Product diversification and large construction firm productivity: the effect of institutional environments in Malaysia

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Purpose: Many large construction firms (LCFs) adopt Product Diversification (PD) to counter downturns and spread risks. However, no detailed information is available concerning the type of PD that improves their performance. In addition, it is still uncertain how much changes in institutional dimensions influence the effectiveness of PD. Therefore, the aim is to resolve this issue by establishing a model that shows the extent of this influence.

Design/methodology/approach: The Generalised Method of Moments (GMM) estimator is used to model the PD strategies of 86 LCFs in Malaysia over 14 years (2003-2016) and its impact on productivity and profitability performance.

Findings: Unrelated Diversification (UD) decreased firm performance in 2003-2016, while Related Diversification (RD) had a positive impact during the more liberal 2010-2016 phase. The models show that the impact of PD is highly dependent on changes in institutional dimensions.

Practical implications: Firstly, managers may adjust the type of PD and its level of diversification to improve firm performance. Secondly, they may devise PD strategies based on changes in institutional dimensions to maximise their effectiveness.

Originality/value: The study contributes to the literature by determining the optimal amount of PD (including RD and UD) and its impact on performance. Secondly, the study is the first to investigate the moderating relationship of the institutional dimensions of economic and regulatory institutions on PD-firm performance. Thirdly, the study is the first to explore the components of technical-scale-scope economies (movement towards and around the production frontier), this being crucial to the strategy that was only conjectured in previous studies.

Keywords: Construction; diversification; institutions; Malaysia; product diversification; productivity; profitability; related diversification; scale economies; scope economies; unrelated diversification

Introduction

Large construction firms (LCFs) need to make strategic decisions to improve their long-term performance. One key strategic decision that LCFs consider is product diversification (PD): this
comprises related diversification (RD) and unrelated diversification (UD). RD denotes diversification in products related to construction business (Aghimien et al., 2018), and includes property development, civil engineering building construction and speciality construction trades, whereas UD denotes diversification in products unrelated to construction business, such as utilities, manufacturing and retail businesses (Ye et al., 2018). The decision to embark on one type of PD instead of another, or a combination of both, is risky, as inappropriate PD can increase the insolvency risks of LCFs (Sung et al., 2017). This strategy caused the 2018 collapse of the UK construction giant, Carillion, for example – increasing the complexity of the firm’s internal management structure to oversee its diversified portfolio rendered it inefficient and unable to control and coordinate the multiple subsidiaries of the different product segments involved (Qamar and Collinson, 2018).

An ideal PD strategy can lead to an improvement in technical efficiency (TE) through the application of appropriate technology. Also, LCFs can improve mix efficiency (ME) and scale efficiency (SE) through the exploitation of the scope/size of firm segments and firm size respectively indicating that managers can maximise the use of resources through PD – the resulting improvement of productivity reducing PD risks associated (Hashai, 2015, Ye et al., 2018). However, the main challenge faced by firms is in determining the appropriate PD under conditions of limited information. In this case, answering the question of What type of PD could improve firm performance? (Alashwal and Alduais, 2019, Horta et al., 2016, Kim and Reinschmidt, 2011). Therefore, it is important to investigate the impact of both RD and UD on firm performance.

Since the 2008 Global Financial Crisis, the Malaysian government has implemented several policies. One is the removal of investment barriers, to allow foreign investors hold majority equities, and encourage capital inflow (National Economic Action Council, 2010). Another is the liberalisation of financial institutions (Bank Negara, 2011) and subsidy reform (International Monetary Fund, 2015, Sufian and Habibullah, 2010). Such policy shifts in Malaysia could change the country’s de jure formal institutional environments. Above all, institutional environments

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1 A country’s de jure formal institutional environment comprises economic, regulatory and political dimensions. Acemoglu, D., Johnson, S. and Robinson, J. A. (2005), “Institutions as a fundamental cause of long-run growth”, Handbook of economic growth, Vol. 1, pp. 385-472. Here, de jure formal institutions are a form of constraints enforced by the legislature which include written regulations, while de facto informal rules are unwritten rules sanctioned by society’s system of beliefs.
shape the incentive structure of organisations, propelling or impeding economic activity and the efficient use of resources – thus affecting economic efficiency in the long run (North, 2005).

Although, in theory, the effect of diversification on firm performance is influenced by institutional environments (Holmes et al., 2018), little is known of how changes in different formal institutional dimensions can moderate the impact of PD on firm performance. Previous studies mainly use an aggregate measure of the institutional dimensions as a moderator and do not specify which dimension affects PD-firm performance (Ramaswamy et al., 2017); therefore, the magnitude of the effect of each institutional dimension on different types of PD-performance is largely unknown (Chittoor et al., 2015). Consequently, not knowing the likely impact of each institutional dimension makes it difficult for managers to decide which institutional dimension would maximise PD-firm performance. It is therefore necessary to examine each institutional dimension to provide a clear view of how it affects PD-firm performance.

The rapid changes of institutional environments in developing economies also make it hard for managers to determine PD. Some studies suggest that the improvement in institutional environments adversely affects PD-firm performance (Hoskisson et al., 2005), while others suggest that the impact is complementary, and therefore enhances PD effectiveness. Nevertheless, it is unclear how much the rapid change of formal institutions can alter the strategy and its impact on PD-firm performance (Carney et al., 2015). In this case, should firm managers adjust their PD strategy to improve firm performance in response to a change in institutional environments? Therefore, the impact of PD on firm performance in the different institutional pre-transition and post-transition phases needs to be examined in detail.

In response, this study aims to develop a model showing the effect of institutional environments on PD-LCF performance. The objective is to evaluate the impact of PD during different phases of institutional environments and the moderating effect of economic and regulatory institutional dimensions on firm performance, such as profitability, productivity and productivity components. In doing this, the study focuses on LCFs in Malaysia during the period 2003-2016, within which 2003-2009 was a pre-transition phase (period of protectionism), with 2010-2016 a post-transition phase (period of liberalism) associated with a substantial improvement in the country’s formal institutional environments.
The paper is divided into six sections. Following this Introduction, Section 2 provides the literature review, Section 3 describes the research method, Section 4 presents the results, Section 5 discusses the empirical results, and the paper concludes in Section 6.

**Literature review**

The form of relationship between PD and firm performance has been theorised as a stylised fact as an inverted U-shaped relationship due to diseconomies of scale – congenital when the number of segments is increased (Palich *et al.*, 2000). However, this cannot be generalised in simple terms. Different industries have different limits on how costs and resources can be coordinated and transferred within firm segments, with S- and U-shapes being found possible too as they depend on which industry the firms operate (Hashai, 2015, Purkayastha, 2013) – making the PD limit is difficult to predict by managers.

Industrial Organisation (I/O) theory suggests that UD in different industries reduces the industry’s congenital association with low profits (Horta *et al.*, 2016, Lee *et al.*, 2016a, Sung *et al.*, 2017). Meanwhile, traditional mean-variance modern portfolio theory suggests that the level of PD is important to reduce risks and maintain stable growth (Kim and Reinschmidt, 2011, Lee *et al.*, 2016b). However, the resource-based view suggests that the key to successful PD depends on how well resources are shared between segments in the diversified firm and this can improve scale-scope economies (scale-mix efficiencies) (Horta *et al.*, 2016, Oyewobi *et al.*, 2013). In this case, RD can be both associated with better interrelatedness to mix resources between multiple segments and can upscale output better.

Nevertheless, the type of PD that can improve scale-mix efficiency (SME) is still a matter of conjecture and suffers from a lack of evidence (Hashai, 2015). A clear measurement framework is needed to determine the effect of SME based on movements along the LCF’s production frontier through mixing the type of outputs (inputs) and adjusting their levels (Ozbas and Scharfstein, 2009, Tate and Yang, 2015). Also, it is not clear how much PD can enhance technical efficiency (TE), which is based on movements towards an LCF’s production frontier: which in turn is associated with an LCF’s ability to increase output or reduce input with a given technology (Chen *et al.*, 2015). This is important because LCFs may enjoy profitability because of their speculative advantage through ‘influence rent’ or being a ‘price-setter’, but not through improvements in efficiency (Ahuja and Yayavaram, 2011, Chen *et al.*, 2015).
LCFs are more likely than smaller ones to be associated with a high level of PD (Kim and Reinschmidt, 2011). High PD LCFs in the U.S. and internationally have higher profits and a steadier growth rate than those that are moderately diversified and focused LCFs (Choi and Russell, 2005, Yee and Cheah, 2006). In contrast, a new study of U.S. LCFs indicates that an increased level of PD entails a reduction in firm growth rate and revenue (Kim and Reinschmidt, 2011). Sung et al. (2017) found that, although high PD international LCFs may experience a growth in assets, they can simultaneously have reduced profits and increased risks. Therefore, at present, a change in industry conditions may not entail the high level of PD for LCFs that was formerly the case in the past.

In Spain and Portugal, highly diversified firms benefit from PD, suggesting that finding the optimal level of PD has an important impact on composite financial performance (Horta et al., 2016). However, a PD strategy might not be suitable in the UK for example, where the profitability of undiversified or moderately diversified LCFs outperforms those that are heavily diversified (Ibrahim and Kaka, 2007).

In Malaysia, PD in property, retailing, manufacturing, oil palm plantations and concessions is a common means of enhancing financial performance, and PD was a typical corporate strategy used by LCFs to counter the impact of the 2008 Global Financial Crisis. However, although it is speculated that UD provides an extra financial boost to LCFs (Ying Lai et al., 2014), a high level of PD ventures forced such firms as Ho Hup Bhd and Renong Bhd (now the UEM Group) to the brink of bankruptcy (Wong et al., 2005). Knowledge of the type of PD that can most affect LCFs is also limited in Malaysia.

Changes in institutional environments because of more liberal policies may affect industry conditions, thus affecting PD effectiveness (Holmes et al., 2018, Ye et al., 2018). However, institutional environments themselves can be separated into economic, regulatory and political institutions. They are different from each other but important to economic market efficiency (North, 2005). Economic institutions are market-creating – in this case, incentivising the availability of factor, product and intermediaries’ markets – while regulatory institutions are market regulating, upholding property rights and arm’s-length transactions. Political institutions ensure electoral accountability, such as the separation of powers in governance (Acemoglu et al., 2005). Currently, previous studies have failed to take into consideration the effect of each
institutional dimension on the different types of PD in developing economies (Ramaswamy et al., 2017). Therefore, the change in a country’s institutional environment could provide a suitable moderating effect on the impact of PD on firm performance.

Previous studies of the construction industry have mixed results of the effectiveness of PD strategies, reflecting their dependence on the local construction market. In South Korea, for example, a high level of PD has been found to improve a firm’s value due to the high property prices associated with RD but increases its risk of insolvency because the construction segment is highly interrelated with business cycles (Lee et al., 2016b) – suggesting that RD might be highly correlated with the business cycle and that UD might produce a better performance during an industry downturn. However, the literature does not consider how RD and UD affect firm performance in any detail. The current construction literature also reveals conflicting results concerning whether PD has a positive impact on LCF performance. There is limited knowledge of which type of PD could help LCFs perform better, because LCFs can embark with RD within the construction industry or involve in UD that is unrelated to the construction core business.

**Research methods**

**Proposed hypotheses**

Based on the literature review, it is clear that PD may bring performance improvement to LCFs. In this case, the strategy can alter resource allocations through technical-scale-scope economies. However, how effective resource allocation can be altered differs for both RD and UD. RD can permit better resource sharing; however, UD may withstand business cycles better, especially downturns. Nevertheless, an improvement in institutional environment during the post-transition phase should be associated with improvements in economic and regulatory institutions that could alter the effectiveness of the strategy. Therefore, each institutional dimension can be considered to be an incentive structure for the strategy. By considering the literature, therefore, three hypotheses are proposed:

**H1: The effectiveness of PD on LCF performance depends on its type.**

**H2: The effectiveness of PD on LCF performance depends on separate phases of the institutional environments.**
H3: The effectiveness of PD on LCF performance depends on the type of institutional dimension.

**Methodology**

This research adopts a positivist approach, which refers to research free from values and meanings by using econometric methods that are suitable for verifying cause and effect through the empirical evidence observed.

**Data collection**

All other variables except the formal institutional dimensions are from the Annual Reports of public-listed Malaysian LCF financial data. The data for 2003-2016 are from financial data providers (Osiris and Eikon). Our sample comprises 86 LCFs based on the Dow Jones Indices’ Global Industry Classification Standard (GICS) classification: Sector (Industrials:20) → Industry Group (Capital Goods:2010) → Industry (Construction & Engineering:201030) → Sub-Industry (Construction & Engineering:20103010). Construction & Engineering denotes firms mainly involved in construction, which include civil engineering firms and contracting firms. According to Malaysian by-laws, large firms are those that can undertake construction projects more than Malaysian Ringgit (MYR) 10 million (April 2020 MYR 1=USD 0.23). 73% of the LCFs sampled are involved in various levels of PD. All the data were screened, and no abnormalities were found.

**The generalised method of moments**

Modelling the effects of PD on firm performance with longitudinal data requires a suitable estimator that can mitigate endogeneity bias. This is important because an explanatory variable such as PD is usually endogenous. In the presence of endogeneity, without a suitable estimator, the results can suffer from biased and inefficient estimates. Therefore, the Blundell and Bond (1998) two-step System GMM (SGMM) is applied to yield a consistent and efficient estimate. SGMM augments both a difference and a level equation in \( x_t \), where \( x_t \) are economic data that contains variables, instruments and errors. SGMM uses lagged values as instruments.

Assuming the past performance affects current performance, the difference equation specification is:

\[
\Delta Y_{it} = \beta_1 \Delta Y_{it-1} + \beta_2 \Delta A_{it} + \beta_3 \Delta B_{it} + \beta_4 \Delta C_t + \Delta \mu_{it}
\] 

(1)
where $Y_{it}$ is the observed firm performance, $Y_{it-1}$ is past performance, $A_{it}$ to $C_t$ are controlled firm specifics, explanatory variables and time dummies respectively. $\mu_{it}$ is the error term.

GMM uses lagged variables as valid instruments within the existing datasets because the estimator assumes sequential exogeneity as opposed to strict exogeneity. In this case,

$$E[\varepsilon_{it-1,t-2\ldots}|X_{it}] = 0$$

(2)

which means that the errors are only uncorrelated with past values; however, they may be correlated with contemporaneous and future values.

The unknown parameters can be estimated based on the moment conditions in the population. In most cases, $q>p$ (over-identification), which means there are more moment conditions the parameters. To minimise the weighted sum of squares, a two-step GMM estimator of $\theta_0$ is used based on $E[f(x_i, \theta_0)] = 0$, $\theta_0$ denoting the unknown parameter vector defined to be

$$Q_N(\theta) = \frac{1}{N} \sum_{i=1}^{N} f(x_i, \theta) W_N \frac{1}{N} \sum_{i=1}^{N} f(x_i, \theta)$$

(3)

where $W_N = L$ by the L weighting matrix (same dimension as the number of moment conditions), with $W_N$ to satisfy certain restrictions so that $Q_N(\theta) \approx 0$

**Measuring PD**

Previous studies consider PD as one strategy. Consequently, managers could embark on a suboptimal type of PD (Horta et al., 2016). Therefore, the Jacquemin and Berry (1979) J-B entropy method is used, which enables the computation of both RD and UD, with

$$PD = RD + UD$$

(4)

in this case

$$RD_j = \sum_{i \in j} P_i^j \ln(1/P_i^j)$$

(5)

where $RD_j$ is the related diversity of business segments within an industry group $j$. $P_i^j$ is the share of segment $i^{th}$ over the $j^{th}$ group share. Therefore,

$$RD = \sum_{j=1}^{M} RD_j P^j$$

(6)
where $RD$ is the weighted average of the related diversification within a firm, $DR_j$ ($j = 1, ..., M$). $P^j$ is the total share of the $j$th group. Each group has a weight equal to its share. In the case of UD,

$$UD = \sum_{j=1}^{M} P^j \ln\left(1/P^j\right)$$

(7)

**Measuring formal institutional dimensions**

Approximations of formal institutional dimensions can be derived from a different number of indices or indicators, and the indices proposed by Holmes et al. (2013) are used here. Nevertheless, a clear and concise idea of the institutions is critical in applying an accurate measuring proxy. This is because the measures of the institutions could be interrelated (Garrido et al., 2014). Therefore, the introduction of a latent variable that aggregates several measures of indices can obviate the possibility of interdependencies (Voigt, 2013). In this case, principal component analysis (PCA) is applied (Garrido et al., 2014, Tan and Chintakananda, 2016).

**Measuring firm productivity and profitability**

Previous studies were unable to uncover the technical-scale-mix efficiency that is important to PD theory. Nevertheless, firm profitability and value are common measures of firm performance because they reflect the ‘desire’ of the shareholders’. Therefore, the adjusted excess Return on Assets (EROA) and Total Factor Productivity (TFP) and its TFP components are often used as a measure of firm performance. Here, the more precise Färe-Primont productivity index (F-PI) and framework is used, which enables TFP to be accurately decomposed into technical efficiency (TE), Scale Efficiency (SE) and ME (Mix Efficiency) (O’Donnell, 2012). Let $x_{it} = (x_{1it}, ..., x_{kit})$ and $q_{it} = (q_{1it}, ..., q_{jit})$ denote the input and output quantity vectors of firm $i$ in period $t$, where $x_{1it}, x_{2it}$ and $x_{3it}$ denote employees, materials and fixed asset costs respectively, while $q_{1it}$ and $q_{2it}$ denote construction and non-construction revenues respectively – derived from financial reports and deflated to a common based year using appropriate price indices. The firm’s TFP is then given by

$$TFP_{it} \equiv \frac{Q_{it}}{X_{it}}$$

(8)

where $Q_{it} = Q(q_{it})$ is an aggregate output, $X_{it} = X(x_{it})$ is an aggregate input and $Q(.)$ and $X(.)$ are aggregator functions

$$Q(q) = D_0(x, q, t)$$

(9)
\[ X(x) = D_I(x, q, t) \]  

(10)

where \( D_0(.) \) and \( D_I(.) \) are output and input distance functions. Both eq. (9) and (10) are substituted into eq. (11), which becomes the F-PI TFP in

\[ TFP_{it} = \frac{D_0(x, q, t)}{D_I(x, q, t)} \]  

(11)

Both \( D_0(.) \) and \( D_I(.) \) are estimated by Data Envelopment Analysis. The TFP decompositions are then derived based on O’Donnell’s (2012) framework

\[ TFP_{it} = TFP^*_t \times TSE_{it} \times SME_{it} \]  

(12)

\[ SME_{it} = ME_{it} \times RSE_{it} \]  

(13)

\[ TFP_{it} = TFP^*_t \times TSME_{it} \]  

(14)

\[ TSME_{it} = TE_{it} \times SME_{it} \]  

(15)

Here, \( TFP^*_t \) denotes technological level while TSME is a combination of TE and SME (known as Technical-Scale-Mix Efficiency). RSE, or Residual Scale Efficiency, is a term used interchangeably with Scale Efficiency. Here, a more precise industry-adjusted profitability that takes into account each firm’s segment is applied, proposed by Purkayastha et al. (2017), with

\[ EROA = \text{Firm} \left( ROA - \text{Imputed ROA} \right) \]  

(16)

\[ \text{Firm's ROA} = \sum_{i=1}^{J} \frac{EBITDA_i}{Assets_i} \times \frac{Assets_i}{Assets_b} \]  

(17)

for the \( i^{th} \) firm within the \( b^{th} \) firms, and

\[ \text{Firm's imputed ROA} = \sum_{k=1}^{n} \sum_{i=1}^{J} \frac{Assets_i}{Assets_b} \times ROA^\text{median}_k \]  

(18)

where \( ROA^\text{median}_k \) is the median ROA for the \( k^{th} \) industry segment. Firm \( i \) belongs to the \( k^{th} \) industry.

**Estimation models**

The approach of Kim et al. (2010) is followed in response to the different phases of institutional environments analysed. First, a full sample of the studied period (2003-2016) is analysed and
divided into the 2003-2009 and 2010-2016 pre- and post-transition periods. Therefore, three separate estimation models can be derived from

\[ Y_{it} = \alpha + Y_{it-1} + B_1 \text{control (firm specific)}_{it} + B_2 \text{control (year dummies)}_{it} + \]
\[ B_3 \text{control (type of firm dummies)}_{it} + B_4 \text{type of PD)}_{it} + e_{it} \quad (19) \]

Meanwhile, the moderating effect of institutional dimensions using the full sample of the studied period (2003-2016) is given by

\[ Y_{it} = \alpha + Y_{it-1} + B_1 \text{control (firm specific)}_{it} + B_2 \text{control (year dummies)}_{it} + \]
\[ B_3 \text{control (type of firm dummies)}_{it} + B_4 \text{type of PD)}_{it} + B_5 \text{type of PD)}_{it} \times \]
\[ \text{Institutional level}_t + e_{it} \quad (20) \]

Table 1 lists the variables in the estimation models

<<Insert Table 1>>

To test H1, UD and RD were modelled against firm performance based on eq. 19, and then divided into the pre and post-transition periods to test H2. Finally, H3 follows eq. 20, which is the moderating effect of institutional dimensions.

**Results**

*Impact of PD on firm performance (2003-2016)*

Table 2 shows the impact of PD during all phases of institutional environments from 2003 to 2016, indicating the significant positive effects to be RD on EROA ($\beta = 0.113, p<0.05$) and RD$^2$ on TFP ($\beta = 0.334, p<0.10$). However, the impact of UD$^2$ on TFP is negative ($\beta = -0.144, p<0.05$), which means that an increase in the level of RD based on J-B entropy improves firm performance. However, an increase in UD based on J-B entropy decreases TFP.

<<insert Table 2>>

*Impact of PD on firm performance during different phases of institutional environments*

Table 3 shows the effect of PD-firm performance during the two phases. During the pre-transition phase, the only significant effects are UD$^3$ on TFP ($\beta = -0.048, p<0.05$), while the impacts of RD on EROA ($\beta = 0.248, p<0.05$), RD$^3$ on TFP ($\beta = 0.430, p<0.05$) and UD$^3$ on TFP ($\beta = -0.128, p<0.05$) are significant in the post-transition phase.
Further analysis of TFP components shows that UD is not a productive strategy during the pre-transition phase because of the scale inefficiencies, which can be seen from the negative RSE ($\beta = -0.079, p<0.05$). However, during the post-transition phase, the negative impact is caused by TE ($\beta = -0.277, p<0.10$). In terms of RD, during the post-transition phase, the positive impact on TFP is influenced by both TE ($\beta = 0.921, p<0.10$) and SME ($\beta = 0.708, p<0.10$).

*Estimated changes in formal institutional dimensions*

This section presents the estimated change in formal institutions from 2003 to 2016. The PCA reveals six components with an Eigenvalue greater than unity, while the scree plot shows that 4 to 5 components are feasible for component reduction. It was therefore decided to retain four components and apply orthogonal varimax rotation with Kaiser Normalization.

Table 4 shows that each component has a variance range of 2.478 to 10.074. The total variance explained is 83%, with components 1-4 explaining 36%, 24%, 14% and 9% respectively. A component loading greater than ±0.30 is considered high (Tabachnick and Fidell, 2014).

Based on the PCA results, all the components are labelled according to their loading importance. Component 1 (capital investment, money supply, GDP, executive constraint and political constraint) reflects the level of capital availability (LCA); component 2 (property right, business freedom, financial freedom and investment freedom) reflects regulatory control (LRC); component 3 (foreign debt, exchange rate and unemployment) reflects foreign debt (LFD); and component 4 (monetary freedom, changes in wages, inflation and stock traded) reflects price control freedom (LPCF). LCA and LRC, therefore, play a more prominent role in the variations of formal institutions in Malaysia, their being positively associated with capital investment, money supply, property rights and regulatory market enforcement (Acemoglu *et al.*, 2005). LFD, on the other hand, is a largely related major source of investment in the construction industry (Ansar *et al.*, 2016), while LPCF is highly associated with monetary freedom due to the government, as a regulatory institution, reducing such interventions as price control, which distorts economic activity (The Heritage Foundation, 2017). Figure 1 shows the institutional dimension of the PCA.
**Effect of institutional dimensions on PD-firm performance**

Table 5 shows the effect of economic institutions on PD-performance, with the significant effects of LCA on RD\textsuperscript{3}-TFP ($\beta = 0.077, p<0.05$) and RD-TFP ($\beta = 0.031, p<0.10$) indicating that a medium to high LCA improves the impact of RD on TFP. In contrast, only a high level of LFD improves the impact of RD on TFP.

<<insert Table 5>>

Table 6 shows the effect of regulatory institutions on PD-performance, with the significant effects being LRC\textsuperscript{2} on RD-EROA ($\beta = -0.125, p <0.05$) and LRC on RD-TFP ($\beta = 0.029, p<0.05$). The effect of LPCF on UD-TFP is positive ($\beta = 0.033, p<0.10$) Further analysis shows a significant positive effect of LCA on RD\textsuperscript{3}-RSE ($\beta = 0.074, p<0.10$), RD\textsuperscript{3} and LFD on ME ($\beta = 0.071, p<0.05$), LRC on RD-RSE ($\beta = 0.035, p<0.05$) and ME ($\beta = 0.060, p <0.05$) and LPCF on UD-TSME ($\beta = 0.045, p< 0.05$).

<<insert Table 6>>

Table 7 indicates that hypothesis H1 holds because RD and UD have a positive and negative impact, respectively, on firm performance. H2 is partly supported because RD had a positive impact on firm performance during the post-transition period. However, UD negatively affects firm performance irrespective of institutional phase. H3 holds because the effectiveness of the type of PD on impact depends on the type of institutional dimension. In this case, both the economic and regulatory institutional dimensions can change the impact of PD on LCF performance.

<<insert Table 7>>

**Robustness tests and checks**

The autocorrelation tests and Hansen’s tests indicate that the models are robust against serial correlation, and the instruments proposed satisfied the required orthogonality conditions ($P>0.05$). The robustness checks also confirm the results still hold when the alternative measure of PD are introduced to replace PD based on J-B entropy. Also, firm size (LN of total sales) is replaced by the LN of total assets, and are all qualitatively similar to our unreported results, which are available upon request.
Discussion

In contrast with previous studies, in which the effect of the type of PD on LCF performance is unclear (Alashwal and Alduais, 2019, Horta et al., 2016), RD is found to be efficient and profitable while UD is unproductive. The impact of RD is dependent on the change in institutional periods and its dimensions, and this is contingent upon industry diversification (Hashai, 2015). Unlike being unexplored in previous studies, the present study highlights the need to facilitate institutions that enable managers to scale-up production and allocate resources more efficiently during the post-transition phase when involved in RD. Also explained, is the possible reason that developed institutional environments in high-income economies facilitate PD mainly in construction and property development, which has a positive impact on composite financial performance in Spain for instance (Horta et al., 2016). Even though the price tends to be more elastic (less price premium), the price-margin could be reduced during a more liberal period fostered by competition. Nevertheless, improved institutions facilitate the efficient allocation of resources (high TFP) from PD strategy and hence long-run profitability. This is due to the improvement of SME and TE.

With regard to UD, the strategy negatively affects TFP during both pre- and post-transition phases, and it has no impact on profitability. While many LCFs are known to be adopt UD – with Choi and Russell (2005) and Yee and Cheah (2006) finding that a large number of segments related to UD improves firms’ profits – our analysis reveals the differences involved; in this case, UD has long been inefficient because of scale inefficiency, which affects a firm’s TFP. There is a possibility that some firms can overcome loss of profits as a price-setter firm when diversifying in UD in the short term (Ahuja and Yayavaram, 2011). However, this does not reflect the ability of managers to use appropriate technology and change the scope-scale of operations. Previous studies show that insolvency risks increase when LCFs diversify in PD (Kim and Reinschmidt, 2011, Lee et al., 2016b, Sung et al., 2017), while our analysis shows that LCFs may generate profits in the short-term but are unlikely to produce long-term profitability and productivity. This might explain the demise of Carillion’s high involvement in UD to service constructed facilities (Qamar and Collinson, 2018).

This study demonstrates that LCA has a positive impact on RD-TFP but not RD-profits, which may be due to more favourable conditions from high external capital-changing price elasticity through the substitution effect with less profitable products (Carlin et al., 2004). Therefore, profit
margins are decreasing *ceteris paribus*. In this case, the positive impact on TFP is primarily due to SE, where most firms are changing their scale of operations to achieve their optimal size by either upscaling their output or downscaling their inputs. LCA facilitates the availability of the product market internally and externally; the boom in the stock market associated with the inflow of capital then leads to a favourable housing market cycle (Wu, 2015) where LCFs could be involved in property development and Public-Private Partnership (PPP) types of infrastructure development (Regan *et al.*, 2010).

A high LFD has a positive impact on RD-TFP and facilitates improvement in ME; therefore, managers could mix the firm’s resources more efficiently. LFD is expected to facilitate RD-TFP, which is related to the external product market in the construction industry via public infrastructure development in developing economies (Ansar *et al.*, 2016). In this case, a LCF can expand its business segment to another construction segment, such as infrastructure maintenance work and toll highways. However, LFD has no impact on UD-firm performance. The positive impact of LFD on RD-TFP could be more industry-specific, especially the construction industry, where infrastructure development is usually the instrument of fiscal policy (Makin, 2015).

The impact of LRC on RD improves profitability and TFP, which allows a better resource allocation through enhanced regulatory enforcement (Djankov *et al.*, 2008, North, 2005). Similarly, legislative improvements enhance PPP delivery in China because they improve governance (Zhang *et al.*, 2015). This study demonstrates the potency of LRC, in which both ME and SE can be improved, compared to the impact of LCA and LFD, and thus improves firm TFP and profitability. This study extends the fact that LRC plays an important role where ME and SE could be improved, and this improves long-term firm profitability. However, it should be noted that LRC can only be effective with more regulatory enforcement: even a medium level of LRC will make little difference.

That LRC has no significant impact on UD-firm performance means the problem of being regulatory under scrutinised could lead to the mismanagement of resources and over-diversification, which could be the reason for the demise of some LCFs and increased insolvency risks (Sung *et al.*, 2017). Some previous studies note that increased PD increases insolvency (Lee *et al.*, 2016b) and decreases the growth of LCFs (Kim and Reinschmidt, 2011). The present study found that RD is increasingly efficient (with improved institutional dimensions), but UD is
systematically inefficient. It is found that UD is scale inefficient, which means that firms are operating at decreasing returns to scale. Moreover, UD is technically inefficient, which means a lack of best practice; this would explain the high financial risks involved because of a lack of knowledge and the correct size to produce outputs.

The change in LPCF does not affect RD-firm performance, but it has a positive impact on UD-TFP through the improvement of TSME. LPCF is also known as the subsidy removal and rationalisation that was intended for certain Malaysian industries. However, the impact is small and does not change UD being an unproductive strategy. Sufian and Habibullah (2010) show that increasing price control increases firms’ profits, but not because of efficiency reasons. A study of subsidy rationalisation in Malaysia shows that subsidies distort production and consumption decisions because they also artificially depress prices in many industries that do not directly benefit from the subsidy program (Chuah et al., 2018). Therefore, the result indicates that UD has been subsidised indirectly, and the strategy is inefficient. However, increasing LPCF improves the allocation of resources and positively affects UD-TFP.

**Conclusions and recommendations**

The results indicate that increasing related diversification (RD) had a positive impact on firm profitability and Total Factor Productivity (TFP) during the post-transition period, but with no impact on firm performance during the pre-transition period. Therefore, the right conditions during improved institutional environments may have caused RD to have a positive impact on firm performance. At a deeper level, the increased RD during the post-transition period is associated with the ability of managers to adjust the size and mixing of inputs (outputs) more efficiently. Moreover, the strategy is associated with the better application of technology, which then improved firm profitability.

An increasing level of unrelated diversification (UD) caused a decline in TFP during the pre- and post-transition periods. Surprisingly, however, it had no impact on profitability. In this case, firms could have pursued possible short-term profits but at the expense of TFP performance. Moreover, the strategy may not be efficient for firms in the long-term. Both economic and regulatory institutions affected PD effectiveness, the moderating effect of economic institutions bringing internal and external product markets to firms, making RD more suitable, while regulatory
institutions are associated with improvements in market regulation and inputs used to RD and UD respectively.

It is therefore recommended that pursuing RD may be a worthwhile strategy for LCFs, especially during moderate to high institutional engagement. A better economic framework could enhance the level of capital and regulatory control. However, the improvement depends on government policies, which are outside the control of managers. In the case of UD, it is recommended that the strategy may not be practical even though it may provide some short-term profitability. However, UD is not productive, and it is suggested that this strategy may have been subsidised indirectly through a government price-control mechanism. This may be one of the reasons for the low productivity of the construction industry in Malaysia and beyond.

The main contribution of this study is in identifying the optimal levels of RD and UD and providing a detailed account of how they could affect LCF performance. It is the first to investigate a complete moderating relationship of the institutional economic and regulatory dimensions on diversification-firm performance in general, and specifically in the construction industry. It is also the first to investigate the productivity components associated with different types of PD. Using a TFP decomposition framework, the effects of scale-scope are revealed, and it clearly highlights that SME and TE can be reaped from the strategy, and how it affects firm productivity. These new results answer long-standing theoretical questions concerning the contribution to TFP components by the strategies in general and the construction industry in particular. In terms of practice, finding the dynamic change in institutional environments to be an important factor affecting firm performance contributes to developing a model to help managers and policymakers improve their decision making. The in-depth investigation of productivity highlights how the allocation of resources can be further improved, which is associated with the need to improve the skills to manage diverse operations and existing policies to improve institutional environments further.

A limitation of the study is that there may be a time lag effect, as the effects of policy changes normally take time to materialise. More research is needed to investigate this issue further. Another limitation is that the model is applied solely to the Malaysian construction industry. More research is therefore also needed to test its applicability in other industries and similar developing economies.
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Figure 1.
Institutional dimension
| No. | Variable                                      | Measure/Proxy                                      | Type       |
|-----|----------------------------------------------|----------------------------------------------------|------------|
| 1   | Firm performance                             | EROA/TFP and its components                        | Observed   |
| 2   | Lag performance                              | Past year EROA/TFP and its components              | Controlled |
| 3   | Firm size                                    | Natural log (LN) total sales in MYR                | Control    |
| 4   | Age                                          | LN Age of the firm in years                        | Control    |
| 5   | Leverage                                     | Total debt/total assets                            | Control    |
| 6   | Type of firm dummies in the industry         | 1 = specialist firm or else (general contractor) = 0| Control    |
| 7   | Capital intensity                            | Capital/total sales                                | Control    |
| 8   | Year dummies                                 | Time dummies                                       | Control    |
| 9   | Excess market diversification (EMD)          | Excess foreign sales to total sales                | Control    |
| 10  | Product diversification (PD)                 | J-B entropy                                        | Explanatory|
| 11  | RD                                           | J-B entropy                                        | Explanatory|
| 12  | UD                                           | J-B entropy                                        | Explanatory|
| 13  | Level of capital availability (LCA)          | Standardised predicted value of PCA’s component scores | Control   |
| 14  | Level of regulatory control (LRC)            |                                                    | Control    |
| 15  | Level of foreign debt (LFD)                  |                                                    | Control    |
| 16  | Level of price control freedom (LPCF)        |                                                    | Control    |
Table 3.
Impact of PD on firm performance

| Model performance | (A1) | (A2) | (A3) | (A4) | (A5) | (A6) |
|-------------------|------|------|------|------|------|------|
| EROA              | -0.053 | 0.059 | 0.334* | 0.113** | -0.548 | -0.144** |
| TFP               | (-0.952) | (1.097) | (1.817) | (2.272) | (-1.334) | (-2.306) |
| RD                | -0.548 |
| UD                | 0.113** |
| UD^2              | -0.144** |
| Observations      | 809 | 790 | 809 | 790 | 809 | 790 |
| R^2               | 0.074 | 0.425 | 0.084 | 0.451 | 0.095 | 0.167 |
| Adj. R^2          | 0.047 | 0.408 | 0.057 | 0.435 | 0.069 | 0.142 |

Note: β coefficient and t statistics in parentheses; * p < 0.10, ** p < 0.05 and *** p < 0.01
Table 4. Impact of PD on firm performance during different phases of the institutional environments

| Phase                  | Pre-transition (2003-2009) | Post-transition (2010-2016) |
|------------------------|----------------------------|----------------------------|
| Model                  | (C1) (C2) (C3) (C4) (C5) (C6) | (D1) (D2) (D3) (D4) (D5) (D6) |
| Performance            | EROA EROA EROA TFP TFP TFP | EROA EROA EROA TFP TFP TFP |
| Main effect            |                            |                            |
| PD                     | -0.104 (-0.820)            | -0.009 (-0.139)            |
| RD                     | 0.080 (0.426)              | 0.248** (2.195)            |
| RD³                    | 0.018 (0.147)              |                            |
| UD                     | -0.129 (-0.699)            | -0.165 (-0.945)            |
| UD³                    | -0.048** (-2.179)          |                            |
| Obs                    | 351 351 351 345 345 345    | 398 398 398 388 388 388    |
| R²                     | 0.191 0.220 0.192 0.169 0.201 0.304 | 0.024 0.041 0.026 0.097 0.139 0.067 |
| Adj R²                 | 0.153 0.183 0.153 0.128 0.162 0.270 | -0.017 0.001 -0.015 0.058 0.102 0.027 |
Table 5.
Principal components and correlation (varimax rotation)

| Component | Variance | Difference | Proportion | Cumulative* |
|-----------|----------|------------|------------|-------------|
| 1         | 10.074   | 3.397      | 0.360      | 0.360       |
| 2         | 6.677    | 2.753      | 0.239      | 0.598       |
| 3         | 3.924    | 1.446      | 0.140      | 0.738       |
| 4         | 2.478    | 0.000      | 0.089      | 0.827       |

| Number of observations | 22 |
| Number of components   | 4  |
| Trace                  | 28 |
| Rho                    | 0.8269 |

*Total variance explained
| Table 6. |
| Effect of economic institutions on PD-firm performance |
| Dimension | LCA | | | | LFD | | | |
| Model | (J1) | (J2) | (J3) | (J4) | (K1) | (K2) | (K3) | (K4) |
| Performance | (J1) | (J2) | (J3) | (J4) | (K1) | (K2) | (K3) | (K4) |
| Interaction effect | | | | | | | | |
| RD $\times$ LCA | 0.010 | | | | | | |
| (0.394) | | | | | | | |
| RD $^3 \times$ LCA | 0.077** | | | | | | |
| (2.225) | | | | | | | |
| RD $\times$ LFD | | | | | 0.013 | 0.031* |
| | | | | | (0.418) | (1.909) |
| UD $\times$ LCA | 0.003 | 0.001 | | | | | |
| (0.128) | (0.137) | | | | | | |
| UD $\times$ LFD | | | | | -0.037 | -0.001 |
| | | | | | (-1.166) | (-0.070) |
| Obs | 809 | 809 | 790 | 790 | 809 | 809 | 790 | 790 |
| R$^2$ | 0.087 | 0.091 | 0.247 | 0.191 | 0.084 | 0.088 | 0.234 | 0.196 |
| Adj R$^2$ | 0.058 | 0.062 | 0.222 | 0.164 | 0.055 | 0.058 | 0.209 | 0.170 |
Table 7.
Effect of regulatory institutions on PD-firm performance

| Dimension | LRC  | LPCF  |
|-----------|------|-------|
|           | (L1) | (L2)  | (L3) | (L4) | (M1) | (M2) | (M3) | (M4) |
| Performance | EROA | EROA  | TFP  | TFP  | EROA | EROA  | TFP  | TFP  |
| Interaction effect |     |       |      |      |     |       |      |      |
| RD × LRC   | 0.029** |       |      |      |     |       |      |      |
| (2.060)    |     |       |      |      |     |       |      |      |
| RD × LRC²  | -0.125** |       |      |      |     |       |      |      |
| (-2.133)   |     |       |      |      |     |       |      |      |
| UD × LRC   |       | -0.001 |      |      |     |       |      |      |
| (-0.060)   |     |       |      |      |     |       |      |      |
| UD × LRC²  |       | -0.000 |      |      |     |       |      |      |
| (-0.009)   |     |       |      |      |     |       |      |      |
| RD × LPCF  |       |       |      |      |     | 0.018  |      | 0.033*  |
| (-0.200)   |     |       |      |      |     | (0.164) |      | (1.959) |
| UD × LPCF  |       |       |      |      |     | 0.018  |      | 0.033*  |
| (-0.200)   |     |       |      |      |     | (0.164) |      | (1.959) |
| Obs        | 809  | 809   | 790  | 790  | 809  | 809   | 790  | 790  |
| R²         | 0.089 | 0.093 | 0.186 | 0.192 | 0.083 | 0.090 | 0.196 | 0.195 |
| Adj R²     | 0.059 | 0.064 | 0.159 | 0.165 | 0.053 | 0.061 | 0.170 | 0.169 |
Table 8.
Summary of results: (a) pre-transition (2003-2009), (b) post-transition (2010-2016), (c) Effect of LCA (d) LFD, (e) LRC and (f) LPCF on PD-firm performance

|       | RD | UD |
|-------|----|----|
| EROA  |    |    |
| TFP   | (-)|    |

(a)

|       | RD | UD |
|-------|----|----|
| EROA  |    |    |
| TFP   | (+)|    |

(b)

|       | RD | UD |
|-------|----|----|
| EROA  |    |    |
| TFP   | (+)|    |

(c)

|       | RD | UD |
|-------|----|----|
| EROA  |    |    |
| TFP   | (+)|    |

(d)

|       | RD | UD |
|-------|----|----|
| EROA  |    |    |
| TFP   | (+)|    |

(e)

|       | RD | UD |
|-------|----|----|
| EROA  | (+)|    |
| TFP   | (+)|    |

(f)