Locals	Foreigners
0-year lag				
ß	0.79***	0.61*	0.65***	0.82*
R_2	71%	35%	69%	42%

1-year lag				
ß	1.31**	1.35**	0.66***	1.20***
R_2	59%	58%	76%	79%
2-year lag				
ß	1.59**	1.69**	0.70***	1.39***
R_2	57%	59%	85.29%	91%
3-year lag				
ß	1.81**	2.03**	0.68***	1.32***
R_2	60%	67%	85.42%	76%
4-year lag				
ß	1.99**	2.04**	0.60***	1.11**
R_2	65%	63%	79%	56%
5-year lag				
ß	1.85**	1.97**	0.35***	0.80**
R_2	53%	58%	74%	58%

Notes: Dark and light grey shades highlight the best and fit models respectively.
*** $p < 0.001$.
** $p < 0.01$.
* $p < 0.1$.

The findings demonstrate an overall support of hypothesis one: NTIPU is upheld, as a minimum standard, but with the exception of pendency for US trademarks. Specifically, we only partially support H_{1a}: Foreign applicants have equal or positive treatment of pendency relative to local applicants. This is because foreign applicants show shorter pendency for Chinese trademarks, but longer pendency for US trademarks. For China, locals can expect the highest probability of granting in the third year (85.42%) in comparison to the foreigns in the second year with a higher probability (91%). The results suggest that foreign applicants enjoy positive discrimination and that their trademarks are approved more quickly than their local peers for three other reasons. Firstly, their fit models are two, one and three years in comparison to locals′ three, two and one years. Secondly, foreign owners have overall consistently higher probability than their local peers for the fit models (except year three). Thirdly, duration probability shows more concentration for foreigns than for locals. For example, there is a clear difference between the fit models (79%, 91% and 76%) and other models (42% 56% and 58%) for foreign owners. In contrast, locals′ fit models and other models are less divided (76%, 85.3, 85.4 vs. 69, 79, 74). These suggest the sheer volume of local applications all year round and the need for quality variations meanwhile foreign applications are relatively smaller and registrations tend to take place for foreign business expansion purposes, thereby a good quality indication.

For US trademarks, locals enjoy shorter pendency than their foreign peers. Three facts evidence the justification. Firstly, the best models are three-year different. Locals expect a zero-year pendency (71%), but foreigns can only expect 35% of the chance for the same year (not a fit model); most should expect three years (67%). Secondly, the three fit models also show differences for the two groups. Locals have higher fit models of zero, four and three years (71%, 65% and 60%) than foreigns with three, four and two years (67%, 63% and 59%). Thirdly, the equality tests prove significantly different suggesting inequality in pendency.

Different from the mixed answer for H_{1a}, we have a full support to H_{1b}: Foreign applicants enjoy equal or positive treatment in granting relative to local applicants. For Chinese trademarks, the fit models demonstrate large gaps between locals and foreigns (0.66 vs 1.20, 0.70 vs. 1.39 and 0.68 vs. 1.32). Moreover, the equality tests show significant differences consistently for all the models. These evidences suggest that there is a positive discrimination toward foreign applicants in granting Chinese trademarks. We argue that such favoritism is also partly due to the inherent advantage that foreign owners enjoy since they are largely from major developed countries.

Meanwhile, we confirm consistent equality for US trademarks because all the models in Table 3 show small gaps in their slope coefficients between the two groups of applicants. The equality tests evidence no significance across all the models. We also observe that for both groups, with time, there is an increased granting from zero to four years (0.79 to 1.99 for locals, and 0.61 to 2.04 for foreigners) suggesting the government effort to treat granting intensively to clear the backlogs with time pressure

4.2. Changing nature of the NTIPU (trademarks, 1985–2002 vs. 2003–2014) vs. 2003–2014)

Table 4 shows the longitudinal data and equality tests about trademarks in both countries for the two comparative periods. We support the broad hypothesis, but refine it that countries progress or remain unchanged toward the NTIPU over time. Relevant to this argument, Countries progress or remain unchanged toward NTIPU in reducing pendency (supporting H_{2a}). Specifically, China progresses toward NTIPU in reducing trademark pendency for locals and foreigns over

Table 4
Longitudinal Comparison of IP Uncertainties.

Model	Pendency	US TRADEMARKS			CHINA TRADEMARKS		
		1985-2002	2003-2014	Equality	1985-2002	2003-2014	Equality
0	Locals	65	71	/	67	69	/
1		64	59	/	63	76	**
2		66	57	/	51	85.3	***
3		70	60	/	50	85.4	***
					60	79	***
					91	74	***
0	Foreigns	59	35	/	72	43	***
1		60	58	/	61	80	***
2		55	59	/	50	91	***
3		55	67	/	45	76	***
4		57	63	/	43	56	/
					53	58	/
	Granting						
0	Locals	0.32	0.79	**	0.61	0.65	/
1		0..31	1.31	**	0.56	0.66	/
2		0.34	1.59	**	0.46	0.7	/
3		0.36	1.81	**	0.43	0..68	*
4		0.37	1.99	**	0.47	0.6	/
5		0.369	1.85	**	0.58	0.35	*
0	Foreigns	0.29	0.61	/	0.75	0.82	/
1		0.25	1.35	**	0.69	1.2	*
2		0.27	1.61	**	0..62	1.39	***
3		0.28	2.03	**	0.59	1.32	*

4	0.3	2.04	**	0.57	1.11	/
5	0.31	1.97	**	0.63	0.796	/

time. For locals, the best fit model shows three-year pendency in 2003–2014 in comparison to five-year pendency. Moreover, all the models in 2003–2014 demonstrates higher certainty for pendency than 1985–2002 except non-change in zero year (which is not a fit model). Differently, foreign owners overall endure less pendency than before due to overall consistent probability. Meanwhile, the US remains unchanged toward NTIPU in reducing trademark pendency. The equality tests for the trademark data between 1985–2002 and 2003–2014 are consistent that no significance is demonstrated; thereby no changes for both groups of applicants.

We also find that countries progress or remain unchanged toward NTIPU in increasing grants (supporting H_{2b}). China is largely unchanged for locals, but demonstrates progress for foreign applicants toward NTIPU in increasing trademark grants in 2003–2014. Therefore, the overall consistency suggests the progressive or non-changing nature in increasing trademark granting for both groups. Meanwhile, the US shows progress toward NTIPU in increasing trademark grants. All the models in 2003–2014 show higher granting than in 1985–2002 period. In addition to this consistency for locals and foreigns, the equality tests show significance at least at the $P < 0.01$ levels although there is no indication of change for zero-year foreigns only.

4.3. NTIPU between patents and trademarks (1985–2014)

This section focuses on the comparators between trademarks and patents to find out how NTIPU fares between the two key IPs as a whole in the past 30 years (1985–2014). Table 5 displays the analytics in summary surrounding which we conclude that NTIPU demonstrates shorter pendency, but lower granting for patents than for trademarks. We support H_3: NTIPU demonstrates shorter pendency for patents than for trademarks. The empirical results are consistent for both the US and China. As shown in Table 5, the locals and foreigns obtain their patents much faster than their trademarks and the certainty is much higher. For China, the locals can be granted within one year (99% of the probability), but their trademarks within two years (89% of the probability). The same result applies to foreign owners for Chinese IP. Foreign patents have even a shorter pendency of zero year with 93% of the probability to compare foreign trademarks with a pendency of one year at 86% of the probability. Such a consistency is further enhanced to support our hypothesis because all the fit models show much higher probability for patents than for trademarks.

The same consistency applies for the US. The results indicate consistently, the locals and foreigns in the US had the highest probability of zero-year pendency followed by one-year and two-year lags for patents in the past 30 years. This consistency was not there for trademark owners′ pendency because local and foreign applicants had the best model for five- and one-year lags respectively. Moreover, all the fit models demonstrate higher certainty of pendency for patents than for trademarks.

Our findings also support H_{3b}: NTIPU demonstrates lower granting for patents than for trademarks. The findings confirm consistency that there is much higher granting in trademarks than in patent in both countries. In China, among the four groups (local patents, foreign patents, local trademarks and foreign trademarks), the grants are in ascending order. Take the first year for example, these four groups′ slope coefficients are 0.20, 0.53, 0.57 and o.79. The same applies for the US, there is much higher granting in trademarks than in patents. Among the four groups (local patents, foreign patents, local trademarks and foreign trademarks), the grants are in ascending order. Take the zero-year as an example, these four groups have slope coefficients of 0.36, 0.41, 0.51 and 0.88.

5. Discussion

5.1. Contributions in comparison to prior research

Our findings make theoretical contribution to explain national treatment from the perspective of IP uncertainties. National treatment, as a global principle, has received sporadic scholarly attention in the area of IP. Prior studies assert that the global principle of national treatment against trademark uncertainties is compiled since countries are either equal or positively discriminative for foreign owners (Gillespie et al., 2002; Yang, 2007). Meanwhile, against patent uncertainties, the argument is between compliance (Yang, 2008; Yang & Sonmez, 2018) and non-compliance (e.g. Kotabe, 1992; Webster et al., 2014). We take prior studies further to explain national treatment in IP as agreements and disagreements, as a changing phenomenon and as two distinctive rights between patents and trademarks.

We contribute to three aspects of the institutional theory with new explanations. Firstly, we enrich the central argument of institutional universalism (e.g. Eden, 2010; Ruggie, 1992; Yang & Sonmez, 2013). Based on the institutional universalism, we argue that all countries should treat locals and foreigners equally when dealing with IP uncertainties. We affirm the expectation because equality overall applies against IP uncertainties (i.e. equality or positive discrimination in handling pendency and granting in both countries). Secondly, we make novel contributions to the studies on trademark uncertainties based on the theoretical argument of institutional change. The theory of institutional change argues that the policy (in)efficiency influences country environments in time leading to progress, regress, or no change, but such changes are often treated as a cause and process (e.g. Bush, 1987; Oliver, 1992), rather than an outcome. Therefore, we contribute to assess the outcome of 30 years of institutional efforts in national treatment. This study therefore enriches the barely studied area of IP uncertainty applying the theory of institutional change (Yang & Sonmez, 2018).

Our third theoretical contribution is reflected in filling a void of NTIPU from the perspective of comparison between trademarks and patents. Global compliance of national treatment in IP has attracted scholarly attention, but existing focus leaned over patent studies (e.g. Kotabe, 1992; Webster et al., 2014; Yang, 2008). Sporadic studies have also noticed the significance of trademark uncertainties and the need for global compliance (e.g. Gillespie et al., 2002; Yang, 2007).

Table 5
NTIPU between Patents and Trademarks.(1985–2014).

`	US Patents		US Trademarks		Chinese Patents		Chinese Trademarks	
	Locals	Foreigners	Locals	Foreigners	Locals	Foreigners	Locals	Foreigners
0-year lag ß	0.36***	0.41***	0.51***	0.8843***	0.22***	0.56***	0.64***	0.82***
R_2	86%	89%	82.77%	75.04%	97%	93%	85%	78.62%
1-year lag ß								
	0.36***	0.39***	0.51***	0.89***	0.20***	0.53***	0.57***	0.7908***
R_2	84%	87%	79%	75.29%	99%	92%	86%	85.67%
2-year lag ß								
	0.35***	0.37***	0.52***	0.888***	0.17***	0.49***	0.5405***	0.7653***
R_2	82%	86%	80.11%	74.67%	99%	90%	89%	85.4%
3-year lag ß								
	0.36***	0.35***	0.53***	0.8865***	0.13***	0.43***	0.4845***	0.6990***
R_2	80%	84%	82.09%	74.78	99%	88%	85.56%	77.17%
4-year lag ß								
	0.37***	0.34***	0.54***	0.8361***	0.09***	0.39***	0.4069***	0.6038***
R_2	79%	81%	83%	74.02	99%	83%	78.65%	66.15%
5-year lag ß								
	0.37***	0.33***	0.54***	0.7888***	0.07***	0.34***	0.2485***	0.4547***
R_2	78%	79%	84%	73.5%	97%	77%	81.12%	74.59%

Notes: Dark and light grey highlight the best and fit models respectively. *** $p < 0.001$.

Nonetheless, no studies have examined both IP rights simultaneously to draw a holistic conclusion and examine their differences. Our study therefore contributes to explain the relationship between global compliance and IP as a whole, its changing nature and comparison. After all, both patents and trademarks represent the pillar of industrial advancement due to their distinct roles representing technological advancement and brand reputation.

We also make empirical contributions in three areas. Firstly, we extend prior studies on the global compliance of national treatment against IP uncertainties (e.g. Kotabe, 1992; Webster et al., 2014) by studying the two largest IP countries. We are able to add clarity to the existing mixed argument as to whether global compliance of national treatment is upheld. We affirm that such mixed results were in the detail of the degree of uncertainty. Secondly, we also affirm that foreign owners play a significant role in these two countries for both patents and trademarks. Both countries demonstrate dynamic IP activities, but foreign owners′ role increases with time. Finally, our study fills in an empirical void to address the temporal nature of national treatment against IP uncertainties. As a result, this paper appears to venture first in examining the progress or regress of global compliance in NTIPU for trademarks.

We add two methodological contributions. Firstly, we use two methods to generate conclusions. We combine statistical modelling, and comparative studies to analyze the data. The lagged regression modeling is based on millions of trademark and patent applications and granting to examine pendency and granting uncertainties. Meanwhile, multiple comparative studies (e.g. owners, different timelines, IP types) focus on word display and analytical detail to identify similar and different behaviors in dealing with IP uncertainties. Therefore, these two methods complement each other to overcome methodological weaknesses (e.g. mono-method bias; partiality). Secondly, we conduct longitudinal studies to reveal comparative changes in treating IP uncertainties. Existing studies of NTIPU were mostly implemented based on the pre-2002 data. Our study has used the most recent data to reflect on changing IP environments.

5.2. Implications for policy makers and practitioners

The findings provide implications for policy makers and practitioners. Firstly, local and foreign owners of patents and trademarks tend to be treated equally or positively discriminated, overall, as we can see in China and the US. Such an equality can be encouraging for owners to consider expanding overseas. After all, in both countries, foreigners may not be able to compete with local owners in terms of the quantity of trademark registration. However, they do lodge high quality famous brands overseas. This does not mean that foreign trademark registration is not hard work. On the contrary, expected delay can happen due to longer pendency than before in both countries for foreign applicants. However, such a delay may vary since granting shows a wide gap of one to four years for foreign owners in the US, for example. This means that companies should take account of such a delay when they plan market entry into the countries.

Secondly, both policy makers and practitioners have to see IP administration as a changing rather than static environment. The findings confirm the reality of overall dynamic changes in both progressive and unchanged forms. The changing nature allows IP policy makers to see the achievements and need for constant improvements, and practitioners to adjust their IP activities. Thus, being prepared to adapt such changes can help practitioners to succeed strategically overseas.

Thirdly, our findings provide a comparative understanding about patents and trademarks to serve policy makers and IP owners since these two tend to come hand in hand in industrial operations. It is necessary to differentiate these two in terms of NTIPU so that they can serve their distinct purposes (technology and brand name) effectively for owners. Recognizing similarities in NTIPU is equally important since patents and trademarks tend to be embedded in products and services together.

The findings provide implications for policy makers from the perspective of IP systems and bilateral cooperation. Firstly, national policy efficiency impacts directly on international activities since both countries lodge large portions of foreign IP. The low efficiency of IP granting will result in foreign investors having a second thought in their business commitment abroad. Without discrimination, countries align globally and take action to introduce standards; thereby encouraging diverse IP owners to invest in a foreign country.

Secondly, the overall compliance in both nations toward local and foreign IP owners help bilateral collaboration, but the degree of uncertainty within

equality will continue to create special cases and actions needed for negotiations. Therefore, both countries have to continue their efforts to challenge themselves and to resolve differences for effective bilateral collaboration. The findings therefore provide broad directions to resolve differences in handling NTIPU. A balanced approach of local and foreign equality in handling IP uncertainties encourage dynamic activities at home and from abroad.

Thirdly, the results also provide implications for policy makers to see differences with other countries. The results based on different comparators, including between trademarks and patents help policy makers see the strengths and weaknesses of their own environments; thereby directions for future improvement. The gaps between national treatment and global standard also allow policy makers to understand the role that the country plays relative to others. The improvement is vital since no country wants to have tension in bilateral collaboration. Understanding these variations allow effective dialogues between IP offices to enhance cooperation.

5.3. Limitations and future research

The limitation of this paper warrants future research. Theoretically, we foresee two directions. One is to conduct studies to apply the explanatory power of national treatment principle and institutional theory to IP uncertainties. After all, our study has only emphasized the aggregated data results, but we should also consider other institutional factors that have been identified in prior research (e.g. applicants′ experience, culture familiarity, and languages, Yang, 2005). Future studies may consider such enrichment with detailed explanation of these factors against IP uncertainties. The other theoretical direction is to examine the impact of IP uncertainties on FDI applying the absorptive capacity theory (Cohen & Levinthal, 1990; Todorova & Durisin, 2007). Despite the internal and external knowledge stocks, firms′ ability to recognize, acquire, assimilate, and realize them to commercial ends forms the fundamental to performance (e.g. mergers and acquisitions, Greenfields). For example, absorptive capacity from FDI plays a significant role in technological progress for Spanish manufacturing firms (Sánchez-Sellero, Rosell-Martínez, & García-Vázquez, 2014). Reverse knowledge acquisition by leading MNEs in emerging economies has also attracted significant attention (e.g. Fu, Sun, & Ghauri, 2018). Firms have achieved global expansion and operations through adopting relevant IP strategies (Li, Yang, Yu, & Wu, 2015). Nonetheless, curiosities on the nuances remain as to how firms deal with the key knowledge stocks of IP, especially its uncertainties to enhance FDI.

Empirically, two-nation study puts constraints in theoretical generalization and requires enrichment of more studies on patents and trademarks, and longitudinal findings. Although we are able to address significant consistency in our findings, we are also aware of the distinctive nature of individual countries. That is, countries continue to rule their own IP systems, inevitable inconsistency in IP uncertainties are bound due to institutional differences. Such differences are particularly profound for the US and China since these two countries represent the cultural extremes of informal institutions. This reality therefore calls for the need to widen the empirical verification, including renewed studies of developed countries and new studies of developing nations to reflect changes.

The other empirical dearth for our study to fill is IP uncertainties by industries. Our study focuses on using aggregate data for multiple comparison, which means that we have not considered different types of owners. Such fine-tuned evaluations can help identify the variations of IP uncertainties by different industrial owners, such as owners of large-, medium- and small-sized enterprises., the traditional industries where few IPs are embedded in a product or service, and the complex industries where multiple IPs are, such as software.

Methodologically, we have also two considerations. Future effort should be made to detail error terms. Our study demonstrates that the trademark and patent systems in both countries are efficient because our models have explained 75%–99% (min-max) of the variations respectively. However, due to the model restriction, we are yet to explain the error terms that consist up to 25% of the explaining power for the US and China. This clarification is significant in the future to understand the IPS (in) efficiency on IP uncertainties and help bilateral collaborative effort. The other direction is to use panel data for analysis. Although we have used the lagged econometric modeling method, applying panel data models will serve two purposes of the study: validating existing findings and help the generalizability of our argument. 6. Conclusion

This paper centers on the global compliance of IP to address three objectives: 1) Whether or not there is a global compliance with national treatment against IP uncertainties (NTIPU); 2) The changing nature of NTIPU in the past 30 years; 3) how NTIPU compares and contrasts between trademarks and patents. Based on the theories (national treatment principle, institutional theory), empirics (e.g. US and China; locals and foreigns; temporal terms), and the practice and our logic, we conduct lagged regression modeling, longitudinal analysis and comparative studies to generate findings.

We evidence an overall positive answer to objective one, that is, there is a global compliance with NTIPU in the two countries studied. China has demonstrated positive discrimination for foreign applicants when it comes to resolving trademark pendency and granting. Meanwhile, the US has also shown a clear equal granting for trademarks although locals enjoy shorter pendency than their foreign peers. Therefore, we can conclude that NTIPU is overall upheld (due to positive discrimination or equality) except the unequal pendency for US trademarks.

In responding objective two, we also evidence the changing nature of NTIPU in the past 30 years toward a positive direction because consistent progress or non-change are observed. We find China demonstrates progress in pendency for both local and foreign groups, and largely unchanged in granting for locals and progress for foreigns in 2003−2014 than in 1985−2002. Meanwhile, for US trademarks, there is no change in pendency, but progress for granting. These mean that despite the backlogs of trademark applications, locals and foreigns in both countries can expect shorter waiting time than before (China) or the same waiting time as before (US). These also mean that locals in the US and foreigns in both countries can expect higher chance of granting than before, but the same chance as before for local applications in China due to the tremendous surge of Chinese trademark applications.

We find consistent evidence in our data analysis to respond objective three. That is, NTIPU demonstrates much shorter pendency for patents than for trademarks in both countries despite the high technicalities of patent examination. We′d argue that such a short pendency reflects the efficiency of patent administration and the dynamic innovative environment in both countries for technological advancement. We also find consistency that NTIPU shows much lower granting for patents than for trademarks in both countries. We argue that such results are related to the different nature of patents and trademarks since the latter is less technical and may be processed in larger volumes than the former.

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