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Analyzing the reliability of Chinese outward FDI studies: a replication approach

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Abstract

Purpose – Many academic studies in international business empirically test the determinants of Chinese outward (O)FDI. A weakness with these studies is the limited critical evaluation given to the way in which Chinese OFDI data is collected and used. Chinese multinational enterprises (C)MNEs frequently establish special purpose entities in tax havens to transit FDI via intermediary jurisdictions. The purpose of this paper is to develop an alternative approach for measuring CMNE OFDI and subsequently explore how the results of previous studies may have been confounded use of tax havens by MNEs. The authors address the latter question by replicating widely cited quantitative studies.

Design/methodology/approach – Replication approach.

Findings – Through the replication of several studies, this paper finds high levels of discrepancies in general sign and significance between global ultimate ownership modeling results and those using officially recorded FDI data. More specifically, the main areas impacted by using official data rather than data which accounts for the use of tax havens are cultural proximity, geographic distance and natural resource seeking.

Practical implications – This paper looks at studies, which use official FDI data to understand CMNE behavior. It is important to note, however, that there are many hundreds, if not thousands, of studies that use other national-level FDI data to draw similar types of inferences about MNE activity. In this sense, the authors' critical evaluation of CMNE work holds a much broader and, arguably, more important question: How reliable, in general, are studies, which use officially recorded FDI data? The results from this paper have already caused reflection on the impact of tax haven use on official FDI collection organizations, such as the OECD.

Social implications – The social implications of companies using tax havens to route FDI is immense. The use of tax havens not only aids in tax minimization for companies, but also obscures the true providence and identity of companies. This is problematic in a society, which increasingly desires to understand where, how and by whom a product or service was created prior to consumption.

Originality/value – This paper argues that the tendency for Chinese MNEs to establish offshore holding companies in tax havens has given rise to significant biases in official FDI statistics. Through the use of global ultimate ownership data, the authors have put forward an alternate approach to measure genuine CMNEs' OFDI activity, one which confronts and deals with their pervasive engagement with tax havens. Through the replication of several Chinese OFDI location choice studies, it was possible to understand how

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methodological issues stemming from the use of official FDI data may influence prior econometric results. In doing so, the authors hope to have sparked a debate which may lead to a re-evaluation of earlier received wisdom regarding Chinese MNE investment strategy and behaviors. This in turn should foster improved theorizing regarding the Chinese MNE and its outward investment activities.

Keywords Outward foreign direct investment, Location choice, Chinese MNEs, Special purpose entities, Tax havens, Replication methodology

Paper type Research paper

Introduction

Chinese multinational enterprises (CMNEs) are growing in importance on the international stage as outward foreign direct investors (UNCTAD, 2017). This has precipitated a rapid increase in the research on CMNEs. To date, dozens of academic studies on the strategies and behaviors of Chinese outward (O)FDI have been published in respected journals (Alon *et al.*, 2018). Topical research themes that have emerged include debate over whether conventional models of the MNE, developed predominantly on the Western now developed market experience, are applicable to CMNEs (Child and Rodrigues, 2005; Hertenstein *et al.*, 2015; Luo and Tung, 2007; Mathews, 2006; Sutherland *et al.*, 2017; Sutherland *et al.*, 2020). As a result, a large body of influential empirical work has been undertaken. Many of these studies use statistical methods and comparatively large data sets to explore these new conceptual issues. Officially published foreign direct investment (FDI) data, in particular, is the commonly used data source in the empirical testing of CMNE (O)FDI strategy and behavior. To make sense of Chinese OFDI data, however, appreciation of the specific institutional context from which CMNEs have emerged and the strategies and behaviors this has fostered is required. In particular, for many years, Chinese businesses faced strong incentives to move their activities offshore, so as to recreate themselves as foreign MNEs. Domestic subsidiaries in China would be owned by a foreign holding company – effectively making them foreign-invested enterprises. They did this to avail lower corporate tax rates offered to attract the inward FDI of foreign MNEs, as well as to benefit from superior offshore institutions, such as international capital markets and strong legal institutions (Buckley *et al.*, 2015). As a result, a considerable share of officially recorded Chinese OFDI shows investments to tax havens to be significant. The investment in these jurisdictions, however, only captures capital injections to offshore special purpose entities (SPEs), such as investment holding companies. It cannot be thought of as "real" investments in any meaningful sense. More worryingly, further genuine investments undertaken from these offshore shell companies are typically not recorded in official FDI data - which only accounts for the initial country of investment - as it is collected only on a bilateral basis. Official FDI data, as a result, suffers from a number of geographical and volume biases (Sutherland and Anderson, 2015). These data issues have led to potentially misguided findings and conclusions regarding the activities and strategies of CMNEs, in turn misleading CMNE-related theorization.

The purpose of this paper is twofold. Past studies in international business tend to underestimate, or otherwise ignore, the complexities of measuring CMNE cross-border investment activities. Without an appreciation for the context from which CMNEs emerge, it is difficult to meaningfully test whether CMNEs conform, or not, to extant theories. Our first objective, therefore, is to propose a contextually appropriate methodological approach for empirically testing the determinants of Chinese OFDI. We do so by outlining an alternative methodology for measuring CMNE activity that does not rely upon official Chinese FDI data. Second, we seek to understand how the extensive use of official FDI data may have led

to erroneous conclusions regarding CMNE strategy and international expansion. To achieve these goals, we replicate four empirical studies on CMNE OFDI but do so using firm-level data sources which overcome some of the problems inherent in the use of official data.

By way of conclusion, we argue, owing to the idiosyncratic investment strategies of CMNEs, many influential empirical studies on CMNE OFDI suffer from serious methodological shortcomings related to their injudicious use of FDI data. Specifically, we find that the impacts of cultural proximity, geographic distance and natural resource endowment all act differently to that currently supposed. At a conceptual level, we question the basis on which past studies have advanced new conceptual understandings of CMNEs. In doing so, we highlight the serious challenges involved in measuring MNE activity in an era characterized by the prominent use of shell companies established in tax havens for the structuring of FDI (OECD, 2015).

Literature review

Issues measuring genuine FDI activity

FDI takes place across geographically dispersed locations via myriad of different investment structures including shell or dummy companies, or what Beugelsdijk *et al.* (2010) refer to as offshore SPEs. SPEs are "firms that have no economic activity except for a part-time accountant or lawyer" (Contractor, 2016, p. 10). SPEs have been used since the 1970s for purposes such as accessing capital at favorable interest rates and diversifying financial risk (Soroosh and Ciesielski, 2004). SPEs have more recently been used by companies such as the now defunct Enron to, "minimize financial-statement losses and volatility, accelerate profits, and avoid adding debt to its balance sheet" (Schwarcz, 2006, p. 1309). The OECD states that

> [. . .] the role of these SPEs is merely to serve as a financial turn table for enterprises in other countries[. . .][and] hardly affect domestic economic activity and do not reflect genuine investment activities in or of the reporting country itself (OECD, 2008, p. 186).

While the difficulty of measuring genuine FDI activity has been highlighted in past studies (Beugelsdijk *et al.*, 2010), compilers of FDI statistics such as the World Bank, OECD and International Monetary Fund (IMF) generally still report only the first destination of foreign investment. This is to say, FDI is generally recorded on an immediate bilateral basis. This is because FDI data was originally compiled for calculating capital account balance of payments positions (IMF, 1993). The global ultimate ownership (GUO) of investments, therefore, was not taken into account. GUO data, however, is more appropriate when trying to understand genuine MNE activity. This is because it accounts for the use of tax havens by crediting the ultimate owners of the investment in the final host destination. In this way, offshore intermediate host destinations used chiefly as transition points for capital transfer are disregarded. Because of the pervasive use of tax havens and SPEs, official data may introduce significant biases into location choice econometric modeling results (Jones and Temouri, 2016). Recent estimates indicate a significant amount of global FDI stocks reside in OECD-recognized tax havens and offshore financial centers (Haberly and Wójcik, 2015a; UNCTAD, 2015). Contractor (2016), for example, "conservatively estimate that 30-40% of all FDI affiliates worldwide in the UNCTAD World Development Reports or World Bank databases are shell companies" (p. 12). Others estimate "approximately 30–50% of global FDI is accounted for by networks of offshore shell companies created by corporations and individuals for tax and other purposes" (Haberly and Wójcik, 2015a, p. 251).Contractor (2016) continues to argue that Chinese MNEs account for the most serious FDI distortions of any major economy. This is not to say, however, that other nations do not suffer from similar FDI distortions. Of all the FDI into The Netherlands, for example, 80% are routed

through a shell company (UNCTAD, 2015). American companies are reported to have between $2 and $3tn stored in shell companies located in tax havens across the world for the purpose of, for example, future international expansion (i.e. genuine FDI) (Contractor, 2016). Other large emerging markets are also impacted by the use of shell companies and tax havens. India, for example, receives nearly one-third of its FDI from Mauritius, much of which is originally OFDI from Indian MNEs (Contractor, 2016; UNCTAD, 2015).

The lack of astute attention to the impact of FDI routed through tax havens in Chinese OFDI location choice studies is puzzling as CMNEs have followed more extreme paths than most MNEs in their use of havens (Sutherland and Anderson, 2015). Since the early 2000s, China's Ministry of Commerce (MOFCOM) has aligned its FDI statistical reporting with internationally established balance-of-payment guidelines, such as those from the OECD, IMF and World Bank (Cheng and Ma, 2007). Tax havens have unfailingly figured prominently as major recipients of China's officially compiled OFDI.

The two main roles tax havens play for CMNEs are "round-tripping" and "onward-journeying" FDI. Round-tripping takes place when a CMNE invests in a tax haven only to immediately route the FDI back to China (Tseng and Zebregs, 2002). This is a common tactic used by CMNEs wishing to be treated as a foreign-invested company in China to secure tax breaks, subsidized land or other perks given only to non-domestic firms (Hong and Sun, 2006). While incentives for round-tripping have been reduced in recent years, official data is still severely confounded by this trend.

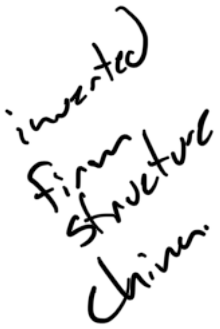
Onward-journeying takes place when firms use tax havens as conduits for investment in third countries (Clegg and Voss, 2011; Sutherland and Ning, 2011). This is also referred to as capital in transit (OECD, 2015). According to officially recorded FDI statistics, the investment from China to the tax haven is recorded as genuine FDI. However, "Investments made via SPEs to third countries. . .are not recorded at all in official Chinese OFDI data (following current OECD guidelines)" (Sutherland and Anderson, 2015, p. 5). The triad of Hong Kong, British Virgin Islands and Cayman Islands are the most prominent tax haven destinations for both round tripping and onward journeying Chinese OFDI (Haberly and Wójcik, 2015a; Sutherland *et al.*, 2019; Sutherland and Anderson, 2015; Vlcek, 2010).

The active routing of FDI through tax havens for round-tripping and onward journeying is highly problematic to understanding CMNE activities. UNCTAD, for example, recently reported that nearly half of all foreign invested subsidiaries worldwide are Chinese (434,248 out of a total of 892,114). If counting only genuine, value-added FDI, this is highly improbable (Contractor, 2016). The country-specific statistics on Chinese OFDI bore out the significance of tax haven use. Between 2003 and 2017, on average, around 73% of officially recorded OFDI flows from China were destined for tax havens (MOFCOM, 2018, 2006). If FDI from China to tax havens and offshore financial centers (hereafter THOFC) is disregarded, studies will be estimating results based on a very small subsample of observations which may not be representative of actual CMNE FDI behavior. Some studies do, however, use this approach (i.e. Kolstad and Wiig, 2012). If FDI from China to THOFC is included in location choice modeling, the most salient features of the most prominent THOFCs are likely to seriously skew the modeling results.

In sum, it is clear China is not alone in its use of tax havens. China is, however, by far the most aggressive user of tax havens as a conduit for FDI among major economies (Contractor, 2016). It is, therefore, surprising to find the majority of location choice studies on Chinese OFDI use official FDI statistics aggregated at the country level. This leads to a significant overestimation of genuine FDI to tax havens in the case of initial investment and a significant underestimation of genuine FDI to final host economies. These counteracting forces may significantly skew econometric modeling results if not handled properly.

Exploring Chinese multinational enterprises OFDI behavior accounting for tax haven and offshore financial center use

Given the geographical and volume biases inherent in official Chinese OFDI data, care must be taken when using both aggregate and firm-level FDI data as an indicator of the genuine FDI activities of MNEs (Beugelsdijk *et al.*, 2010; OECD, 2008). China's MOFCOM data does not, therefore, appear to be a promising source for investigating Chinese MNE activity. To date, however, many empirical studies have looked at the country location determinants of Chinese OFDI using this aggregated official OFDI data source (Table 1). Surprisingly, many of the studies in Table 1 do not address the SPE issue. Huang and Wang (2011), for example, include tax havens (such as the Bahamas and Luxembourg). This is troubling as MOFCOM data reports around 30% of all Chinese FDI into Europe takes place in Luxembourg (Blomkvist and Drogendijk, 2016). When accounting for GUO, however, this drops to 0.1%. Zhang and Daly (2011) include a number of offshore subsidiaries. Armstrong (2011) acknowledges the SPE problem but simply ignores the biases introduced "as there are no more reliable sources" (p. 28). The rest, with few exceptions, include Chinese OFDI to Hong Kong while excluding other THOFCs. This, however, is also highly problematic. Hong Kong is a major offshore financial center and tax haven and, as a result, an important location for Chinese SPE creation (Buckley *et al.*, 2015). Further troubling are Chinese firms which choose to un-incorporate in China only to incorporate in a THOFC and subsequently create wholly owned subsidiaries in China and elsewhere. In this case, nothing changes from a headquarters, production or distribution perspective. Only corporate structure (on paper) changes. Unless FDI is undertaken by a "subsidiary" in China to a third country, which is rare, these investments are also lost in officially collected FDI statistics. The issue of SPE use in THOFCs, therefore, affects all cross-country studies that use official national-level OFDI data. A recent study by Sutherland *et al.* (2019), moreover, also shows that the implications for empirical studies using firm-level data are also very serious if the SPE problem is not fully addressed. They directly assess papers on Chinese OFDI recently published in *Journal of International Business Studies* (JIBS) and find serious problems in



Name and year of study	Type of data used in the empirical study	No. of citations*
Buckley *et al.* (2007)	$SAFE_a$	2,603
Kolstad and Wiig (2012)	UNCTAD	788
Cheung and Qian (2009)	MOFCOM	502
Cui and Jiang (2012)	MOFCOM	504
Kang and Jiang (2012)	MOFCOM	349
Liu *et al.* (2005)	MOFCOM/UNCTAD	292
Zhang and Daly (2011)	MOFCOM	219
Cheng and Ma (2007)	MOFCOM	166
Cheng and Ma (2010)	MOFCOM	156
Huang and Wang (2011)	MOFCOM	117
Blomkvist and Drogendijk (2013)	MOFCOM	83
Hurst (2011)	MOFCOM	64
Chang (2014)	MOFCOM	51
Armstrong (2011)	MOFCOM/OECD	22
Zhang and Roelfsema (2014)	MOFCOM	18
Total		5,934

Table 1.
A sample of 13 statistical studies which use official FDI data sources to explore CMNE FDI behavior

Notes: *Google Scholar citations as of May 27, 2020; [a]State Administration of Foreign Exchange, or SAFE, is under the direct supervision of MOFCOM

the handling of SPEs in most JIBS publications over the past decade. Subsidiaries in countries such as The Netherlands, they show, are consistently but incorrectly included in firm-level empirical studies. They cite recent OECD data, showing around 19 of the US$20bn of Chinese FDI to The Netherlands is SPE related.

Data collection accounting for global ultimate ownership. As noted, FDI data collected at a national level was originally compiled mainly for balance of payments purposes. As such, bilateral flows of capital are what FDI data focuses upon. It is thus the immediate country (source and destination) which is important and recorded in FDI data (Beugelsdijk *et al.*, 2010). Commercial firm-level databases, however, such as Thomson One and the Financial Times fDi Markets database, were specifically created to understand firm-level investment behavior (not macro-level international balance of payments positions). In such databases, the GUO refers to the ultimate beneficial owner of an investment. In many commercial data sets, both the investing company and its GUO (i.e. parent firm) are available. If, for example, a Chinese company invests in the USA through its subsidiary in the Cayman Islands, commercial data would state the name and location of both the Cayman Islands company and the Chinese GUO. Using the GUO data alleviates onward journeying concerns by capturing genuine FDI flows. Using GUO data also facilitates the removal of round-tripping FDI. In the previous example, official data sources, such as MOFCOM and UNCTAD, would record the investment as coming from China and going to the Cayman Islands. Using GUO data, therefore, meaningfully controls for both onward journeying and round tripping investments made by CMNEs.

Organizations which incorporate parent firms in THOFCs are more difficult to disentangle than firms engaging in onward journeying or round tripping FDI. In this case, it is important to cross-reference home country global headquarters and home country incorporation. If headquarters are located outside the country of incorporation, these companies should be flagged and checked manually. When firms are incorporated in THOFCs with little to no value-added activity taking place in that country, FDI is seen to originate from the global headquarters home country. If multiple headquarters are reported, control is derived by looking at the physical locations of the board of directors, CEOs or other individuals who control significant portions of the operation of the firm. In this way, with a few additional steps, GUO is able to be meaningfully derived from commercial data sources. Because of the level of data aggregation, uncovering GUO is not possible for officially reported FDI statistics.

Past studies have recorded the pervasive use THOFCs by Chinese companies, such as China Mobile (Wójcik and Camilleri, 2015). Shunfeng International Clean Energy Limited (SFCE) is another classic example of a Chinese organization which has incorporated in a THOFC. SFCE is incorporated in the Cayman Islands, but is headquartered in China and the vast majority of its board of directors are Chinese nationals. The primary business of SFCE is the production of solar panels – none of which are designed, produced or distributed in the Cayman Islands. SFCE has three main branches: trading, holding company and investment. By far, the largest value-adding entity of these is the holding company. This holding company is incorporated in the Cayman Islands, but the vast majority of its factories are located in China – places such as Jiangsu, Qinghai, Wuxi, Jiangxi, Shanghai and others (SFCE, 2017).

Many of the first-level parents (i.e. not ultimate parent) of these factories are also incorporated in THOFCs. Take the SFCE entity Wuxi Suntech Power as an example. It is headquartered in Wuxi, China but incorporated in the Cayman Islands as Suntech Power Holdings. This entity has 100% ownership over Power Solar Systems, which is incorporated in the British Virgin Islands. Power Solar Systems owns 100% of Wuxi Suntech Power,

which is incorporated in China and is where production takes place (see Figure 1). For official FDI statistics to credit FDI from SFCE as a Chinese company to an ultimate investment destination, it would have to be officially undertaken by the Chinese-incorporated affiliate (Wuxi Suntech Power) and gone directly to the host destination. This was not found to be the case in any of SFCE's investments. Rather, FDI stemming from SFCE, or one of its entities, was without exception routed through a tax haven back to China or onward to a third-country destination. These types of investments are not captured by official FDI, but using the methodological approach described above (i.e. using firm-level GUO data and understanding beneficial ownership of value-adding portions of the business where GUO data are difficult to obtain), it is possible to capture a valid picture of investment behavior by Chinese firms. Building from the above discussion, the question remains: how do the results of past empirical studies using official Chinese OFDI data change, if at all, when using alternative sources that account for the significant volumes of investments transited through offshore SPEs?

Data and methodology

To methodologically address our research question, it is vital to first understand the results of past studies which use official data to perform statistical analysis. After surveying the literature, we identified studies which: explore Chinese OFDI; use an official data source for the dependent variable; use publicly accessible data for all variables; and use a period of study starting in 2003, or after, as this is the timeframe available for our firm-level data which accounts for GUO of Chinese investments. Studies which match these criteria are

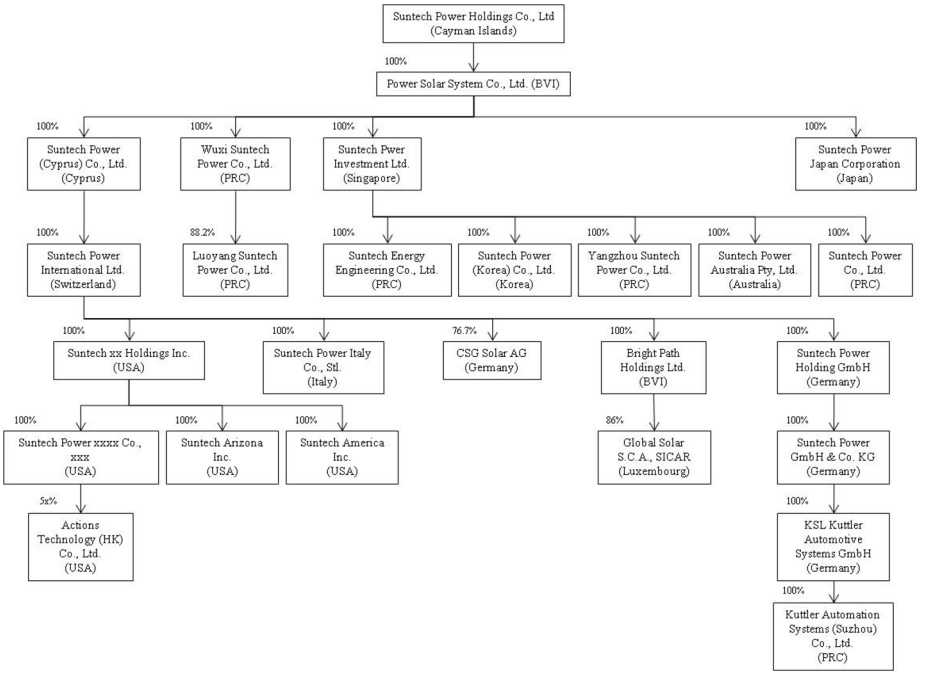


Figure 1.
Suntech Power Holding Co.'s organizational structure, 2010

Source: Suntech (2010)

Kolstad and Wiig (2012),Cheng and Ma (2010) and Hurst (2011). Buckley *et al.* (2007) meet all of the above criteria aside from an outdated period of study. In light of the enormous influence of Buckley *et al.*'s (2007) study on Chinese OFDI research (nearly half of all citations in our sample of studies identified in Table 1), we elect to update the findings of Buckley *et al.* (2007) to 2003–2017 using the same variable measurements and data sources as the original study. Thus, we use four studies to explore how the results of past studies may have been confounded by the pervasive use of tax havens by CMNEs. We do this through replication methodology. More specifically, we first gathered the exact same variables specified in each study. We then used the same econometric modeling methodology exactly as expressed in the original paper. After the original studies were successfully replicated, we make one – and only one – change to each model. The dependent variable from each study, which used official OFDI data, is replaced by a dependent variable which takes GUO into account. Table 2 shows the relative geographic dispersion of Chinese OFDI broken down by official (MOFCOM) data and commercial (GUO) data by value of investments. As can be seen, the top destination countries for Chinese OFDI are drastically

	GUO data			MOFCOM data	
Rank	Country	% of total	Rank	Country	% of total
			Year 2005		
1	Canada	29	1	Cayman Island	42
2	Indonesia	22	2	Hong Kong	28
3	Russia	10	3	British Virgin Island	10
4	South Korea	4	4	Korea South	5
5	Philippines	3	5	USA	2
6	Mongolia	3	6	Russia	2
7	India	3	7	Australia	2
8	Egypt	3	8	Germany	1
9	Pakistan	2	9	Kazakhstan	1
10	Angola	2	10	Sudan	1
			Year 2010		
1	Brazil	17	1	Hong Kong	56
2	Australia	9	2	British Virgin Island	9
3	USA	8	3	Cayman Island	5
4	Hong Kong	7	4	Luxembourg	5
5	Canada	7	5	Australia	2
6	Argentina	6	6	Sweden	2
7	Russia	6	7	USA	2
8	Indonesia	5	8	Canada	2
9	India	4	9	Singapore	2
10	Sweden	3	10	Myanmar	1
			Year 2015		
1	India	12	1	Hong Kong	41
2	Indonesia	11	2	The Netherlands	6
3	USA	8	3	Singapore	5
4	Pakistan	7	4	Cayman Island	5
5	Hong Kong	6	5	Eritrea	4
6	Australia	6	6	Trinidad and Tobago	4
7	Malaysia	4	7	Sierra Leone	4
8	United Kingdom	4	8	USA	4
9	The Netherlands	4	9	Serbia	3
10	South Korea	3	10	Chile	3

Table 2. Geographic dispersion of Chinese OFDI broken down by official (MOFCOM) and commercial (GUO) data sets by value of investments for years 2005, 2010 and 2015

different for MOFCOM and GUO data. THOFCs are the main host economies reported in the MOFCOM data. The opposite is true of GUO data – few prominent THOFCs are featured on the list of top 10 Chinese OFDI host economies.

In many cases, the replication models yielded slightly different results to those reported in each original study. The notable exception is Cheng and Ma (2010)[1]. We were able to replicate all of Cheng and Ma's (2010) models exactly except one (which was a very close replication). Replication of Hurst (2011) and Kolstad and Wiig (2012) was less precise than Cheng and Ma (2010) but is still usable for the purposes of this study. Prior to replication, the data from Buckley *et al.* (2007) was first updated from 1984–2001 to 2003–2017 using the same variable measurements and data sources as the original study.

All studies in our sample, and replications, used location choice modeling techniques. Cheng and Ma (2010) used a balanced panel data set for the period 2003–2006 to estimate a gravity equation of Chinese OFDI flows to between 90 and 98 host economies and OFDI stocks to between 125 and 150 host economies (depending on the model), as reported by MOFCOM. Hurst (2011) used Chinese OFDI flows data from MOFCOM for the period 2003–2008. Their unbalanced panel data set is estimated using random effects generalized least squares models. OECD reported tax havens are excluded from their analysis[2]. Kolstad and Wiig (2012) used UNCTAD data for their dependent variable of Chinese OFDI. Similar to Cheng and Ma (2010), they use a time period of 2003–2006. They note: "this data captures Chinese FDI more comprehensively than earlier studies such as Buckley *et al.* (2007) and Cheung and Qian (2009), which only captured approved flows" (p. 30). However, Kolstad and Wiig (2012) go on to exclude FDI to tax havens as "ultimate destinations of FDI flows are difficult to discern" (p. 28). While this effectively takes out round tripping FDI, it also removes onward-journeying FDI, which is highly problematic. They estimate their models using OLS on cross-sectional, rather than panel, data.

Finally, Buckley *et al.* (2007) used both pooled ordinary and generalized least squares models to estimate the location choice of Chinese MNEs. They used project data from the State Administration of Foreign Exchange (SAFE) for their dependent variable for the time period 1984–2001. SAFE is under the direct supervision of MOFCOM and uses parallel methods for generating OFDI statistics. MOFCOM and two departments under its supervision, SAFE and National Bureau of Statistics, jointly release the statistical communique on China's direct investment overseas (MOFCOM, 2013).

Global ultimate ownership dependent variable data

As previously discussed, our GUO-dependent variable data are derived from commercial databases. All mergers and acquisitions (M&A) data were drawn from the Thomson ONE Banker database. All greenfield data were drawn from the Financial Times fDi Markets database. Thomson ONE captures M&A deals of approximately $1,000,000 or more. It has a team dedicated to tracking and verifying M&A deals from the "announced" stage all the way to the "completed" stage, including value of investment as well as disentangling complex issues such as ownership and deal structures. Data reported by FT fDi Markets captures greenfield data of approximately $500,000 or more. Similar to Thomson ONE, the global ultimate parental owner is generally reported for these firms.

While much of the data is publicly available across dispersed company and news sources for both greenfield and M&A data, understanding corporate structures for reporting GUO is tedious and time-consuming. This is exacerbated in the case of Chinese firms because of their extensive use of Hong Kong, Cayman Islands, British Virgin Islands and other tax havens as subsidiary headquarters for investments abroad. To understand GUO patterns of

investment, it is vital to take parent company headquarters, the geography of value-added activities and the profit distribution among major stakeholders into account.

Results

Original, replication and "new" results are reported for every relevant model in all four studies. One exception to this is Cheng and Ma (2010) where original and replication results match exactly. In this case, replication results are not reported. Original results refer to modeling results as reported in the original study. Replication results are reported when a perfect replication of the original study was not possible. New results refer to modeling results which replace official data-dependent variables with those which take GUO into account. New models are based on the independent variables used in replication models. Results for all models are reported in Appendixes 1–12.

Modeling results, unsurprisingly, do generally show that studies which use official data sources for the dependent variable differ considerably from our updated results which use GUO data. There are changes in both sign and significance level in the majority of variables. In the Cheng and Ma (2010) replications (Appendix 1–3), all variables except one (common border) were found to be different in sign, significance or both. In the Kolstad and Wiig (2012) replications, three of six variables in the first model (Appendix 4), four of eight in the second model (Appendix 5), two of eight in the third model (Appendix 6) and four of eight in the fourth model (Appendix 7) were found to differ in sign, significance or both. Replications of Hurst (2011) found the first model (Appendix 8) to have 6 of 11 variables changing in sign, significance or both and the second model (Appendix 9) reporting 3 of 11 variables changing. Buckley *et al.* (2007) replication results indicate 9 of 13 variables in the first model (Appendix 10), 9 of 13 variables in the second model (Appendix 11) and 7 of 13 variables in the third model (Appendix 12) differ in sign, significance or both. These results lend strong support to our general argument, namely, that use of official FDI data seriously undermines the credibility of many Chinese OFDI studies.

While knowing discrepancies in results because of the use of official FDI data rather than data which accounts for the GUO is important, it is of interest to understand where those discrepancies take place. We, therefore, evaluate the findings of replication results in an attempt to understand common threads among their findings. The main areas impacted by using official data rather than data which accounts for the use of THOFCs are cultural proximity, geographic distance and natural resource seeking. Replication and original results were far more similar for gross domestic product (GDP) and political risk variables than other independent variables. Replication and "new" results are summarized in Table 3.

Cultural proximity

A commonly used variable in our sample studies is cultural proximity. Cultural proximity is an interesting variable to consider as it is argued that CMNEs may be attracted to destinations with strong ethnic networks. This is because of considerations such as the ability to engage in information sharing and the enforcement of community sanctions, such as network-wide disengagement with firms which participate in unfavorable or opportunistic behavior (Kennedy, 2016; Rauch and Trindade, 2002; Song, 2011).

We find modeling results for the cultural proximity variable changed in sign or significance when using ultimate global ownership data. The impact of data discrepancies is not, however, straightforward. While there was movement in sign, significance or both in five of seven models, there was not strong cohesion in the nature of the changes. This is most likely because of the significantly different methods for measuring the cultural proximity variable across studies.

Table 3.
Replication and new modeling results summary

Study	GDP – Replication	GDP – new	Geographic distance – replication	Geographic distance – new	Culture – replication	Culture – new	Natural resources – replication	Natural resources – new	Institutions – replication	Institutions – new
Cheng and Ma (2010)	+***	+***	−ns	−**	+***	+ns				
Kolstad and Wiig (2012)	+***	+***	+ns	−ns			+**	+ns	+ns	+ns
Hurst (2011) – OECD only	+***	+***	−ns	+ns	+***	+***	+*	−ns	+*	+***
Buckley *et al.* (2007)	+***	+***	+ns	−**	+ns	+***	+***	+ns	−ns	−ns

Notes: Full model or main model specification reported. +, positive; −, negative; *significant at 10% level; **significant at 5% level; ***significant at 1% level; ns = not significant

Proxies for the cultural proximity variable ranged from countries with Chinese as an official language (Cheng and Ma, 2010) to the percentage of ethnic Chinese in a country's general population (Hurst, 2011) and a dummy variable, where 1 represents greater than 1% of the country population is ethnically Chinese (Buckley *et al.*, 2007). These proxies range from a very narrow number of countries (Cheng and Ma, 2010) to a relatively large number of countries included in this variable (Buckley *et al.*, 2007). Chinese is, for example, the official language of only four economies outside of mainland China: Hong Kong, Macau, Taiwan and Singapore. The number of countries with ethnic Chinese populations greater than 1% is 31. While measures such as GDP, inflation rate and distance are likely to be measured in qualitatively similar manners, the cultural proximity variables used in our sample studies are vastly different. The multiple measurements for this variable, therefore, make it very difficult to assess the impact of official Chinese OFDI data versus GUO data.

With the above in mind, we attempt to disaggregate the cultural proximity modeling results of each individual study. Cheng and Ma (2010) find cultural proximity to be a highly significant driver in the investment location decision. Replication results accounting for GUO do not find cultural proximity to be significant in any model. Because of a significant amount of Chinese investments flowing to Hong Kong according to official data (i.e. MOFCOM), it is perhaps unsurprising that this variable becomes insignificant when accounting for GUO. Genuine FDI flows (i.e. those which are not round-tripping or onward-journeying) from China to Hong Kong are overstated in official data and cause a bias in modeling results toward culturally similar economies.

Buckley *et al.* (2007) group all countries with more than 1% of the population together as culturally similar to China. In this case, the cultural proximity of Hong Kong is weighted equally with the USA and 29 other economies. In the full sample (i.e. OECD and non-OECD countries), the cultural proximity variable went from positive and insignificant to positive and highly significant. In the OECD sample, it went from positive and significant to negative and insignificant. In the non-OECD sample, it went from negative and insignificant to positive and significant. These results indicate the use of official FDI data rather than data which accounts for GUO is highly disruptive to modeling results for the cultural proximity variable when it is broadly measured and defined.

When using the proportion of ethnic Chinese to total population (Hurst, 2011), modeling results do not change in sign or significance when accounting for GUO in FDI data. This indicates using a continuous variable may be an attractive alternative for measuring cultural proximity as it is more robust than dummy variables which group large (or small) segments of observations as equally culturally similar or dissimilar to China. This seems reasonable when the proportion of ethnic Chinese varies widely across countries: approximately 74% in Singapore, 24% in Malaysia, 14% in Thailand, 4% in Australia and 1% in the USA (UNCTAD, 2015).

Geographic distance

Gravity modeling theory suggests investment transaction costs (such as transportation and communication) increase as geographic distance increases (Berry *et al.*, 2010). This indicates investment will generally maintain a negative and significant relationship with FDI, which has been found in many earlier location choice studies looking at a wide variety of target/host country combinations. In our sample studies, the distance variable, which was measured similarly across sample studies, tended to change from negative to positive when accounting for GUO. This was especially true for disaggregated samples (i.e. not fully specified samples). This finding indicates the impact of geographic distance on Chinese OFDI may be contrary to that commonly assumed for most MNEs. As the geographic

distance between China and the host country increases, investments also increase. A significant amount of Chinese investments picked up by official data in places such as Hong Kong may, therefore, be subsequently invested in geographically distant third countries.

This is of interest, as considerable anecdotal discussion has highlighted the tendency of CMNEs to undertake aggressive strategic asset-seeking strategies (Anderson *et al.*, 2015; Anderson and Sutherland, 2015a; Elia and Santangelo, 2017; Sutherland *et al.*, 2017; Zheng *et al.*, 2016). These are typically undertaken in developed markets, such as the USA and Europe, which are geographically distant (Child and Rodrigues, 2005; Deng, 2009). In many cases, foreign direct investment laws and preferences are biased against Chinese companies (Sauvant, 2009). This, in turn, propagates the use of THOFCs as intermediate investment destinations to, in some cases, reduce investment scrutiny.

How may the exclusion of round-tripping FDI and inclusion of onward-journeying FDI impact modeling results? The relative volume of FDI being routed through other prominent THOFCs, such as British Virgin Islands and Cayman Islands, has diminished to a certain degree over the past decade while the prominence of FDI to Hong Kong has increased according to official statistics (see Table 2). The sheer volume of FDI reported going to Hong Kong by official FDI statistics compilers, therefore, may again be the primary culprit for confounding past results. Because of round-tripping considerations, when taking GUO into account, the volume of FDI to geographically near host economies is likely to diminish. Because of onward-journeying FDI routed through Hong Kong, the volume of investments going to geographically distant economies will likely increase. Thus, accounting for changes to the investment patterns when measuring genuine (i.e. value-added) FDI to Hong Kong, it is logical that the impact of geographic distance generally turned from negative to positive. These findings are collaborated by past studies in the areas of, for example, financial and economic geography (Buckley *et al.*, 2015; Haberly and Wójcik, 2015b, 2015a), China Studies (Sutherland and Anderson, 2015; Vlcek, 2010; Wójcik and Camilleri, 2015) and international business (Beugelsdijk *et al.*, 2010; Sutherland *et al.*, 2019).

Natural resource endowments

Relative natural resource scarcity in China has driven many, primarily state-owned, CMNEs to engage in aggressive natural resource source-seeking FDI. Many, although not all [see Anderson and Sutherland (2015a, 2015b) for an example], of these investments have taken place in economies which are less developed than China such as Sub-Saharan Africa (Kaplinsky and Morris, 2009) and Latin America (Ludeña, 2012). Following large natural resource investments by state-owned CMNEs into less-developed economies, many private CMNEs have co-located to offer necessary subsistent production activities as well as other manufacturing retailing services (Sanfilippo, 2010). Much of the FDI from China into less-developed countries is directly or indirectly encouraged by central government officials; there are:

> [. . .] a range of different incentives which encourage investment in Africa by Chinese firms. For example, companies investing in Africa gain access to prioritized credit at lower interest rates as well as tax incentives and other benefits (Whalley and Weisbrod, 2012, p. 10).

From a theoretical standpoint, therefore, Chinese MNEs have limited incentive to use THOFCs as a conduit for natural resource-seeking investments.

The nature of investments in natural resource extraction projects, in the case of CMNEs, is generally handled on a government-to-government basis (Anderson and Sutherland, 2015b; Luo *et al.*, 2010). This greatly diminishes the likelihood of using SPEs to facilitate investments. That said, even though the natural resource endowment variable was

measured in roughly similar manners across sample studies, in no case did any model which takes GUO into account find significant modeling results for the natural resource variable. While there is little doubt CMNEs go abroad to secure natural resources, the intensity of natural resource-seeking behavior by CMNEs may be overstated relative to other investment initiatives. The importance of various other drivers or deterrents to investment may have been masked by the large FDI flows to tax havens in official data. In other words, the proportion of FDI flowing from China to countries with large amounts of natural resources is inherently different when taking account for GUO. The amount of FDI flowing to countries which are well-endowed with natural resources remained the same (there is little evidence natural resource-related investments are routed through tax havens), but the amount of Chinese FDI flowing from tax havens to countries which do not register high levels of natural resources (such as Europe) are understated in official data.

GDP and political risk

GDP is often included as a proxy for market size and can thus be interpreted as a proxy for market-seeking motives (i.e. MNEs are attracted to larger markets in which to sell their products or services). It is generally found to be positive and significant in empirical studies, especially when tax havens are excluded from modeling estimations. When ultimate global ownership is taken into account, theory suggests high levels of GDP are generally a driver for investment.

The impact of political risk on Chinese FDI is a topical question. In most cases, our sample studies find this variable to be positive, but insignificant. This indicates that Chinese FDI is drawn to politically risky destinations, but not significantly so. This finding is considered unusual, as most MNEs avoid political risk (Alon *et al.*, 2014). As mentioned, tax havens by definition enjoy strong institutions and low political risk. The political risk of Hong Kong, for example, has been among the lowest in the world. Further, much of the literature argues CMNEs engage in politically risky environments primarily to obtain natural resources (Quer *et al.*, 2012). As previously discussed, THOFCs are unlikely to be significantly impacted by geographic dispersion and volume biases because of natural resource-seeking FDI.

In line with theoretical predictions, the use of official data does not seem to have a large impact on GDP and political risk variables. The modeling results for the GDP variable did not change in sign or significance when using GUO data. In no case, did the sign (positive) change for this variable. Further, in the vast majority of cases, the significance level remained the same across replication and new results. Modeling results for the political risk variable also did not change in sign or significance when using ultimate global ownership data. In the majority of cases, neither sign nor significance levels changed with the introduction of the dependent variable which takes GUO into account.

Discussion

The primary goal of this research was to propose a methodologically appropriate approach for testing the determinants of Chinese OFDI and subsequently understand how the use of official data in past studies may have confounded understanding of CMNE behaviors. Through the replication of several studies, we found high levels of discrepancies in general sign and significance between our modeling results and those using officially recorded FDI data. More specifically, the main areas impacted by using official data rather than data which accounts for the use of THOFCs are cultural proximity, geographic distance and

natural resource seeking. The use of official data, however, does not seem to have a large impact on the modeling results for GDP and political risk variables.

Many of the studies exploring Chinese OFDI, published in International Business, Strategy, Management and Economics journals, fail to account for the highly nuanced nature of conducting business in and from China. This failure has led to the misuse of official FDI statistics and subsequent misleading results and conclusions. Popular discourse surrounding the determinants of Chinese OFDI is increasingly being shaped by methodologically questionable results. The four papers replicated in this study, for example, have over 3,600 citations alone. It is vital to understand the important nuances of using China and Chinese companies as a focal point for academic work. Our first goal was to elucidate methodologically sound prescriptions for measuring CMNE OFDI activity. Our findings help disentangle the impact of the complexity of China's home institutional context and how this may warrant change in methodological assumptions when performing econometric analysis.

The results of our replication work raise important questions regarding the validity of the conclusions of past studies. More specifically, our results spur discussion on the biases created by using official FDI data in econometric modeling. The highly influential nature of the studies on CMNEs which use official FDI data may, for example, have unintentionally misled subsequent theoretical studies to call for new theories or extension to existing theories to account for the behavior of CMNEs as many of the calls for new theorization are resting on a tenuous foundation involving methodologically flawed results. Our results, in addition, draw attention to the need for further research on the problems associated with studies that use firm-level data to explore CMNE activity. This is because many such studies suffer from a somewhat similar problem to those that use officially collected data. This is to say, more often than not, they fail to adequately distinguish between SPE-related subsidiary investments and genuine FDI projects (Sutherland *et al.*, 2019). Indeed, as noted earlier, it has been shown that most of the studies over the past decade published in the Academy of International Business's flagship journal, *Journal of International Business Studies*, have made this kind of error. This testifies to the pervasive complacency in the international business academic literature which empirically investigates MNEs and their international investment strategies.

Broader implications of our findings

We have looked at studies which use official FDI data to understand CMNE behavior. It is important to note, however, that there are many hundreds, if not thousands, of studies that use other national-level FDI data to draw similar types of inferences about MNE activity. In this sense, our critical evaluation of CMNE work holds a much broader and, arguably, more important question: how reliable, in general, are studies which use officially recorded FDI data?

Official FDI data is collected according to agreed international guidelines set by influential organizations such as the OECD, World Bank and IMF. While the country-level institutions in China may exacerbate the use of tax havens, and thus introduce data biases in official Chinese OFDI statistics, the Chinese case is by no means unique. Most national-level data suffer from identical collection problems. Interestingly, the OECD is well aware of and have acknowledged these deficiencies for some time now. In particular, the problem of FDI that transits between several countries (capital in transit), inflates FDI to the first port of call and underestimates that to the second has been recognized. Such is the perceived scale of the problem today that the OECD has recently gone so far as to amend its guidelines for collecting FDI data (OECD, 2015). It has advised that the reporting of SPE-related

investments should now be reported separate from non-SPE-related (i.e. genuine) FDI. The drive by the OECD to more accurately capture SPE-related investments reflects their desire to not only improve the reporting system so that it accurately captures MNE activity, but also so that appropriate ways of taxing MNEs can be developed.

While only a small number of countries have yet adopted the new OECD reporting requirements, disaggregated reporting of SPE- and non-SPE-related FDI has already produced some very provocative results. It allows for a disaggregation of FDI by immediate and ultimate investing country. For example, the largest investor in France is the USA, according to GUO measures. By immediate investing country, however, The Netherlands and Luxembourg are by far the most important sources of FDI into France. This is because US MNEs commonly transit capital through The Netherlands and Luxembourg for subsequent investment in France, which affords them certain benefits, including the potential for tax rate reductions (OECD, 2015).

CMNE use of SPEs may be pervasive, thus limiting the usefulness of official FDI statistics, but the problem is not unique to Chinese firms. The specific home institutional context of CMNEs has, however, inflamed the seriousness of this issue. This finding adds further legitimacy to the importance of the institutional perspective as a productive lens for understanding emerging market MNEs generally and CMNEs specifically (Sutherland *et al.*, 2020). Official data from other countries may have uniquely serious methodological concerns relating to their specific contexts. Further research is necessary to understand the degree to which this is so.

Conclusion

The volume of Chinese OFDI has undoubtedly grown enormously over the past decade. Particular caution, however, must be exercised when using official FDI data to evaluate the cross-border investment behavior of CMNEs. This is because early in China's economic reforms, preferential tax rates for foreign businesses created strong incentives for Chinese businesses to become "foreign" MNEs. Chinese businesses responded to these incentives by creating offshore holding companies. These offshore structures provided convenient vehicles for the round-tripping of capital back to China. Even with the introduction of the new Enterprise Income Tax Law in 2008, which has harmonized tax rates for foreign and domestic businesses, the tendency toward offshore incorporation remains strong. This is because offshore companies allow Chinese businesses access to international capital markets, to circumvent domestic regulations, undertake property rights transactions (i.e. institutional arbitrage) and, potentially, lower their tax rates.

The tendency for CMNEs to establish offshore holding companies in THOFCs has given rise to significant biases in official FDI statistics, as well also as confounding many studies that use firm-level data. Using GUO data, we have put forward an alternate approach to measure genuine CMNE OFDI activity, one which confronts and deals with their pervasive engagement with tax havens. Through the replication of several Chinese OFDI location choice studies, moreover, we were able to understand how methodological issues stemming from the use of official FDI data may influence prior econometric results. In doing so, we hope to have sparked a debate which may lead to a re-evaluation of earlier received wisdom regarding CMNE investment strategy and behaviors. This in turn should foster improved theorizing regarding the Chinese multinational enterprise and its outward investment activities. In addition, it is vital that other disciplines, particularly studies published within the field of economics, become far more cognizant of the serious problems associated with using FDI data to measure MNE activity.

Notes

1. Professors Cheng and Ma were gracious enough to send us the exact data used in their study.
2. The OECD list of tax havens does not include Hong Kong, but does include locations with large amounts of Chinese OFDI (according to official statistics) including, for example, the British Virgin Islands and Cayman Islands.

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Appendix 1

Table A1. Cheng and Ma (2010) full sample results comparison

2003–2006	Original – full sample	New – full sample
GDP	0.34782*** (0.06634)	0.3767** (0.1760)
PGDP	−0.07953 (0.10504)	−0.5206** (0.2241)
Dist	−0.33384 (0.21989)	0.7430* (0.3976)
Chinese Lang	4.21955*** (0.77379)	0.4597 (1.2475)
Border	1.12032*** (0.39081)	1.9608*** (0.6351)
Landlock	−0.59648** (0.27200)	0.7699 (0.5496)
Island	−0.19364 (0.30334)	1.9559*** (0.7331)
R^2	0.3087	0.262
No. of observations	392	330

Notes: ***0.01; **0.05; *0.1 significance levels. Standard error in parentheses

Appendix 2

Table A2. Cheng and Ma (2010) tax haven economies (OECD list) excluded results comparison

2003–2006	Original – full sample	New – full sample
GDP	0.37272*** (0.07164)	0.3767** (0.1760)
PGDP	−0.09717 (0.10908)	−0.5206** (0.2241)
Dist	−0.43786** (0.21883)	0.7430* (0.3976)
Chinese Lang	4.26286*** (0.76620)	0.4597 (1.2475)
Border	0.98454** (0.38849)	1.9608** (0.6351)
Landlock	−0.57681** (0.26986)	0.7699 (0.5496)
Island	−0.35730 (0.31798)	1.9559*** (0.7331)
R^2	0.3212	0.262
No. of observations	375	313

Notes: ***0.01; **0.05; *0.1 significance levels. Standard error in parentheses

Appendix 3

Table A3. Cheng and Ma (2010) offshore financial center economies (IMF list) excluded results comparison

2003–2006	Original – full sample	Replication – full sample	New – full sample
GDP	0.35160*** (0.07252)	0.36509*** (0.07391)	0.3721** (0.1765)
PGDP	−0.07004 (0.11214)	−0.09195 (0.11450)	−0.5536** (0.2272)
Dist	−0.45050** (0.21889)	−0.45799** (0.21960)	0.7163* (0.3998)
Chinese Lang			
Border	0.83061** (0.39380)	0.81437** (0.39515)	1.9422*** (0.6372)
Landlock	−0.53456* (0.27474)	−0.51684* (0.27599)	0.6338 (0.5662)
Island	−0.37500 (0.35283)	−0.36555 (0.35385)	1.9354*** (0.7358)
R^2	0.2364	0.2377	0.2679
No. of observations	362	362	301

Notes: ***=0.01; **=0.05; *=0.1 significance levels. Standard error in parentheses

Appendix 4

2003–2006	Original – regression 1	Replication – regression 1	New – regression 1
GDP	1.24e−11*** (2.5e−12)	1.343e−05*** (1.669e−06)	7.226e−05*** (2.162e−05)
Trade	−0.007 (0.069)	4.071 (4.392)	−15.30 (53.73)
Inflation	0.102 (0.166)	−0.2798 (8.183)	103.1 (105.6)
Distance	−0.002 (0.001)	−0.0002653 (0.000491)	−0.009412 (0.006263)
Institutions	−2.046 (3.364)	−1.069 (2.060)	−24.51 (25.86)
Natural resources	25.841 (20.682)	37.92*** (15.14)	282.5 (186.1)
Institutions × Nat. resources			
Constant	21.923 (15.976)	3.536 (6.871)	177.3 (86.23)
Obs	104	97	105
R^2	0.236	0.4561	0.1546

Notes: ***0.01; **0.05; *0.1 significance levels. Standard error in parentheses

Table A4. Kolstad and Wiig (2012) Regression 1 results comparison

Appendix 5

2003–2006	Original – regression 2	Replication – regression 2	New – regression 2
GDP	1.15e−11*** (2.50e−12)	1.296e−05*** (1.659e−06)	6.400e−11*** (2.115e−11)
Trade	−0.010 (0.073)	3.788 (4.325)	−2.051e−05 (5.205e−05)
Inflation	0.087 (0.144)	1.056 (8.081)	1.202e−04 (1.024e−04)
Distance	−0.002 (0.001)	2.987e−04 (4.835e−04)	−9.747e−09 (6.066e−09)
Institutions	2.106 (3.560)	1.431 (2.388)	1.840e−05 (2.952e−05)
Natural resources	29.906 (18.911)	36.67** (14.92)	2.770e−04 (1.802e−04)
Institutions × Nat. resources	−46.473 (21.625)	−35.20* (17.77)	−5.986e−04*** (2.181e−04)
Constant	21.625 (15.944)	3.743 (6.762)	1.804e−04 (8.350e−05)
Obs	104	97	105
R^2	0.236	0.4791	0.2155

Notes: ***0.01; **0.05; *0.1 significance levels. Standard error in parentheses

Table A5. Kolstad and Wiig (2012) Regression 2 results comparison

Appendix 6

Table A6. Kolstad and Wiig (2012) OECD (Regression 3) results comparison

2003–2006	Original – OECD (Regression 3)	Replication – OECD (Regression 3)	New – OECD (Regression 3)
GDP	1.08e−11* (5.63e−12)	1.208e−05*** (3.093e−06)	5.637e−05* (3.208e−05)
Trade	−0.237 (0.308)	−10.33 (18.18)	−106.9 (188.6)
Inflation	0.832 (0.824)	35.84 (92.21)	294.6 (956.4)
Distance	−0.008 (0.009)	0.002207 (0.003387)	0.004475 (0.03513)
Institutions	42.263 (34.331)	12.69 (22.39)	166.4 (232.2)
Natural resources	3655.282 (2584.299)	−278.5 (1597)	2491 (16570)
Institutions × Nat. resources	−1960.285 (1386.431)	150.3 (904.6)	−1605 (9383)
Constant	13.258 (71.861)	−22.99 (30.08)	−99.59 (312.1)
Obs	25	24	24
R^2	0.388	0.6386	0.3153

Notes: ***0.01; **0.05; *0.1 significance levels. Standard error in parentheses

Appendix 7

Table A7. Kolstad and Wiig (2012) non-OECD (Regression 4) results comparison

2003–2006	Original – Non-OECD (Regression 4)	Replication – Non-OECD (Regression 4)	New – Non-OECD (Regression 4)
GDP	6.96e−11 (4.87e−11)	3.360e−05* (1.331e−03)	9.730e−04*** (2.481e−04)
Trade	0.068 (0.048)	6.040 (3.936)	21.14 (52.48)
Inflation	0.105 (0.157)	0.5885 (6.561)	114.7 (93.09)
Distance	−0.001* (0.001)	−6.221e−04 (4.211e−04)	−0.01243** (0.005885)
Institutions	−1.898 (3.364)	1.054 (2.898)	−13.39 (40.14)
Natural resources	33.085** (14.760)	28.13** (12.27)	214.0 (165.3)
Institutions × Nat. resources	−42.514** (20.382)	−43.60*** (15.63)	−657.1*** (213.1)
Constant	4.339 (7.724)	5.045 (6.593)	129.5 (90.55)
Obs	79	73	81
R^2	0.261	0.3001	0.3444

Notes: ***0.01; **0.05; *0.1 significance levels. Standard error in parentheses

Appendix 8

2003–2008	Original – OECD	Replication – OECD	New – OECD
GDP	1.343*** (0.280)	1.2056*** (0.38875)	5.9029*** (1.4349)
Trade openness	6.656 (10.429)	2.2791* (1.1676)	3.5601 (4.6133)
OFDI from recipient country	−0.894** (0.338)	−0.12243 (0.26662)	−0.72836 (1.1541)
Property rights	−0.0584* (0.0296)	−0.02.8554 (0.026231)	−0.089740 (0.084418)
Natural resources	2.946 (17.39)	30.428* (16.861)	−44.916 (79.616)
Labor freedom	−0.0117 (0.0211)	0.0012679 (0.019381)	0.018950 (0.052167)
Chinese population	197.5*** (48.64)	73.106*** (22.701)	234.16*** (67.225)
Distance	−0.000111 (0.000148)	−0.00015093 (0.00010291)	1.6524e−05 (0.0004007)
Inflation	−0.0485 (0.234)	−0.02.8481 (0.096432)	0.66022* (0.34300)
Government spending	0.0373 (0.0221)	0.0076994 (0.01.5076)	0.032281 (0.048983)
Investment freedom	0.0848*** (0.0239)	0.046665* (0.024802)	0.23326*** (0.086570)
Constant	−39.03 (8.829)	−16.835 (8.4435)	−148.28 (29.722)
Observations	56	76	59
R^2 (%)	84.44	44.14	69.73

Notes: ***0.01; **0.05; *0.1 significance levels. Standard error in parentheses

Table A8. Hurst (2011) OECD results comparison

Appendix 9

2003–2008	Original – Non-OECD	Replication – Non-OECD	New – Non-OECD
GDP	0.0993 (0.273)	0.16626 (0.26327)	1.9783 (1.2054)
Trade openness	3.313* (1.631)	1.7218 (1.0514)	2.8337 (5.1232)
OFDI from recipient country	−0.0807 (0.0734)	0.14556 (0.11166)	0.43374 (0.5.3308)
Property rights	−0.0469* (0.0209)	−0.0036311 (0.021264)	0.14150 (0.099177)
Natural resources	57.25* (28.15)	28.112 (19.651)	31.490 (91.037)
Labor freedom	0.0259 (0.0212)	0.0077242 (0.020396)	−0.058106 (0.092921)
Chinese population	8.439 (10.01)	−7.9158 (7.6375)	−18.394 (36.161)
Distance	−0.00000620 (0.0000783)	−1.0340e−04 (6.4293e−05)	−4.6379e−04 (2.9837e−04)
Inflation	0.0302 (0.0624)	0.0053648** (0.0026109)	0.065259 (0.11543)
Government spending	−0.00169 (0.0184)	0.016717 (0.019133)	0.11759 (0.087225)
Investment freedom	0.0203 (0.0260)	−0.002608 (0.017075)	−0.097078 (0.078464)
Constant	−1.527 (7.433)	6.9326 (5.7001)	−50.252 (26.519)
Observations	92	107	99
R^2 (%)	40.42	41.52	24.81

Notes: ***0.01; **0.05; *0.1 significance levels. Standard error in parentheses

Table A9. Hurst (2011) non-OECD results comparison

Appendix 10

2003–2017	Original – full sample (GLS)	Updated replication – full sample (GLS)	New – full sample (GLS)
GDP	0.3448** (0.1640)	2.3889495*** (0.4301735)	2.74549*** (0.53033)
Natural resources	0.1447 (0.1057)	0.5433132*** (0.3657551)	0.32672 (0.42225)
Patents	0.0363 (0.0359)	0.0785843 (0.2572466)	0.90678*** (0.32939)
Political risk	1.7997** (0.6974)	−0.4188620 (5.3993070)	−1.23195 (7.61612)
Cultural proximity	1.4929*** (0.4276)	0.4442698 (1.1101785)	4.26017*** (1.27236)
Exchange rate	0.0688 (0.0463)	0.0002283 (0.2039829)	−0.15590 (0.20469)
Inflation rate	0.1891** (0.0734)	0.1937923 (0.3356823)	1.21681** (0.50911)
Exports	0.6153*** (0.1291)	0.3777064** (0.1674394)	0.15315 (0.25742)
Imports	0.2544** (0.1027)	0.0437073 (0.1185307)	−0.13375 (0.18071)
Distance	0.1554 (0.2972)	0.2892958 (0.9197834)	−2.26395** (0.97377)
Openness to FDI	0.0510 (0.1244)	0.5970746 (0.4454041)	0.92822 (0.57754)
GDP per capita	Not reported	−1.6449439*** (0.4373443)	−1.98319*** (0.46514)
GDP growth	Not reported	−0.5251119* (0.3091009)	0.17684 (0.49501)
N	402	602	559
Adj. R^2	0.6019	0.15992	0.25461

Notes: ***0.01; **0.05; *0.1 significance levels. Standard error in parentheses

Table A10. Buckley *et al.* (2007) updated (2003–2017) generalized least squares (GLS) model results comparison

Appendix 11

2003–2017	Original – OECD	Updated replication – OECD	New – OECD
GDP	0.6674* (0.3650)	2.132761* (1.091615)	69.965** (34.952)
Natural resources	−0.0138 (0.3906)	0.311203 (0.806263)	−7.6779 (5.0880)
Patents	0.0752 (0.0773)	1.056982 (0.901128)	1.3614 (2.5224)
Political risk	1.8973 (1.8807)	−21.366881* (11.801906)	−57.023* (31.826)
Cultural proximity	2.0464** (0.8415)	4.421283** (2.035357)	−62.967 (4.8091e + 05)
Exchange rate	0.2319 (0.1866)	0.339981 (0.441828)	−7.9996* (4.6914)
Inflation rate	0.3487** (0.1579)	0.069292 (0.824061)	3.9000** (1.8280)
Exports	0.4062** (0.2053)	0.016401 (0.222308)	0.40772 (0.48961)
Imports	0.1914 (0.1898)	0.012972 (0.179955)	−0.64579* (0.34874)
Distance	0.7452 (0.7360)	−4.522384* (2.578652)	42.331 (3.6563e + 05)
Openness to FDI	0.1181 (0.2480)	4.872971*** (1.270489)	3.6477 (3.7596)
GDP per capita	Not reported	−3.470209** (1.401497)	−74.530** (35.520)
GDP growth	Not reported	−0.170167 (0.589157)	1.7235 (1.1492)
N	198	113	99
Adj. R^2	0.5763	0.42164	0.2706

Notes: ***0.01; **0.05; *0.1 significance levels. Standard error in parentheses

Table A11. Buckley *et al.* (2007) updated (2003–2017) OECD generalized least squares (GLS) model results comparison

Appendix 12

2003–2017	Original – Non-OECD	Updated replication – Non-OECD	New – Non-OECD
GDP	0.3472 (0.2238)	2.3548635*** (0.4999492)	2.993500*** (0.606155)
Natural resources	0.1820 (0.1144)	0.7015196 * (0.4086566)	0.366116 (0.485040)
Patents	0.0262 (0.0447)	0.1234570 (0.2945858)	0.746953 * (0.386532)
Political risk	1.4560 (0.8903)	3.9567123 (6.0020592)	5.370431 (8.434074)
Cultural proximity	0.8414 (0.6563)	−0.0564705 (1.3246957)	3.931147*** (1.515514)
Exchange rate	0.0142 (0.0540)	0.0656681 (0.2358865)	−0.148652 (0.243155)
Inflation rate	0.1320 (0.0914)	0.1870946 (0.3704899)	1.095618 (0.564286)
Exports	0.8375*** (0.1964)	0.6355355** (0.2278209)	0.190555 (0.331667)
Imports	0.3677*** (0.1374)	−0.0037991 (0.1476380)	−0.082602 (0.220293)
Distance	0.0171 (0.4259)	0.3953803 (1.0436005)	−1.998200* (1.099585)
Openness to FDI	0.1218 (0.1546)	0.0826199 (0.4934368)	0.562811 (0.656708)
GDP per capita	Not reported	−1.4018000*** (0.5188343)	−2.050073*** (0.555817)
GDP growth	Not reported	−0.6476058* (0.3591685)	0.035931 (0.562047)
N	204	507	460
Adj. R^2	0.6737	0.15317	0.21596

Notes: ***0.01; **0.05; *0.1 significance levels. Standard error in parentheses

Table A12. Buckley *et al.* (2007) updated (2003–2017) non-OECD generalized least squares (GLS) model results comparison

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