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Debt versus Equity: Open Innovation to reduce Asymmetric Information

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Abstract

We aim to examine capital structure decisions on a firm-specific and lifecycle basis. 3.343 pooled data were collected from public companies listed on the Indonesian Stock Exchange from 2008 to 2019. The total sample explains that companies still prefer debt issuance to equity to finance growth opportunities. By adding life cycle and firmspecific, during introductions with asymmetric information that is greater than growth and maturity, they miss growth opportunities with leverage. When growth and maturity, companies still issue Debt instead of equity, even though they can issue equity. In general, we conclude that information asymmetry is still found when issuing equity, even though the manager has done open innovation,

Keywords: Leverage, Growth Opportunities, Specific Firms, Life Cycle.

Introduction

Managers as agents with superior information can act in their interests, majority shareholders, and conflict with debtholders and other shareholders [1], [2]. Thus, the information asymmetry situation can occur in Indonesia with a concentrated ownership structure[3] and a family relationship between the manager and controlling shareholders [4].

Companies use leverage signalling to convey information to reduce information asymmetry [5]–[7]. The presence of information asymmetry results in equity friction in the market[8] that is not following the company's claims, so the company prioritizes internal financing, Debt and subsequently equity, according to the hierarchical Pecking Order Theory [7], [9]. It seems that the POT does well empirically at sending asymmetric information-reducing signals, but it doesn't and doesn't perform well when it's needed.[10] and still unexplained [11], depending on the specific firm and institutional.[12].

Open innovation paradigm is the most important,[13]reporting should, with the use of information technology and digitization (TID), reduce information asymmetry in equity issuance. But it is not used optimally, so it is still found a high cost of equity and in line with POT, which is signal leverage that is better than equity.

We predict POT can explain better when TID as a form of open innovation is used to deliver firm specifics and a better life cycle. As a result, the information asymmetry is reduced, so that the POT hierarchy is reversed, the company prefers equity issuance to Debt. Firm-specific variables such as size, profitability and risk-specific[14], [15] and the life cycle are in introduction, growth and mature [16], [17]. We are motivated to develop capital structure decisions based on conflicts of majority-minority shareholders following the characteristics of the ownership structure in Indonesia, which may be different from other developing countries. Financial Services Authority The Republic of Indonesia (OJKRI), as an institution, has an essential role in developing open innovation[18]and use TID implementation for information disclosure [19]; so that the information content is less and it prefers equity compared to Debt.

Literature Review

Leverage, Firm-Specific and Growth: The Role of Open Innovation

Companies with less valuable opportunities can mimic those offered with more valuable opportunities. The results are overvalued securities at companies with less valuable opportunities and undervalued at companies with more valuable opportunities. Therefore, when growth opportunities have asymmetric information, a good quality company will issue a Debt higher than equity[5], [6], [20], as a positive convey the signal to the market.

Thus, the company will take advantage of growth opportunities with increased leverage, as an indication that the company's information asymmetry is lower than if it were to issue equity, inline POT. On the other hand, it was found that when information asymmetry was high, majority shareholders prevented share dilution through debt issuance. Furthermore, the company will take advantage of growth opportunities with equity so that growth to leverage has a negative effect[21].

Debt issuance is a mechanism to reduce the agency problem of ex-ante information asymmetry. Managers who act in the interests of shareholders are better off skipping growth opportunities with leverage[22] because high leverage will only increase the risk of bankruptcy and transfer of welfare to debtholders only [23].

The difference in previous research regarding the relationship between leverage and growth was developed in firm-specific terms, namely size, profitability and risk-specific. Large companies have a lower level of information asymmetry than small companies, increasing collateral assets for lenders[12], [24]. Larger companies have bigger cash flow and more assets, so they have easy access to banking because they are considered less risky borrowers.[20]. As support for their behaviour, profitability will have an impact on leverage. Managers prefer to keep retained earnings and use Debt to finance growth opportunities[25]. The higher the company-specific risk, the shareholders will do risk-shifting[26] whenever possible. The use of excessive

leverage, with the presence of bankruptcy costs and the limited responsibility of shareholders, is a risk for debtholders who bear it[8].

Market failure among participants is not due to product quality but rather due to information asymmetry[27]. In this context, the use of TID is a form of open innovation that can reduce information asymmetry[13]. Thus the informed agent has a strategic role compared to the uninformed agent in delivering firm-specific information to the market[28], equity friction becomes lower and prioritizes equity over Debt, which is inversely related to POT.

Hypothesis: the presence of TID open innovation resulted in a low level of information asymmetry so that the company prioritized equity financing over Debt.

Lifecycle stage, Specific Firm: Open Innovation

Each stage of the life cycle produces a different and more specific level of asymmetry [29]. For example, the technology life cycle is more applicable during growth and maturity than introduction[30]. Relevant with[16]In table 1, it was possible for cash flow for greater investment during introduction and growth, including TID, but tended to use cash flow from debt issuance. Thus, open innovation investment in TID has decreased asymmetric information from introduction, growth, and maturity.

Cashflow	Introduction	Growth	Mature	ShakeOut	Decline
Operating	-	+	+	Void in theory	-
Investing	-	-	-	Void in theory	+
Financing	+	+	-	Void in theory	+ or -

Table 1: Cashflow patterns for each lifecycle stage.

Older companies have better information credibility, more assets and a better reputation than younger companies that use more leverage. Therefore, during maturity, the company substituted Debt with internal financing[14]; or prefers Debt to equity[31] as a form of low information asymmetry.

As additional information, the relationship between specific firms and the life cycle is that profitability negatively affects and leverage has a positive effect. The longer the age of the company shows decreasing profitability, and the company prioritizes debt issuance. In more detail, leverage is shown as the smallest determinant of financing during the introduction[17]. The company at an early stage faces significant business uncertainty and business risk, which is exacerbated by high information asymmetry, so that it prioritizes internal funding[15]. However, when internal funding that comes from profitability has decreased[17], the company prefers Debt, which has a lower risk of stock price friction than equity.

Company size affects the use of leverage at each stage of the life cycle. During the introduction, leverage shows a negative sign and during growth and maturity shows

a positive sign[15]. At the introduction stage, there is a large asymmetry problem that the company uses internal funds to reduce leverage. Companies have less information asymmetry and greater collateral asset ownership during growth and maturity, so they prioritize external funding through Debt over equity.[17]. More extreme, companies at an early stage, due to high information asymmetry, are limited in using external funds. In the next stage, the company does re-balancing, not on increasing Debt, but substituting internal funding where the frictional risk of share prices is smaller than Debt and equity.[14].

During the introduction, companies are faced with higher information asymmetry because of the uncertainty of future cash flows. As a result, they have a higher external cost of capital. In more detail, it is reported that companies are faced with higher risks during the period of introduction, growth and decline when the risk is lower during maturity[32]. In contrast, there is a non-linear relationship, namely low investment inefficiency during introduction and increases when growth and maturity[15]. POT theory is more suitable during maturity than younger ones[33], [34]

Hypothesis: The presence of open innovation and the increasing stages of the life cycle results in less asymmetry about firm-specific information so that companies prefer equity rather than leverage in financing growth opportunities.

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Research Methods

Variable measurement

The total debt ratio to total assets (leverage) is used as the regressand variable [21]. When growth opportunities become information asymmetry of information, issuance of information asymmetry of debt results in companies still being able to issue leverage greater than total assets even though market leverage is depreciating. Growth opportunities are measured by (total sales t - total sales t-1) / total sales t-1[35], [36].

Our firm-specific variable uses ln asset as a proxy for size[37], profitability as return on assets[38], and specific risk as to the variance of return on assets [39]. Life cycle uses the age measured in years since it was recorded[40]. The life cycle consists of 5 stages: introduction, growth, mature, shake-out, and decline[16]. Since cash flow investing, operating, and financing can better explain the lifecycle, we then use the first three[17]. The company age in each life cycle stage is categorized quartile 1 as an introduction, above quartile 2 as a mature company, between 1 and 3 as a growth company[41]

Data and sample selection

Pooled data were used as many as 3343 units of observation originating from companies from 8 industrial sectors listed on the Indonesian Stock Exchange (IDX) for the period 2008 - 2019. Total data is reported in table 2, excluding the financial and banking sectors due to differences in different policies.[42]. The data that we analyzed have been censored with a trim data of 5% extreme data above and below. The data

description based on the industrial sector is agriculture, infrastructure, utilities and transportation, manufacturing, mining, property, real estate and building construction, trade, services and investment in the order of 3.92%; 11.22%; 32.93%; 9.39%; 15.23%; 27.31%

We use OLS regression with the dummy equation or LSDV because the scalable explanatory variable is nominal [43]; namely introduction, growth and mature, with 2 dummy categories to avoid dummy traps.

$$E(Y_i|X_i) = \alpha_1 + \alpha_2 X_i + \alpha_3 FirmSpecific_i + \alpha_4 D_{2i} + \alpha_5 D_{3i}$$

Y is leverage; X are growth opportunities; Firm-Specific is size, profitability and risk-specific; D2i if 1 is growth and 0 is another; D3i if 1 is mature and 0 is another; if D2i = 0 and D3i = 0 it is introduction.

Result and Findings

Data

Table 1 the data has kurtosis, which tends to be homogeneous and has varied skewness as long as growth has to mean leverage greater than introduction and maturity. The increase in leverage from introduction to growth resulted in greater debt issuance due to reduced information asymmetry.[15]. In contrast, there is no significant difference in mean leverage during maturity compared to growth, as an effort to prevent the risk of bankruptcy[32] and a more stable cash flow is used to replace ageing equipment, instead of paying debt [16].

Panel A	Descrip	otive Statistics							
	Obs		(25th		75th			
Life Cycle		Variables	Mean	quartile	Median	quartile	St. Dev	Kurtosis	Skewness
Introduction	692	Leverage	0.456	0.284	0.458	0.611	0.222	2,069	0.511
	692	Growth Opp.	0.169	-0.035	0.109	0.267	0.393	6,008	1,894
	692	Size	28,250	27,328	28,287	29,219	1,420	11,362	1,121
	692	Profitability	0.035	0.003	0.035	0.075	0.089	15,951	-1,604
	692	Risk-Specific	0.008	0.000	0.001	0.005	0.033	235,562	13,538
Growth	1682	Leverage	0.486	0.321	0.475	0.637	0.217	-0.131	0.326
	1682	Growth Opp.	0.122	-0.050	0.079	0.221	0.323	8,411	2,085
	1682	Size	28,442	27,190	28,507	29,677	1,761	-0.050	-0.134
	1682	Profitability	0.029	0.001	0.028	0.070	0.131	214,966	-9,860
	1682	Risk-Specific	0.017	0.000	0.001	0.006	0.254	1302,150	34,864
Mature	969	Leverage	0.484	0.302	0.479	0.616	0.248	6,441	1,283
	969	Growth Opp.	0.093	-0.031	0.072	0.175	0.262	9,817	1,881
	969	Size	28,626	27,375	28,560	29,962	1,858	0.212	0.099
	969	Profitability	0.061	0.009	0.045	0.098	0.141	37,755	2,342
	969	Risk-Specific	0.021	0.000	0.002	0.008	0.129	460,111	19,271
Total	3343	Leverage	0.479	0.308	0.473	0.629	0.228	3,001	0.721

Table 1



Panel A	Descriptive Statistics								
	Obs			25th		75th			
Life Cycle		Variables	Mean	quartile	Median	quartile	St. Dev	Kurtosis	Skewness
	3343	Growth Opp.	0.123	-0.041	0.081	0.217	0.324	8,558	2,092
	3343	Size	28,456	27,270	28,453	29,610	1,730	1,150	0.129
	3343	Profitability	0.040	0.003	0.034	0.079	0.128	141,355	-4,581
	3343	Risk-Specific	0.016	0.000	0.001	0.006	0.194	1962,489	41,208
Panel B	Mean Differences								
				Mean Di	Mean Diff (Growth minus				
Variables				Introductio	on		Mean Diff (Mature minus Growth		
Leverage				0.030 *			-0.002		
Growth Opp.				-0.047 *			-0.029 *		
Size				0.192 *			0.185 *		
Profitability				-0.006 *			0.032 *		
Risk-Specific				-0.063 *			0.004		

As long as growth has less information asymmetry than the introduction of increasing assets as collateral, the company issues more Debt. Conversely, during maturity, the information asymmetry is smaller than growth and the increase in collateral results in reduced leverage; prefers internal financing instead of equity[29].

As long as growth has cash flow from large investments, it exceeds the profitability, which is relatively stable compared to the introduction[16], resulting in a decrease in profitability. On the other hand, there is an increase in profitability because investment is more efficient during maturity than[15]. Business risk during the growth period compared to introduction has decreased, and during the mature period compared to growth, there is no difference in business risk. The risk of uncertainty can be reduced at this stage and a mature stage compared to relatively stable growth[15]. Business risk, during growth compared to the previous one, has decreased significantly[44].

There was a decrease in growth opportunities, resulting in more debt issuance; riskshifting problem[26], [45]. When managers-majority shareholders have better quality information about growth opportunities than minority, they prefer Debt to equity. Debtholders are promised high returns if the project is successful, even if the probability of success is low because if it is successful, the majority manager will benefit, and if it fails, the debtholders will share the risk. Conversely, if the riskspecific is unknown and the sequential Debt, the company will tend to issue equity. Further information asymmetry results in a "mean revision" of the leverage level.[24], [34]. They'd better skip taking advantage of growth opportunities because they created a new agency of Debt.

Table 2 reports multicollinearity absences, which indicated a VIF value of about 1 and a correlation between explanatory variables of less than 0.8.[43].

Panel A	Correlation Matrix						
	td bl	td growth	Size	net inc / t as	std roa		
Leverage	1						
Growth Opp.	0.002446	1					
Size	0.12642	-0.01661	1				
Profitability	-0.24849	0.118867	0.114479	1			
Risk-Specific	0.020752	-0.02165	-0.06079	-0.36919	1		
Panel B	VIF Factor	S					
Variables	VIF						
Growth Opp.	1,096						
Size	1,017						
Profitability	1,042						
Risk-Specific	1,109						

Table 1 regarding descriptive statistics reports the significant difference in mean leverage between growth and introduction with mature and grow. However, because this simple description does not add together size, profitability and risk-specific variables, more interesting findings are examined further in the LSDV regression, as discussed in Table 3.

Table 3

Table 3			nderemen		
Variables	All Firm	All Firm	Introduction	Growth	Maturity
Constant	0.479 *	-0.087	-0.572 *	-0.089	0.042
	0.000	0.160	0.000	0.265	0.713
Growth Opp	0.002	0.027 *	0.015	0.033 *	0.135 *
	0.888	0.019	0.437	0.034	0.000
Size		0.021 *	0.037 *	0.021 *	0.016 *
		0.000	0.000	0.000	0.000
Profitability		-0.536 *	-0.989 *	-0.815 *	-0.627 *
		0.000	0.000	0.000	0.000
Risk Specific		-0.094 *	0.318	-0.280 *	0.514 *
		0.000	0.198	0.000	0.000
Obs	3343	3343	692	1682	969
F Test	0.019	85,482	43,193	69,663	36,473
Sig F Test	0.888	0.000	0.000	0.000	0.000
Multiple R	0.002	0.305	0.448	0.377	0.363
R Square	0.000	0.093	0.201	0.142	0.131

Column 1 reports that when majority-minority shareholders do not have specific firm information. As a result, they are faced with uncertainty in cash flow and high risk, so

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that the issuance of Debt becomes risky. As a result, they refused financing for valuable growth opportunities; to prevent loss of control over the company[45]. Due to the limited responsibility of shareholders, if there is bankruptcy, the company will be taken over by debtholders. When there is no disclosure of specific firm information, insider-outsider shareholder, debtholders will not make transactions because it can depreciate Debt and equity.

Column 2 reports the presence of specific firms, namely the increase in assets as collateral increases, the specific risk increases and the profitability decreases, the company increases the leverage to finance the rise invaluable growth. [10], [46]. It shows that the effect of profitability on leverage is greater than size and risk-specific. The presence of increasing assets and decreasing risk-specificity can provide a positive signal than profitability as a negative signal to the market. Management will issue Debt to provide a positive signal to the market as a quality company[5]; management prevents losing control of a quality company[6]. From the perspective of agency theory, they avoid exposure to the capital market[47].

Thus, the specific firm information submitted by companies with agency problems still contains asymmetric information. The result is that they issue Debt rather than equity when financing growth opportunities. As previously thought, there is still information asymmetry so that the POT hierarchy works, even though the manager already has an incentive for open innovation with TID in information disclosure following OJKRI regulations. The existence of a high cost of equity resulting from asymmetric information has resulted in companies using debt financing[13], apart from the factor of Indonesia as a bank-based system [48].

Column 3, 4 and 5, show the difference in results. Companies in the introduction stage have high business uncertainty and risk[44]. Managers-majority shareholders have higher quality information than minority shareholders regarding growth opportunities; growth opportunities have higher information asymmetry than total assets[21]. An interesting result, by adding the specific firm size and profitability, they missed taking advantage of the growth opportunities with leverage. When faced with high risk and reduced profitability, they will not finance growth opportunities with leverage even if there is an increase in collateral assets. However, they do risk-avoidance[45], to prevent loss of control and as rent for future corporate value increases.

In the growth stage, companies buy many assets to carry out a competitive advantage strategy. Demand for cash flow for investment is more than the availability of internal financing and lower information asymmetry than during the introduction. Although there is an increase in size as a proxy for collateral and a decrease in company risk, the fact is that long-term investment needs are greater than profitability, so the presence of asymmetric information exacerbates this condition, so they prefer debt issuance to equity.[7], [16].

The mature stage is a condition with fewer asymmetric information indications than the previous stage. Companies should be able to issue equity instead of Debt, in fact, they still reference Debt, which is different from research[14], [21]. Managers-majority shareholders avoid issuing equity because they are more sensitive to the market response than Debt, or there is still an imbalance of information between insiders and outsiders.

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Open innovation carried out by insiders as a mechanism to reduce information asymmetry has proven not to work optimally. With the provisions of the OJKRI, they do not have an incentive to issue equity compared to leverage in financing growth opportunities because if they use the equity, they will face a high cost of equity as the production of asymmetric information.[13].

Conclusion

Managers have a strategic role in open innovation using TID for information disclosure. In the absence of firm-specific information, issuance of leverage or equity will only depreciate. Conversely, when specific firm information is added as disclosure of information, it is found that there is still information asymmetry, thus avoiding the issuance of equity which is more sensitive to market response; then they issue Debt.

When adding lifecycles and specific firms to test the effect of growth on leverage, during the introduction, the company did not issue Debt to finance growth opportunities even though it had lower market sensitivity than equity. The next stage shows severe asymmetric information when companies have disclosed firm-specific but still use debt financing to finance growth opportunities.

In the total sample without including the life cycle, firms prefer the issuance of leverage over equity when specific firm information is included in the test. An interesting result, namely the disclosure of information as a form of open innovation, has not provided incentives for companies during growth and maturity to prefer equity issuance over Debt. Managers and majority shareholders have more incentives to prevent equity, which results in dilution even though there has been disclosure of information, which is their obligation.

Following the[27], information asymmetry results in adverse selection and moral hazard. So that the limitations of our research, first, it is possible to have omitted variables present in modelling. The behaviour of agents who act in majority shareholders' interests is still likely to have better information than other shareholders even though information disclosure is required as a form of open innovation. Second, we did not explore firm heterogeneity via panel data.

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Type of the Paper Debt Versus Equity-Open Innovation to Reduce Asymmetric Information

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Abstract: We aimed to examine capital structure decisions on a firm-specific and life_cycle basis. We collected 3:343 pooled datapoints data were collected from public companies listed on the Indonesian Stock Exchange from 2008 to 2019. The total results sample explains revealed that companies still prefer debt issuance to equity to to finance finance growth opportunities. By adding life cycle and-firm-specific life cycle variables, we found that during introductions with asymmetric information was greater at the introduction stage than during that is greater than the growth and maturity stages, and that companies they miss growth opportunities with leverage. When-During the growth and maturity stages, companies still issue dDebt instead of equity, even though they can could issue equitythe latter. In general, w. We conclude that information asymmetry is still found when issuing equity, even though the manager has done also performed open innovation.

Keywords: leverage; growth opportunities; specific firms; life_-cycle

1. Introduction

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Managers as agents with superior information can act in their <u>own</u> interests <u>and those</u> <u>of</u>_majority shareholders, and rather than onflict with in the interests of debtholders and other shareholders [1,2]. Thus, <u>the an</u> information asymmetry situation can occur in Indonesia with a concentrated ownership structure [3] and a family relationship between the manager and controlling shareholders [4].

Companies use leverage signalling to convey information to and reduce information asymmetry [5–7]. The presence of information asymmetry results in equity friction in the market [8] that and doesis not following the company's claims, so the company prioritizes internal financing, <u>Delebt</u> and then-subsequently equity, according to the hierarchical Ppecking Qorder Ttheory (POT) [7,9]. It seems that tThe POT seems to perform does well empirically at with regard to sending asymmetric information-reducing signals, but it does <u>n'not always and doesn't</u> perform well when it's needed in reality [10] and still remains largely unexplained [11], depending on the specific firm and institutional [12].

<u>The Oopen innovation paradigm is the most important [13], that is, that</u> reporting should___with the use of information technology and digitization (TID)___reduce information asymmetry in equity issuance. <u>But However</u>, it is not used optimally, <u>so meaning that there is it is still found a high cost of equity, which is and in line with POT, which indicating that is signal leverage that is better than equity.</u>

We predict <u>that the POT</u> can explain <u>a situation</u> better when TID, as a form of open innovation, is used to deliver firm specifics and a better life_-cycle. As a result, the information asymmetry is reduced, d, so that the POT hierarchy is reversed, and the company prefers equity issuance to over debtDebt. Firm-specific variables include such as size, profitability, and risk-specific [14,15], while the and the life _cycle comprises are in introduction, growth and maturity stagese [16,17]. We are motivated to develop Ceapital structure decisions are developed based on conflicts of majority- and minority shareholders following the characteristics of the ownership structure in Indonesia, which may be differ to ent from-other developing countries. The Financial Services Authority of Fthe Republic of Indonesia (OJKRI) <u>plays</u>, as an institution, has an essential role in developing open innovation [18] and using e-TID implementation for information disclosure [19] in orders so that the to reduce the level of information content, and it is less and it prefers equity compared tovere D_debt. **Commented [ts10]:** please check intended meaning has been retained here

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2. Literature Review

2.1. Firm-Specific Leverage, Firm_Specific and Growth_+ The Role of Open Innovation

Companies with <u>less fewer</u> valuable opportunities can mimic those <u>offered</u> with more valuable <u>opportunitiesones</u>. Th<u>is can</u>e result<u>in s are</u> overvalued securities at companies with <u>less fewer</u> valuable opportunities and undervalued <u>securities</u> at companies with more valuable opportunities. Therefore, when growth opportunities have asymmetric information, a good quality company will issue a <u>d</u>Debt higher than equity [5,6,20], <u>as</u> to convey a positive <u>convey the</u> signal to the market.

_Thus, the company will take advantage of growth opportunities with increased leverage, as an indication that the company's information asymmetry is lower than if it were to issue equity, in_line <u>with the</u> POT. On the other hand, <u>it was found that</u> when information asymmetry <u>was is</u> high, majority shareholders <u>may</u> prevented share dilution through debt issuance. Furthermore, the company <u>will-could</u> take advantage of growth opportunities with equity so that growth to leverage has a negative effect [21].

Debt issuance is a mechanism <u>used</u> to reduce the agency problem of ex-ante information asymmetry. Managers who act in the interests of shareholders are better off skipping growth opportunities with leverage [22] because high leverage <u>will</u>-only increases the risk of bankruptcy and transfer of welfare to debtholders only [23].

The One difference in between this study and previous research regarding the relationship between leverage and growth was is in the use developofed in firm-specific terms including-namely size, profitability and risk specific. Large companies have a lower level of information asymmetry than small companies, increasing collateral assets for lenders [12,24], and -Larger companies have bigger-higher cash flow and more assets, so they have easy access to banking because they are considered less risky borrowers [20]. As support for their behaviour behavior, profitability will have an impact on leverage. Managers prefer to keep retained earnings and use dDebt to finance growth opportunities [25]. When the The higher the company-specific risk is high, the shareholders will do-perform risk-shifting [26] whenever possible. The use of excessive leverage, with the presence of bankruptcy costs and the limited responsibility of shareholders, is a risk for the debtholders who bear it [8].

Market failure among participants is not due to product quality but rather due-to information asymmetry [27]. In this context, the use of TID is a form of open innovation that can reduce information asymmetry [13]. Thus, the informed agent has a strategic role compared to the uninformed agent in delivering firm-specific information to the market [28]. As a result, equity friction becomes lowerreduces and prioritizes equity is prioritized over pdebt, which is inversely related to the POT.

Hypothesis 1. The presence of TID open innovation resulted in a low level of information asymmetry so that the company prioritized equity financing over <u>d</u>Pebt.

2.2. Firm-Specific Life_eCycle Stage, Specific Firm: -- Open Innovation

Each stage of the life_-cycle produces a different and more specific level of asymmetry [29]. For example, the technology life_-cycle is more applicable during the growth and maturity stages than the introduction stage [30]. RelevantBased on-with [16], In-Table 1 shows that, it was possible for to use cash flow for greater investment during the introduction and growth_stages, including TID, but tended to use cash flow tended to come from debt issuance. Thus, open innovation investment in TID has decreased the asymmetric information from in the introduction, growth, and maturity stages.

Table 1. Cashflow patterns for each life_cycle stage.

Cashflow	Introduction	Growth	Mature	ShakeOut	Decline
Operating	-	+	+	Void in theory	-
Investing	-	-	-	Void in theory	+

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Financing	+	+	-	-	Void in theory	+ or -	-

Older companies <u>generally</u> have better information credibility, more assets, and a better reputation than younger companies that use more leverage. Therefore, <u>during-in</u> the maturity <u>stage</u>, <u>the a</u> company <u>can</u> substituted <u>D</u> debt with internal financing [14], for <u>may</u> prefers <u>d</u>Debt to equity [31] as a form of low information asymmetry.

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As additional information<u>In addition</u>, the relationship between specific firms and the life_-cycle is that profitability <u>has a</u> negative <u>effectly affects</u> and leverage has a positive effect. The longer the<u>As the</u> age of the company shows_increases the decreasing profitability <u>decreases</u>, and the company prioritizes debt issuance. In more detailSpecifically, leverage is shown as the smallest determinant of financing during the introduction <u>stage</u> [17]. The company at<u>During the</u> an early stage, a company faces significant business uncertainty and <u>business</u>-risk, which is exacerbated by high information asymmetry, so that it prioritizes internal funding [15]. However, when internal funding that comes from profitability has decreased [17], the company prefers <u>d</u>Debt, which has a lower risk of stock price friction than equity.

<u>A</u> Company's size affects the use of leverage at each stage of the life_-cycle. During the introduction stage, leverage shows a negative sign is low, while and during the growth and maturity stages it is highshows a positive sign [15]. At the introduction stage, if there is a large asymmetry problem that the company uses internal funds to reduce leverage. Companies have less information asymmetry and greater collateral asset ownership during the growth and maturity stages, so they prioritize external funds through dDebt over-instead of equity [17]. More extremely, companies at an early stage, due to the high information asymmetry, are limited in using external funds. In the next stage, the company dees-performs re-balancing, not on by increasing Ddebt, but by substituting internal funding where the frictional risk of share prices is smaller than dDebt and equity [14].

During the introduction <u>stage</u>, companies are faced with higher information asymmetry because of the uncertainty of future cash flows. As a result, they have a higher external cost of capital. In more detail, it is reported that <u>C</u> companies <u>face higher levels of</u> <u>risk are faced with higher risks</u> during the <u>period of</u> introduction <u>and</u> <u>-</u>growth <u>stages</u>, but <u>risk reduces</u> and decline when the risk is lower during the maturity stage [32]. In contrast, there is a non linear relationship, namely low investment inefficiency is low during the introduction <u>stage but this and</u>-increases <u>non-linearly during when the</u> growth and <u>ma-</u> turity <u>stages</u> [15]. <u>Therefore, the</u> POT theory is more <u>suitable-applicable</u> during <u>the</u> maturity <u>stagethan younger ones</u> [33,34].

Hypothesis 2, The presence of open innovation and the increasing stages of the life_-cycle results in <u>less reduced</u> asymmetry <u>about regarding firm</u>-specific information<u>_such_-so</u> that companies prefer equity <u>rather thanto</u> leverage <u>in when</u> financing growth opportunities.

3. Research Methods

3.1. Variable Measurement

The total debt ratio to total assets (leverage) is was used as the regressiond dependent variable in a regression [21]. When growth opportunities become reach information asymmetry of information, the issuance of information asymmetry of debt results in companies still being able to issue leverage greater than the total assets, even though market leverage is depreciating depreciates. Growth opportunities are measured by (total sales t_{-} -total sales t_{-} 1]35,36].

Our firm-specific variable uses<u>d</u> in asset as a proxy for size [37], profitability as a return on assets [38], and specific risk as to-the variance of return on assets [39]. For the Life cycle we used uses the age measured in years since it was recorded [40]. The life cycle consisteds of five 5-stages: <u>H</u>introduction, growth, maturitye, shake-out, and decline [16]. Since cash flow investing, operating, and financing can better explain the life <u>c</u>eycle, we

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then used only the first three stages [17]. The <u>A</u> company's life cycle stage was categorized as follows: 1 = -age in each life cycle stage is categorized quartile 1 as an introduction introduction, 2 = growth, and 3 = maturity above quartile 2 as a mature company, between 1 and 3 as a growth company [41].

3.2. Data and Sample Selection

Pooled data were used as many asof 3343 units of observations originating fromgathered from companies from eight8 industrial sectors listed on the Indonesian Stock Exchange (IDX) for the period 2008–2019. Total data is reported in Table 2 shows the collinearity of variables used in the analysis and their corresponding VIF values; -excluding the financial and banking sectors were excluded_due to differences in different policies [42]. We removed outliers from Thethe dataset by excluding the _-that we analyzed have been censored with a trim data-highest aofnd lowest 5% of valuesextreme data above and below. The Data were obtained from data description based on the eight industrial sectors; is _-Aaagriculture (3.92% of observations), infrastructure (11.22%), utilities and transportation (11.22%), manufacturing (32.93%), mining (9.39%), property (15.23%), real estate and building construction (27.31%), trade, and services and investment in the order of 3.92%; 11.22%; 32.93%; 9.39%; 15.23%; 27.31%-

 Table 2
 reports mMulticollinearity
 absencesamong variables included in the analysis, which indicated a VIF value of about 1 and a correlation between explanatory variables of less than 0.8 [43].

Panel A	Correlation Matrix							
	td bl	td growth	<mark>Size</mark>	<mark>net inc/t as</mark>	<mark>std roa</mark>			
Leverage	1		0					
Growth Opp.	0.002446	1						
Size	0.12642	<mark>-</mark> 0.01661	1	0				
Profitability	<mark>-</mark> 0.24849	0.118867	0.114479	1				
Risk-Specific	0.020752	<mark>-</mark> 0.02165	<mark>-</mark> 0.06079	<mark>-</mark> 0.36919	1			
Panel B			VIF Factor	s				
Variables			VIF					
Growth Opp.			1096					
Size		\bigcirc	1017					
Profitability			<mark>1042</mark>					
Risk-Specific			<mark>1109</mark>					

We used OLS regression with the a dummy equation or LSDV because the scalable explanatory variable is was nominal [43](; namely introduction, growth and mature), with two 2 dummy categories to avoid dummy traps [43];-

 $E(Y_i|X_i) = \alpha_1 + \alpha_2 X_i + \alpha_3 FirmSpecific_i + \alpha_4 D_{2i} + \alpha_5 D_{3i}$

where Y is leverage; X are represents growth opportunities; _-Firm-Specific is represents size, profitability and risk-specific; D_{2i} if 1 is 1 if the stage is growth, otherwise it is 0-and 0 is another; D_{3i} if is 1 if the stage is mature, otherwise it is -and 0 is another; and if $D_{2i} = 0$ and $D_{3i} = 0$ then it is the introduction stage.

4. Results and Findings

Data

Table 1 <u>shows that</u> the data has kurtosis, which tends to be homogeneous and has varied skewness as long as <u>the growth stage has tohas a</u> mean leverage greater than <u>the</u> introduction and maturity <u>stages</u>. The increase in leverage from_-introduction to growth resulted in greater debt issuance due to reduced information asymmetry [15]. In contrast, there <u>is-was</u> no significant difference in mean leverage during maturity compared to

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Variables

Leverage

Growth Opp.

Size Profitability

Risk–Specific

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growth, as an effort to prevent reduce the risk of bankruptcy [32], and a more stable cash flow is-was used to replace ageing equipment, instead of paying debt [16].

				Table	1.				
Panel A	Descriptive Statistics								
Life Cycle	Obs	Variables	Mean	25th Quartile	Median	75th Quartile	St. Dev	Kurtosis	Skewness
Introduction	692	Leverage	0.456	0.284	0.458	0.611	0.222	2,069	0.511
	692	Growth Opp.	0.169	-0.035	0.109	0.267	0.393	<mark>6,008</mark>	<mark>1,894</mark>
	692	Size	28,250	27,328	28,287	29,219	<mark>1,420</mark>	11,362	<mark>1,121</mark>
	692	Profitability	0.035	0.003	0.035	0.075	0.089	15,951	– <mark>1,604</mark>
	692	Risk-Specific	0.008	0.000	0.001	0.005	0.033	235,562	13,538
Growth	1682	Leverage	0.486	0.321	0.475	0.637	0.217	-0.131	0.326
	1682	Growth Opp.	0.122	-0.050	0.079	0.221	0.323	<mark>8,411</mark>	<mark>2,085</mark>
	1682	Size	28,442	27,190	28,507	29,677	<mark>1,761</mark>	-0.050	-0.134
	1682	Profitability	0.029	0.001	0.028	0.070	0.131	214,966	– <mark>9,860</mark>
	1682	Risk-Specific	0.017	0.000	0.001	0.006	0.254	1,302,150	34,864
Mature	969	Leverage	0.484	0.302	0.479	0.616	0.248	<mark>6,441</mark>	<mark>1,283</mark>
	969	Growth Opp.	0.093	-0.031	0.072	0.175	0.262	<mark>9,817</mark>	<mark>1,881</mark>
	969	Size	28,626	27,375	28,560	29,962	<mark>1,858</mark>	0.212	0.099
	969	Profitability	0.061	0.009	0.045	0.098	0.141	37,755	<mark>2,342</mark>
	969	Risk-Specific	0.021	0.000	0.002	0.008	0.129	460,111	19,271
Total	3343	Leverage	0.479	0.308	0.473	0.629	0.228	<mark>3,001</mark>	0.721
	3343	Growth Opp.	0.123	-0.041	0.081	0.217	0.324	<mark>8,558</mark>	<mark>2,092</mark>
	3343	Size	28,456	27,270	28,453	29,610	<mark>1,730</mark>	<mark>1,150</mark>	0.129
	3343	Profitability	0.040	0.003	0.034	0.079	0.128	141,355	– <mark>4,581</mark>
	3343	Risk-Specific	0.016	0.000	0.001	0.006	0.194	1,962,489	41,208
Panel B				Me	ean Differ	ences			
				Mean Dif	f-(Growth	Minus vs.	Mean	Diff (Mature	Minus vs.

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As long as the growth stage has less lower information asymmetry than the introduction stage of when increasing assets increase as collateral, the company issues more dDebt. Conversely, during the maturity stage, the information asymmetry is smaller-reduced compared to the than growth stage and the increase in collateral results in reduced leverage, leading to a company preferring; prefers __internal financing instead overof equity [29].

Growth

-0.002

-0.029 *

0.185 *

0.032 *

0.004

Introduction

0.030 *

-0.047 *

0.192 *

-0.006 *

-0.063 *

As long as <u>a company in the growth stage growth</u> has cash flow from large investments, it exceeds the profitability, which <u>makes it is</u> relatively stable compared to <u>a company in</u> the introduction <u>stage</u> [16], resulting in a decrease in profitability. On the other hand, there is an increase in profitability because investment is more efficient <u>than</u> during the maturity <u>stage than</u> [15]. Business risk <u>during the growth period compared to introduction has decreased, and during the mature period compared to growthdecreases as the age of the company increases, there is no difference in business risk. The risk of uncertainty can be reduced at this stage and a mature stage compared to relatively stable growth</u>

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[15]. Business risk, during growth compared to the previous one, has decreased significantly [44].

There was a decrease inWhen growth opportunities <u>decreased there was</u>, resulting in-more debt issuance; and a risk-shifting problem [26,45]. When managers <u>and</u>-majority shareholders have better quality information about growth opportunities than minority <u>shareholders</u>, they prefer <u>d</u>Debt to equity. Debtholders are promised high returns if the project is successful, even if the probability of success is low₂ because if it is successful, the majority manager will benefit, and if it fails, the debtholders will share the risk. Conversely, if the risk-specific is unknown and the sequential Debt, the company will tend to issue equity. Further information asymmetry results in a "mean revision" of the leverage level [24,34]. In this case, it would be <u>They'd</u> better to avoid <u>skip</u>-taking advantage of growth opportunities because they created a new agency of <u>d</u>Debt.

Table 1 <u>showed a regarding descriptive statistics reports the</u> significant difference in mean leverage between <u>the</u> growth and introduction <u>stages</u> and <u>the with</u> mature and grow<u>th</u> <u>stages</u>. However, because this simple description <u>does_did</u> not add together <u>include firm-specific</u> size, profitability and risk-<u>specific</u> variables, <u>more interestingthe</u> findings <u>of anare examined further in the</u> LSDV regression<u>which included these</u> <u>-are</u> <u>shown in as discussed in Table Table</u> 3.

Table 3 <mark>.</mark>				,O	
Variables	All Firms	All Firms	Introduction	Growth	Maturity
Constant	0.479 *	-0.087	-0.572 *	-0.089	0.042
	0.000	0.160	0.000	0.265	0.713
Growth Opp	0.002	0.027 *	0.015	0.033 *	0.135 *
	0.888	0.019	0.437	0.034	0.000
Size		0.021 *	0.037 *	0.021 *	0.016 *
		0.000	0.000	0.000	0.000
Profitability		-0.536 *	-0.989 *	-0.815 *	-0.627 *
		0.000	0.000	0.000	0.000
Risk Specific		-0.094 *	0.318	-0.280 *	0.514 *
		0.000	0.198	0.000	0.000
Obs	3343	3343	692	1682	969
F Test	0.019	85,482	43,193	69,663	36,473
Sig F Test	0.888	0.000	0.000	0.000	0.000
Multiple R	0.002	0.305	0.448	0.377	0.363
R Square	0.000	0.093	0.201	0.142	0.131

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Column I of Table 3 Column 1-shows reports-that when majority and -minority shareholders do not have specific firm information_e. As a result, they are faced with uncertainty in cash flow and high risk, so that the issuance of dDebt becomes risky. As a result, they refused financing for valuable growth opportunities-to prevent loss of control over the company [45]. Due to the limited responsibility of shareholders, if there is bankruptcy<u>then</u>, the company will be taken over by debtholders. When there is no disclosure of specific firm information, <u>insider outsider shareholder</u>, debtholders will not make transactions because it can depreciate dDebt and equity.

Column 2<u>of Table 3</u> reports the presence of specific firms, namely shows that as the increase in assets<u>assets</u> increase, the <u>-as</u>-collateral increases; <u>as the</u>-the specific risk increases <u>and</u> the profitability decreases; <u>and that</u>, the company increases the leverage to finance the rise invaluable growth [10,46]. It <u>also</u> shows that the effect of profitability on leverage is greater than size and risk-specific. The presence of increasing assets and decreasing risk-specificity can provide a <u>more</u> positive signal than profitability, <u>which has</u> as a negative signal, to the market. Management will issue <u>d</u>Debt to provide a positive

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signal to the market as a quality company [5] in order to maintain; management prevents losing control of a quality company [6]. From the perspective of agency theory, they avoid exposure to the capital market [47].

Thus, the specific firm-specific information submitted by companies with agency problems still contains asymmetric information. The result is that they issue <u>d</u>Debt rather than equity when financing growth opportunities. As previously thought, there is still information asymmetry so that the POT hierarchy works, even though the manager already has an incentive for open innovation with TID in information disclosure, following OJKRI regulations. The existence of a high cost of equity resulting from asymmetric information has resulted in companies using debt financing [13], apart-despite from the factor of Indonesia being as a bank-based system [48].

Columns 3–5 of Table 3,-show the difference in results across life cycle stages. Companies in the introduction stage have high business uncertainty and risk [44]. Managersand majority shareholders have higher quality information than minority shareholders regarding growth opportunities, so; growth opportunities have lead to greaterhigher information asymmetry than total assets [21]. An interesting resultInterestingly, by adding the specific firm size and profitability, they managers and majority shareholders missed out on taking advantage of the growth opportunities with leverage. When faced with high risk and reduced profitability, they will not finance growth opportunities with leverage even if there is an increase in collateral assets. However, they do perform risk_avoidance [45], to prevent loss of control and as rent for future corporate value increases.

In the growth stage, companies buy many assets to carry out as part of a competitive advantage strategy. Demand for cash flow for investment is **more greater** than the availability of internal financing and <u>there is</u> lower information asymmetry than during the introduction. Although there is an increase in size as a proxy for collateral and a decrease in company risk, the fact is that-long-term investment needs are greater than profitability, so the presence of asymmetric information exacerbates this condition, <u>so and they companies</u> prefer debt issuance to equity [7,16].

The mature stage is a condition with <u>fewer-less</u> asymmetric information indications than the <u>previous growth</u> stage. <u>Therefore</u> Companies should be able to issue equity instead of <u>dDebt</u>, <u>but we found that they in fact, they</u> still <u>reference referenceD debt</u>, which is different from researchdiffers from findings of other research [14,21]. Managers- and majority shareholders avoid issuing equity because they are more sensitive to the market response than <u>Ddebt</u>, or there is still an imbalance of information between insiders and outsiders.

Open innovation carried out by insiders as a mechanism to reduce information asymmetry has proven not to work optimally to be sub-optimal in practice. With the provisions of the OJKRI, they do not have an incentive to issue equity compared to leverage in financing growth opportunities, because if they use the equity, they will face a high cost of equity as the production of asymmetric information [13].

5. Conclusions

Managers have a strategic role in open innovation using TID for information disclosure. In the absence of firm-specific information, issuance of leverage or equity will only depreciate. Conversely, when specific firm-specific information is added as <u>a</u> disclosure of information, it is found that there is still information asymmetry, thus avoiding to the issuance of equity₂ which is more sensitive to market responses; then they issue <u>d</u>Pebt.

When adding <u>firm-specific</u> lifecycles and specific firms-to test the effect of growth on leverage, during the introduction_<u>stage</u>, the company did not issue <u>Dd</u>ebt to finance growth opportunities even though it had lower market sensitivity than equity. The next stage show<u>eds</u> severe asymmetric information, when companies <u>have</u> disclosed firm-specific <u>information</u> but still use<u>d</u> debt financing to finance growth opportunities.

In the total_overall_sample without including the life-cycle, firms prefer<u>red</u> the issuance of leverage over equity when specific firm_specific information is-was_included_in

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the test. An interesting resultInterestingly, namely the disclosure of information as a form of open innovation <u>did n</u>, has not provided incentives for companies during growth and maturity to prefer equity issuance over <u>d</u>Debt. Managers and majority shareholders have more incentives to prevent equity, which results in dilution, even though there has been was disclosure of information, which is their obligation.

Following the [27], information asymmetry results in <u>an</u> adverse selection and moral hazard. So that, With regard to the limitations of our research, first, it is possible to that some variables may have been have omitted variables present in in the modelling procedure. The behaviour of agents who act in majority shareholders' interests is are still likely to have have _better information than other shareholders, even though information disclosure is required as a form of open innovation. Second, we did not explore firm heterogeneity via panel data.

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- Informed Consent Statement:
- Data Availability Statement:

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Article Debt Versus Equity—Open Innovation to Reduce Asymmetric Information

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Abstract: We aimed to examine capital structure decisions on a firm-specific and life cycle basis. We collected 3343 pooled datapoints from public companies listed on the Indonesian Stock Exchange from 2008 to 2019. The results revealed that companies still prefer debt issuance to equity to finance growth opportunities. By adding firm-specific life cycle variables, we found that asymmetric information was greater at the introduction stage than during the growth and maturity stages, and that companies miss growth opportunities with leverage. During the growth and maturity stages, companies still issue debt instead of equity, even though they could issue the latter. We conclude that information asymmetry is still found when issuing equity, even though the manager also performed open innovation.

Keywords: leverage; growth opportunities; specific firms; life cycle

1. Introduction

Managers as agents with superior information can act in their own interests and those of majority shareholders, rather than in the interests of debtholders and other shareholders [1,2]. Thus, an information asymmetry situation can occur in Indonesia with a concentrated ownership structure [3] and a family relationship between the manager and controlling shareholders [4].

Companies use leverage signaling to convey information and reduce information asymmetry [5–7]. The presence of information asymmetry results in equity friction in the market [8], and does not follow the company's claims, so the company prioritizes internal financing, debt, and then equity according to the hierarchical pecking order theory (POT) [7,9]. The POT seems to perform well empirically with regard to sending asymmetric information-reducing signals, but it does not always perform well in reality [10], and remains largely unexplained [11], depending on the specific firm and institution [12].

The open innovation paradigm is the most important [13], that is, that reporting should—with the use of information technology and digitization (TID)—reduce information asymmetry in equity issuance. However, it is not used optimally, meaning that there is still a high cost of equity, which is in line with POT, indicating that leverage is better than equity.

We predict that the POT can explain a situation better when TID, as a form of open innovation, is used to deliver firm specifics and a better life cycle. As a result, information asymmetry is reduced, the POT hierarchy is reversed, and the company prefers equity issuance over debt. Firm-specific variables include size, profitability, and risk [14,15], while the life cycle comprises introduction, growth and maturity stages [16,17]. Capital structure decisions are developed based on conflicts of majority and minority shareholders following the characteristics of the ownership structure in Indonesia, which may differ

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to other developing countries. The Financial Services Authority of the Republic of Indonesia (OJKRI) plays an essential role in developing open innovation [18] and using TID implementation for information disclosure [19], in order to reduce the level of information content, and it prefers equity over debt.

2. Literature Review

2.1. Firm-Specific Leverage and Growth-The Role of Open Innovation

Companies with fewer valuable opportunities can mimic those with more valuable ones. This can result in overvalued securities at companies with fewer valuable opportunities and undervalued securities at companies with more valuable opportunities. Therefore, when growth opportunities have asymmetric information, a good quality company will issue a debt higher than equity [5,6,20], to convey a positive signal to the market. Thus, the company will take advantage of growth opportunities with increased leverage, as an indication that the company's information asymmetry is lower than if it were to issue equity, in line with the POT. On the other hand, when information asymmetry is high, majority shareholders may prevent share dilution through debt issuance. Furthermore, the company could take advantage of growth opportunities with equity so that growth to leverage has a negative effect [21].

Debt issuance is a mechanism used to reduce the agency problem of ex-ante information asymmetry. Managers who act in the interests of shareholders are better off skipping growth opportunities with leverage [22] because high leverage only increases the risk of bankruptcy and transfer of welfare to debtholders only [23].

One difference between this study and previous research regarding the relationship between leverage and growth is in the use of firm-specific terms including size, profitability and risk. Large companies have a lower level of information asymmetry than small companies, increasing collateral assets for lenders [12,24], and larger companies have higher cash flow and more assets, so they have easy access to banking because they are considered less risky borrowers [20]. As support for their behavior, profitability will have an impact on leverage. Managers prefer to keep retained earnings and use debt to finance growth opportunities [25]. When the company-specific risk is high, the shareholders will perform risk-shifting [26] whenever possible. The use of excessive leverage, with the presence of bankruptcy costs and the limited responsibility of shareholders, is a risk for the debtholders who bear it [8].

Market failure among participants is not due to product quality but rather to information asymmetry [27]. In this context, the use of TID is a form of open innovation that can reduce information asymmetry [13]. Thus, the informed agent has a strategic role compared to the uninformed agent in delivering firm-specific information to the market [28]. As a result, equity friction reduces and equity is prioritized over debt, which is inversely related to the POT.

Hypothesis 1. *The presence of TID open innovation resulted in a low level of information asymmetry so that the company prioritized equity financing over debt.*

2.2. Firm-Specific Life Cycle Stage-Open Innovation

Each stage of the life cycle produces a different and more specific level of asymmetry [14]. For example, the technology life cycle is more applicable during the growth and maturity stages than the introduction stage [30]. Table 1 shows that it was possible to use cash flow for greater investment during the introduction and growth stages, including TID, but cash flow tended to come from debt issuance [16]. Thus, open innovation investment in TID decreased the asymmetric information in the introduction, growth, and maturity stages.

		3 с

		-	-	-	
Cashflow	Introduction	Growth	Mature	ShakeOut	Decline
Operating	-	+	+	Void in theory	-
Investing	-	-	-	Void in theory	+
Financing	+	+	-	Void in theory	+ or –

Table 1. Cashflow patterns for each life cycle stage.

Older companies generally have better information credibility, more assets, and a better reputation than younger companies that use more leverage. Therefore, in the maturity stage, a company can substitute debt with internal financing [14], or may prefer debt to equity [31] as a form of low information asymmetry.

In addition, the relationship between specific firms and the life cycle is that profitability has a negative effect and leverage has a positive effect. As the age of the company increases the profitability decreases, and the company prioritizes debt issuance. Specifically, leverage is shown as the smallest determinant of financing during the introduction stage [17]. During the early stage, a company faces significant business uncertainty and risk, which is exacerbated by high information asymmetry, so that it prioritizes internal funding [15]. However, when internal funding that comes from profitability has decreased [17], the company prefers debt, which has a lower risk of stock price friction than equity.

A company's size affects the use of leverage at each stage of the life cycle. During the introduction stage, leverage is low, while during the growth and maturity stages it is high [15]. At the introduction stage, if there is a large asymmetry problem the company uses internal funds to reduce leverage. Companies have less information asymmetry and greater collateral asset ownership during the growth and maturity stages, so they prioritize external funding through debt instead of equity [17]. More extremely, companies at an early stage, due to the high information asymmetry, are limited in using external funds. In the next stage, the company performs re-balancing, not by increasing debt, but by substituting internal funding where the frictional risk of share prices is smaller than debt and equity [14].

During the introduction stage, companies are faced with higher information asymmetry because of the uncertainty of future cash flows. As a result, they have a higher external cost of capital. Companies face higher levels of risk during the introduction and growth stages, but risk reduces during the maturity stage [32]. Investment efficiency is low during the introduction stage but this increases non-linearly during the growth and maturity stages [15]. Therefore, the POT theory is more applicable during the maturity stage [33,34].

Hypothesis 2. The presence of open innovation and the increasing stages of the life cycle results in reduced asymmetry regarding firm-specific information, such that companies prefer equity to leverage when financing growth opportunities.

3. Research Methods

3.1. Variable Measurement

The total debt ratio to total assets (leverage) was used as the dependent variable in a regression [21]. When growth opportunities reach information asymmetry, the issuance of debt results in companies still being able to issue leverage greater than the total assets, even though market leverage depreciates. Growth opportunities are measured by (total sales t – total sales t – 1)/total sales t – 1 [35,36].

Our firm-specific variable used in asset as a proxy for size [37], profitability as a return on assets [38], and specific risk as the variance of return on assets [39]. For the life cycle we used the age measured in years since it was recorded [40]. The life cycle consisted of five stages: introduction, growth, maturity, shake-out, and decline [16]. Since cash flow investing, operating, and financing can better explain the life cycle, we used only the first

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three stages due to the prominent aspect [17]. A company's life cycle stage was categorized as follows: 1 = introduction, 2 = growth, and 3 = maturity [41].

3.2. Data and Sample Selection

Pooled data of 3343 observations gathered from companies from eight industrial sectors listed on the Indonesian Stock Exchange (IDX) for the period 2008–2019. Table 2 shows the collinearity of variables used in the analysis and their corresponding VIF values; the financial and banking sectors were excluded due to differences in each company policies [42]. We removed outliers from the dataset by excluding the highest and lowest 5% of values. Data were obtained from eight industrial sectors: agriculture (3.92% of observations), infrastructure (11.22%), utilities and transportation (11.22%), manufacturing (32.93%), mining (9.39%), property (15.23%), real estate and building construction (27.31%), trade, and services and investment. Table 2 indicated a VIF value of about 1 and a correlation between explanatory variables of less than 0.8 [43]

Panel A	Correlation Matrix									
	Leverage	Growth	Size	Profitability	Risk-Spe- cific					
Leverage	1	_								
Growth Opp.	0.002446	1								
Size	0.12642	-0.01661	1							
Profitability	-0.24849	0.118867	0.114479	1						
Risk-Specific	0.020752	-0.02165	-0.06079	-0.36919	1					
Panel B	20,06		VIF Facto	ors						
Variables			VIF							
Growth Opp.			1.096							
Size			1.017							
Profitability			1.042							
Risk–Specific			1.109							

Table 2. Multicollinearity test result among variables

We used OLS regression with a dummy equation or LSDV because the scalable explanatory variable was nominal (introduction, growth and mature), with two dummy categories to avoid dummy traps [43]:

$$E(Y_i|X_i) = \alpha_1 + \alpha_2 X_i + \alpha_3 FirmSpecific_i + \alpha_4 D_{2i} + \alpha_5 D_{3i}$$

where *Y* is leverage; *X* represents growth opportunities; Firm-Specific represents size, profitability and risk; D_{2i} is 1 if the stage is growth, otherwise it is 0; D_{3i} is 1 if the stage is mature, otherwise it is 0; and if $D_{2i} = 0$ and $D_{3i} = 0$ then it is the introduction stage.

4. Results and Findings

Data

Table 1 shows that the data has kurtosis, which tends to be homogeneous and has varied skewness as long as the growth stage has a mean leverage greater than the introduction and maturity stages. The increase in leverage from introduction to growth resulted in greater debt issuance due to reduced information asymmetry [15]. In contrast, there was no significant difference in mean leverage during maturity compared to growth, as an effort to reduce the risk of bankruptcy [32], and a more stable cash flow was used to replace ageing equipment, instead of paying debt [16].

Panel A				Des	criptive Sta	atistics			
Life Cycle	Obs	Variables	Mean	25th Quartile	Median	75th Quartile	St. Dev	Kurtosis	Skewness
Introduction	692	Leverage	0.456	0.284	0.458	0.611	0.222	2.069	0.511
	692	Growth Opp.	0.169	-0.035	0.109	0.267	0.393	6.008	1.894
	692	Size	28,250	27,328	28,287	29,219	1.420	11,362	1.121
	692	Profitability	0.035	0.003	0.035	0.075	0.089	15,951	-1.604
	692	Risk-Specific	0.008	0.000	0.001	0.005	0.033	235,562	13,538
Growth	1682	Leverage	0.486	0.321	0.475	0.637	0.217	-0.131	0.326
	1682	Growth Opp.	0.122	-0.050	0.079	0.221	0.323	8.411	2.085
	1682	Size	28,442	27,190	28,507	29,677	1.761	-0.050	-0.134
	1682	Profitability	0.029	0.001	0.028	0.070	0.131	214,966	-9.860
	1682	Risk-Specific	0.017	0.000	0.001	0.006	0.254	1,302,150	34,864
Mature	969	Leverage	0.484	0.302	0.479	0.616	0.248	6.441	1.283
	969	Growth Opp.	0.093	-0.031	0.072	0.175	0.262	9.817	1.881
	969	Size	28,626	27,375	28,560	29,962	1.858	0.212	0.099
	969	Profitability	0.061	0.009	0.045	0.098	0.141	37,755	2.342
	969	Risk-Specific	0.021	0.000	0.002	0.008	0.129	460,111	19,271
Total	3343	Leverage	0.479	0.308	0.473	0.629	0.228	3.001	0.721
	3343	Growth Opp.	0.123	-0.041	0.081	0.217	0.324	8,558	2.092
	3343	Size	28,456	27,270	28,453	29,610	1.730	1.150	0.129
	3343	Profitability	0.040	0.003	0.034	0.079	0.128	141,355	-4.581
	3343	Risk-Specific	0.016	0.000	0.001	0.006	0.194	1,962,489	41,208
Panel B				M	ean Differe	ences			
Variables			Growt	h vs. Introd	luction	Μ	lature vs. Gi	rowth	
	Leve	erage			0.030 *			-0.002	
Growth Opp.				-0.047 *		-0.029 *			
	Si	ze		0.192 *			0.185 *		
	Profit	ability		-0.006 *				0.032 *	
	Ri	sk		-0.063 *				0.004	

Table 3. Descriptive Statistic and Mean Differences

*significant at 0.05

As long as the growth stage has lower information asymmetry than the introduction stage when assets increase collateral, the company issues more debt. Conversely, during the maturity stage, the information asymmetry is reduced compared to the growth stage and the increase in collateral results in reduced leverage, leading to a company preferring internal financing over equity [29].

As long as a company in the growth stage has cash flow from large investments, it exceeds profitability, which makes it relatively stable compared to a company in the introduction stage [16], resulting in a decrease in profitability. On the other hand, there is an increase in profitability because investment is more efficient than during the maturity stage [15]. Business risk decreases as the age of the company increases [15,44].

When growth opportunities decreased there was more debt issuance and a risk-shifting problem [26,45]. When managers and majority shareholders have better quality information about growth opportunities than minority shareholders, they prefer debt to equity. Debtholders are promised high returns if the project is successful, even if the probability of success is low, because if it is successful the majority manager will benefit, and if it fails, the debtholders will share the risk. Conversely, if the risk is unknown, the com-

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pany will tend to issue equity. Further information asymmetry results in a "mean revision" of the leverage level [24,34]. In this case, it would be better to avoid taking advantage of growth opportunities because they created a new agency of debt.

Table 1 showed a significant difference in mean leverage between the growth and introduction stages and the mature and growth stages. However, because this simple description did not include firm-specific size, profitability and risk variables, the findings of an LSDV regression which included these are shown in Table 3.

Variables	All Firms	All Firms	Introduction	Growth	Maturity
Constant	0.479 *	-0.087	-0.572 *	-0.089	0.042
	0.000	0.160	0.000	0.265	0.713
Growth Opp	0.002	0.027 *	0.015	0.033 *	0.135 *
	0.888	0.019	0.437	0.034	0.000
Size		0.021 *	0.037 *	0.021 *	0.016 *
		0.000	0.000	0.000	0.000
Profitability		-0.536 *	-0.989 *	-0.815 *	-0.627 *
		0.000	0.000	0.000	0.000
Risk Specific		-0.094 *	0.318	-0.280 *	0.514 *
		0.000	0.198	0.000	0.000
Obs	3343	3343	692	1682	969
F Test	0.019	85,482	43,193	69,663	36,473
Sig F Test	0.888	0.000	0.000	0.000	0.000
Multiple R	0.002	0.305	0.448	0.377	0.363
R Square	0.000	0.093	0.201	0.142	0.131

Table 4. Regression Analysis

*significant at 0.05

Column 1 of Table 4 shows that when majority and minority shareholders do not have specific firm information, they are faced with uncertainty in cash flow and high risk, so that the issuance of debt becomes risky. As a result, they refuse financing for valuable growth opportunities to prevent loss of control over the company [45]. Due to the limited responsibility of shareholders, if there is bankruptcy then the company will be taken over by debtholders. When there is no disclosure of specific firm information, debtholders will not make transactions because it can depreciate debt and equity.

Column 2 of Table 3 shows that as assets increase, the collateral increases; as the specific risk increases the profitability decreases; and that the company increases the leverage to finance the rise invaluable growth [10,46]. It also shows that the effect of profitability on leverage is greater than size and risk. The presence of increasing assets and decreasing risk can provide a more positive signal than profitability, which has a negative signal, to the market. Management will issue debt to provide a positive signal to the market [5] in order to maintain control of a quality company [6]. From the perspective of agency theory, they avoid exposure to the capital market [47].

Thus, the firm-specific information submitted by companies with agency problems still contains asymmetric information. The result is that they issue debt rather than equity when financing growth opportunities. As previously thought, there is still information asymmetry so that the POT hierarchy works, even though the manager already has an incentive for open innovation with TID in information disclosure, following OJKRI regulations. The existence of a high cost of equity resulting from asymmetric information has resulted in companies using debt financing [13], despite Indonesia being a bank-based system [48].

Columns 3–5 of Table 4 show the difference in results across life cycle stages. Companies in the introduction stage have high business uncertainty and risk [44]. Managers and majority shareholders have higher quality information than minority shareholders regarding growth opportunities, so growth opportunities lead to greater information asymmetry than total assets [21]. Interestingly, by adding the specific firm size and profitability, managers and majority shareholders missed out on taking advantage of the growth opportunities with leverage. When faced with high risk and reduced profitability, they will not finance growth opportunities with leverage even if there is an increase in collateral assets. However, they perform risk avoidance [45] to prevent loss of control and as rent for future corporate value increases.

In the growth stage, companies buy many assets as part of a competitive advantage strategy. Demand for cash flow for investment is greater than the availability of internal financing and there is lower information asymmetry than during the introduction. Although there is an increase in size as a proxy for collateral and a decrease in company risk, long-term investment needs are greater than profitability, so the presence of asymmetric information exacerbates this condition, and companies prefer debt issuance to equity [7,16].

The mature stage is a condition with less asymmetric information indications than the growth stage. Therefore, companies should be able to issue equity instead of debt, but we found that they still reference debt, which differs from findings of other research [14,21]. Managers and majority shareholders avoid issuing equity because they are more sensitive to the market response than debt, or there is still an imbalance of information between insiders and outsiders.

Open innovation carried out by insiders as a mechanism to reduce information asymmetry has proven to be sub-optimal in practice. With the provisions of the OJKRI, they do not have an incentive to issue equity compared to leverage in financing growth opportunities, because if they use the equity, they will face a high cost of equity as the production of asymmetric information [13].

5. Conclusions

Managers have a strategic role in open innovation using TID for information disclosure. In the absence of firm-specific information, issuance of leverage or equity will only depreciate. Conversely, when firm-specific information is added as a disclosure of information, there is still information asymmetry, thus to the issuance of equity, which is more sensitive to market responses, they issue debt.

When adding firm-specific life cycles to test the effect of growth on leverage, during the introduction stage, the company did not issue debt to finance growth opportunities even though it had lower market sensitivity than equity. The next stage showed severe asymmetric information, when companies disclosed firm-specific information but still used debt financing to finance growth opportunities.

In the overall sample without including the life cycle, firms preferred the issuance of leverage over equity when firm-specific information was included. Interestingly, the disclosure of information as a form of open innovation did not provided incentives for companies during growth and maturity to prefer equity issuance over debt. Managers and majority shareholders have more incentives to prevent equity, which results in dilution, even though there was disclosure of information, which is their obligation.

Following [27], information asymmetry results in an adverse selection and moral hazard. With regard to the limitations of our research, it is possible that some variables may have been omitted in the modelling procedure. The agents who act in majority shareholders' interests are still likely to have better information than other shareholders, even though information disclosure is required as a form of open innovation. Second, we did not explore firm heterogeneity via panel data.

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Generally, this article is a good empirical study applying the POT, while bringing meaningful specific firms and/or life cycle variants analysis into consideration. Listed below are some suggestions for authors' consideration in further complementing their arguments and/or assumptions;

- Sometimes, the sentences or phrases tend to be awkward for understanding, for instance, between lines 30-33, it's said: "The open innovation paradigm is the most important [13], that is, that reporting should—with the use of information technology and digitization (TID)—reduce information asymmetry in equity issuance. However, it is not used optimally, meaning that there is still a high cost of equity, which is in line with POT, indicating that leverage is better than equity." The authors might need to re-graph it. Indeed, this is not the only one. Accordingly, it's highly recommended that the work be improved in its wording and expression as a whole.
- 2. Between lines 43-46, there has been an interesting finding concerning the capital structure decision of Indonesia. Would this be anything special (implications) to the result and/or conclusion of this article? Especially, would that be anything to do with the role of Financial Services Authority playing? Should that be taken as a sensitivity adjustment variant for the final result found?
- 3. The authors seem to suggest that the Indonesia "Capital structure decisions are developed based on conflicts of majority and minority shareholders following the characteristics of the ownership structure, which may differ to other developing countries." However, is this really something unique from most of the developing countries in the world?
- 4. The term life cycle has been used in various way, it's recommended that the authors be more concise when using the term in different occasion, so as to avoid the unnecessary confusion; for instance, between lines 86-88, the correlation of "life cycle" to "the technology life cycle" is somewhat confusion to readers, regarding the general concept of "life cycle" applied in this article.
- 5. Between lines 88-91, the authors try to explain the findings shown on Table1. However, it seems that the finding "that it was possible to use cash flow for greater investment during the introduction and growth stages, including TID, but cash flow tended to come from debt issuance [16]" can barely reach the conclusion "Thus, open innovation investment in TID decreased the asymmetric

information in the introduction, growth, and maturity stages." It's suggested that the author need to explain more in details for the argument.

- 6. Similar logic issue occurs between lines 119-121, when the authors jump to the conclusionary remark as "As a result, they have a higher external cost of capital. As a result, companies face higher levels of risk during the introduction and growth stages, but risk reduces during the maturity stage."
- 7. On line 95, the authors seem to distinguish the "Older companies" from "younger companies" that use more leverage. However, on line 96, the analysis jumps into an argument that "a company can substitute debt with internal financing [14] or prefer debt to equity [32] as a form of low information asymmetry." The question is which type of the company in any way? Also, in this article, it seems that the selected target companies have been all the public listed ones. In turns, would it be necessary to make the differentiation?
- 8. On line 124, what does "an increase in life-cycle stages" mean?
- 9. Between lines 263-272, the authors have a very important finding that, even though a legally abided "open innovation strategy through TID" might reduce the asymmetric information, "There are still agents and majority shareholders who have superior information compared to minority shareholders" and one case was given to support the argument. However, could one case be enough to support the comment? Do authors imply the government failure or market failure, in addition to said information failure?

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Edit Profile	Abstract	basis. We collected 3343 pooled data points from public companies listed on
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Comments and Suggestions for Authors Information asymmetry and its relationship to open innovation have already been discussed in the literature, however the life cycle approach to interpreting Debt Versus Equity options can be considered original and of interest to the readers of this journal. Below I highlight some parts that should be improved.

Abstract: It does not follow the usual pattern, even recommended by this journal. It lacks a framing of the topic and a justification for the purposes of this study that should precede the methodological description, results, and conclusions.

Introduction: In addition to providing an overview of the topic under investigation, this section should make clear to the reader what gaps in the literature require further research and how this study intends to fill them, making an innovative contribution to knowledge. These parts are not clear.

Literature Review: the theoretical framework provided by this section requires further study and updating; in fact, many of the studies cited are not recent and therefore a review is needed. In addition, it would be appropriate for the authors to clarify how this study complements and differs from the citation [13]: https://doi.org/10.3390/joitmc7010048

Results: the mathematical model, data processing and analysis is described with rigor and clarity.

Conclusions: the authors should argue in more detail the theoretical and managerial implications of their study, also specifying better the contribution made to knowledge on the topic. Furthermore, among the limitations, they would also like to argue the geographical and socio-cultural nature of the sample of businesses analyzed, specifying whether, in the authors' opinion, the mathematical model can be applied, and the results generalized to other social, economic, and managerial realities.

Based on my previous comments, I encourage the authors to refine their manuscript in order to make it suitable for publication.

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Comments and Dear Authors, Suggestions for Authors

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In the latest version of your manuscript, the significant improvements you have made are evident. Before publication, I would like to point out that you still need to update the abstract, because the Research Background is still missing. In this regard, I recommend that you follow the following journal guidelines:

Abstract: The abstract should be a total of about 200 words maximum. The abstract should be a single paragraph and should follow the style of structured abstracts, but without headings: 1) **Background**: Place the question addressed in a broad context and highlight the purpose of the study; 2) **Methods**: Describe briefly the main methods or treatments applied. Include any relevant preregistration numbers, and species and strains of any animals used. 3) **Results**: Summarize the article's main findings; and 4) **Conclusion**: Indicate the main conclusions or interpretations. The abstract should be an objective representation of the article: it must not contain results which are not presented and substantiated in the main text and should not exaggerate the main conclusions.

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Article Debt Versus Equity—Open Innovation to Reduce Asymmetric Information

Arief Yulianto¹,* Rini Setyo Witiastuti¹, Widiyanto²

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Abstract: We aimed to examine capital structure decisions on a firm-specific and life cycle basis. We collected 3343 pooled data points from public companies listed on the Indonesian Stock Exchange from 2008 to 2019. The results revealed that companies still prefer debt issuance to equity to finance growth opportunities. By adding firm-specific life cycle variables, we found that asymmetric information was greater at the introduction stage than during the growth and maturity stages and that companies miss growth opportunities with leverage. Furthermore, companies still issue debt instead of equity during the growth and maturity stages, even though they could issue the latter. We conclude that companies tend to employ closed innovation during the mature stage than the previous stage, and information asymmetry is still found; moreover, resulting in issuing debt, which, in turn, they prefer to equity if necessary to growth financing.

Keywords: leverage; growth opportunities; specific firms; life cycle

Citation: Yulianto, A; Witiastuti, R.S; Widiyanto, W. Debt versus Equity – Open Innovation to Reduce Asymmetric Information. *J. Open Innov. Technol. Mark. Complex.* **2021**, 7, x. https://doi.org/10.3390/xxxxx

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1. Introduction

Managers as agents with superior information can act in their own interests and those of majority shareholders, rather than in the interests of debtholders and other shareholders [1], [2]. Thus, an information asymmetry situation can occur in Indonesia with a concentrated ownership structure [3] and a family relationship between the manager and controlling shareholders [4].

Companies use leverage signaling to convey information and reduce information asymmetry [5]–[7]. The presence of information asymmetry results in equity friction in the market [8], and does not follow the company's claims, so the company prioritizes internal financing, debt, and then equity according to the hierarchical pecking order theory (POT) [7], [9]. The POT seems to perform well empirically with regard to sending asymmetric information-reducing signals, but it does not always perform well in reality [10], and remains largely unexplained [11], depending on the specific firm and institution [12].

The open innovation paradigm is the most important [13], that is, that reporting should—with the use of information technology and digitization (TID)—reduce information asymmetry in equity issuance. However, it is not used optimally, meaning that there is still a high cost of equity, which is in line with POT, indicating that leverage is better than equity.

We predict that the POT can explain a situation better when TID, as a form of open innovation, is used to deliver firm specifics and a better life cycle. As a result, information asymmetry is reduced, the POT hierarchy is reversed, and the company prefers equity issuance over debt. Firm-specific variables include size, profitability, and risk [14], [15], while the life cycle comprises introduction, growth and maturity stages [16], [17]. The open innovation strategy in using TID is mostly done by companies in the introduction

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and growth stages because the development is faster than their ability, than growth and is mature [18]. Resulting, they are more sensitive to financing decisions.

Capital structure decisions are developed based on conflicts of majority and minority shareholders following the characteristics of the ownership structure in Indonesia, which may differ to other developing countries. The Financial Services Authority of the Republic of Indonesia (OJKRI) plays an essential role in developing open innovation [19] and using TID implementation for information disclosure [20], to reduce the level of information content, and it prefers equity over debt.

2. Literature Review

2.1. Firm-Specific Leverage and Growth—The Role of Open Innovation

Companies with fewer valuable opportunities can mimic those with more valuable ones. This can result in overvalued securities at companies with fewer valuable opportunities and undervalued securities at companies with more valuable opportunities. Therefore, when growth opportunities have asymmetric information, a good quality company will issue a debt higher than equity [5,6,20], to convey a positive signal to the market. Thus, the company will take advantage of growth opportunities with increased leverage, which indicates that the company's information asymmetry is lower than if it were to issue equity, in line with the POT. On the other hand, majority shareholders may prevent share dilution through debt issuance when information asymmetry is high. Furthermore, the company could take advantage of growth opportunities with equity so that growth to leverage has a negative effect [21].

Debt issuance is a mechanism used to reduce the agency problem of ex-ante information asymmetry. Managers who act in the interests of shareholders are better off skipping growth opportunities with leverage [22] because high leverage only increases the risk of bankruptcy and welfare transfer to debtholders [23].

One difference between this study and previous research regarding the relationship between leverage and growth is in the use of firm-specific terms, including size, profitability, and risk. Large companies have a lower level of information asymmetry than small companies, increasing collateral assets for lenders [12], [24], and larger companies have higher cash flow and more assets, so they have easy access to banking because they are considered less risky borrowers [25]. As support for their behavior, profitability will have an impact on leverage. Managers prefer to keep retained earnings and use debt to finance growth opportunities [26]. When the company-specific risk is high, the shareholders will perform risk-shifting [27] whenever possible. The use of excessive leverage, with the presence of bankruptcy costs and the limited responsibility of shareholders, is a risk for the debtholders who bear it [8].

Market failure among participants is not due to product quality but rather to information asymmetry [28]. In this context, the use of TID is a form of open innovation that can reduce information asymmetry [13]. Thus, the informed agent has a strategic role compared to the uninformed agent in delivering firm-specific information to the market [29]. As a result, equity friction reduces, and equity is prioritized over debt, which is inversely related to the POT.

Hypothesis 1. *The presence of TID open innovation resulted in a low level of information asymmetry so that the company prioritized equity financing over debt.*

2.2. Firm-Specific Life Cycle Stage-Open Innovation

Each stage of the life cycle produces a different and more specific level of asymmetry [14]. For example, the technology life cycle is more applicable during the growth and maturity stages than the introduction stage [31]. Table 1 shows that it was possible to use cash flow for greater investment during the introduction and growth stages, including

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TID, but cash flow tended to come from debt issuance [16]. Thus, open innovation investment in TID decreased the asymmetric information in the introduction, growth, and maturity stages.

Cashflow	Introduction	Growth	Mature	ShakeOut	Decline
Operating	_	+	+	Void in theory	-
Investing	_	-	-	Void in theory	+
Financing	+	+	-	Void in theory	+ or –

Table 1. Cashflow patterns for each life cycle stage.

Older companies generally have better information credibility, more assets, and a better reputation than younger companies that use more leverage. Therefore, in the maturity stage, a company can substitute debt with internal financing [14] or prefer debt to equity [32] as a form of low information asymmetry.

In addition, the relationship between specific firms and the life cycle is that profitability has a negative effect and leverage has a positive effect. As the age of the company increases the profitability decreases, and the company prioritizes debt issuance. Specifically, leverage is shown as the smallest determinant of financing during the introduction stage [17]. During the early stage, a company faces significant business uncertainty and risk, which is exacerbated by high information asymmetry, so that it prioritizes internal funding [15]. However, when internal funding that comes from profitability has decreased [17], the company prefers debt, which has a lower risk of stock price friction than equity.

A company's size affects the use of leverage at each stage of the life cycle. During the introduction stage, leverage is low, while it is high during the growth and maturity stages [15]. At the introduction stage, if there is a large asymmetry problem, the company uses internal funds to reduce leverage. Companies have less information asymmetry and greater collateral asset ownership during the growth and maturity stages, prioritizing external funding through debt instead of equity [17]. More extremely, companies at an early stage, due to the high information asymmetry, are limited in using external funds. In the next stage, the company performs re-balancing, not by increasing debt, but by substituting internal funding where the frictional risk of share prices is smaller than debt and equity [14].

During the introduction stage, companies are faced with higher information asymmetry because of the uncertainty of future cash flows. As a result, they have a higher external cost of capital. As a result, companies face higher levels of risk during the introduction and growth stages, but risk reduces during the maturity stage [33]. Investment efficiency is low during the introduction stage but this increases non-linearly during the growth and maturity stages [15]. Therefore, the POT theory is more applicable during the maturity stage [34], [35]. Thus, an increase in life-cycle stages and reduced asymmetric information results in greater closed innovation [18], as shown in Figure 1. As a result, starting from mature, the financing for open innovation is reduced, and if needed they prefer equity because there is less asymmetric information.



Figure 1. Relationship between Technology Life Cycle and Open Innovation

Hypothesis 2. The presence of open innovation and the increasing stages of the life cycle results in reduced asymmetry regarding firm-specific information, such that companies prefer equity to leverage when financing growth opportunities.

3. Methods

3.1. Variable Measurement

The total debt ratio to total assets (leverage) was used as the dependent variable in a regression [21]. When growth opportunities reach information asymmetry, the issuance of debt results in companies still being able to issue leverage greater than the total assets, even though market leverage depreciates. Growth opportunities are measured by (total sales t – total sales t – 1)/total sales t – 1 [36], [37].

Our firm-specific variable used in asset as a proxy for size [38], profitability as a return on assets [39], and specific risk as the variance of return on assets [40]. For the life cycle we used the age measured in years since it was recorded [41]. The life cycle consisted of five stages: introduction, growth, maturity, shake-out, and decline [16]. Since cash flow investing, operating, and financing can better explain the life cycle, we used only the first three stages due to the prominent aspect [17]. A company's life cycle stage was categorized as follows: 1 = introduction, 2 = growth, and 3 = maturity [42].

3.2. Data and Sample Selection

Pooled data of 3343 observations gathered from companies from eight industrial sectors listed on the Indonesian Stock Exchange (IDX) for the period 2008–2019. Table 2 shows the collinearity of variables used in the analysis and their corresponding VIF values; the financial and banking sectors were excluded due to differences in each company policies [43]. We removed outliers from the dataset by excluding the highest and lowest 5% of values. Data were obtained from eight industrial sectors: agriculture (3.92% of observations), infrastructure (11.22%), utilities and transportation (11.22%), manufacturing (32.93%), mining (9.39%), property (15.23%), real estate and building construction (27.31%), trade, and services and investment. Table 2 indicated a VIF value of about 1 and a correlation between explanatory variables of less than 0.8 [44]

Table 2. Multicollinearity test result among variables

Panel A	Correlation Matrix							
	Leverage	Growth	Size	Profitability	Risk-Spe- cific			
Leverage	1							
Growth Opp.	0.002446	1						
Size	0.12642	-0.01661	1					
Profitability	-0.24849	0.118867	0.114479	1				

Risk-Specific	0.020752	-0.02165	-0.06079	-0.36919	1
Panel B			VIF Factor	S	
Variables			VIF		
Growth Opp.			1.096		
Size			1.017		
Profitability			1.042		
Risk–Specific			1.109		

We used OLS regression with a dummy equation or LSDV because the scalable explanatory variable was nominal (introduction, growth and mature), with two dummy categories to avoid dummy traps [44]:

$$E(Y_i|X_i) = \alpha_1 + \alpha_2 X_i + \alpha_3 FirmSpecific_i + \alpha_4 D_{2i} + \alpha_5 D_{3i}$$

where *Y* is leverage; *X* represents growth opportunities; Firm-Specific represents size, profitability and risk; D_{2i} is 1 if the stage is growth, otherwise it is 0; D_{3i} is 1 if the stage is mature, otherwise it is 0; and if $D_{2i} = 0$ and $D_{3i} = 0$ then it is the introduction stage.

4. Results

4.1. Data

Table 1 shows that the data has kurtosis, which tends to be homogeneous and has varied skewness as long as the growth stage has a mean leverage greater than the introduction and maturity stages. The increase in leverage from introduction to growth resulted in greater debt issuance due to reduced information asymmetry [15]. In contrast, there was no significant difference in mean leverage during maturity compared to growth, as an effort to reduce the risk of bankruptcy [33], and a more stable cash flow was used to replace aging equipment instead of paying debt [16].

Panel A **Descriptive Statistics** 25th 75th Life Cycle Obs Variables Mean Median St. Dev **Kurtosis** Skewness Quartile Quartile Introduction 692 0.456 0.284 0.458 0.222 2.069 0.511 Leverage 0.611 692 Growth Opp. -0.0350.109 0.267 0.393 6.008 1.894 0.169 692 Size 28,250 27,328 28,287 29,219 1.420 11,362 1.121 692 0.075 0.089 15,951 Profitability 0.035 0.003 0.035 -1.60413,538 692 **Risk-Specific** 0.008 0.000 0.001 0.005 0.033 235,562 Growth 0.486 0.321 0.475 0.637 0.217 -0.1310.326 1682 Leverage 1682 Growth Opp. 0.122 -0.0500.079 0.221 0.323 8.411 2.085 1682 Size 28,442 27,190 28,507 29,677 1.761 -0.050-0.1341682 Profitability 0.029 0.001 0.070 0.131 -9.8600.028 214,966 1682 **Risk-Specific** 0.017 0.000 0.001 0.006 0.254 1,302,150 34,864 Mature 969 Leverage 0.4840.302 0.479 0.616 0.248 6.441 1.283 969 Growth Opp. 0.093 -0.0310.072 0.175 0.262 9.817 1.881 969 29,962 0.099 Size 28,626 27,375 28,560 1.858 0.212 0.009 969 2.342 Profitability 0.061 0.045 0.098 0.141 37,755 969 **Risk-Specific** 0.021 0.000 0.002 0.008 0.129 460,111 19,271 Total 3343 Leverage 0.479 0.308 0.473 0.629 0.228 3.001 0.721 3343 0.123 0.217 Growth Opp. -0.0410.081 0.324 8,558 2.092 3343 27,270 28,453 29,610 1.730 1.150 0.129 Size 28,456

	3343 3343	Profitability Risk–Specific	0.040 0.016	0.003 0.000	0.034 0.001	0.079 0.006	0.128 0.194	141,355 1,962,489	-4.581 41,208
Panel B		Mean Differences							
	Vari	ables		Growth vs. Introduction Mature vs. Growth			owth		
Leverage			0.030 *		-0.002				
Growth Opp.			-0.047 *			-0.029 *			
Size			0.192 *		0.185 *				
Profitability			-0.006 *		0.032 *				
Risk			-0.063 *			0.004			

*significant at 0.05

As long as the growth stage has lower information asymmetry than the introduction stage when assets increase collateral, the company issues more debt. Conversely, during the maturity stage, the information asymmetry is reduced compared to the growth stage and the increase in collateral results in reduced leverage, leading to a company preferring internal financing over equity [30].

As long as a company in the growth stage has cash flow from large investments, it exceeds profitability, which makes it relatively stable compared to a company in the introduction stage [16], resulting in a decrease in profitability. On the other hand, there is an increase in profitability because investment is more efficient than during the maturity stage [15]. In addition, business risk decreases as the age of the company increases [15,44].

When growth opportunities decreased there was more debt issuance and a riskshifting problem [27], [46]. When managers and majority shareholders have better quality information about growth opportunities than minority shareholders, they prefer debt to equity. Debtholders are promised high returns if the project is successful, even if the probability of success is low, because if it is successful the majority manager will benefit, and if it fails, the debtholders will share the risk. Conversely, if the risk is unknown, the company will tend to issue equity. Further information asymmetry results in a "mean revision" of the leverage level [24], [35]. In this case, it would be better to avoid taking advantage of growth opportunities because they created a new agency of debt.

4.2. Regression Analysis

Table 1 showed a significant difference in mean leverage between the growth and introduction stages and the mature and growth stages. However, because this simple description did not include firm-specific size, profitability and risk variables, the findings of an LSDV regression which included these are shown in Table 3.

Variables	All Firms	All Firms	Introduction	Growth	Maturity
Constant	0.479 *	-0.087	-0.572 *	-0.089	0.042
	0.000	0.160	0.000	0.265	0.713
Growth Opp	0.002	0.027 *	0.015	0.033 *	0.135 *
	0.888	0.019	0.437	0.034	0.000
Size		0.021 *	0.037 *	0.021 *	0.016 *
		0.000	0.000	0.000	0.000
Profitability		-0.536 *	-0.989 *	-0.815 *	-0.627 *
		0.000	0.000	0.000	0.000
Risk Specific		-0.094 *	0.318	-0.280 *	0.514 *
		0.000	0.198	0.000	0.000
Obs	3343	3343	692	1682	969
F Test	0.019	85,482	43,193	69,663	36,473
Sig F Test	0.888	0.000	0.000	0.000	0.000

Table 4. Regression Analysis

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Multiple R	0.002	0.305	0.448	0.377	0.363	
R Square	0.000	0.093	0.201	0.142	0.131	
*significant at 0.05						

*significant at 0.05

Column 1 of Table 4 shows that when majority and minority shareholders do not have specific firm information, they are faced with uncertainty in cash flow and high risk, so that the issuance of debt becomes risky. As a result, they refuse financing for valuable growth opportunities to prevent loss of control over the company [46]. Due to the limited responsibility of shareholders, if there is bankruptcy then the company will be taken over by debtholders. When there is no disclosure of specific firm information, debtholders will not make transactions because it can depreciate debt and equity.

Column 2 of Table 3 shows that as assets increase, the collateral increases; as the specific risk increases the profitability decreases; and that the company increases the leverage to finance the rise invaluable growth [10], [47]. It also shows that the effect of profitability on leverage is greater than size and risk. The presence of increasing assets and decreasing risk can provide a more positive signal than profitability, which has a negative signal, to the market. Management will issue debt to provide a positive signal to the market [5] to maintain control of a quality company [6]. From the perspective of agency theory, they avoid exposure to the capital market [48].

Thus, the firm-specific information submitted by companies with agency problems still contains asymmetric information. The result is that they issue debt rather than equity when financing growth opportunities. As previously thought, there is still information asymmetry so that the POT hierarchy works, even though the manager already has an incentive for open innovation with TID in information disclosure, following OJKRI regulations. A high cost of equity resulting from asymmetric information has resulted in companies using debt financing [13], despite Indonesia being a bank-based system [49].

Columns 3–5 of Table 4 show the difference in results across life cycle stages. Companies in the introduction stage have high business uncertainty and risk [45]. Managers and majority shareholders have higher quality information than minority shareholders regarding growth opportunities, so growth opportunities lead to greater information asymmetry than total assets [21]. Interestingly, by adding the specific firm size and profitability, managers and majority shareholders missed out on taking advantage of the growth opportunities with leverage. When faced with high risk and reduced profitability, they will not finance growth opportunities with leverage even if there is an increase in collateral assets. However, they perform risk avoidance [46] to prevent loss of control and as rent for future corporate value increases.

In the growth stage, companies buy many assets as part of a competitive advantage strategy. As a result, demand for cash flow for investment is greater than the availability of internal financing and there is lower information asymmetry than during the introduction. Although there is an increase in size as a proxy for collateral and a decrease in company risk, long-term investment needs are greater than profitability, so the presence of asymmetric information exacerbates this condition, and companies prefer debt issuance to equity [7], [16].

The mature stage is a condition with less asymmetric information indications than the growth stage. Therefore, companies should be able to issue equity instead of debt, but we found that they still reference debt, which differs from findings of other research [14], [21]. Managers and majority shareholders avoid issuing equity because they are more sensitive to the market response than debt, or there is still an imbalance of information between insiders and outsiders.

Open innovation carried out by insiders as a mechanism to reduce information asymmetry has proven to be sub-optimal in practice. With the provisions of the OJKRI, they do not have an incentive to issue equity compared to leverage in financing growth opportunities. If they use the equity, they will face a high cost of equity as the production of asymmetric information [13]. The Republic of Indonesia government requires companies to provide disclosure of information before, when and after the company is listed on IDX and the accompanying sanctions for not disclosing information [50]. Open innovation strategy through TID as information disclosure through the company website and IDX, thus reducing asymmetric information. There are still agents and majority shareholders who have superior information compared to minority shareholders.

As one of the Bakrie Group companies, PT Bakrieland Development requires equity financing with the right issue for business expansion in Bukit Jonggol Asti. Based on interview, Kurniawati Budiman said "the fact is that the rights issue is underpricing due to the finding of differences in investment savings in 2010 Q1 between what was conveyed to the public by PT Bakrie Sumatera Plantation and PT Energi Mega Persada", which is included in the Bakri Group, and those recorded at PT Bank Capital.

The difference in the investment saving notes shows asymmetric information resulting in adverse selection and right issue underpricing in other companies in the Bakrie Group. Another phenomenon, such as PT Garuda Indonesia, reported an increase in net profit of US \$ 809.5 million in 2018, the result of the collaboration between PT Citilink as a subsidiary and PT Mahata Aero Tech, which invested in entertainment equipment on their aircraft. In fact, until December 2018, PT Mahata Aero Tech had not made any payments to PT Citi-link.

The presence of TID as an open innovation strategy provides insiders with incentives to convey information disclosure to the market, however, the information conveyed is not under the actual situation. So that stock prices experience a contraction and they finance growth opportunities by issuing debt, such as the growth and introduction stages. Different companies in a mature stage, such as PT Unilever, with more lower asymmetric information, resulted in an overpricing share price in 2000 and 2003, resulting in a stock split. As a result, debt financing began to decrease because during maturity, growth opportunities decreased compared to the previous stage, and the company chose a closed innovation strategy. The company reduced TID investment as an open innovation strategy due to reduced asymmetric information at the mature stage..

5. Conclusions

Managers have a strategic role in open innovation using TID for information disclosure. In the absence of firm-specific information, issuance of leverage or equity will only depreciate. Conversely, when firm-specific information is added as a disclosure of information, there is still information asymmetry, thus to the issuance of equity, which is more sensitive to market responses, they issue debt.

When adding firm-specific life cycles to test the effect of growth on leverage, during the introduction stage, the company did not issue debt to finance growth opportunities even though it had lower market sensitivity than equity. However, the next stage showed severe asymmetric information when companies disclosed firm-specific information but still used debt financing to finance growth opportunities.

In the overall sample without including the life cycle, firms preferred the issuance of leverage over equity when firm-specific information was included. Interestingly, the disclosure of information as a form of open innovation did not provide incentives for companies to prefer equity issuance over debt during growth and maturity. Managers and majority shareholders have more incentives to prevent equity, which results in dilution, even though there was disclosure of information, which is their obligation. Furthermore, because as long as mature has reduced growth opportunities and tends to be closed innovation, the need for financing is less. If it is necessary, they prioritize debt over equity because it is still found that equity issuance is more sensitive in the capital market than debt. Information asymmetry results in an adverse selection and moral hazard [28]. With regard to the limitations of our research, some variables may have been omitted in the modelling procedure. First, the agents who act in majority shareholders' interests are still likely to have better information than other shareholders, even though

information disclosure is required as a form of open innovation. Second, we did not explore firm heterogeneity via panel data.

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Debt Versus Equity—Open Innovation to Reduce Asymmetric Information

Keywords: leverage; growth opportunities; specific firms; life cycle

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Abstract: The research aims to examine the difference between absence and presence life cycle stage in [Technology information digitalization (TID) as a form of open innovation in reducing information asymmetry. Furthermore, companies with asymmetric information prefer debt over equity. The study collects 3.343 pooled data observation units of companies listed in the Indonesian capital market period 2008 to 2019. We use OLS regression analysis to determine the difference between the absence and presence lifecycle stage in determining capital structure relations and exploiting growth opportunities. The study found information disclosure obligation of the capital market regulator has not been fully disclosed through TID. As a result, companies choose to pass in growth opportunities with debt or equity in the absence life cycle stage. Presence lifecycle stage, in the introduction stage, the company misses growth opportunities. The company prefers the issuance of debt with lower information sensitivity than equity. Presence culture, such as majority ownership, generates incentives for open innovation from capital market regulators, which still contain information asymmetry.

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1. Introduction

Managers as agents with superior information can act in their interests and those of majority shareholders, rather than in debtholders and other shareholders [1,2]. Thus, an information asymmetry situation can occur in Indonesia with a concentrated ownership structure [3] and a family relationship between the manager and controlling shareholders [4].

Companies use leverage signallingsignaling to convey information and reduce information asymmetry [5–7]. The presence of information asymmetry results in equity friction in the market [8]. It does not follow the company's claims, so the company prioritizes internal financing, debt, and then equity according to the hierarchical pecking order theory (POT) [7,9]. The POT seems to perform well empirically concerning sending asymmetric information-reducing signals. <u>HoweverStill</u>, it does not always perform well in reality [10] and remains unexplained mainly [11], depending on the specific firm and institution [12].

The open innovation paradigm is the most important [13]; that is, reporting should use information technology and digitization (TID) to reduce information asymmetry in equity issuance. However, it is not used optimally, meaning that there is still a high cost of equity, which is in line with POT, indicating that leverage is better than equity.

We predict that the POT can explain a situation better when TID, as a form of open innovation, is used to deliver firm specifics and a better life cycle. As a result, information

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asymmetry is reduced, the POT hierarchy is reversed, and the company prefers equity issuance over debt. Firm-specific variables include size, profitability, and risk [14,15], while the life cycle comprises introduction, growth and maturity stages [16,17]. The open innovation strategy in using TID is mostly done by companies in the introduction and growth stages because the development is faster than their ability, than growth and is mature [18]. <u>As a resultResulting</u>, they are more sensitive to financing decisions.

Capital structure decisions are developed based on conflicts of majority and minority shareholders following the characteristics of the ownership structure in Indonesia, which may differ to other developing countries. The Financial Services Authority of the Republic of Indonesia (OJKRI) plays an essential role in developing open innovation [19] and using TID implementation for information disclosure [20], to reduce the level of information content, and it prefers equity over debt. The presence of culture makes the impact of openness on open innovation more complex than without the presence of culture [21]. Disclosure information as a form of openness strategy through TID is primarily determined by a set of norms and values that are widely adopted and adhered to throughout the company (culture).

2. Literature Review

2.1. Open Innovation: A Culture and Complexity with Evolutionary Economics

Open innovation uses the inflow and outflow of knowledge to accelerate internal innovation and expand the market of internal innovation [22]. When a company is an openness to knowledge and information, it has the potential to produce open innovation so that it can take advantage of growth opportunities and better market response [21].

The presence of culture produces a relationship between openness and open innovation, which is more complex than the inverted u-shaped. Absence of culture, companies can increase openness to accelerate open innovation. Still, at the optimal point when companies are more open, it is difficult to manage information and knowledge, which will result in a decrease in open innovation [23].

Culture helps explain firm performance, even when individuals only adopt shared values and norms and is strengthened when adopting organizational values that are the values of the company's founders [21]. To sum up, a constructive culture impacts cooperation within organizational units and between organizational units that directly or indirectly affect firm performance. Stock market regulators in Indonesia require disclosure of information in the TID as a form of open innovation that stimulates the openness of every issuer listed in the capital market [13]. Thus, a stable environment in the form of disclosure information requirements from OJKRI generates incentives for managers and companies to create a strong culture. Therefore, their capabilities are increasingly exploited in achieving company goals.

The development of the <u>four</u>4th industrial revolution era demands the use of engineering (TID) directly and more heartily than before in responding to the needs of the market and society [24]. Companies as part of an entity from the capital market have more incentives to disclose information as a demand for an open business model. As a result, companies can use technology to connect to the market [25]. They added that the presence of the accelerated IT revolution along with the deepening of the knowledge-based economy resulted in a new business model that connected companies and access to markets more intensively than before.

It is still debatable when it cannot be compared between the benefits and costs due to open innovation. As a result, companies will limit the disclosure of financial information entirely because it can affect their competitive position [26], like the complexity with evolutionary economics hypothesis, which is different from the neo-classic outlook, which prioritizes dynamic analysis over static. Thus placing behavioral, institutional, technological and other explanatory variables in other forms [27].

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One possible explanation regarding the difference in benefits and costs in TID use is due to the firm lifecycle [28]. They reported that companies in the mature stage have a better green innovation process than growth stage firms—furthermore, technology capability as a mediation between green innovation performance and life-stage firm.

Thus, regulators from OJKRI and the 4th industry revolution have produced better use of TID in the open business model. It is easier for companies to convey information disclosure to the market through JATS (Jakarta Automated Trading System Next Generation) to reduce asymmetric information [29]. PT Bank Pembangunan Daerah Jawa Barat and Banten, Tbk reports information on last, present performance and business development plans [30]. In addition, a change in the company's ownership structure was reported through the PMT-HMETD (Capital Additions Without Preemptive Rights Program).

$2.2.\ Firm-Specific\ Leverage\ and\ Growth-The\ Role\ of\ Open\ Innovation$

Companies with fewer valuable opportunities can mimic those with more valuable ones. This can result in overvalued securities at companies with fewer valuable opportunities and undervalued securities at companies with more valuable opportunities. Therefore, when growth opportunities have asymmetric information, a good quality company will issue a debt higher than equity [5,6,20] to convey a positive signal to the market. Thus, the company will take advantage of growth opportunities with increased leverage, which indicates that the company's information asymmetry is lower than if it were to issue equity, in line with the POT. On the other hand, majority shareholders may prevent share dilution through debt issuance when information asymmetry is high. next, [31].

Debt issuance is a mechanism used to reduce the agency problem of ex-ante information asymmetry. Managers who act in the interests of shareholders are better off skipping growth opportunities with leverage [32] because high leverage only increases the risk of bankruptcy and welfare transfer to debtholders [33]

One difference between this study and previous research regarding the relationship between leverage and growth is in using firm-specific terms, including size, profitability, and risk. Large companies have lower information asymmetry than small companies, increasing collateral assets for lenders [12,34]. Larger companies have higher cash flow and more assets, so they have easy access to banking because they are considered less risky borrowers [35]. As support for their behavior, profitability will have an impact on leverage. Managers prefer to keep retained earnings and use debt to finance growth opportunities [36]. When the company-specific risk is high, the shareholders will perform riskshifting [37] whenever possible. The use of excessive leverage, with the presence of bankruptcy costs and the limited responsibility of shareholders, is a risk for the debtholders who bear it [8].

Market failure among participants is not due to product quality but rather to information asymmetry [38]. In this context, TID is a form of open innovation that can reduce information asymmetry [13]. Thus, the informed agent has a strategic role compared to the uninformed agent in delivering firm-specific information to the market [39]. As a result, equity friction reduces, and equity is prioritized over debt, which is inversely related to the POT.

Hypothesis 1 (H1). TID open innovation can be in a low level of information asymmetry so that the company prioritized equity financing over debt.

2.3. Firm-Specific Life Cycle Stage-Open Innovation

Each stage of the life cycle produces a different and more specific level of asymmetry [14]. For example, the technology life cycle is more applicable during the growth and maturity stages than the introduction stage [41]. Table 1 shows that it was possible to use cash flow for greater investment during the introduction and growth stages, including TID, but cash flow tended to come from debt issuance [16]. Thus, open innovation invest-

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ment in TID decreased the asymmetric information in the introduction, growth, and maturity stages. Open innovation delivers transparent information, therefore decrease asymmetric information.

Table 1. Cashflow patterns for each life cycle stage.

Cashflow	Introduction	Growth	Mature	ShakeOut	Decline
Operating	-	+	+	Void in theory	
Invest	-	-	-	Void in theory	+
Financing	+	+		Void in theory	+ or

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Older companies generally have better information credibility, more assets, and a better reputation than younger companies that use more leverage. Therefore, in the maturity stage, a company can substitute debt with internal financing [14] or prefer debt to equity [42] as a form of low information asymmetry.

In addition, the relationship between specific firms and the life cycle is that profitability has a negative effect and leverage has a positive effect. As the age of the company increases, the profitability decreases, and the company prioritizes debt issuance. In particular, leverage is shown as the smallest determinant of financing during the introduction stage [17]. During the early stage, a company faces significant business uncertainty and risk, which is exacerbated by high information asymmetry, so that it prioritizes internal funding [15]. However, when internal funding from profitability has decreased [17], the company prefers debt, which has a lower risk of stock price friction than equity.

A company's size affects the use of leverage at each stage of the life cycle. During the introduction stage, leverage is low while high during the growth and maturity stages [15]. If there is a large asymmetry problem at the introduction stage, the company uses internal funds to reduce leverage. Companies have less information asymmetry and greater collateral asset ownership during the growth and maturity stages, prioritizing external funding through debt instead of equity [17]. More extremely, companies at an early stage, due to the high information asymmetry, are limited in using external funds. In the next stage, the company performs re-balancing, not by increasing debt, but by substituting internal funding where the frictional risk of share prices is smaller than debt and equity [14].

During the introduction stage, companies are faced with higher information asymmetry because of the uncertainty of future cash flows. As a result, they have a higher external cost of capital. As a result, companies face higher levels of risk during the introduction and growth stages, but risk reduces during the maturity stage [43]. The mMaturity stage gives a chance for stakeholder to collect many information, therefore the risk is reduce. Investment efficiency is low during the introduction stage; however, this increases non-linearly during the growth and maturity stages [15]. Therefore, the POT theory is more applicable during the maturity stage [44,45]. Thus, an increase in lifecycle stages and reduced asymmetric information results in greater closed innovation [18], as shown in Figure 1. As a result, starting from maturity, the financing for open innovation is reduced, and if needed, they prefer equity because there is less asymmetric information.



Figure 1. Relationship between Technology Life Cycle and Open Innovation.

Hypothesis 2 (H2). The presence of open innovation and the increasing stages of the life cycle result in reduced asymmetry regarding firm-specific information. Companies prefer equity to leverage when financing growth opportunities.

3. Methods

3.1. Variable Measurement

The total debt ratio to total assets (leverage) was used as the dependent variable in a regression [31]. When growth opportunities reach information asymmetry, the issuance of debt results in companies still being able to issue leverage greater than the total assets, even though market leverage depreciates. Growth opportunities are measured by (total sales t – total sales t 1)/total sales t –1 [46,47].

Our firm-specific variable used in asset as a proxy for size [48], profitability as a return on assets [49], and specific risk as to the variance of return on assets [50]. We used the age measured in years since it was recorded [51]. The life cycle consists of five stages: introduction, growth, maturity, shake-out, and decline [16]. Since cash flow investing, operating, and financing can better explain the life cycle, we used only the first three stages due to the prominent aspect [17]. A company's life cycle stage was categorized as follows: 1 = introduction, 2 = growth, and 3 = maturity [52].

3.2. Data and Sample Selection

Pooled data of 3343 observations gathered from companies from eight industrial sectors listed on the Indonesian Stock Exchange (IDX) for 2008–2019. Table 2 shows the collinearity of variables used in the analysis and their corresponding VIF values; the financial and banking sectors were excluded due to differences in each company policy [53]. We removed outliers from the dataset by excluding the highest and lowest 5% of values. Data were obtained from eight industrial sectors: agriculture (3.92%) of observations), infrastructure (11.22%), utilities and transportation (11.22%), manufacturing (32.93%), mining (9.39%), property (15.23%), real estate and building construction (27.31%), trade, and services and investment. Table 2 indicated a VIF value of about 1 and a correlation between explanatory variables of less than 0.8 [54].

Table 2. Multicollinearity test result among variables.

Panel A	Correlation Matrix						
	Leverage	Growth	Size	Profitability	Risk-Spe- cific		
Leverage	1						
Growth Ops.	0.002446	1					
Size	0.12642	0.01661	1				
Profitability	0.24849	0.118867	0.114479	1			

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Risk-Specific Panel B	0.020752	0.02165	0.06079 <mark>VIF Factors</mark>	0.36919	1
<mark>Variables</mark>			VIF		
Growth Ops.			1.096		
Size			1.017		
Profitability			1.042		
Risk-Specific			1.109		

We used OLS regression with a dummy equation or LSDV because the scalable explanatory variable was nominal (introduction, growth and mature), with two dummy categories to avoid dummy traps [54]:

$E(Y_i|X_i) = \alpha_1 + \alpha_2 X_i + \alpha_3 FirmSpecific_i + \alpha_4 D_{2i} + \alpha_5 D_{3i}$

where Y is leveraged; X represents growth opportunities; $Firm_{S}$ pecific size, profitability and risk; D2i is 1 if the stage is growth; otherwise it is 0; D3i is 1 if the stage is mature; otherwise it is 0; and if D2i = 0 and D3i = 0 then it is the introduction stage.

4. Results

4.1. Data

Table 1 shows that the data has kurtosis, which tends to be homogeneous and has varied skewness as long as the growth stage has a mean leverage greater than the introduction and maturity stages. The increase in leverage from introduction to growth in greater debt issuance reduces information asymmetry [15]. In contrast, there was no significant difference in mean leverage during maturity compared to growth, as an effort to reduce the risk of bankruptcy [43], and a more stable cash flow was used to replace aging equipment instead of paying debt [16].

As long as the growth stage has lower information asymmetry than the introduction stage when assets increase collateral, the company issues more debt. Conversely, during the maturity stage, the information asymmetry is reduced compared to the growth stage. The increase in collateral results in reduce leverage, leading to a company preferring internal financing over equity [40].

As long as a company in the growth stage has cash flow from large investments, it exceeds profitability, making it relatively stable compared to a company in the introduction stage [16], resulting in a decrease in profitability. On the other hand, there is an increase in profitability because investment is more efficient than during maturity [15]. In addition, the business risk decreases as the age of the company increases [15,44].

There was more debt issuance and a risk-shifting problem [37,56]. When managers and majority shareholders have better quality information about growth opportunities than minority shareholders, they prefer debt to equity. Debtholders are promised high returns if the project is successful, even if the probability of success is low, because if it is successful, the majority manager will benefit. If it fails, the debtholders will share the risk. Conversely, if the risk is unknown, the company will tend to issue equity. Further information asymmetry results in a "mean revision" of the leverage level [34,45]. In this case, it would be better to avoid taking advantage of growth opportunities because they created a new debt agency.

4.2. Regression Analysis

Table 1 showed a significant difference in mean leverage between the growth and introduction stages and the mature and growth stages. However, because this simple description did not include firm-specific size, profitability and risk variables, the findings of an LSDV regression represent in Table 3.

Table 3. Descriptive Statistics and Mean Differences.

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Derral A				D					
Panel A		Descriptive Statistics							
Life Cycle	Obs	Variables	Mean	25th Quar- tile	Median	75th Quar- tile	St. Dev	Kurtosis	Skewness
Introduction	692	Leverage	0.456	0.284	0.458	0.611	0.222	2069	0.511
	692	Growth Ops.	0.169	0.035	0.109	0.267	0.393	6.008	1894
	692	Size	28,250	27,328	28,287	29,219	1420	11,362	1.121
	692	Profitability	0.035	0.003	0.035	0.075	0.089	15,951	1604
	692	Risk-Specific	0.008	0.000	0.001	0.005	0.033	235,562	13,538
Growth	1682	Leverage	0.486	0.321	0.475	0.637	0.217	0.131	0.326
	1682	Growth Ops.	0.122	0.050	0.079	0.221	0.323	8,411	2.085
	1682	Size	28,442	27,190	28,507	29,677	1761	0.050	0.134
	1682	Profitability	0.029	0.001	0.028	0.070	0.131	214,966	9860
	1682	Risk-Specific	0.017	0.000	0.001	0.006	0.254	1,302,150	34,864
Mature	969	Leverage	0.484	0.302	0.479	0.616	0.248	6.441	1283
	969	Growth Ops.	0.093	0.031	0.072	0.175	0.262	9.817	1881
	969	Size	28,626	27 <mark>.</mark> 375	28,560	29,962	1.858	0.212	0.099
	969	Profitability	0.061	0.009	0.045	0.098	0.141	37,755	2.342
	969	Risk-Specific	0.021	0.000	0.002	0.008	0.129	460,111	19,271
Total	3343	Leverage	0.479	0.308	0.473	0.629	0.228	3001	0.721
	3343	Growth Ops.	0.123	0.041	0.081	0.217	0.324	8558	2092
	3343	Size	28,456	27,270	28,453	29,610	1730	1.150	0.129
	3343	Profitability	0.040	0.003	0.034	0.079	0.128	141,355	4.581
	3343	Risk-Specific	0.016	0.000	0.001	0.006	0.194	1,962,489	41,208
Panel B		-		M	ean Differ	ences			
	Varia	ables		Growt	h vs. Intro	duction	-20-	Mature vs. Gr	awth

ranel B	Mean Differences	
Variables	Growth vs. Introduction	Mature vs. Growth
Leverage	0.030 *	0.002
Growth Ops.	0.047 *	0.029 *
Size	0.192 *	0.185 *
Profitability	0.006 *	0.032 *
risk	0.063 *	0.004
	* Seignificant at 0.05	

Column 1 of Table 4 shows that when majority and minority shareholders do not have specific firm information, they are faced with uncertainty in cash flow and high risk so that the issuance of debt becomes risky. As a result, they refuse financing for valuable growth opportunities to prevent control over the company [56]. Due to the limited responsibility of shareholders, if there is bankruptcy, the company will be taken over by debtholders. When there is no disclosure of specific firm information, debtholders will not make transactions because it can depreciate debt and equity.

Table 4. Regression Analysis.

Variables	All Firms	All Firms	Introduction	Growth	Maturity
Constant	0.479 *	0.087	0.572 *	0.089	0.042
	0.000	0.160	0.000	0.265	0.713
Growth Op	0.002	0.027 *	0.015	0.033 *	0.135 *
	0.888	0.019	0.437	0.034	0.000
Size		0.021 *	0.037 *	0.021 *	0.016 *
		0.000	0.000	0.000	0.000
Profitability		0.536 *	0.989 *	0.815 *	0.627 *
-		0.000	0.000	0.000	0.000
Risk Specific		0.094 *	0.318	0.280 *	0.514 *
		0.000	0.198	0.000	0.000
Obs	3343	3343	692	1682	969
F Test	0.019	85,482	43,193	69,663	36,473
Sig F Test	0.888	0.000	0.000	0.000	0.000

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Multiple R	0.002	0.305	0.448	0.377	0.363
R Square	0.000	0.093	0.201	0.142	0.131
* Scientificant at 0.0	าต				

* <u>S</u>significant at 0.05.

Column 2 of Table 3 shows that as assets increase, the collateral increases; as the specific risk increases, the profitability decreases. The company increases the leverage to finance the rise invaluable growth [10,57]. It also shows that the effect of profitability on leverage is greater than size and risk. Increasing assets and decreasing risk can provide a more positive signal than profitability, which has a negative signal, to the market. Management will issue debt to provide a positive signal to the market [5] to maintain control of a quality company [6]. From the perspective of agency theory, they avoid exposure to the capital market [58].

Thus, the firm-specific information submitted by companies with agency problems still contains asymmetric information. The result is that they issue debt rather than equity when financing growth opportunities. As previously thought, there is still information asymmetry. Even though the manager already has an incentive for open innovation with TID in information disclosure, the POT hierarchy works, following OJKRI regulations. A high cost of equity resulting from asymmetric information has resulted in companies using debt financing [13], despite Indonesia being a bank-based system [59].

Columns 3–5 of Table 4 show the difference in results across life cycle stages. Companies in the introduction stage have high business uncertainty and risk [55]. Managers and majority shareholders have higher quality information than minority shareholders regarding growth opportunities, so growth opportunities lead to greater information asymmetry than total assets [31]. By adding the specific firm size and profitability, managers and majority shareholders missed out on taking advantage of the growth opportunities with leverage. When faced with high risk and reduced profitability, they will not finance growth opportunities with leverage even if there is an increase in collateral assets. However, they perform risk avoidance [56] to prevent loss of control and rent for future corporate value increases.

In the growth stage, companies buy many assets as part of a competitive advantage strategy. As a result, demand for cash flow for investment is greater than the availability of internal financing, and there is lower information asymmetry than during the introduction. Although there is an increase in size as a proxy for collateral and decreased company risk, long-term investment needs are greater than profitability. Hence, the presence of asymmetric information exacerbates this condition, and companies prefer debt issuance to equity [7,16].

The mature stage is a condition with fewer asymmetric information indications than the growth stage. Therefore, companies should issue equity instead of debt, but we found that they still reference debt, which differs from findings of other research [14,31]. Managers and majority shareholders avoid issuing equity because they are more sensitive to the market response than debt or an imbalance of information between insiders and outsiders.

Open innovation carried out by insiders as a mechanism to reduce information asymmetry has proven to be sub-optimal in practice. With the provisions of the OJKRI, they do not have an incentive to issue equity compared to leverage in financing growth opportunities. If they use the equity, they will face a high cost of equity as the production of asymmetric information [13]. The Republic of Indonesia government requires companies to disclose information before, when and after the company is listed on IDX and the accompanying sanctions for not disclosing information [60]. Through TID as information disclosure through the company website and IDX, Open innovation strategy reduces asymmetric information. There are still agents and majority shareholders who have superior information compared to minority shareholders.

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As one of the Bakrie Group companies, PT Bakrieland Development requires equity financing with the right issue for business expansion in Bukit Jonggol Asti. Based on interview, Kurniawati Budiman said "the fact is that the rights issue is underpricing due to the finding of differences in investment savings in 2010 Q1 between what was conveyed to the public by PT Bakrie Sumatera Plantation and PT Energi Mega Persada", which is included in the Bakri Group, and those recorded at PT Bank Capital.

The difference in the investment saving notes shows asymmetric information resulting in adverse selection and right issue underpricing in other companies in the Bakrie Group. Another phenomenon, such as PT Garuda Indonesia, reported an increase in net profit of USD \$809.5 million in 2018, resulting from the collaboration between PT Citilink as a subsidiary and PT Mahata Aero Tech, which invested in entertainment equipment on their aircraft. In fact, until December 2018, PT Mahata Aero Tech had not made any payments to PT Citi-link.

The presence of TID as an open innovation strategy provides insiders with incentives to convey information disclosure to the market; however, the information conveyed is not under the actual situation. This is sose that stock prices experience a contraction, and they finance growth opportunities by issuing debt, such as the growth and introduction stages. Different companies in a mature stage, such as PT Unilever, with more-lower asymmetric information, and in an overpricing share price in 2000 and 2003, resulting in a stock split. As a result, debt financing began to decrease because during maturity, growth opportunities decreased compared to the previous stage, and the company chose a closed innovation strategy. The company reduced TID investment as an open innovation strategy due to reduced asymmetric information at the mature stage.

Innovation-oriented culture has not yet been manifested in responding to the demands of disclosure of information as the capital market demands. The company has not been able to take the characteristics of the local culture to change the game-oriented to open innovation and therefore can take advantage of growth opportunities. The presence of culture is proven to change the inverted u-shaped relationship between openness and open innovation to become more complex [21]. The company does not optimally use external technology to convey actual company information and knowledge.

Firm culture should encourage innovation and flexibility regarding the core values of treating employees, customers, suppliers and other shareholders. It has not been fully implemented, even though it can directly determine firm performance, in this case reducing undervalued, if the company issues equity. Static study of open innovation inadequacy of openness, aversion to risk-taking, organizational inertia and not invented here (NIH) syndrome has not motivated open innovation in the capital market [21]. OJKRI (The Financial Services Authority of the Republic of Indonesia), as the regulatory body, has carried out open innovation intending to disclose information for all IDX listed issuers and encourages the delivery of information regularly. However, it has not been optimally balanced with the actual delivery of information due to its reluctance to take a risk. Because companies think they will lose their competitive advantage if they tell the truth [26].

It is undeniable that the reluctance of voluntary information disclosure results in greater opportunities for financial distress than non-financial distress [61]. In fact, because the culture in companies with the majority and concentrated ownership prevents the risk of losing discretionary power, they avoid being issued shared because the capital market will be monitored [58]. Therefore, So the culture may be static towards open innovation from capital market regulations.

4.3. Technology Life Cycle, and Open Innovation

Based on the life-cycle stage, differences in the company's growth depend on the availability of resources, and opportunities are characteristic of each stage [28]. Moving through each stage of the lifecycle requires innovation processes in different TIDs [18,22,62]. In the initial stage, the company develops technology (TID) as an innovation

process. In the growth stage, the company deploys technology so that the company's mature stage gets a positive profit (harvest technology). When the decline stage occurs, the company needs to develop new technology.

Implementation of TID improves financial performance because it results in a better quality of financial reporting [26], thereby reducing information asymmetry between managers and shareholders and debtholders. Higher information asymmetry and the use of new technology during the introduction stimulate companies to miss growth opportunities through debt or equity issues. They prefer big data in new technology and have not combined market-based [24]. The level of information asymmetry is lower at the growth and maturity stages than the introduction and the ability to connect technology with the market better, encouraging better disclosure of information to the market.

Thus, the presence of an openness culture produced by the majority and concentrated ownership determines open innovation technology in information disclosure. An interesting finding, when open innovation of technology is less actualized in the introduction, in contrast, companies in Korea are in the initial stage of developing IT medical care, IT industrial robots so that the next stage can be informed in the market to earn profits_[18]. Companies in Indonesia develop open innovation of technology that relates to core business more than reducing information asymmetry.

To sum up, we added a model proof in the introduction. The company focuses more on new technology based on core business than on the latest technology based on information disclosure as OJK's obligation [18]. During the introduction, the company is small, so managers are oriented to aligning open innovation with the company's strategy (core business) to overcome potential obstacles and failures when implemented [63]. As a result, information disclosure has not been fully carried out because it prevents capital market monitoring [58], then the issuance of debt and equity depreciated and missed growth opportunities. In contrast to growth and maturity, when they are aligned with open innovation and strategy, their technology is used for greater openness, according to OJK regulations. It still does not reduce information asymmetry because it prefers debt over equity. The presence of a culture of ownership structure results in the existence of information asymmetry, even though TID is actually able to reduce it.

5. Conclusions

Managers have a strategic role in open innovation using TID for information disclosure. In the absence of firm-specific information, the issuance of leverage or equity will only depreciate. Conversely, when firm-specific information is added as a disclosure of information, there is still information asymmetry, thus to the issuance of equity, which is more sensitive to market responses, they issue debt.

When adding firm-specific life cycles to test the effect of growth on leverage, the company did not issue debt to finance growth opportunities during the introduction stage even though it had lower market sensitivity than equity. However, the next stage showed severe asymmetric information when companies disclosed firm-specific information but still used debt financing to finance growth opportunities.

In the overall sample without including the life cycle, firms preferred the issuance of leverage over equity when firm-specific information was included. The disclosure of information as a form of open innovation did not incentivize companies to prefer equity issuance over debt during growth and maturity. Managers and majority shareholders have more incentives to prevent equity, which results in dilution, even though there was disclosure of information, which is their obligation. Furthermore, because as long as mature has reduced growth opportunities and tends to be closed innovation, the need for financing is less. If it is necessary, they prioritize debt over equity because it is still found that equity issuance is more sensitive in the capital market than debt [38]. With regard to the limitations of our research, some variables may have been committed in the modeling procedure. First, the agents who act in majority shareholders' interests are still likely to have better information than other shareholders, even though information disclosure is

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required as a form of open innovation. Second, we did not explore firm heterogeneity via the data panel.

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Article

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Debt Versus Equity—Open Innovation to Reduce Asymmetric Information

Keywords: leverage; growth opportunities; specific firms; life cycle

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Abstract: The research aims to examine the difference between absence and presence life cycle stage in [Technology information digitalization (TID) as a form of open innovation in reducing information asymmetry. Furthermore, companies with asymmetric information prefer debt over equity. The study collects 3.343 pooled data observation units of companies listed in the Indonesian capital market period 2008 to 2019. We use OLS regression analysis to determine the difference between the absence and presence lifecycle stage in determining capital structure relations and exploiting growth opportunities. The study found information disclosure obligation of the capital market regulator has not been fully disclosed through TID. As a result, companies choose to pass in growth opportunities with debt or equity in the absence life cycle stage. Presence lifecycle stage, in the introduction stage, the company misses growth opportunities. The company prefers the issuance of debt with lower information sensitivity than equity. Presence culture, such as majority ownership, generates incentives for open innovation from capital market regulators, which still contain information asymmetry.

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1. Introduction

Managers as agents with superior information can act in their interests and those of majority shareholders, rather than in debtholders and other shareholders [1,2]. Thus, an information asymmetry situation can occur in Indonesia with a concentrated ownership structure [3] and a family relationship between the manager and controlling shareholders [4].

Companies use leverage signallingsignaling to convey information and reduce information asymmetry [5–7]. The presence of information asymmetry results in equity friction in the market [8]. It does not follow the company's claims, so the company prioritizes internal financing, debt, and then equity according to the hierarchical pecking order theory (POT) [7,9]. The POT seems to perform well empirically concerning sending asymmetric information-reducing signals. <u>HoweverStill</u>, it does not always perform well in reality [10] and remains unexplained mainly [11], depending on the specific firm and institution [12].

The open innovation paradigm is the most important [13]; that is, reporting should use information technology and digitization (TID) to reduce information asymmetry in equity issuance. However, it is not used optimally, meaning that there is still a high cost of equity, which is in line with POT, indicating that leverage is better than equity.

We predict that the POT can explain a situation better when TID, as a form of open innovation, is used to deliver firm specifics and a better life cycle. As a result, information

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asymmetry is reduced, the POT hierarchy is reversed, and the company prefers equity issuance over debt. Firm-specific variables include size, profitability, and risk [14,15], while the life cycle comprises introduction, growth and maturity stages [16,17]. The open innovation strategy in using TID is mostly done by companies in the introduction and growth stages because the development is faster than their ability, than growth and is mature [18]. <u>As a resultResulting</u>, they are more sensitive to financing decisions.

Capital structure decisions are developed based on conflicts of majority and minority shareholders following the characteristics of the ownership structure in Indonesia, which may differ to other developing countries. The Financial Services Authority of the Republic of Indonesia (OJKRI) plays an essential role in developing open innovation [19] and using TID implementation for information disclosure [20], to reduce the level of information content, and it prefers equity over debt. The presence of culture makes the impact of openness on open innovation more complex than without the presence of culture [21]. Disclosure information as a form of openness strategy through TID is primarily determined by a set of norms and values that are widely adopted and adhered to throughout the company (culture).

2. Literature Review

2.1. Open Innovation: A Culture and Complexity with Evolutionary Economics

Open innovation uses the inflow and outflow of knowledge to accelerate internal innovation and expand the market of internal innovation [22]. When a company is an openness to knowledge and information, it has the potential to produce open innovation so that it can take advantage of growth opportunities and better market response [21].

The presence of culture produces a relationship between openness and open innovation, which is more complex than the inverted u-shaped. Absence of culture, companies can increase openness to accelerate open innovation. Still, at the optimal point when companies are more open, it is difficult to manage information and knowledge, which will result in a decrease in open innovation [23].

Culture helps explain firm performance, even when individuals only adopt shared values and norms and is strengthened when adopting organizational values that are the values of the company's founders [21]. To sum up, a constructive culture impacts cooperation within organizational units and between organizational units that directly or indirectly affect firm performance. Stock market regulators in Indonesia require disclosure of information in the TID as a form of open innovation that stimulates the openness of every issuer listed in the capital market [13]. Thus, a stable environment in the form of disclosure information requirements from OJKRI generates incentives for managers and companies to create a strong culture. Therefore, their capabilities are increasingly exploited in achieving company goals.

The development of the <u>four</u>4th industrial revolution era demands the use of engineering (TID) directly and more heartily than before in responding to the needs of the market and society [24]. Companies as part of an entity from the capital market have more incentives to disclose information as a demand for an open business model. As a result, companies can use technology to connect to the market [25]. They added that the presence of the accelerated IT revolution along with the deepening of the knowledge-based economy resulted in a new business model that connected companies and access to markets more intensively than before.

It is still debatable when it cannot be compared between the benefits and costs due to open innovation. As a result, companies will limit the disclosure of financial information entirely because it can affect their competitive position [26], like the complexity with evolutionary economics hypothesis, which is different from the neo-classic outlook, which prioritizes dynamic analysis over static. Thus placing behavioral, institutional, technological and other explanatory variables in other forms [27].

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One possible explanation regarding the difference in benefits and costs in TID use is due to the firm lifecycle [28]. They reported that companies in the mature stage have a better green innovation process than growth stage firms—furthermore, technology capability as a mediation between green innovation performance and life-stage firm.

Thus, regulators from OJKRI and the 4th industry revolution have produced better use of TID in the open business model. It is easier for companies to convey information disclosure to the market through JATS (Jakarta Automated Trading System Next Generation) to reduce asymmetric information [29]. PT Bank Pembangunan Daerah Jawa Barat and Banten, Tbk reports information on last, present performance and business development plans [30]. In addition, a change in the company's ownership structure was reported through the PMT-HMETD (Capital Additions Without Preemptive Rights Program).

$2.2.\ Firm-Specific\ Leverage\ and\ Growth-The\ Role\ of\ Open\ Innovation$

Companies with fewer valuable opportunities can mimic those with more valuable ones. This can result in overvalued securities at companies with fewer valuable opportunities and undervalued securities at companies with more valuable opportunities. Therefore, when growth opportunities have asymmetric information, a good quality company will issue a debt higher than equity [5,6,20] to convey a positive signal to the market. Thus, the company will take advantage of growth opportunities with increased leverage, which indicates that the company's information asymmetry is lower than if it were to issue equity, in line with the POT. On the other hand, majority shareholders may prevent share dilution through debt issuance when information asymmetry is high. next, [31].

Debt issuance is a mechanism used to reduce the agency problem of ex-ante information asymmetry. Managers who act in the interests of shareholders are better off skipping growth opportunities with leverage [32] because high leverage only increases the risk of bankruptcy and welfare transfer to debtholders [33]

One difference between this study and previous research regarding the relationship between leverage and growth is in using firm-specific terms, including size, profitability, and risk. Large companies have lower information asymmetry than small companies, increasing collateral assets for lenders [12,34]. Larger companies have higher cash flow and more assets, so they have easy access to banking because they are considered less risky borrowers [35]. As support for their behavior, profitability will have an impact on leverage. Managers prefer to keep retained earnings and use debt to finance growth opportunities [36]. When the company-specific risk is high, the shareholders will perform riskshifting [37] whenever possible. The use of excessive leverage, with the presence of bankruptcy costs and the limited responsibility of shareholders, is a risk for the debtholders who bear it [8].

Market failure among participants is not due to product quality but rather to information asymmetry [38]. In this context, TID is a form of open innovation that can reduce information asymmetry [13]. Thus, the informed agent has a strategic role compared to the uninformed agent in delivering firm-specific information to the market [39]. As a result, equity friction reduces, and equity is prioritized over debt, which is inversely related to the POT.

Hypothesis 1 (H1). TID open innovation can be in a low level of information asymmetry so that the company prioritized equity financing over debt.

2.3. Firm-Specific Life Cycle Stage-Open Innovation

Each stage of the life cycle produces a different and more specific level of asymmetry [14]. For example, the technology life cycle is more applicable during the growth and maturity stages than the introduction stage [41]. Table 1 shows that it was possible to use cash flow for greater investment during the introduction and growth stages, including TID, but cash flow tended to come from debt issuance [16]. Thus, open innovation invest-

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ment in TID decreased the asymmetric information in the introduction, growth, and maturity stages. Open innovation delivers transparent information, therefore decrease asymmetric information.

Table 1. Cashflow patterns for each life cycle stage.

Cashflow	Introduction	Growth	Mature	ShakeOut	Decline
Operating	-	+	+	Void in theory	
Invest	-	-	-	Void in theory	+
Financing	+	+		Void in theory	+ or

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Older companies generally have better information credibility, more assets, and a better reputation than younger companies that use more leverage. Therefore, in the maturity stage, a company can substitute debt with internal financing [14] or prefer debt to equity [42] as a form of low information asymmetry.

In addition, the relationship between specific firms and the life cycle is that profitability has a negative effect and leverage has a positive effect. As the age of the company increases, the profitability decreases, and the company prioritizes debt issuance. In particular, leverage is shown as the smallest determinant of financing during the introduction stage [17]. During the early stage, a company faces significant business uncertainty and risk, which is exacerbated by high information asymmetry, so that it prioritizes internal funding [15]. However, when internal funding from profitability has decreased [17], the company prefers debt, which has a lower risk of stock price friction than equity.

A company's size affects the use of leverage at each stage of the life cycle. During the introduction stage, leverage is low while high during the growth and maturity stages [15]. If there is a large asymmetry problem at the introduction stage, the company uses internal funds to reduce leverage. Companies have less information asymmetry and greater collateral asset ownership during the growth and maturity stages, prioritizing external funding through debt instead of equity [17]. More extremely, companies at an early stage, due to the high information asymmetry, are limited in using external funds. In the next stage, the company performs re-balancing, not by increasing debt, but by substituting internal funding where the frictional risk of share prices is smaller than debt and equity [14].

During the introduction stage, companies are faced with higher information asymmetry because of the uncertainty of future cash flows. As a result, they have a higher external cost of capital. As a result, companies face higher levels of risk during the introduction and growth stages, but risk reduces during the maturity stage [43]. The mMaturity stage gives a chance for stakeholder to collect many information, therefore the risk is reduce. Investment efficiency is low during the introduction stage; however, this increases non-linearly during the growth and maturity stages [15]. Therefore, the POT theory is more applicable during the maturity stage [44,45]. Thus, an increase in lifecycle stages and reduced asymmetric information results in greater closed innovation [18], as shown in Figure 1. As a result, starting from maturity, the financing for open innovation is reduced, and if needed, they prefer equity because there is less asymmetric information.



Figure 1. Relationship between Technology Life Cycle and Open Innovation.

Hypothesis 2 (H2). The presence of open innovation and the increasing stages of the life cycle result in reduced asymmetry regarding firm-specific information. Companies prefer equity to leverage when financing growth opportunities.

3. Methods

3.1. Variable Measurement

The total debt ratio to total assets (leverage) was used as the dependent variable in a regression [31]. When growth opportunities reach information asymmetry, the issuance of debt results in companies still being able to issue leverage greater than the total assets, even though market leverage depreciates. Growth opportunities are measured by (total sales t – total sales t 1)/total sales t –1 [46,47].

Our firm-specific variable used in asset as a proxy for size [48], profitability as a return on assets [49], and specific risk as to the variance of return on assets [50]. We used the age measured in years since it was recorded [51]. The life cycle consists of five stages: introduction, growth, maturity, shake-out, and decline [16]. Since cash flow investing, operating, and financing can better explain the life cycle, we used only the first three stages due to the prominent aspect [17]. A company's life cycle stage was categorized as follows: 1 = introduction, 2 = growth, and 3 = maturity [52].

3.2. Data and Sample Selection

Pooled data of 3343 observations gathered from companies from eight industrial sectors listed on the Indonesian Stock Exchange (IDX) for 2008–2019. Table 2 shows the collinearity of variables used in the analysis and their corresponding VIF values; the financial and banking sectors were excluded due to differences in each company policy [53]. We removed outliers from the dataset by excluding the highest and lowest 5% of values. Data were obtained from eight industrial sectors: agriculture (3.92%) of observations), infrastructure (11.22%), utilities and transportation (11.22%), manufacturing (32.93%), mining (9.39%), property (15.23%), real estate and building construction (27.31%), trade, and services and investment. Table 2 indicated a VIF value of about 1 and a correlation between explanatory variables of less than 0.8 [54].

Table 2. Multicollinearity test result among variables.

Panel A	Correlation Matrix						
	Leverage	Growth	Size	Profitability	Risk-Spe- cific		
Leverage	1						
Growth Ops.	0.002446	1					
Size	0.12642	0.01661	1				
Profitability	0.24849	0.118867	0.114479	1			

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Risk-Specific Panel B	0.020752	0.02165	0.06079 <mark>VIF Factors</mark>	0.36919	1
<mark>Variables</mark>			VIF		
Growth Ops.			1.096		
Size			1.017		
Profitability			1.042		
Risk-Specific			1.109		

We used OLS regression with a dummy equation or LSDV because the scalable explanatory variable was nominal (introduction, growth and mature), with two dummy categories to avoid dummy traps [54]:

$E(Y_i|X_i) = \alpha_1 + \alpha_2 X_i + \alpha_3 FirmSpecific_i + \alpha_4 D_{2i} + \alpha_5 D_{3i}$

where Y is leveraged; X represents growth opportunities; $Firm_{S}$ pecific size, profitability and risk; D2i is 1 if the stage is growth; otherwise it is 0; D3i is 1 if the stage is mature; otherwise it is 0; and if D2i = 0 and D3i = 0 then it is the introduction stage.

4. Results

4.1. Data

Table 1 shows that the data has kurtosis, which tends to be homogeneous and has varied skewness as long as the growth stage has a mean leverage greater than the introduction and maturity stages. The increase in leverage from introduction to growth in greater debt issuance reduces information asymmetry [15]. In contrast, there was no significant difference in mean leverage during maturity compared to growth, as an effort to reduce the risk of bankruptcy [43], and a more stable cash flow was used to replace aging equipment instead of paying debt [16].

As long as the growth stage has lower information asymmetry than the introduction stage when assets increase collateral, the company issues more debt. Conversely, during the maturity stage, the information asymmetry is reduced compared to the growth stage. The increase in collateral results in reduce leverage, leading to a company preferring internal financing over equity [40].

As long as a company in the growth stage has cash flow from large investments, it exceeds profitability, making it relatively stable compared to a company in the introduction stage [16], resulting in a decrease in profitability. On the other hand, there is an increase in profitability because investment is more efficient than during maturity [15]. In addition, the business risk decreases as the age of the company increases [15,44].

There was more debt issuance and a risk-shifting problem [37,56]. When managers and majority shareholders have better quality information about growth opportunities than minority shareholders, they prefer debt to equity. Debtholders are promised high returns if the project is successful, even if the probability of success is low, because if it is successful, the majority manager will benefit. If it fails, the debtholders will share the risk. Conversely, if the risk is unknown, the company will tend to issue equity. Further information asymmetry results in a "mean revision" of the leverage level [34,45]. In this case, it would be better to avoid taking advantage of growth opportunities because they created a new debt agency.

4.2. Regression Analysis

Table 1 showed a significant difference in mean leverage between the growth and introduction stages and the mature and growth stages. However, because this simple description did not include firm-specific size, profitability and risk variables, the findings of an LSDV regression represent in Table 3.

Table 3. Descriptive Statistics and Mean Differences.

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Derral A				D					
Panel A		Descriptive Statistics							
Life Cycle	Obs	Variables	Mean	25th Quar- tile	Median	75th Quar- tile	St. Dev	Kurtosis	Skewness
Introduction	692	Leverage	0.456	0.284	0.458	0.611	0.222	2069	0.511
	692	Growth Ops.	0.169	0.035	0.109	0.267	0.393	6.008	1894
	692	Size	28,250	27,328	28,287	29,219	1420	11,362	1.121
	692	Profitability	0.035	0.003	0.035	0.075	0.089	15,951	1604
	692	Risk-Specific	0.008	0.000	0.001	0.005	0.033	235,562	13,538
Growth	1682	Leverage	0.486	0.321	0.475	0.637	0.217	0.131	0.326
	1682	Growth Ops.	0.122	0.050	0.079	0.221	0.323	8,411	2.085
	1682	Size	28,442	27,190	28,507	29,677	1761	0.050	0.134
	1682	Profitability	0.029	0.001	0.028	0.070	0.131	214,966	9860
	1682	Risk-Specific	0.017	0.000	0.001	0.006	0.254	1,302,150	34,864
Mature	969	Leverage	0.484	0.302	0.479	0.616	0.248	6.441	1283
	969	Growth Ops.	0.093	0.031	0.072	0.175	0.262	9.817	1881
	969	Size	28,626	27 <mark>.</mark> 375	28,560	29,962	1.858	0.212	0.099
	969	Profitability	0.061	0.009	0.045	0.098	0.141	37,755	2.342
	969	Risk-Specific	0.021	0.000	0.002	0.008	0.129	460,111	19,271
Total	3343	Leverage	0.479	0.308	0.473	0.629	0.228	3001	0.721
	3343	Growth Ops.	0.123	0.041	0.081	0.217	0.324	8558	2092
	3343	Size	28,456	27,270	28,453	29,610	1730	1.150	0.129
	3343	Profitability	0.040	0.003	0.034	0.079	0.128	141,355	4.581
	3343	Risk-Specific	0.016	0.000	0.001	0.006	0.194	1,962,489	41,208
Panel B		-		M	ean Differ	ences			
	Varia	ables		Growt	h vs. Intro	duction	-20-	Mature vs. Gr	awth

ranel B	Mean Differences	
Variables	Growth vs. Introduction	Mature vs. Growth
Leverage	0.030 *	0.002
Growth Ops.	0.047 *	0.029 *
Size	0.192 *	0.185 *
Profitability	0.006 *	0.032 *
risk	0.063 *	0.004
	* Seignificant at 0.05	

Column 1 of Table 4 shows that when majority and minority shareholders do not have specific firm information, they are faced with uncertainty in cash flow and high risk so that the issuance of debt becomes risky. As a result, they refuse financing for valuable growth opportunities to prevent control over the company [56]. Due to the limited responsibility of shareholders, if there is bankruptcy, the company will be taken over by debtholders. When there is no disclosure of specific firm information, debtholders will not make transactions because it can depreciate debt and equity.

Table 4. Regression Analysis.

Variables	All Firms	All Firms	Introduction	Growth	Maturity
Constant	0.479 *	0.087	0.572 *	0.089	0.042
	0.000	0.160	0.000	0.265	0.713
Growth Op	0.002	0.027 *	0.015	0.033 *	0.135 *
	0.888	0.019	0.437	0.034	0.000
Size		0.021 *	0.037 *	0.021 *	0.016 *
		0.000	0.000	0.000	0.000
Profitability		0.536 *	0.989 *	0.815 *	0.627 *
-		0.000	0.000	0.000	0.000
Risk Specific		0.094 *	0.318	0.280 *	0.514 *
		0.000	0.198	0.000	0.000
Obs	3343	3343	692	1682	969
F Test	0.019	85,482	43,193	69,663	36,473
Sig F Test	0.888	0.000	0.000	0.000	0.000

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Multiple R	0.002	0.305	0.448	0.377	0.363
R Square	0.000	0.093	0.201	0.142	0.131
* Scientificant at 0 (าต				

* <u>S</u>significant at 0.05.

Column 2 of Table 3 shows that as assets increase, the collateral increases; as the specific risk increases, the profitability decreases. The company increases the leverage to finance the rise invaluable growth [10,57]. It also shows that the effect of profitability on leverage is greater than size and risk. Increasing assets and decreasing risk can provide a more positive signal than profitability, which has a negative signal, to the market. Management will issue debt to provide a positive signal to the market [5] to maintain control of a quality company [6]. From the perspective of agency theory, they avoid exposure to the capital market [58].

Thus, the firm-specific information submitted by companies with agency problems still contains asymmetric information. The result is that they issue debt rather than equity when financing growth opportunities. As previously thought, there is still information asymmetry. Even though the manager already has an incentive for open innovation with TID in information disclosure, the POT hierarchy works, following OJKRI regulations. A high cost of equity resulting from asymmetric information has resulted in companies using debt financing [13], despite Indonesia being a bank-based system [59].

Columns 3–5 of Table 4 show the difference in results across life cycle stages. Companies in the introduction stage have high business uncertainty and risk [55]. Managers and majority shareholders have higher quality information than minority shareholders regarding growth opportunities, so growth opportunities lead to greater information asymmetry than total assets [31]. By adding the specific firm size and profitability, managers and majority shareholders missed out on taking advantage of the growth opportunities with leverage. When faced with high risk and reduced profitability, they will not finance growth opportunities with leverage even if there is an increase in collateral assets. However, they perform risk avoidance [56] to prevent loss of control and rent for future corporate value increases.

In the growth stage, companies buy many assets as part of a competitive advantage strategy. As a result, demand for cash flow for investment is greater than the availability of internal financing, and there is lower information asymmetry than during the introduction. Although there is an increase in size as a proxy for collateral and decreased company risk, long-term investment needs are greater than profitability. Hence, the presence of asymmetric information exacerbates this condition, and companies prefer debt issuance to equity [7,16].

The mature stage is a condition with fewer asymmetric information indications than the growth stage. Therefore, companies should issue equity instead of debt, but we found that they still reference debt, which differs from findings of other research [14,31]. Managers and majority shareholders avoid issuing equity because they are more sensitive to the market response than debt or an imbalance of information between insiders and outsiders.

Open innovation carried out by insiders as a mechanism to reduce information asymmetry has proven to be sub-optimal in practice. With the provisions of the OJKRI, they do not have an incentive to issue equity compared to leverage in financing growth opportunities. If they use the equity, they will face a high cost of equity as the production of asymmetric information [13]. The Republic of Indonesia government requires companies to disclose information before, when and after the company is listed on IDX and the accompanying sanctions for not disclosing information [60]. Through TID as information disclosure through the company website and IDX, Open innovation strategy reduces asymmetric information. There are still agents and majority shareholders who have superior information compared to minority shareholders.

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As one of the Bakrie Group companies, PT Bakrieland Development requires equity financing with the right issue for business expansion in Bukit Jonggol Asti. Based on interview, Kurniawati Budiman said "the fact is that the rights issue is underpricing due to the finding of differences in investment savings in 2010 Q1 between what was conveyed to the public by PT Bakrie Sumatera Plantation and PT Energi Mega Persada", which is included in the Bakri Group, and those recorded at PT Bank Capital.

The difference in the investment saving notes shows asymmetric information resulting in adverse selection and right issue underpricing in other companies in the Bakrie Group. Another phenomenon, such as PT Garuda Indonesia, reported an increase in net profit of USD \$809.5 million in 2018, resulting from the collaboration between PT Citilink as a subsidiary and PT Mahata Aero Tech, which invested in entertainment equipment on their aircraft. In fact, until December 2018, PT Mahata Aero Tech had not made any payments to PT Citi-link.

The presence of TID as an open innovation strategy provides insiders with incentives to convey information disclosure to the market; however, the information conveyed is not under the actual situation. This is sose that stock prices experience a contraction, and they finance growth opportunities by issuing debt, such as the growth and introduction stages. Different companies in a mature stage, such as PT Unilever, with more-lower asymmetric information, and in an overpricing share price in 2000 and 2003, resulting in a stock split. As a result, debt financing began to decrease because during maturity, growth opportunities decreased compared to the previous stage, and the company chose a closed innovation strategy. The company reduced TID investment as an open innovation strategy due to reduced asymmetric information at the mature stage.

Innovation-oriented culture has not yet been manifested in responding to the demands of disclosure of information as the capital market demands. The company has not been able to take the characteristics of the local culture to change the game-oriented to open innovation and therefore can take advantage of growth opportunities. The presence of culture is proven to change the inverted u-shaped relationship between openness and open innovation to become more complex [21]. The company does not optimally use external technology to convey actual company information and knowledge.

Firm culture should encourage innovation and flexibility regarding the core values of treating employees, customers, suppliers and other shareholders. It has not been fully implemented, even though it can directly determine firm performance, in this case reducing undervalued, if the company issues equity. Static study of open innovation inadequacy of openness, aversion to risk-taking, organizational inertia and not invented here (NIH) syndrome has not motivated open innovation in the capital market [21]. OJKRI (The Financial Services Authority of the Republic of Indonesia), as the regulatory body, has carried out open innovation intending to disclose information for all IDX listed issuers and encourages the delivery of information regularly. However, it has not been optimally balanced with the actual delivery of information due to its reluctance to take a risk. Because companies think they will lose their competitive advantage if they tell the truth [26].

It is undeniable that the reluctance of voluntary information disclosure results in greater opportunities for financial distress than non-financial distress [61]. In fact, because the culture in companies with the majority and concentrated ownership prevents the risk of losing discretionary power, they avoid being issued shared because the capital market will be monitored [58]. Therefore, So the culture may be static towards open innovation from capital market regulations.

4.3. Technology Life Cycle, and Open Innovation

Based on the life-cycle stage, differences in the company's growth depend on the availability of resources, and opportunities are characteristic of each stage [28]. Moving through each stage of the lifecycle requires innovation processes in different TIDs [18,22,62]. In the initial stage, the company develops technology (TID) as an innovation

process. In the growth stage, the company deploys technology so that the company's mature stage gets a positive profit (harvest technology). When the decline stage occurs, the company needs to develop new technology.

Implementation of TID improves financial performance because it results in a better quality of financial reporting [26], thereby reducing information asymmetry between managers and shareholders and debtholders. Higher information asymmetry and the use of new technology during the introduction stimulate companies to miss growth opportunities through debt or equity issues. They prefer big data in new technology and have not combined market-based [24]. The level of information asymmetry is lower at the growth and maturity stages than the introduction and the ability to connect technology with the market better, encouraging better disclosure of information to the market.

Thus, the presence of an openness culture produced by the majority and concentrated ownership determines open innovation technology in information disclosure. An interesting finding, when open innovation of technology is less actualized in the introduction, in contrast, companies in Korea are in the initial stage of developing IT medical care, IT industrial robots so that the next stage can be informed in the market to earn profits_[18]. Companies in Indonesia develop open innovation of technology that relates to core business more than reducing information asymmetry.

To sum up, we added a model proof in the introduction. The company focuses more on new technology based on core business than on the latest technology based on information disclosure as OJK's obligation [18]. During the introduction, the company is small, so managers are oriented to aligning open innovation with the company's strategy (core business) to overcome potential obstacles and failures when implemented [63]. As a result, information disclosure has not been fully carried out because it prevents capital market monitoring [58], then the issuance of debt and equity depreciated and missed growth opportunities. In contrast to growth and maturity, when they are aligned with open innovation and strategy, their technology is used for greater openness, according to OJK regulations. It still does not reduce information asymmetry because it prefers debt over equity. The presence of a culture of ownership structure results in the existence of information asymmetry, even though TID is actually able to reduce it.

5. Conclusions

Managers have a strategic role in open innovation using TID for information disclosure. In the absence of firm-specific information, the issuance of leverage or equity will only depreciate. Conversely, when firm-specific information is added as a disclosure of information, there is still information asymmetry, thus to the issuance of equity, which is more sensitive to market responses, they issue debt.

When adding firm-specific life cycles to test the effect of growth on leverage, the company did not issue debt to finance growth opportunities during the introduction stage even though it had lower market sensitivity than equity. However, the next stage showed severe asymmetric information when companies disclosed firm-specific information but still used debt financing to finance growth opportunities.

In the overall sample without including the life cycle, firms preferred the issuance of leverage over equity when firm-specific information was included. The disclosure of information as a form of open innovation did not incentivize companies to prefer equity issuance over debt during growth and maturity. Managers and majority shareholders have more incentives to prevent equity, which results in dilution, even though there was disclosure of information, which is their obligation. Furthermore, because as long as mature has reduced growth opportunities and tends to be closed innovation, the need for financing is less. If it is necessary, they prioritize debt over equity because it is still found that equity issuance is more sensitive in the capital market than debt [38]. With regard to the limitations of our research, some variables may have been committed in the modeling procedure. First, the agents who act in majority shareholders' interests are still likely to have better information than other shareholders, even though information disclosure is

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required as a form of open innovation. Second, we did not explore firm heterogeneity via the data panel.

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Debt Versus Equity—Open Innovation to Reduce Asymmetric Information

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Abstract: We aimed to examine capital structure decisions on a firm-specific and life cycle basis. We collected 3343 pooled datapoints from public companies listed on the Indonesian Stock Exchange from 2008 to 2019. The results revealed that companies still prefer debt issuance to equity to finance growth opportunities. By adding firm-specific life cycle variables, we found that asymmetric information was greater at the introduction stage than during the growth and maturity stages, and that companies still issue debt instead of equity, even though they could issue the latter. We conclude that information asymmetry is still found when issuing equity, even though the manager also performed open innovation.

Keywords: leverage; growth opportunities; specific firms; life cycle

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1. Introduction

Managers as agents with superior information can act in their own interests and those of majority shareholders, rather than in the interests of debtholders and other shareholders [1,2]. Thus, an information asymmetry situation can occur in Indonesia with a concentrated ownership structure [3] and a family relationship between the manager and controlling shareholders [4].

Companies use leverage signaling to convey information and reduce information asymmetry [5–7]. The presence of information asymmetry results in equity friction in the market [8] and does not follow the company's claims, so the company prioritizes internal financing, debt, and then equity according to the hierarchical pecking order theory (POT) [7,9]. The POT seems to perform well empirically with regard to sending asymmetric information-reducing signals, but it does not always perform well in reality [10] and remains largely unexplained [11], depending on the specific firm and institution [12].

The open innovation paradigm is the most important [13], that is, that reporting should—with the use of information technology and digitization (TID)—reduce information asymmetry in equity issuance. However, it is not used optimally, meaning that there is still a high cost of equity, which is in line with POT, indicating that leverage is better than equity.

We predict that the POT can explain a situation better when TID, as a form of open innovation, is used to deliver firm specifics and a better life cycle. As a result, information asymmetry is reduced, the POT hierarchy is reversed, and the company prefers equity issuance over debt. Firm-specific variables include size, profitability, and risk [14,15], while the life cycle comprises introduction, growth and maturity stages [16,17]. Capital structure decisions are developed based on conflicts of majority and minority shareholders following the characteristics of the ownership structure in Indonesia, which may differ

to other developing countries. The Financial Services Authority of the Republic of Indonesia (OJKRI) plays an essential role in developing open innovation [18] and using TID implementation for information disclosure [19] in order to reduce the level of information content, and it prefers equity over debt.

2. Literature Review

2.1. Firm-Specific Leverage and Growth – The Role of Open Innovation

Companies with fewer valuable opportunities can mimic those with more valuable ones. This can result in overvalued securities at companies with fewer valuable opportunities and undervalued securities at companies with more valuable opportunities. Therefore, when growth opportunities have asymmetric information, a good quality company will issue a debt higher than equity [5,6,20], to convey a positive signal to the market. Thus, the company will take advantage of growth opportunities with increased leverage, as an indication that the company's information asymmetry is lower than if it were to issue equity, in line with the POT. On the other hand, when information asymmetry is high, majority shareholders may prevent share dilution through debt issuance. Furthermore, the company could take advantage of growth opportunities with equity so that growth to leverage has a negative effect [21].

Debt issuance is a mechanism used to reduce the agency problem of ex-ante information asymmetry. Managers who act in the interests of shareholders are better off skipping growth opportunities with leverage [22] because high leverage only increases the risk of bankruptcy and transfer of welfare to debtholders only [23].

One difference between this study and previous research regarding the relationship between leverage and growth is in the use of firm-specific terms including size, profitability and risk. Large companies have a lower level of information asymmetry than small companies, increasing collateral assets for lenders [12,24], and larger companies have higher cash flow and more assets, so they have easy access to banking because they are considered less risky borrowers [20]. As support for their behavior, profitability will have an impact on leverage. Managers prefer to keep retained earnings and use debt to finance growth opportunities [25]. When the company-specific risk is high, the shareholders will perform risk-shifting [26] whenever possible. The use of excessive leverage, with the presence of bankruptcy costs and the limited responsibility of shareholders, is a risk for the debtholders who bear it [8].

Market failure among participants is not due to product quality but rather to information asymmetry [27]. In this context, the use of TID is a form of open innovation that can reduce information asymmetry [13]. Thus, the informed agent has a strategic role compared to the uninformed agent in delivering firm-specific information to the market [28]. As a result, equity friction reduces and equity is prioritized over debt, which is inversely related to the POT.

Hypothesis 1. The presence of TID open innovation resulted in a low level of information asymmetry so that the company prioritized equity financing over debt.

2.2. Firm-Specific Life Cycle Stage-Open Innovation

Each stage of the life cycle produces a different and more specific level of asymmetry [29]. For example, the technology life cycle is more applicable during the growth and maturity stages than the introduction stage [30]. Table 1 shows that it was possible to use cash flow for greater investment during the introduction and growth stages, including TID, but cash flow tended to come from debt issuance [16]. Thus, open innovation investment in TID decreased the asymmetric information in the introduction, growth, and maturity stages.

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Table 1. Cashflow patterns for each life cycle stage.

Cashflow	Introduction	Growth	Mature	ShakeOut	Decline
Operating	-	+	+	Void in theory	-
Investing	-	<mark>-</mark>	<mark>-</mark>	Void in theory	+
Financing	+	+	<mark>-</mark>	Void in theory	+ or <mark>-</mark>

Older companies generally have better information credibility, more assets, and a better reputation than younger companies that use more leverage. Therefore, in the maturity stage, a company can substitute debt with internal financing [14], or may prefer debt to equity [31] as a form of low information asymmetry.

In addition, the relationship between specific firms and the life cycle is that profitability has a negative effect and leverage has a positive effect. As the age of the company increases the profitability decreases, and the company prioritizes debt issuance. Specifically, leverage is shown as the smallest determinant of financing during the introduction stage [17]. During the early stage, a company faces significant business uncertainty and risk, which is exacerbated by high information asymmetry, so that it prioritizes internal funding [15]. However, when internal funding that comes from profitability has decreased [17], the company prefers debt, which has a lower risk of stock price friction than equity.

A company's size affects the use of leverage at each stage of the life cycle. During the introduction stage, leverage is low, while during the growth and maturity stages it is high [15]. At the introduction stage, if there is a large asymmetry problem the company uses internal funds to reduce leverage. Companies have less information asymmetry and greater collateral asset ownership during the growth and maturity stages, so they prioritize external funding through debt instead of equity [17]. More extremely, companies at an early stage, the company performs re-balancing, not by increasing debt, but by substituting internal funding where the frictional risk of share prices is smaller than debt and equity [14].

During the introduction stage, companies are faced with higher information asymmetry because of the uncertainty of future cash flows. As a result, they have a higher external cost of capital. Companies face higher levels of risk during the introduction and growth stages, but risk reduces during the maturity stage [32]. Investment efficiency is low during the introduction stage but this increases non-linearly during the growth and maturity stages [15]. Therefore, the POT theory is more applicable during the maturity stage [33,34].

Hypothesis 2. The presence of open innovation and the increasing stages of the life cycle results in reduced asymmetry regarding firm-specific information, such that companies prefer equity to leverage when financing growth opportunities.

3. Research Methods

3.1. Variable Measurement

The total debt ratio to total assets (leverage) was used as the dependent variable in a regression [21]. When growth opportunities reach information asymmetry, the issuance of debt results in companies still being able to issue leverage greater than the total assets, even though market leverage depreciates. Growth opportunities are measured by (total sales t - total sales t - 1)/total sales t - 1 [35,36].

Our firm-specific variable used in asset as a proxy for size [37], profitability as a return on assets [38], and specific risk as the variance of return on assets [39]. For the life cycle we used the age measured in years since it was recorded [40]. The life cycle consisted of five stages: introduction, growth, maturity, shake-out, and decline [16]. Since cash flow investing, operating, and financing can better explain the life cycle, we used only the first three stages due to the prominent aspect [17]. A company's life cycle stage was categorized as follows: 1 = introduction, 2 = growth, and 3 = maturity [41].

3.2. Data and Sample Selection

Pooled data of 3343 observations gathered from companies from eight industrial sectors listed on the Indonesian Stock Exchange (IDX) for the period 2008–2019. Table 2 shows the collinearity of variables used in the analysis and their corresponding VIF values; the financial and banking sectors were excluded due to differences in each company **policies** [42]. We removed outliers from the dataset by excluding the highest and lowest 5% of values. Data were obtained from eight industrial sectors: agriculture (3.92% of observations), infrastructure (11.22%), utilities and transportation (11.22%), manufacturing (32.93%), mining (9.39%), property (15.23%), real estate and building construction (27.31%), trade, and services and investment. Table 2 indicated a VIF value of about 1 and a correlation between explanatory variables of less than 0.8 [43]

Table 2. Multicollinearity test result among variables

Panel A	Correlation Matrix								
	<mark>td bl</mark>	<mark>td growth</mark>	<mark>Size</mark>	<mark>net inc/t as</mark>	<mark>std roa</mark>				
Leverage	1			.C					
Growth Opp.	0.002446	1							
Size	0.12642	<mark>-</mark> 0.01661	1						
Profitability	<mark>-</mark> 0.24849	0.118867	0.114479	1					
Risk-Specific	0.020752	<mark>-</mark> 0.02165	<mark>-</mark> 0.06079	<mark>-</mark> 0.36919	1				
Panel B			VIF Factor	rs					
Variables			VIF	C					
Growth Opp.			1.096						
Size			1.017						
Profitability			1.042						
Risk-Specific) <mark>1.109</mark>						

We used OLS regression with a dummy equation or LSDV because the scalable explanatory variable was nominal (introduction, growth and mature), with two dummy categories to avoid dummy traps [43]:

$E(Y_i|X_i) = \alpha_1 + \alpha_2 X_i + \alpha_3 FirmSpecific_i + \alpha_4 D_{2i} + \alpha_5 D_{3i}$

where *Y* is leverage; *X* represents growth opportunities; Firm-Specific represents size, profitability and risk; D_{2i} is 1 if the stage is growth, otherwise it is 0; D_{3i} is 1 if the stage is mature, otherwise it is 0; and if $D_{2i} = 0$ and $D_{3i} = 0$ then it is the introduction stage.

4. Results and Findings

Data

Table 1 shows that the data has kurtosis, which tends to be homogeneous and has varied skewness as long as the growth stage has a mean leverage greater than the introduction and maturity stages. The increase in leverage from introduction to growth resulted in greater debt issuance due to reduced information asymmetry [15]. In contrast, there was no significant difference in mean leverage during maturity compared to growth, as an effort to reduce the risk of bankruptcy [32], and a more stable cash flow was used to replace ageing equipment, instead of paying debt [16].

Table 3. Descriptive Statistic and Mean Differences

n 1	
Panel	Δ
- i anci	

Descriptive Statistics

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Life Cycle	Obs	Variables	Mean	25th Quartile	Median	75th Quartile	St. Dev	Kurtosis	Skewness
Introduction	692	Leverage	0.456	0.284	0.458	0.611	0.222	<mark>2,069</mark>	0.511
	692	Growth Opp.	0.169	-0.035	0.109	0.267	0.393	<mark>6,008</mark>	<mark>1,894</mark>
	692	Size	28,250	27,328	28,287	29,219	<mark>1,420</mark>	11,362	<mark>1,121</mark>
	692	Profitability	0.035	0.003	0.035	0.075	0.089	15,951	- <mark>1,604</mark>
	692	Risk-Specific	0.008	0.000	0.001	0.005	0.033	235,562	13,538
Growth	1682	Leverage	0.486	0.321	0.475	0.637	0.217	-0.131	0.326
	1682	Growth Opp.	0.122	-0.050	0.079	0.221	0.323	<mark>8,411</mark>	<mark>2,085</mark>
	1682	Size	28,442	27,190	28,507	29,677	<mark>1,761</mark>	-0.050	-0.134
	1682	Profitability	0.029	0.001	0.028	0.070	0.131	214,966	- <mark>9,860</mark>
	1682	Risk-Specific	0.017	0.000	0.001	0.006	0.254	1,302,150	34,864
Mature	969	Leverage	0.484	0.302	0.479	0.616	0.248	<mark>6,441</mark>	<mark>1,283</mark>
	969	Growth Opp.	0.093	-0.031	0.072	0.175	0.262	<mark>9,817</mark>	<mark>1,881</mark>
	969	Size	28,626	27,375	28,560	29,962	<mark>1,858</mark>	0.212	0.099
	969	Profitability	0.061	0.009	0.045	0.098	0.141	37,755	<mark>2,342</mark>
	969	Risk-Specific	0.021	0.000	0.002	0.008	0.129	460,111	19,271
Total	3343	Leverage	0.479	0.308	0.473	0.629	0.228	<mark>3,001</mark>	0.721
	3343	Growth Opp.	0.123	-0.041	0.081	0.217	0.324	<mark>8,558</mark>	<mark>2,092</mark>
	3343	Size	28,456	27,270	28,453	29,610	<mark>1,730</mark> 🔹	1,150	0.129
	3343	Profitability	0.040	0.003	0.034	0.079	0.128	141,355	- <mark>4,581</mark>
	3343	Risk-Specific	0.016	0.000	0.001	0.006	0.194	1,962,489	41,208
Panel B				Me	ean Differ	ences	0	2	

Tuller D	Micuit Differences		
Variables	Growth vs. Introduction	Mature vs. Growth	
Leverage	0.030 *	-0.002	
Growth Opp.	-0.047 *	-0.029 *	
Size	0.192 *	0.185 *	
Profitability	-0.006 *	0.032 *	
Risk	-0.063 *	0.004	
Risk	-0.063 *	0.004	

As long as the growth stage has lower information asymmetry than the introduction stage when assets increase collateral, the company issues more debt. Conversely, during the maturity stage, the information asymmetry is reduced compared to the growth stage and the increase in collateral results in reduced leverage, leading to a company preferring internal financing over equity [29].

As long as a company in the growth stage has cash flow from large investments, it exceeds profitability, which makes it relatively stable compared to a company in the introduction stage [16], resulting in a decrease in profitability. On the other hand, there is an increase in profitability because investment is more efficient than during the maturity stage [15]. Business risk decreases as the age of the company increases [15,44].

When growth opportunities decreased there was more debt issuance and a risk-shifting problem [26,45]. When managers and majority shareholders have better quality information about growth opportunities than minority shareholders, they prefer debt to equity. Debtholders are promised high returns if the project is successful, even if the probability of success is low, because if it is successful the majority manager will benefit, and if it fails, the debtholders will share the risk. Conversely, if the risk is unknown, the company will tend to issue equity. Further information asymmetry results in a "mean revision" of the leverage level [24,34]. In this case, it would be better to avoid taking advantage of growth opportunities because they created a new agency of debt. Commented [M1]: Please add explanation for "*"

Table 1 showed a significant difference in mean leverage between the growth and introduction stages and the mature and growth stages. However, because this simple description did not include firm-specific size, profitability and risk variables, the findings of an LSDV regression which included these are shown in Table 3.

Ta	ıbl	le 4
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Variables	All Firms	All Firms	Introduction	n Growth	Maturity
Constant	0.479 *	-0.087	-0.572 *	-0.089	0.042
	0.000	0.160	0.000	0.265	0.713
Growth Opp	0.002	0.027 *	0.015	0.033 *	0.135 *
	0.888	0.019	0.437	0.034	0.000
Size		0.021 *	0.037 *	0.021 *	0.016 *
		0.000	0.000	0.000	0.000
Profitability		-0.536 *	-0.989 *	-0.815 *	-0.627 *
		0.000	0.000	0.000	0.000
Risk Specific		-0.094 *	0.318	-0.280 *	0.514 *
		0.000	0.198	0.000	0.000
Obs	3343	3343	692	1682	969
F Test	0.019	85,482	43,193	69,663	36,473
Sig F Test	0.888	0.000	0.000	0.000	0.000
Multiple R	0.002	0.305	0.448	0.377	0.363
R Square	0.000	0.093	0.201	0.142	0.131
				0 2	

Commented [M2]: Please add explanation for "*"

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Column 1 of Table 3 shows that when majority and minority shareholders do not have specific firm information, they are faced with uncertainty in cash flow and high risk, so that the issuance of debt becomes risky. As a result, they refuse financing for valuable growth opportunities to prevent loss of control over the company [45]. Due to the limited responsibility of shareholders, if there is bankruptcy then the company will be taken over by debtholders. When there is no disclosure of specific firm information, debtholders will not make transactions because it can depreciate debt and equity.

Column 2 of Table 3 shows that as assets increase, the collateral increases; as the specific risk increases the profitability decreases; and that the company increases the leverage to finance the rise invaluable growth [10,46]. It also shows that the effect of profitability on leverage is greater than size and risk. The presence of increasing assets and decreasing risk can provide a more positive signal than profitability, which has a negative signal, to the market. Management will issue debt to provide a positive signal to the market [5] in order to maintain control of a quality company [6]. From the perspective of agency theory, they avoid exposure to the capital market [47].

Thus, the firm-specific information submitted by companies with agency problems still contains asymmetric information. The result is that they issue debt rather than equity when financing growth opportunities. As previously thought, there is still information asymmetry so that the POT hierarchy works, even though the manager already has an incentive for open innovation with TID in information disclosure, following OJKRI regulations. The existence of a high cost of equity resulting from asymmetric information has resulted in companies using debt financing [13], despite Indonesia being a bank-based system [48].

Columns 3–5 of Table 3 show the difference in results across life cycle stages. Companies in the introduction stage have high business uncertainty and risk [44]. Managers and majority shareholders have higher quality information than minority shareholders regarding growth opportunities, so growth opportunities lead to greater information asymmetry than total assets [21]. Interestingly, by adding the specific firm size and profitability, managers and majority shareholders missed out on taking advantage of the **Commented [ts3]:** Do you mean Column 2? Column 1 is actually just the variable names. Please check this very carefully. This is not a typical way to refer to a Table, so I would recommend changing approach.

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growth opportunities with leverage. When faced with high risk and reduced profitability, they will not finance growth opportunities with leverage even if there is an increase in collateral assets. However, they perform risk avoidance [45] to prevent loss of control and as rent for future corporate value increases.

In the growth stage, companies buy many assets as part of a competitive advantage strategy. Demand for cash flow for investment is greater than the availability of internal financing and there is lower information asymmetry than during the introduction. Although there is an increase in size as a proxy for collateral and a decrease in company risk, long-term investment needs are greater than profitability, so the presence of asymmetric information exacerbates this condition, and companies prefer debt issuance to equity [7,16].

The mature stage is a condition with less asymmetric information indications than the growth stage. Therefore, companies should be able to issue equity instead of debt, but we found that they still reference debt, which differs from findings of other research [14,21]. Managers and majority shareholders avoid issuing equity because they are more sensitive to the market response than debt, or there is still an imbalance of information between insiders and outsiders.

Open innovation carried out by insiders as a mechanism to reduce information asymmetry has proven to be sub-optimal in practice. With the provisions of the OJKRI, they do not have an incentive to issue equity compared to leverage in financing growth opportunities, because if they use the equity, they will face a high cost of equity as the production of asymmetric information [13].

5. Conclusions

Managers have a strategic role in open innovation using TID for information disclosure. In the absence of firm-specific information, issuance of leverage or equity will only depreciate. Conversely, when firm-specific information is added as a disclosure of information, there is still information asymmetry, thus to the issuance of equity, which is more sensitive to market responses, they issue debt.

When adding firm-specific life cycles to test the effect of growth on leverage, during the introduction stage, the company did not issue debt to finance growth opportunities even though it had lower market sensitivity than equity. The next stage showed severe asymmetric information, when companies disclosed firm-specific information but still used debt financing to finance growth opportunities.

In the overall sample without including the life cycle, firms preferred the issuance of leverage over equity when firm-specific information was included. Interestingly, the disclosure of information as a form of open innovation did not provided incentives for companies during growth and maturity to prefer equity issuance over debt. Managers and majority shareholders have more incentives to prevent equity, which results in dilution, even though there was disclosure of information, which is their obligation.

Following [27], information asymmetry results in an adverse selection and moral hazard. With regard to the limitations of our research, it is possible that some variables may have been omitted in the modelling procedure. The agents who act in majority shareholders' interests are still likely to have better information than other shareholders, even though information disclosure is required as a form of open innovation. Second, we did not explore firm heterogeneity via panel data.

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Article Debt versus Equity—Open Innovation to Reduce Asymmetric Information

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Abstract: The research aims to examine the difference between absence and presence life cycle stage in technology information digitalization (TID) as a form of open innovation in reducing information asymmetry. Furthermore, companies with asymmetric information prefer debt over equity. The study collects 3.343 pooled data observation units of companies listed in the Indonesian capital market period 2008 to 2019. We use OLS regression analysis to determine the difference between the absence and presence lifecycle stage in determining capital structure relations and exploiting growth opportunities. The study found information disclosure obligation of the capital market regulator has not been fully disclosed through TID. As a result, companies choose to pass in growth opportunities with debt or equity in the absence life cycle stage. Presence lifecycle stage, in the introduction stage, the company misses growth opportunities. Growth and mature stage, debt has a positive effect on the utilization of growth opportunities. The company prefers the issuance of debt with lower information sensitivity than equity. Presence culture, such as majority ownership, generates incentives for open innovation from capital market regulators, which still contain information asymmetry.

Keywords: leverage; growth opportunities; specific firms; life cycle

1. Introduction

Managers as agents with superior information can act in their interests and those of majority shareholders, rather than in debtholders and other shareholders [1,2]. Thus, an information asymmetry situation can occur in Indonesia with a concentrated ownership structure [3] and a family relationship between the manager and controlling shareholders [4].

Companies use leverage signaling to convey information and reduce information asymmetry [5–7]. The presence of information asymmetry results in equity friction in the market [8]. It does not follow the company's claims, so the company prioritizes internal financing, debt, and then equity according to the hierarchical pecking order theory (POT) [7,9]. The POT seems to perform well empirically concerning sending asymmetric information-reducing signals. However, it does not always perform well in reality [10] and remains unexplained mainly [11], depending on the specific firm and institution [12].

The open innovation paradigm is the most important [13]; that is, reporting should use information technology and digitization (TID) to reduce information asymmetry in equity issuance. However, it is not used optimally, meaning that there is still a high cost of equity, which is in line with POT, indicating that leverage is better than equity.

We predict that the POT can explain a situation better when TID, as a form of open innovation, is used to deliver firm specifics and a better life cycle. As a result, information asymmetry is reduced, the POT hierarchy is reversed, and the company prefers equity issuance over debt. Firm-specific variables include size, profitability, and risk [14,15], while the life cycle comprises introduction, growth and maturity stages [16,17]. The open



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innovation strategy in using TID is mostly done by companies in the introduction and growth stages because the development is faster than their ability, than growth and is mature [18]. As a result, they are more sensitive to financing decisions.

Capital structure decisions are developed based on conflicts of majority and minority shareholders following the characteristics of the ownership structure in Indonesia, which may differ to other developing countries. The Financial Services Authority of the Republic of Indonesia (OJKRI) plays an essential role in developing open innovation [19] and using TID implementation for information disclosure [20], to reduce the level of information content, and it prefers equity over debt. The presence of culture makes the impact of openness on open innovation more complex than without the presence of culture [21]. Disclosure information as a form of openness strategy through TID is primarily determined by a set of norms and values that are widely adopted and adhered to throughout the company (culture).

2. Literature Review

2.1. Open Innovation: A Culture and Complexity with Evolutionary Economics

Open innovation uses the inflow and outflow of knowledge to accelerate internal innovation and expand the market of internal innovation [22]. When a company is an openness to knowledge and information, it has the potential to produce open innovation so that it can take advantage of growth opportunities and better market response [21].

The presence of culture produces a relationship between openness and open innovation, which is more complex than the inverted u-shaped. Absence of culture, companies can increase openness to accelerate open innovation. Still, at the optimal point when companies are more open, it is difficult to manage information and knowledge, which will result in a decrease in open innovation [23].

Culture helps explain firm performance, even when individuals only adopt shared values and norms and is strengthened when adopting organizational values that are the values of the company's founders [21]. To sum up, a constructive culture impacts cooperation within organizational units and between organizational units that directly or indirectly affect firm performance. Stock market regulators in Indonesia require disclosure of information in the TID as a form of open innovation that stimulates the openness of every issuer listed in the capital market [13]. Thus, a stable environment in the form of disclosure information requirements from OJKRI generates incentives for managers and companies to create a strong culture. Therefore, their capabilities are increasingly exploited in achieving company goals.

The development of the fourth industrial revolution era demands the use of engineering (TID) directly and more heartily than before in responding to the needs of the market and society [24]. Companies as part of an entity from the capital market have more incentives to disclose information as a demand for an open business model. As a result, companies can use technology to connect to the market [25]. They added that the presence of the accelerated IT revolution along with the deepening of the knowledge-based economy resulted in a new business model that connected companies and access to markets more intensively than before.

It is still debatable when it cannot be compared between the benefits and costs due to open innovation. As a result, companies will limit the disclosure of financial information entirely because it can affect their competitive position [26], like the complexity with evolutionary economics hypothesis, which is different from the neo-classic outlook, which prioritizes dynamic analysis over static. Thus placing behavioral, institutional, technological and other explanatory variables in other forms [27].

One possible explanation regarding the difference in benefits and costs in TID use is due to the firm lifecycle [28]. They reported that companies in the mature stage have a better green innovation process than growth stage firms—furthermore, technology capability as a mediation between green innovation performance and life-stage firm.

Thus, regulators from OJKRI and the 4th industry revolution have produced better use of TID in the open business model. It is easier for companies to convey information disclosure to the market through JATS (Jakarta Automated Trading System Next Generation) to reduce asymmetric information [29]. PT Bank Pembangunan Daerah Jawa Barat and Banten, Tbk reports information on last, present performance and business development plans [30]. In addition, a change in the company's ownership structure was reported through the PMT-HMETD (Capital Additions Without Preemptive Rights Program).

2.2. Firm-Specific Leverage and Growth—The Role of Open Innovation

Companies with fewer valuable opportunities can mimic those with more valuable ones. This can result in overvalued securities at companies with fewer valuable opportunities and undervalued securities at companies with more valuable opportunities. Therefore, when growth opportunities have asymmetric information, a good quality company will issue a debt higher than equity [5,6,20] to convey a positive signal to the market. Thus, the company will take advantage of growth opportunities with increased leverage, which indicates that the company's information asymmetry is lower than if it were to issue equity, in line with the POT. On the other hand, majority shareholders may prevent share dilution through debt issuance when information asymmetry is high. next, [31].

Debt issuance is a mechanism used to reduce the agency problem of ex-ante information asymmetry. Managers who act in the interests of shareholders are better off skipping growth opportunities with leverage [32] because high leverage only increases the risk of bankruptcy and welfare transfer to debtholders [33].

One difference between this study and previous research regarding the relationship between leverage and growth is in using firm-specific terms, including size, profitability, and risk. Large companies have lower information asymmetry than small companies, increasing collateral assets for lenders [12,34]. Larger companies have higher cash flow and more assets, so they have easy access to banking because they are considered less risky borrowers [35]. As support for their behavior, profitability will have an impact on leverage. Managers prefer to keep retained earnings and use debt to finance growth opportunities [36]. When the company-specific risk is high, the shareholders will perform risk-shifting [37] whenever possible. The use of excessive leverage, with the presence of bankruptcy costs and the limited responsibility of shareholders, is a risk for the debtholders who bear it [8].

Market failure among participants is not due to product quality but rather to information asymmetry [38]. In this context, TID is a form of open innovation that can reduce information asymmetry [13]. Thus, the informed agent has a strategic role compared to the uninformed agent in delivering firm-specific information to the market [39]. As a result, equity friction reduces, and equity is prioritized over debt, which is inversely related to the POT.

Hypothesis 1 (H1). *TID open innovation can be in a low level of information asymmetry so that the company prioritized equity financing over debt.*

2.3. Firm-Specific Life Cycle Stage—Open Innovation

Each stage of the life cycle produces a different and more specific level of asymmetry [14]. For example, the technology life cycle is more applicable during the growth and maturity stages than the introduction stage [40,41]. Table 1 shows that it was possible to use cash flow for greater investment during the introduction and growth stages, including TID, but cash flow tended to come from debt issuance [16]. Thus, open innovation investment in TID decreased the asymmetric information in the introduction, growth, and maturity stages. Open innovation delivers transparent information, therefore decrease asymmetric information.

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Cashflow	Introduction	Growth	Mature	Shake out	Decline
Operating	_	+	+	Void in theory	_
Invest	_	_	_	Void in theory	+
Financing	+	+	_	Void in theory	+ or

Table 1. Cashflow patterns for each life cycle stage.

Older companies generally have better information credibility, more assets, and a better reputation than younger companies that use more leverage. Therefore, in the maturity stage, a company can substitute debt with internal financing [14] or prefer debt to equity [42] as a form of low information asymmetry.

In addition, the relationship between specific firms and the life cycle is that profitability has a negative effect and leverage has a positive effect. As the age of the company increases, the profitability decreases, and the company prioritizes debt issuance. In particular, leverage is shown as the smallest determinant of financing during the introduction stage [17]. During the early stage, a company faces significant business uncertainty and risk, which is exacerbated by high information asymmetry, so that it prioritizes internal funding [15]. However, when internal funding from profitability has decreased [17], the company prefers debt, which has a lower risk of stock price friction than equity.

A company's size affects the use of leverage at each stage of the life cycle. During the introduction stage, leverage is low while high during the growth and maturity stages [15]. If there is a large asymmetry problem at the introduction stage, the company uses internal funds to reduce leverage. Companies have less information asymmetry and greater collateral asset ownership during the growth and maturity stages, prioritizing external funding through debt instead of equity [17]. More extremely, companies at an early stage, due to the high information asymmetry, are limited in using external funds. In the next stage, the company performs re-balancing, not by increasing debt, but by substituting internal funding where the frictional risk of share prices is smaller than debt and equity [14].

During the introduction stage, companies are faced with higher information asymmetry because of the uncertainty of future cash flows. As a result, they have a higher external cost of capital. As a result, companies face higher levels of risk during the introduction and growth stages, but risk reduces during the maturity stage [43]. The maturity stage gives a chance for stakeholder to collect many information, therefore the risk is reduce. Investment efficiency is low during the introduction stage; however, this increases non-linearly during the growth and maturity stages [15]. Therefore, the POT theory is more applicable during the maturity stage [44,45]. Thus, an increase in lifecycle stages and reduced asymmetric information results in greater closed innovation [18], as shown in Figure 1. As a result, starting from maturity, the financing for open innovation is reduced, and if needed, they prefer equity because there is less asymmetric information.



Figure 1. Relationship between Technology Life Cycle and Open Innovation.

Hypothesis 2 (H2). The presence of open innovation and the increasing stages of the life cycle result in reduced asymmetry regarding firm-specific information. Companies prefer equity to leverage when financing growth opportunities.

3. Methods

3.1. Variable Measurement

The total debt ratio to total assets (leverage) was used as the dependent variable in a regression [31]. When growth opportunities reach information asymmetry, the issuance of debt results in companies still being able to issue leverage greater than the total assets, even though market leverage depreciates. Growth opportunities are measured by (total sales t–total sales t 1)/total sales t–1 [46,47].

Our firm-specific variable used in asset as a proxy for size [48], profitability as a return on assets [49], and specific risk as to the variance of return on assets [50]. We used the age measured in years since it was recorded [51]. The life cycle consists of five stages: introduction, growth, maturity, shake-out, and decline [16]. Since cash flow investing, operating, and financing can better explain the life cycle, we used only the first three stages due to the prominent aspect [17]. A company's life cycle stage was categorized as follows: 1 = introduction, 2 = growth, and 3 = maturity [52].

3.2. Data and Sample Selection

Pooled data of 3343 observations gathered from companies from eight industrial sectors listed on the Indonesian Stock Exchange (IDX) for 2008–2019. Table 2 shows the collinearity of variables used in the analysis and their corresponding VIF values; the financial and banking sectors were excluded due to differences in each company policy [53]. We removed outliers from the dataset by excluding the highest and lowest 5% of values. Data were obtained from eight industrial sectors: agriculture (3.92% of observations), infrastructure (11.22%), utilities and transportation (11.22%), manufacturing (32.93%), mining (9.39%), property (15.23%), real estate and building construction (27.31%), trade, and services and investment. Table 2 indicated a VIF value of about 1 and a correlation between explanatory variables of less than 0.8 [54].

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Panel A	Correlation Matrix							
	Leverage	Growth	Size	Profitability	Risk- Specific			
Leverage	1							
Growth Ops.	0.002446	1						
Size	0.12642	0.01661	1					
Profitability	0.24849	0.118867	0.114479	1				
Risk-Specific	0.020752	0.02165	0.06079	0.36919	1			
Panel B			VIF Factors					
Variables			VIF					
Growth Ops.			1.096					
Size			1.017					
Profitability			1.042					
Risk-Specific			1.109					

Table 2. Multicollinearity test result among variables.

We used OLS regression with a dummy equation or LSDV because the scalable explanatory variable was nominal (introduction, growth and mature), with two dummy categories to avoid dummy traps [54]:

$$E(Y_i|X_i) = \alpha_1 + \alpha_2 X_i + \alpha_3 FirmSpecific_i + \alpha_4 D_{2i} + \alpha_5 D_{3i}$$

where *Y* is leveraged; *X* represents growth opportunities; firm-specific size, profitability and risk; D_{2i} is 1 if the stage is growth; otherwise it is 0; D_{3i} is 1 if the stage is mature; otherwise it is 0; and if $D_{2i} = 0$ and $D_{3i} = 0$ then it is the introduction stage.

4. Results

4.1. Data

Table 1 shows that the data has kurtosis, which tends to be homogeneous and has varied skewness as long as the growth stage has a mean leverage greater than the introduction and maturity stages. The increase in leverage from introduction to growth in greater debt issuance reduces information asymmetry [15]. In contrast, there was no significant difference in mean leverage during maturity compared to growth, as an effort to reduce the risk of bankruptcy [43], and a more stable cash flow was used to replace aging equipment instead of paying debt [16].

As long as the growth stage has lower information asymmetry than the introduction stage when assets increase collateral, the company issues more debt. Conversely, during the maturity stage, the information asymmetry is reduced compared to the growth stage. The increase in collateral results in reduce leverage, leading to a company preferring internal financing over equity [14].

As long as a company in the growth stage has cash flow from large investments, it exceeds profitability, making it relatively stable compared to a company in the introduction stage [16], resulting in a decrease in profitability. On the other hand, there is an increase in profitability because investment is more efficient than during maturity [15]. In addition, the business risk decreases as the age of the company increases [15,44].

There was more debt issuance and a risk-shifting problem [37,55]. When managers and majority shareholders have better quality information about growth opportunities than minority shareholders, they prefer debt to equity. Debtholders are promised high returns if the project is successful, even if the probability of success is low, because if it is successful, the majority manager will benefit. If it fails, the debtholders will share the risk. Conversely, if the risk is unknown, the company will tend to issue equity. Further information asymmetry results in a "mean revision" of the leverage level [34,45]. In this case, it would be better to avoid taking advantage of growth opportunities because they created a new debt agency.

4.2. Regression Analysis

Table 1 showed a significant difference in mean leverage between the growth and introduction stages and the mature and growth stages. However, because this simple description did not include firm-specific size, profitability and risk variables, the findings of an LSDV regression represent in Table 3.

Panel A				Descriptive Statistics						
Life Cycle	Obs	Variables	Mean	25th Quar- tile	Median	75th Quartile	St. Dev	Kurtosis	Skewness	
Introduction	692	Leverage	0.456	0.284	0.458	0.611	0.222	2069	0.511	
	692	Growth Ops.	0.169	0.035	0.109	0.267	0.393	6.008	1894	
	692	Size	28,250	27,328	28,287	29,219	1420	11,362	1.121	
	692	Profitability	0.035	0.003	0.035	0.075	0.089	15,951	1604	
	692	Risk-Specific	0.008	0.000	0.001	0.005	0.033	235,562	13,538	
Growth	1682	Leverage	0.486	0.321	0.475	0.637	0.217	0.131	0.326	
	1682	Growth Ops.	0.122	0.050	0.079	0.221	0.323	8,411	2.085	
	1682	Size	28,442	27,190	28,507	29,677	1761	0.050	0.134	
	1682	Profitability	0.029	0.001	0.028	0.070	0.131	214,966	9860	
	1682	Risk-Specific	0.017	0.000	0.001	0.006	0.254	1,302,150	34,864	
Mature	969	Leverage	0.484	0.302	0.479	0.616	0.248	6.441	1283	
	969	Growth Ops.	0.093	0.031	0.072	0.175	0.262	9.817	1881	
	969	Size	28,626	27.375	28,560	29,962	1.858	0.212	0.099	
	969	Profitability	0.061	0.009	0.045	0.098	0.141	37,755	2.342	
	969	Risk-Specific	0.021	0.000	0.002	0.008	0.129	460,111	19,271	
Total	3343	Leverage	0.479	0.308	0.473	0.629	0.228	3001	0.721	
	3343	Growth Ops.	0.123	0.041	0.081	0.217	0.324	8558	2092	
	3343	Size	28,456	27,270	28,453	29,610	1730	1.150	0.129	
	3343	Profitability	0.040	0.003	0.034	0.079	0.128	141,355	4.581	
	3343	Risk-Specific	0.016	0.000	0.001	0.006	0.194	1,962,489	41,208	
Panel B	Mean Differences									
Variables				Growth vs. Introduction			Mature vs. Growth			
Leverage				0.030 *			0.002			
Growth Ŏps.				0.047 *			0.029 *			
Size				0.192 *			0.185 *			
Profitability risk				0.006 * 0.063 *			0.032 * 0.004			

Table 3. Descriptive Statistics and Mean Differences.

* Significant at 0.05.

Column 1 of Table 4 shows that when majority and minority shareholders do not have specific firm information, they are faced with uncertainty in cash flow and high risk so that the issuance of debt becomes risky. As a result, they refuse financing for valuable growth opportunities to prevent control over the company [55]. Due to the limited responsibility of shareholders, if there is bankruptcy, the company will be taken over by debtholders. When there is no disclosure of specific firm information, debtholders will not make transactions because it can depreciate debt and equity.

Variables	All Firms	All Firms	Introduction	Growth	Maturity
Constant	0.479 *	0.087	0.572 *	0.089	0.042
	0.000	0.160	0.000	0.265	0.713
Growth Op	0.002	0.027 *	0.015	0.033 *	0.135 *
-	0.888	0.019	0.437	0.034	0.000
Size		0.021 *	0.037 *	0.021 *	0.016 *
		0.000	0.000	0.000	0.000
Profitability		0.536 *	0.989 *	0.815 *	0.627 *
		0.000	0.000	0.000	0.000
Risk Specific		0.094 *	0.318	0.280 *	0.514 *
*		0.000	0.198	0.000	0.000
Obs	3343	3343	692	1682	969
F Test	0.019	85,482	43,193	69,663	36,473
Sig F Test	0.888	0.000	0.000	0.000	0.000
Multiple R	0.002	0.305	0.448	0.377	0.363
R Square	0.000	0.093	0.201	0.142	0.131
Ciamificant at 0 0E					

 Table 4. Regression Analysis.

* Significant at 0.05.

Column 2 of Table 3 shows that as assets increase, the collateral increases; as the specific risk increases, the profitability decreases. The company increases the leverage to finance the rise invaluable growth [10,56]. It also shows that the effect of profitability on leverage is greater than size and risk. Increasing assets and decreasing risk can provide a more positive signal than profitability, which has a negative signal, to the market. Management will issue debt to provide a positive signal to the market [5] to maintain control of a quality company [6]. From the perspective of agency theory, they avoid exposure to the capital market [57].

Thus, the firm-specific information submitted by companies with agency problems still contains asymmetric information. The result is that they issue debt rather than equity when financing growth opportunities. As previously thought, there is still information asymmetry. Even though the manager already has an incentive for open innovation with TID in information disclosure, the POT hierarchy works, following OJKRI regulations. A high cost of equity resulting from asymmetric information has resulted in companies using debt financing [13], despite Indonesia being a bank-based system [58].

Columns 3–5 of Table 4 show the difference in results across life cycle stages. Companies in the introduction stage have high business uncertainty and risk [59]. Managers and majority shareholders have higher quality information than minority shareholders regarding growth opportunities, so growth opportunities lead to greater information asymmetry than total assets [31]. By adding the specific firm size and profitability, managers and majority shareholders missed out on taking advantage of the growth opportunities with leverage. When faced with high risk and reduced profitability, they will not finance growth opportunities with leverage even if there is an increase in collateral assets. However, they perform risk avoidance [55] to prevent loss of control and rent for future corporate value increases.

In the growth stage, companies buy many assets as part of a competitive advantage strategy. As a result, demand for cash flow for investment is greater than the availability of internal financing, and there is lower information asymmetry than during the introduction. Although there is an increase in size as a proxy for collateral and decreased company risk, long-term investment needs are greater than profitability. Hence, the presence of asymmetric information exacerbates this condition, and companies prefer debt issuance to equity [7,16].

The mature stage is a condition with fewer asymmetric information indications than the growth stage. Therefore, companies should issue equity instead of debt, but we found that they still reference debt, which differs from findings of other research [14,31]. Managers

and majority shareholders avoid issuing equity because they are more sensitive to the market response than debt or an imbalance of information between insiders and outsiders.

Open innovation carried out by insiders as a mechanism to reduce information asymmetry has proven to be sub-optimal in practice. With the provisions of the OJKRI, they do not have an incentive to issue equity compared to leverage in financing growth opportunities. If they use the equity, they will face a high cost of equity as the production of asymmetric information [13]. The Republic of Indonesia government requires companies to disclose information before, when and after the company is listed on IDX and the accompanying sanctions for not disclosing information [60]. Through TID as information disclosure through the company website and IDX, Open innovation strategy reduces asymmetric information. There are still agents and majority shareholders who have superior information compared to minority shareholders.

As one of the Bakrie Group companies, PT Bakrieland Development requires equity financing with the right issue for business expansion in Bukit Jonggol Asti. Based on interview, Kurniawati Budiman said "the fact is that the rights issue is underpricing due to the finding of differences in investment savings in 2010 Q1 between what was conveyed to the public by PT Bakrie Sumatera Plantation and PT Energi Mega Persada", which is included in the Bakri Group, and those recorded at PT Bank Capital.

The difference in the investment saving notes shows asymmetric information resulting in adverse selection and right issue underpricing in other companies in the Bakrie Group. Another phenomenon, such as PT Garuda Indonesia, reported an increase in net profit of USD 809.5 million in 2018, resulting from the collaboration between PT Citilink as a subsidiary and PT Mahata Aero Tech, which invested in entertainment equipment on their aircraft. In fact, until December 2018, PT Mahata Aero Tech had not made any payments to PT Citi-link.

The presence of TID as an open innovation strategy provides insiders with incentives to convey information disclosure to the market; however, the information conveyed is not under the actual situation. This is so that stock prices experience a contraction, and they finance growth opportunities by issuing debt, such as the growth and introduction stages. Different companies in a mature stage, such as PT Unilever, with more-lower asymmetric information, and in an overpricing share price in 2000 and 2003, resulting in a stock split. As a result, debt financing began to decrease because during maturity, growth opportunities decreased compared to the previous stage, and the company chose a closed innovation strategy. The company reduced TID investment as an open innovation strategy due to reduced asymmetric information at the mature stage.

Innovation-oriented culture has not yet been manifested in responding to the demands of disclosure of information as the capital market demands. The company has not been able to take the characteristics of the local culture to change the game-oriented to open innovation and therefore can take advantage of growth opportunities. The presence of culture is proven to change the inverted u-shaped relationship between openness and open innovation to become more complex [21]. The company does not optimally use external technology to convey actual company information and knowledge.

Firm culture should encourage innovation and flexibility regarding the core values of treating employees, customers, suppliers and other shareholders. It has not been fully implemented, even though it can directly determine firm performance, in this case reducing undervalued, if the company issues equity. Static study of open innovation inadequacy of openness, aversion to risk-taking, organizational inertia and not invented here (NIH) syndrome has not motivated open innovation in the capital market [21]. OJKRI (The Financial Services Authority of the Republic of Indonesia), as the regulatory body, has carried out open innovation intending to disclose information for all IDX listed issuers and encourages the delivery of information regularly. However, it has not been optimally balanced with the actual delivery of information due to its reluctance to take a risk. Because companies think they will lose their competitive advantage if they tell the truth [26].

It is undeniable that the reluctance of voluntary information disclosure results in greater opportunities for financial distress than non-financial distress. In fact, because the culture in companies with the majority and concentrated ownership prevents the risk of losing discretionary power, they avoid being issued shared because the capital market will be monitored [57]. Therefore, the culture may be static towards open innovation from capital market regulations.

4.3. Technology Life Cycle, and Open Innovation

Based on the life-cycle stage, differences in the company's growth depend on the availability of resources, and opportunities are characteristic of each stage [28]. Moving through each stage of the lifecycle requires innovation processes in different TIDs [18,22]. In the initial stage, the company develops technology (TID) as an innovation process. In the growth stage, the company deploys technology so that the company's mature stage gets a positive profit (harvest technology). When the decline stage occurs, the company needs to develop new technology.

Implementation of TID improves financial performance because it results in a better quality of financial reporting [26], thereby reducing information asymmetry between managers and shareholders and debtholders. Higher information asymmetry and the use of new technology during the introduction stimulate companies to miss growth opportunities through debt or equity issues. They prefer big data in new technology and have not combined market-based [24]. The level of information asymmetry is lower at the growth and maturity stages than the introduction and the ability to connect technology with the market better, encouraging better disclosure of information to the market.

Thus, the presence of an openness culture produced by the majority and concentrated ownership determines open innovation technology in information disclosure. An interesting finding, when open innovation of technology is less actualized in the introduction, in contrast, companies in Korea are in the initial stage of developing IT medical care, IT industrial robots so that the next stage can be informed in the market to earn profits [18]. Companies in Indonesia develop open innovation of technology that relates to core business more than reducing information asymmetry.

To sum up, we added a model proof in the introduction. The company focuses more on new technology based on core business than on the latest technology based on information disclosure as OJK's obligation [18]. During the introduction, the company is small, so managers are oriented to aligning open innovation with the company's strategy (core business) to overcome potential obstacles and failures when implemented. As a result, information disclosure has not been fully carried out because it prevents capital market monitoring [57], then the issuance of debt and equity depreciated and missed growth opportunities. In contrast to growth and maturity, when they are aligned with open innovation and strategy, their technology is used for greater openness, according to OJK regulations. It still does not reduce information asymmetry because it prefers debt over equity. The presence of a culture of ownership structure results in the existence of information asymmetry, even though TID is actually able to reduce it.

5. Conclusions

Managers have a strategic role in open innovation using TID for information disclosure. In the absence of firm-specific information, the issuance of leverage or equity will only depreciate. Conversely, when firm-specific information is added as a disclosure of information, there is still information asymmetry, thus to the issuance of equity, which is more sensitive to market responses, they issue debt.

When adding firm-specific life cycles to test the effect of growth on leverage, the company did not issue debt to finance growth opportunities during the introduction stage even though it had lower market sensitivity than equity. However, the next stage showed severe asymmetric information when companies disclosed firm-specific information but still used debt financing to finance growth opportunities.

In the overall sample without including the life cycle, firms preferred the issuance of leverage over equity when firm-specific information was included. The disclosure of information as a form of open innovation did not incentivize companies to prefer equity issuance over debt during growth and maturity. Managers and majority shareholders have more incentives to prevent equity, which results in dilution, even though there was disclosure of information, which is their obligation. Furthermore, because as long as mature has reduced growth opportunities and tends to be closed innovation, the need for financing is less. If it is necessary, they prioritize debt over equity because it is still found that equity issuance is more sensitive in the capital market than debt [38]. With regard to the limitations of our research, some variables may have been committed in the modeling procedure. First, the agents who act in majority shareholders' interests are still likely to have better information than other shareholders, even though information disclosure is required as a form of open innovation. Second, we did not explore firm heterogeneity via the data panel.

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