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Extended executive summary of the thesis

Valuation determinants of private entrepreneurial ventures at acquisition: the effects of information asymmetries and venture capital-related signals in an auction setting

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1. Introduction

Mergers and acquisitions (M&As) have become increasingly relevant for the economy, as deals have vastly grown in volume and value over the last decades. However, the determinants of valuation at acquisition is still an understudied topic. Indeed, only few theoretical studies and mathematical models have been published, using auctions as a framework to model acquisitions and analyze the drivers of the exit valuation. However, empirical proof to back the findings of theoretical studies is still largely lacking. Moreover, despite the fact that signaling theory has been already adopted in the M&As context, relevant literature gaps can still be spotted. In particular, few studies investigated how the signal sent by the sender (the target of an acquisition) is contingent to the characteristics (i.e., the level of information) of the receiver (the acquirer) [1]. This work aims at integrating signaling theory with auction theory and exploring how signals' effectiveness on the valuation of entrepreneurial ventures at acquisition changes on the basis of who are the signals' receivers and how well-informed they are. In this thesis, the focus is mainly on signals generated by being backed by venture capitalists before being targeted for an acquisition. Results on a

sample of 1325 private European, British and Israeli startups find no evidence on a significant relationship between the number of bidders or their information level and the exit valuation but provide proof on the relevance of signals and their contingent effects.

Last, this work holds both theoretical and practical value, as is enriches the extant comprehension on acquisitions and the exit valuation, while at the same time filling important gaps in the literature and integrating auction and signaling theory, which scholars adopted in an M&As context only independently one to the other. However, this dissertation also generates relevant implications for practitioner, as the results provide relevant insights to entrepreneurs looking to exit their venture through an acquisition.

2. Theoretical background

To study the topic of acquisitions, scholars applied auction theory. Indeed, auctions and M&As share many similarities: a seller seeks the highest possible valuation for the auctioned item while prospect acquirers compete with one another to buy the item and thus have to propose better conditions than competitors, while simultaneously minimizing the price paid. Scholars have greatly investigated the factors influencing the final sale price of an auctioned object, hinting at a positive relationship between the number of players involved in an auction and their information level (i.e., information asymmetries), and the final sale price. Such studies, however, remain theoretical, and mostly outside the boundaries of M&As. A second theoretical lens employed in the acquisition literature is signaling theory. However, while the literature on signaling theory in IPOs is abundant, few scholars focused on M&As to understand if some well-established signals in the IPO context can have the similar effects in M&As, as the two exits are different. Sending signals can be beneficial for the target, as it increases its payoff by

reducing the price discounting resulting from the risk of adverse selection and the winner's curse, which are both due to asymmetries. In this regard, scholars (see e.g., [2]) suggest that for high-tech ventures (such as startups) an important signal that a firm can leverage on is the presence of equity investors such as venture capitalists.

Given the above, it holds great research value to further investigate if, and how, the number of bidders, their level of information and the presence of relevant signals influences the price paid in an acquisition of a private venture.

2.1 Number of bidders

Competition, measured by the number of bidders taking part in an auction, is expected to push a more aggressive bidding behavior to favor the chances of winning, making the auction more dynamic (as it is characterized by faster bidding) and thus moving the price of an item towards efficiency price. Specifically, when the number of competing bidders approaches infinite, the winning bid would allow the seller to make all the profits, thus maximizing his payoff. Whereas mathematical and theoretical studies (e.g., [3]) seem to suggest that an increase in competition positively affects the final valuation of a target, practical evidence is still scarce. Hence, this work aims at testing the following hypothesis:

H0: *the exit valuation is positively correlated with the number of bidders*

2.2 Number of informed bidders

Theorists studying asset pricing commonly agree that information asymmetries reduce asset prices since prospect buyers minimize the risk of overpaying by underbidding. This is particularly true in M&As: as bidders are confronted with the potential issue of the winner's curse they discount their offers, reducing the target's profits [4]. If bidders were instead informed, then they should be willing to offer higher prices, hence driving the overall valuation up [4]. Since empirical studies on the

matter are lacking, the second hypothesis that is going to be tested is the following:

H1: *the exit valuation is positively correlated with the number of informed bidders*

2.3 Interactive effects between signals and bidders' characteristics

Signals might mitigate uncertainty in different measures as they could be contingent to other variables [1], leading to the idea that a signal is weaker and the discount on information asymmetry is smaller when bidders are already well informed. Still, the contingent effect of signals is an understudied topic, especially in M&As. By generalizing on the idea that signals are contingent to other variables, this dissertation aims at testing the following hypotheses:

H2: *the effect of the signal is larger if the number of non-informed bidders is larger*

H3: *the effect of the signal is smaller if the number of informed bidders is larger*

3. Methodology

The hypotheses were tested on a database of 1325 European, British and Israeli entrepreneurial ventures founded between 1988 and 2017 and exited through an acquisition between 1997 and 2017. The initial database comprised of 7892 acquisition, but some deals had to be excluded due to missing information (e.g., geographical information), leaving a sample of 6456 firms, of which only 1325 had complete financial information. All the information needed was retrieved from three distinct databases, namely Zephyr, Orbis and RISIS-VICO 4.0.

3.1 Definition of bidders

To assess the effect of competition on exit valuation, it was necessary to define the number of potential bidders for each target venture. A bidder was defined as a company, taken from the list of the 6456 acquirers,

simultaneously respecting the following conditions:

i. It performed an acquisition of a venture belonging to the same industry (identified by the first two digits of the NACE Rev. 2 code), of the target which is being evaluated; **AND**

ii. Such acquisition happened in the same year in which the target being evaluated was acquired.

3.2 Definition of informed bidders

Subsequently, it was necessary to discriminate between informed and non-informed bidders in order to test how the level of information affects the exit value. A bidder was categorized as informed if the following conditions were respected:

1. It was geographically close to the target; this translates to the bidder being closer than the median of the geographical distances. **and**

2. It was culturally close to the target; this translates to the bidder having a lower Kogut and Singh Index (KSI) than the median value.

Or, alternatively:

1. It was close to the target from an industry standpoint (the market relatedness index between target and bidder is higher than the median value). **or**

2. It had relevant past M&A experience in the same industry of the target, meaning that the bidder performed at least one acquisition of a company operating in the same industry (identified by the 4 digits of the NACE Rev. 2 code) of the target in the 5 years prior to the acquisition completion of the target.

For the first three conditions, adjusted measures were employed. These were computed considering not just the bidder itself, but also any other company that it acquired in the five-year period before the target of the

sample being evaluated was acquired. The adjusted measures then considered either the lowest (for geographical distance and KSI) or highest (for market relatedness) of the values between the target of the sample and the bidder, or the target of the sample and any of the companies acquired by the bidder in consideration. The median values were computed on the list of 6456 deals.

3.3 Dependent Variable

As a measure of the startup's exit value, it was decided to employ the Tobin's Q in the natural logarithm form, computed as the sum of the exit valuation (i.e., the ratio between the deal value and acquired stake) and the book value of assets less the book value of common stock, over the book value of assets.

3.4 Independent Variables

3.4.1 Number of bidders

As the goal of this dissertation is that of assessing the effect of both the number of bidders and their level of information on the exit valuation, three distinct variables were introduced, namely: *N_Bidders*, *N_Informed* and *N_Non_Informed*. All variables were winsorized at 5% level.

3.4.2 External equity investors

This second set of variables was introduced to study the effect of signals (i.e., the presence of VCs) on the exit valuation, as well as their contingent effects. Consequently, the dummy *VC_Backed* was introduced to track whether the target was backed by a VC firm (value equal to 1) or not (value equal to 0). Two additional variables, namely *VC_High* and *VC_Low*, were introduced in order to also account for the "quality" of the VC backing the target. A highly reputable VC is defined as one whose "exit performance" falls within the top 25% for the calendar year being considered.

3.5 Control Variables

The models' specification include several control variables employed to ensure the validity of the study by limiting the influence

of confounding variance. Six dummies were introduced to account for the geographical location, and four for the industry classification. *TotalAssets* (ln form) was employed as a proxy of the company's size and *CompanyAge* (ln form) as a proxy of the company's maturity. A set of other variables was also introduced, namely measuring: the market sentiment (*AcqMarketSentiment*), the probability of being acquired (*ProbAcquisition*), the media coverage of the target (*MediaCoverage*), the method of payment (5 dummies), the financials of the venture (*TotalDebt* and *Cash&Equivalents*), the presence of a toehold by the real acquirer (*Toehold*) and a dummy controlling for domestic acquisitions (*Domestic*).

3.6 Instrumental Variables

Several scholars have pointed out the existence of an endogeneity problem with VC financing. To better investigate this issue and add value to the research, the instrumental variable *Dist_Closest_VC_hub* was introduced, computed as the minimum distance of the target from the closest venture capital hub. As proxies, the first ten European VC Hubs identified by [5] were employed.

3.7 Models

The hypotheses were tested using three different multiple linear regression models of growing complexity, with additional four models acting as robustness checks. Robust standard errors have been employed in all the regression tests.

4. Results

The results (Tables 1 and 2) show that H0 can be neither confirmed nor rejected. Similarly, it is not possible to confirm nor reject H1 as no statistically significant results are obtained for the effect of the number of informed bidders both for Model 2 and its robustness check (Model 2A), in which VCs are distinguished on the basis of their reputation. However, upon further inspection, it was found that the

proportion of informed bidders with respect to the total number of bidders is positively and significantly correlated to the exit value (Table 3).

Variable	Model 1	Model 2	Model 3
N_Bidders[1]	-0.000105	//	//
VC_Backed	0.258121***	0.255246***	0.179087*
N_Informed[1]	//	0.001841	0.003530
N_Non_Informed[1]	//	-0.008434*	-0.015921**
VC_Backed#N_Informed	//	//	-0.003244
VC_Backed#N_Non_Informed	//	//	0.015310**

1. Winsorized at 5% level   * p-value < 10% ** p-value < 5% ***p-value<1%

Table 1: summary of results for the independent variables in the main models

Variable	Model 2A	Model 3	Model 2C
N_Informed[1]	0.001919	0.003738	0.001645
N_Non_Informed[1]	-0.008398*	-0.015824**	-0.008149**
VC_Backed	//	//	0.260370
VC_High	0.364628**	0.258868*	//
VC_Low	0.225503**	0.156050	//
VC_High#N_Informed	//	0.002909	//
VC_High#N_Non_Informed	//	0.001955	//
VC_Low#N_Informed	//	-0.005113*	//
VC_Low#N_Non_Informed	//	0.020116**	//

1. Winsorized at 5% level   * p-value < 10% ** p-value < 5%

Table 2: summary of results for the independent variables in three robustness checks' models

Variable	Model 2B
Ratio_Informed	0.453038**
VC_Backed	0.248588**

* p-value < 10% ** p-value < 5%

Table 3: Results from robustness check Model 2B

Moving to H2, the results confirm the existence of a positive and significant interactive effect between the signal and the number of non-informed bidders. Specifically, the exit valuation is higher when the number of non-informed bidders is higher and the target is backed by a VC. Moreover, a further analysis shows that there is a significant and positive difference in the marginal effects of the number of non-informed bidder in the case in which a VC is present against the case in which it is not. H3 is also confirmed, as Model 3 shows that the marginal effect of a signal is lower as the number of informed bidder is higher. In the results of the robust regression (Model 3A), in which VCs are split between highly and lowly reputable, the results remain valid for VC_Low (Tables 6 and 7).

	N_Informed	N_Non_Informed
VC_backed	dy/dx	dy/dx
0. VC_backed	(base outcome)	(base outcome)
1. VC_backed		
1	0.330249**	0.118230
2	0.304297**	0.194779**
3	0.210223**	0.332567**
4	-0.003876	0.715312**

N_Informed: 1. at=4; 2 at=12; 3 at=41; 4 at=107   * p-value < 10%
N_Non_Informed: 1. at=2; 2 at=7; 3 at=16; 4 at=41   ** p-value < 5%

Table 4: Marginal effect of dummy VC_Backed at different values of the number of bidders for Model 3

Variable	N_Informed	N_Non_Informed
VC_Backed	dy/dx	dy/dx
0	0.003530	-0.015921**
1	0.000286	-0.000611
1 vs 0	-0.003244	0.015309**

0: VC not present 1: VC present   * p-value < 10% ** p-value < 5%

Table 5: Marginal effect of the number of bidders at different values of dummy VC_Backed for Model 3

	N_Informed	N_Non_Informed
VC_High	dy/dx	dy/dx
0. VC_High	(base outcome)	(base outcome)
1. VC_High		
1	0.291466**	0.344814**
2	0.314739***	0.354590***
3	0.399105***	0.372187***
4	0.591110*	0.421066
VC_Low	dy/dx	dy/dx
0. VC_Low	(base outcome)	(base outcome)
1. VC_Low		
1	0.351265***	0.052113
2	0.310365***	0.152693*
3	0.162103*	0.333737***
4	-0.175321	0.836636***

N_Informed: 1. at=4; 2 at=12; 3 at=41; 4 at=107   * p-value < 10% ** p-value < 5%
N_Non_Informed: 1. at=2; 2 at=7; 3 at=16; 4 at=41   *** p-value < 1%

Table 6: Marginal effect of dummies VC_High and VC_Low at different values of the number of bidders for Model 3A of robustness check

Variable	N_Informed	N_Non_Informed
VC_High	dy/dx	dy/dx
0	0.002150	-0.009576*
1	0.005060	-0.007621
1 vs 0	0.002909	0.001955
VC_Low	dy/dx	dy/dx
0	0.004013*	-0.015921**
1	-0.001099	-0.000611
1 vs 0	-0.005112*	0.015309**

0: VC not present 1: VC present   * p-value < 10% ** p-value < 5%

Table 7: Marginal effect of the number of bidders at different values of dummies VC_High and VC_Low for Model 3A of robustness check

5.   Conclusions   and Managerial Implications

While this work contributes to the literature in several ways, the findings of this dissertation

do not stop at mere research value, but rather generate relevant implications for a variety of actors.

First, this dissertation fills important gaps regarding both auction theory and signaling theory in the M&As framework and, is so doing, it integrates the two theories, which were previously adopted only independently one to the other in the M&As context. Thus, this work acts as a basis for further studies on the topic, while enriching the extant comprehension of M&As and the exit valuation.

Second, the results offer evidence on the importance, as valuable signals, of the presence of VCs as shareholders in the target. Moreover, an important contribution regards the findings on the contingent effect of signals, as no empirical study is available on the topic, since the characteristics of the signal receiver have been largely overlooked by academics when considering the effectiveness and impact of the signal itself. The results show that the signal (the presence of a VC as a shareholder in the venture) is stronger when the number of non-informed bidders is larger (positively affecting the valuation with increasing marginal effects), while it is weaker when the number of informed bidders is larger (positively affecting the valuation with decreasing marginal effects). Given their positive effect on the exit value, coupled with the general support they provide to founders, the results of this work suggest that entrepreneurs, despite diluting their ownership, would benefit from raising venture capital. Indeed, VCs' strategic support, as well as their certification effect, allow to generate better returns for them, the founders and, more generally, the entire economic environment. For these reasons, policy makers should focus their efforts on fostering the development of this type of financial player.

Last, even though no evidence was found regarding the first two hypotheses, the results are still a valuable contribution to the literature, which is almost non-existent on the topic. Indeed, the results of the models show that acquisitions appear to be rather complex, and that the relationship between the number of bidders and the exit valuation is likely non-linear, contrasting with what posited by traditional economic theories. Moreover, the results show that bidders with low information asymmetry do not positively and significantly contribute to raising the final sale price (as posited by theoretical studies). On the other hand, non-informed bidders were found to have a significant negative impact on the exit valuation. Therefore, this dissertation provides useful insights to entrepreneurs on which bidders to involve when selling their venture: opposite to what traditional economic theories suggest, the entrepreneur is better off selecting the "right bidders", rather than focusing on involving the highest possible number.

6. References

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