

Investments in recessions

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INVESTMENTS IN RECESSIONS

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ABSTRACT

We argue that the strategy literature has been virtually silent on the issue of recessions, and that this constitutes a regrettable sin of omission. A key route to rectify this omission is to focus on how recessions affect investment behavior, and thereby firms stocks of assets and capabilities which ultimately will affect competitive outcomes. In the present paper we aim to contribute by analyzing how two key aspects of recessions, demand reductions and reductions in credit availability, affect three different types of investments: physical capital, R&D and innovation and human- and organizational capital. We point out that recessions not only affect the level of investment, but also the composition of investments. Some of these effects are quite counterintuitive. For example, investments in R&D are more sensitive to credit constraints than physical capital is. Investments in human capital grow as demand falls, and both R&D and human capital investments show important nonlinearities with respect to changes in demand.

INTRODUCTION

One surprising realization that came out of the financial crisis of 2008-9 was that the strategy literature has very little to say on the subject of recessions and business cycles (Agarwal, Barney, Foss, & Klein, 2009; Bromiley, Navarro, & Sottile, 2008; Latham & Braun, 2011; Mascarenhas & Aaker, 1989). We can only speculate why this is the case. One possible reason is that the coming of age of the strategy field occurred in an unusually stable period, so it did perhaps not seem as important as exploring the opportunities opened up by the resource and capabilities view, the knowledge based view of the firm, NK-landscapes, etc. In addition, the empirical findings of a small year effect in the variance decomposition literature may further have strengthened the notion that research opportunities were greater elsewhere (e.g. McGahan & Porter, 2002). Since then events have shown us that recessions are not always mild, not always far between, and can have profound impact on the competitive process and its outcomes. Recessions seem to be too important to ignore for a field that purports to understand competitive behavior and competitive outcomes.

Given the interest the field of strategy has devoted to understanding competitive behavior - and how competitive behavior is influenced by forces in firms' external environment - the strategy literature would seem a natural place to look for insights into how recessions affect firm behavior. What little we *do* know seems to be knowledge generated as a byproduct of research in other fields that are not primarily interested in firm level competitive behavior and outcomes per se, but have generated such knowledge in order to understand aggregate effects better (e.g. macroeconomics), or to understand the implications of recessions for financial decisions and financial markets (e.g. finance).

Our goal here falls short of developing a complete strategic theory of recessions and business cycles. Instead our more modest aim is to contribute by laying some of the groundwork for such a theory by synthesizing and conceptualizing a crucial piece of the knowledge that would need to go into such a theory. This knowledge is (by necessity) mostly taken from outside the strategy field. The subject matter we focus on is investment behavior, in particular we examine and contrast how recessions affect investments in tradable (Barney, 1986) and non-tradable (Dierickx & Cool, 1989) assets.

The hallmark of recessions (and more generally business cycles) is changes in investment levels and investment behavior. Also, the strategy literature has since the 1990s placed accumulation and acquisition of resources and capabilities at the center in terms of

understanding competitive behavior and outcomes. Recessions affect these processes via changes in firms' investment behavior. Therefore it seems logical to make changes in investment behavior a key point of departure for building a strategic theory of recessions. We devote special attention to knowledge investments due to the almost universally accepted primary importance of knowledge stocks in determining competitive outcomes (Barney, 1991; Dierickx & Cool, 1989; Wernerfelt, 1984). Understanding how recessions affect knowledge stocks via changes in investment behavior, is presumably of particular value to strategy researchers.

To get some traction on the link between recession and knowledge investments we split knowledge investments into different types of knowledge stocks, specifically investments in R&D and innovation, and investments in human- and organizational capital. To simplify the terminology we will refer to the former as R&D and the latter as human capital investments. A key distinction between the two is that R&D and innovation is primarily oriented at creating new knowledge, while investments in human- and organizational capital primarily deals with acquiring, disseminating and exploiting existing knowledge. As we elaborate below there are important differences between how these two categories of knowledge investments are affected by recessions. We also examine investments in physical assets, partly to form a contrast to knowledge assets, but also because giving prominence to non-tradable assets does not imply that we believe tradable assets can safely be ignored.

Moreover, and equally important, we split the effects of recessions into demand reductions and problems with access to credit. Both of these are relevant in most recessions, but firms may experience them in different degrees and different combinations (Tong & Wei, 2008). We separate these two in order to analyze whether their effects on the different types of investments vary.

Our analysis generates the following predictions. First, R&D investments will be less sensitive to demand reductions than physical investments, and more sensitive to internal finance. Second, firms will prefer increasing debt to cutting investments in R&D, and R&D investments are therefore more sensitive to binding credit constraints than are physical investments. This implies that credit market imperfections may have greater effects on competitive dynamics than usually assumed in the strategy literature, since it hampers firms' ability to fund R&D investments, and because firms differ in their dependence of- and access to credit. Third, human capital investments are stimulated by mild demand reductions, but for

strong demand reductions they decrease, and notably, they also decrease for firms that experience increases in demand. This implies that there are important nonlinearities in the relationship between demand and human capital investments.

The rest of the paper is structured as follows: First we present a general theory of how firms' investments are affected by changes in demand and credit, and apply this to physical investments. With this as the standard apparatus we then contrast physical investments with investments in R&D and innovation, and subsequently with investments in human- and organizational capital. In each section we formulate propositions about effects of changes in demand and credit on investments, and also about differences across asset types with respect to these effects. We close the paper with conclusions and implications.

INVESTMENTS IN RECESSIONS: A GENERAL APPROACH

While recessions differ in their specific causes, intensity and duration, some common features are present in most recessions, in particular reductions in demand and reductions in access to credit. Both are relevant in most recessions, but firms may experience them in different degrees and in different combinations (Tong & Wei, 2008). For example, the bank channel has been designated as particularly important in depressing investments (Bernanke & Gertler, 1989, 1990) causing firms and industries that are particularly dependent on credit to cut deeper in investments than those that are less dependent, even controlling for investment opportunities (Braun & Larrain, 2005; Campello, 2003).

The business cycle literature in economics and finance provide ample evidence of the strength of the aggregate effects of recessions. For instance, when lenders experience an adverse shock or a mounting fear of future losses, they reduce lending and raise interest rates (Chava & Purnanandam, 2011). Ivashina and Scharfstein (2010) find that in the US during the financial crisis of 2008, new loans to large borrowers fell by 79% relative to the peak of the boom, and that the volume of loans for real investments fell by 72% relative to the peak level in 2007. Gilchrist and Sim (2007) estimate that 50- 80% of the drop in investment during a recession is due to financial factors that constrain firms' ability fund investments. Gan (Gan, 2007) estimate that the same measure was 20% after the burst of the housing bubble in Japan in the early 1990s. Liquidity in capital markets is thus pro-cyclical with the cost and scarcity of capital increasing in recessions (e.g. Acharya & Viswanathan, 2011; Bernanke & Gertler,

1989; Bernanke, Gertler, & Gilchrist, 1996; Eisfeldt, 2004; Eisfeldt & Rampini, 2006; Shleifer & Vishny, 1992). In sum, then, recessions may cause serious distortions in both the level and composition of investment - factors that are important to competitive behavior and ultimately competitive outcomes.

To illustrate the general effect of reductions in demand and reductions in access to credit we draw on Gertler and Hubbard (1988) and Hubbard (1997). Figure 1 shows the relationship between a firm's demand for capital and the supply of capital it faces. The quantity of investments is on the horizontal axis while the cost of capital is on the vertical axis. The demand curve, D , illustrates demand for capital by the firm, and is downward sloping as lower capital costs increase the desired level of investments. The location of the demand curve is determined by the expected future profits of the investments. The supply curve, S , illustrates the supply of capital to the firm. As firms will finance some (or all) of their investments using internal funds, the supply curve is horizontal to the point CF , which is the firm's cash flow. From here, external capital is needed to fund further investments. The cost of internal funds is depicted as r , the risk adjusted market rate of return (which is the opportunity cost of internal funds)¹. The slope of the curve of external capital (the S -curve from CF and onwards) depends on how much the creditors must be compensated for risk, and will be upward sloping since increasing debt increases the risk to credit suppliers – which they must be compensated for. The equilibrium investments are $I_{t=0}$ where the expected marginal profitability of capital equals the marginal interest rate.

The effect of changes in demand on investments

Changes in demand can affect firms' investments, one is by changing the investment opportunities, and the other by reducing profits and thus access to internal funding. We start with the former.

A reduction in the expected future profit of investments causes the demand-curve to shift inwards, while an increase makes it shift outwards. The rather unsurprising result of a reduction in investment opportunities is a new equilibrium with reduced investment and reduced demand for credit. Conversely, an increase in investment opportunities will make firms increase their investments. Figure 1 shows how a reduction in investment opportunities causes the firms to reduce their investments.

¹ The cost of internal capital (r) is here shown as a horizontal line, indicating that a firm can invest its internal capital outside the firm (in the market).

[INSERT FIGURE 1 HERE]

Changes in demand conditions can also affect firms' investments via their access to internal funding, i.e., their cash flow. This effect is illustrated in figure 2 as a shift in the cash flow from CF to $CF_{t=1}$, which causes the supply curve, S , to shift inwards. After this shift external sources are needed to fund a larger portion of its investments. The upward slope of the external part of the supply curve means that the cost of investments are now higher, and this reduces the desired level of investments as illustrated in Figure 2. Obviously, an increase in the cost of internal capital (r), for example because of an increase of the risk free rate of return and/or an increase in the risk premium, will cause an upward shift in the S curve and reduce the investment.

[INSERT FIGURE 2 HERE]

Physical capital

The general theory is best illustrated with investments in physical capital. A fall in demand drives down capacity utilization, driving down the expected profitability of physical investments. This in turn will cause the demand for capital curve (D) to shift inwards and investments to be reduced. An additional effect shifting D inwards is the option value associated with postponing investments in times of uncertainty (Bernanke, 1983). Bernanke (1983) argues that an option value on awaiting new information is created when investment are associated with some degree of irreversibility - *and* new information relevant to assess the long-run return of an investment arrives over time. Firms are better off waiting for new information if improved information is more valuable than the short-term return of undertaking the investments immediately. The option value will be inversely related to the time span needed to activate the investment.

The other main effect is that a negative demand shock reduces a firms' cash flow and thereby also their access to internal funds. This implies an inward shift supply of capital curve (S) and a negative effect on physical investments.

The effect of reductions in access to credit on investments

In figure 3 we show the effect of reduced credit availability. This makes the S -curve steeper, as capital providers demand larger compensation for providing funds. The marginal

cost of credit is upwards sloping, and the steepness of the curve depends on a) the value of collateral and b) lenders perceived risk (Fazzari, Hubbard, & Petersen, 1988). Both a) and b) may cause the S-curve to become steeper in recessions. Collateral becomes less valuable because assets are expected to generate less profit (Bernanke & Gertler, 1990), perceived risk increases due to the general spike in uncertainty. Following the rotation of the supply curve, the firm has to pay a higher price for its external funds, and the desired level of investments decline.

[INSERT FIGURE 3 HERE]

Physical capital

Two central features of physical investments are important when looking at the effect of reduced access to credit. The first is that some portion of physical capital is normally financed by credit. The second is about the steepness of the curve. Physical investments are tangible assets that work better as collateral than intangible assets. There is also relatively less uncertainty related to the outcome of investment in physical capital than intangible capital. While physical capital is normally purchased via market transactions where price and quality is (more or less) known ex ante, intangible capital involves accumulation processes whose outcome are uncertain (Lippman & Rumelt, 1982). Both these points imply that the supply curve for external finance will be less steep for physical assets than for intangible assets, and also that the steepness will increase relatively less in periods of recessions.

Net effects of recessions on investments in physical capital

As seen, the effects of reductions in demand- and in access to credit both work in the same direction. Demand fall in recessions will lower the *incentives* for firms to invest in new capacity, while reduced access to credit will lower firms' *ability* to finance new physical investments externally. Theory thus implies that physical investments should be pro-cyclical. However, the *ability* to access finance will only affect investments for firms with *incentives* to invest in physical capital, which implies that demand reductions are likely to have a larger effect on physical investments than reductions in access to credit.

[INSERT FIGURE 4 HERE]

R&D INVESTMENTS IN RECESSIONS

So far, we have merely looked at the “classical” theory of physical investments and not made any distinction between different asset types. However, differences across asset types will affect the placement and shape of the demand- and supply curves in the general model, and also the way the curves shift in a recession. We therefore examine investments in two other categories; investments in R&D and human capital. We let R&D refer to all R&D-activities and process and product innovation, and human capital investments encompass investments in training of employees and organizational development programs. In the following we examine how these two categories of investments are affected by recessions, and the differences between these and physical investments.

The effect of reductions in demand on knowledge capital investments

As with physical investments, reductions in demand will have two distinct effects, one by altering investment opportunities and one by reducing firms’ cash flow. We start with the former.

Changes in investment opportunities

Investments in R&D and innovation are long-term investments that are more difficult to scale up and down than investments in physical capital. If you cut in R&D, you are unlikely to be able to scale investments back up quickly (Li, 2011). A large portion of investments in R&D is related to paying scientists and engineers, and a considerable share of the new knowledge will exist in the form of tacit, highly specialized and firm specific knowledge carried by these workers, or embedded in teams (Hall, 2010). Laying off this type of personnel is costly, because valuable knowledge investments will be lost, and because R&D productivity cannot easily be restored by hiring replacement when demand picks up. As a direct result of this, firms smooth their R&D investments over time to avoid having to lay off the workers who embed the knowledge (Hall, 2010). Put differently, R&D investments have higher adjustment costs than physical capital (Aghion, Angeletos, Banerjee, & Manova, 2010; Hall, Blanchard, & Hubbard, 1986), and will therefore be less sensitive to transitory fluctuations in demand (Hubbard, 1997).

A further argument is the option value discussed above (Bernanke, 1983). As noted the option value will be inversely related to the time span needed to activate the investment. As the time span for building for instance plants or buying equipment is relatively short compared to R&D projects, the option value of waiting is relatively low for R&D investments (Ghemawat, 2009).

In sum this implies that the share of knowledge investments to physical investments should be countercyclical (Aghion & Saint-Paul, 1991; Bean, 1990; Bloom, 2007; Gali & Hammour, 1993) which basically means that firms' cut R&D investments proportionally less than physical investments:

Proposition 1: R&D investments will be less sensitive to demand reductions than physical investments

Investments in R&D have a two component cost structure where one component is out-of-pocket-costs, and the other is the opportunity cost of personnel and other resources involved. The opportunity cost dimension creates important differences between knowledge investments and physical capital. The pit-stop view of recessions (Aghion & Saint-Paul, 1991; Davis & Haltiwanger, 1990; Gali & Hammour, 1993; Hall, 1991) claims that the opportunity costs of using idle labor resources in R&D are much lower in periods of low capacity utilization. In fact, under low capacity utilization this opportunity cost can drop to zero. Under high capacity utilization, the opportunity cost of using personnel in R&D is the value of the output they could have produced if they were assigned to production. The upshot from this is that R&D become more attractive during recessions. Note that there is no equivalent pit-stop effect for physical capital.

Proposition 2: The higher the value from reallocating idle employees to R&D, the more demand reductions will stimulate R&D-investments

Reduced access to internal finance

The second effect of reduced demand on R&D is by reducing firms' cash flow and thereby access to internal funding. R&D investments are more costly to finance externally (elaborated below), and such investments will therefore primarily be financed internally (Bertoni,

Colombo, & Croce, 2010; Bougheas, Görg, & Strobl, 2003; Carpenter & Petersen, 2002; Czarnitzki & Hottenrott, 2011; Müller & Zimmermann, 2009; Ughetto, 2008). There is considerably uncertainty related to the output of knowledge investments (Hall, 2010), and more uncertain projects are less attractive to credit providers. The reason for this is that lenders cannot benefit from the upside of the projects, while equity investors can. So while lenders lack the upside potential, they are confronted with the downside of R&D projects, which may be considerable. The output from R&D investments is usually both intangible and characterized by high specificity, making the salvage value low if the project should fail (Gugler, 2001). Also, the levels of information asymmetries associated with investments in new knowledge are higher than for other types of investment (Hall, 2002), and finally, the low initial cash flow from the innovation projects may be insufficient to cover interest rates on a loan (Gugler, 2001).

All the above implies that the capital supply curve is steeper for knowledge investments than for physical investments, and also that the steepness will increase in recessions, when uncertainty increases. For this reason R&D investments are quite sensitive to the availability of internal finance, as several empirical studies have found (e.g. Bertoni et al., 2010; Bhagat & Obreja, 2011; Bhagat & Welch, 1995; Brown, Fazzari, & Petersen, 2009; Hall, 1992; Harhoff, 1998; Himmelberg & Petersen, 1994; Rafferty, 2003).

Proposition 3: R&D investments are more sensitive to internal finance than physical investments

Integrated effects of changes in investment opportunities and access to internal finance

The discussion above implies that the relationship between demand reduction and R&D investments is non-linear. Regarding the form of this linearity, we reason as follows: For mild reductions in demand, the opportunity costs of investing in R&D will fall, stimulating R&D investments. The strength of this effect will depend on the value of utilizing non-R&D personnel in R&D activities (cfr. P2). However, at a certain level of demand reduction, the cash flow of the firm is so diminished that it needs external finance to fund its investments (cfr. P3). The weak collateral and high risk R&D investments pose to creditors, makes it difficult to fund the desired investments. From this point on, the cash flow effect will dominate the opportunity cost effect, and demand reductions will have an increasingly

negative impact on R&D investments. The above discussion can be summarized as tracing out a negative cubic function as illustrated in Figure 5:

[INSERT FIGURE 5 HERE]

Proposition 4: The relationship between changes in demand and R&D investments is a negative cubic function

The effect of reductions in access to credit on R&D investments

As noted, when a negative demand shock occurs, firms that are able to finance R&D and innovation from earnings will tend to maintain these investments, while firms that are unable to do so must either cut investment or increase borrowing. Due to the high adjustment costs of knowledge investments, firms will prefer increasing debt to cutting investments in R&D and innovation. The reason why firms would rather increase debt than cut R&D investment, even if credit is expensive, is that loans can be repaid, refinanced or substituted with new equity when conditions allow it. A crippled R&D department may take years to rebuild. There is in other words an essential difference in reversibility between the two options, leading firms to prefer an increase in debt.

Proposition 5: Firms will prefer increasing debt to cutting investments in R&D

If firms prefer to increase debt over cutting R&D (P5), credit constrained firms will be the ones that cut these investments most, while unconstrained firms will borrow to maintain them (Aghion, Askenazy, Berman, Cetto, & Eymard, 2008). Paradoxically, then, even though R&D investments are not usually financed by credit, these investments are quite sensitive to increasing credit constraints in a recession. The reason being that credit constrained firms cannot turn to credit to maintain R&D. Many studies have investigated this empirically and found that credit constraints do indeed affect R&D investments negatively (e.g. Canepa & Stoneman, 2008; Gorodnichenko & Schnitzer, 2010; Mancusi & Vezzulli, 2010; Mohnen, Palm, van der Loeff, & Tiwari, 2008; Paunov, 2012; Savignac, 2008; Schneider & Veugelers, 2010)

If we compare R&D investments with physical investments, it is clearly easier to finance physical investments by credit given lower information asymmetries, higher collateral value, etc. The counterintuitive conclusion from this is that credit constraints will actually have a larger negative impact on R&D investments than physical investments. Due to the larger adjustment cost of R&D investments firms have a stronger incentive to turn to credit when internal finance is insufficient, than they have for physical investments. This makes R&D investments more, not less, sensitive to credit availability.

Proposition 6: Firms R&D investments are more sensitive to credit constraints than their physical investments

Net effects of recessions on knowledge investments

The opportunity costs argument implies that firms should be more willing to invest in R&D during recessions, while the financial constraints (both internal- and external) argument states that intangible investments should be more difficult to finance during recessions, So, which of the two dominate?

There is considerable empirical (macro-level) evidence that the absolute level of R&D investments is procyclical, implying that the reduced cash flow effect dominates the pit stop effect (e.g. Barlevy, 2007; Comin & Gertler, 2006; Fatas, 2000; Filippetti & Archibugi, 2010; Geroski & Walters, 1995; Ouyang, 2011; Wälde & Woitek, 2004). Another set of studies has investigated the relative sizes of the opportunity cost- and the financial constraints effect on knowledge investments. Aghion et al. (2008) use a panel of French firms in the period 1993-2004 to analyze the relationship between financial constraints and firms investments in R&D over the business cycle. Their main findings are that R&D investments as a share of total investments are countercyclical for firms that do not face financial constraints, while they become more pro-cyclical as the credit constraints increase. They also find that the latter result is magnified in sectors that rely heavily on external finance. These results indicate that in the presence of credit constraints, the effects of financial constraints dominate the opportunity costs effect. Lopez-Garcia, Montero and Moral-Benito (2012) and Bovha Padilla, Damijan and Konings (2009) also find that R&D investments are countercyclical for firms without credit constraints and pro-cyclical for constrained firms (for Spanish- and Slovenian firms respectively).

Summing up, financial constraints (internal and external) have a stronger negative effect on R&D investments than the positive effect of reduced opportunity costs. The above studies suggest that this can explain the observed pro-cyclical behavior of the absolute level of R&D investments on the macro level. Similarly R&D investments are less sensitive to changes in demand than physical investments, due to the higher adjustment cost and the opportunity cost effect.

HUMAN CAPITAL INVESTMENTS IN RECESSIONS

The effect of reductions in demand on human capital investments

When demand falls, some human capital is likely to become underutilized. Firms have two options regarding this excess human capacity. One option is to reduce the number of employees to compensate for the excess capacity created. This will cut costs in the short run. However, if the demand fall is expected to be temporary, firms will have to rehire employees to scale their capacity back up, which in turn implies new costs related to searching, hiring and training the new employees. The other option is to hoard labor, that is, keep the employees in periods when there is not enough work. This will increase costs in the short run, but the firm will avoid costs of searching, hiring and training new employees if and when demand rises again (Becker, 1962; Oi, 1962; Rosen, 1966). The pit-stop argument also works in favor of labor hoarding since the firm can use the excess capacity of employees on training and solving organizational problems, thus increasing the firms stock of human capital.

The more specialized the employees are, the more expensive (and difficult) it will be to rehire workers, and the more likely it becomes that the firm will hoard labor. In addition, the amount of uncertainty related to when (and if) demand will readjust to pre-crisis levels will also affect the incentives for labor hoarding. Bloom et al (2007) find that higher levels of uncertainty lead to preference for the status quo (doing as before), which in this context is keeping employees who might be costly to replace later.

Changes in investment opportunities

Similar to knowledge capital, human capital investments have a two component cost structure, where one component is the out of pocket costs associated with training employees

(e.g. an external course), and the other is the opportunity costs associated with taking an employee out of her ordinary work. Reductions in demand increase the level of excess capacity, which lowers the opportunity costs of human capital investments, and this gives firms stronger incentives to invest in such activities. Human capital investments thus become “cheaper” when demand falls, and the demand curve (D) will shift outwards due to the positive shift in investment opportunities. This implies a positive effect of demand reductions on human capital investments. This notion of recessions as reorganizations is supported by several studies advocating the pit-stop view (Aghion & Saint-Paul, 1991; Caballero & Hammour, 1996; Davis & Haltiwanger, 1990; Hall, 1991).

Compared to R&D investments, the opportunity cost component as a share of total costs will be larger for human capital investments, and the pit-stop effects of recessions will therefore be relatively stronger than for R&D.

Changes in access to internal funding

Reductions in demand reduce firms’ cash flow and thereby also their access to internal funding. If the fall in cash flow is very large and the firm ends up in a liquidity squeeze, it may be forced to abandon labor hoarding and turn to layoffs.

Empirical studies of job creation and destruction over the business cycle find that the rate of job destruction increases in recessions, while job creation is rather unresponsive to the business cycle (e.g. Davis & Haltiwanger, 1990). However, while there is net job destruction in recessions, much of this activity takes place within a relatively small number of firms that make large cutbacks (Davis & Haltiwanger, 1990). This again indicates that the fall in demand has to be of a certain size before a firm starts laying off employees in response to a demand shock it believes will be temporary.

Based on the above findings, changes in demand should have a non-linear relationship to human capital investments. Reduced opportunity costs associated with training employees when excess capacity rises, increase firms’ incentives to invest in human capital. This effect will increase up to a point where the cost of carrying excess capacity becomes too high, that is, when the expected gains from retaining and training employees will be lower than the forgone savings from layoffs, and the firm will increasingly turn to layoffs. This, in turn, reduces human capital investments. Conversely, the opportunity costs of training and investments in organizational capital increases when demand increases, and investments

should then fall (Bean, 1990). For sufficiently large increases the firm will have to start hiring, which will tend to drive the need for training upwards. The change in investments in training and organizational capital should therefore be a negative cubic function of demand problems. I.e. if demand increases, investments should fall. If demand is reduced, investments should initially increase, but eventually decrease (for sufficiently large reductions in demand) as firms turn to layoffs instead of labor hoarding. Similar to R&D investments this pattern is what a negative cubic function traces out (See Figure 6), but the nonlinearity is stronger for human capital investments because the opportunity cost effect is stronger, and the credit effects are weaker.

Proposition 7: The relationship between changes in demand and human capital investments is a negative cubic function, and the nonlinearity is stronger than for R&D investments

The effects of reductions in access to credit on human capital investments

Capital market imperfections are less relevant for human capital investments than for investments in R&D- and physical capital. The major costs component of human capital investments is the opportunity costs of time spent on training, rather than the actual out-of-pocket costs. Also, human capital investments are considered to be maintenance or development of existing knowledge, so the salvage value of such investments will be very low, if any at all. These investments are therefore more likely to be financed internally than externally (Nickell & Bell, 1995). Reductions in access to credit are therefore of little relevance for human capital investments, except for firms that are forced to turn to layoffs for liquidity reasons. For these firms, external finance becomes relevant if it can be used to avoid involuntarily layoffs, i.e. when the firm would have preferred to hoard labor. For firms that do not have incentives to hoard labor, ability to finance labor hoarding is irrelevant.

Proposition 8: Investments in human capital are only sensitive to reduced credit availability if and when the firm is both dependent on credit and have incentives to hoard labor.

Net effects

Since the demand effect is relevant as long as the firm has incentives to hoard labor, while the credit effect only applies when a binding credit constraint exists, the net effect of demand and credit will be equal to the demand effect up to the point where the ability to hoard labor depends on access to credit. From this point on the negative effect of recessions on human capital investments increases rapidly (see Figure 6). For less severe negative demand shocks, the positive demand effect implies a countercyclical relationship between recessions and human capital investments. Empirical studies have found this predicted countercyclical pattern of investments in human capital both on firm level (e.g. López-García et al., 2012), and on individual level in the form of increased college enrolments in recessions as individuals use their own excess capacity to accumulate skills in such periods (DeJong & Ingram, 2001; Dellas & Sakellaris, 2003; Heylen & Pozzi, 2007). Also, Geroski and Gregg (1997) found that firms were less likely to cut back on investments relating to training of their employees than other investments in the UK recession in the early 1990s. The discussion of human capital investments in recessions are summarized in Figure 6.

[INSERT FIGURE 6 HERE]

CONCLUSION

The central premise of the present paper has been that the strategy literature has been virtually silent on the issue of recessions, and that this constitutes a regrettable sin of omission. Furthermore, we have argued that a key route to rectify this omission is to focus on how recessions affect investment behavior, and thereby firms stocks of assets and capabilities, which ultimately will affect competitive outcomes.

The key contribution we have attempted to make here is at the front end of this link, that is, on how recessions affect investment behavior, while we have remained silent on the implications of our propositions for competitive outcomes. We believe a focus on how investment behavior is affected must come before a discussion of the ensuing consequences, which is why we have focused on investment and not performance consequences. Nevertheless, it seems pertinent to offer some illustrative thoughts on the implication for competitive outcomes in this concluding section.

For example, we have pointed out that under some circumstances recessions will have a positive effect on investments in human and organizational capital, since excess capacity can imply a de facto subsidy of the (opportunity) costs of making such investments. One might speculate that this will put pressure on competitive advantages that are founded on advantages in human- and organizational capital, for example if followers experience slightly more excess capacity than leaders. We can also speculate that this tendency will be stronger when incentives to hoard labor are strong.

We have also pointed out that firms attempt to shield R&D investments in recessions, but that the ability to do so depends on financing constraints. A firm that cannot fully fund R&D internally will face serious cost increases as it turns to external finance for R&D, and if it cannot borrow to maintain R&D it must cut its investment. Because of the high adjustment costs of R&D, this could create a lasting negative effect on competitiveness. Consider the effects of this from a game theoretic perspective. It would seem likely that a firm barely able to keep up its R&D would make an inviting target for a more well financed competitor. If the stronger firm could lower the weaker firm's margins slightly, it could inflict long lasting damage to its competitor by manipulating it to make irreversible cuts in R&D.

In terms of physical investments, consider the fire sales mechanism (Shleifer & Vishny, 1992, 2010). If there is excess capacity in an industry some firms might experience problems in keeping the collateral agreed with creditors. Those firms are then forced to sell assets. If there is a surplus of sellers relative to buyers, the firm will have to lower the price extensively to sell its asset. This turn revalues the collateral for all firms in the industry, leading more firms to problems with their collateral, which means still more firms will have to sell, pushing collateral values further down, etc. The result of such a process is that the price of physical assets - or other assets for that matter - can deviate substantially from their intrinsic value (expected net present value). A firm that can invest in physical capital at such dislocated prices can potentially lock in a significant advantage because it can obtain assets at prices levels that cannot be recreated unless a similar situation is recreated.

More generally, we believe that the discussion here shows that some of the common background assumptions in strategy are highly problematic during recessions. For example, the strategy literature typically assumes that a number of markets are reasonably well functioning, most notably capital markets, so that positive NPV-investments will be financed. The business cycle literature in economics and finance provide ample evidence that this

assumption is violated during a recession, and this can have important implications for competitive behavior – investment behavior in particular.

Another common background assumption in the strategy literature is that the *ability* to finance profitable investments does not vary across different asset types. I.e., while capital markets do assess the risk/return profile of different investments, there is no discrimination for or against tangible assets once the risk is taken into account. This means that firms are free to allocate their investments so that the expected marginal returns are equal across different asset types. Again, this is not necessarily the case during recessions. Since intangible assets are typically weaker collateral than physical capital, funding for intangible assets will be particularly difficult for firms that cannot finance these by retained profit (Aghion et al., 2008; Hall, 2002, 2010). So the more dependent you are on credit, the more difficult it will be to finance investments in intangibles and the more you will have to cut in such investments. Moreover, the *incentives* to invest during recessions will also vary across different asset types. As we have seen some investments become less attractive during periods of low demand, while other investments become relatively cheaper and hence more attractive during a recession

In sum, then, recessions may cause serious distortions in both the level and composition of investment - factors that are important to competitive behavior and ultimately competitive outcomes. This is something strategy researchers cannot sweep under the rug if we want to understand the strategic implications of recessions.

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FIGURES

Figure 1 Reductions in demand (investments opportunities)

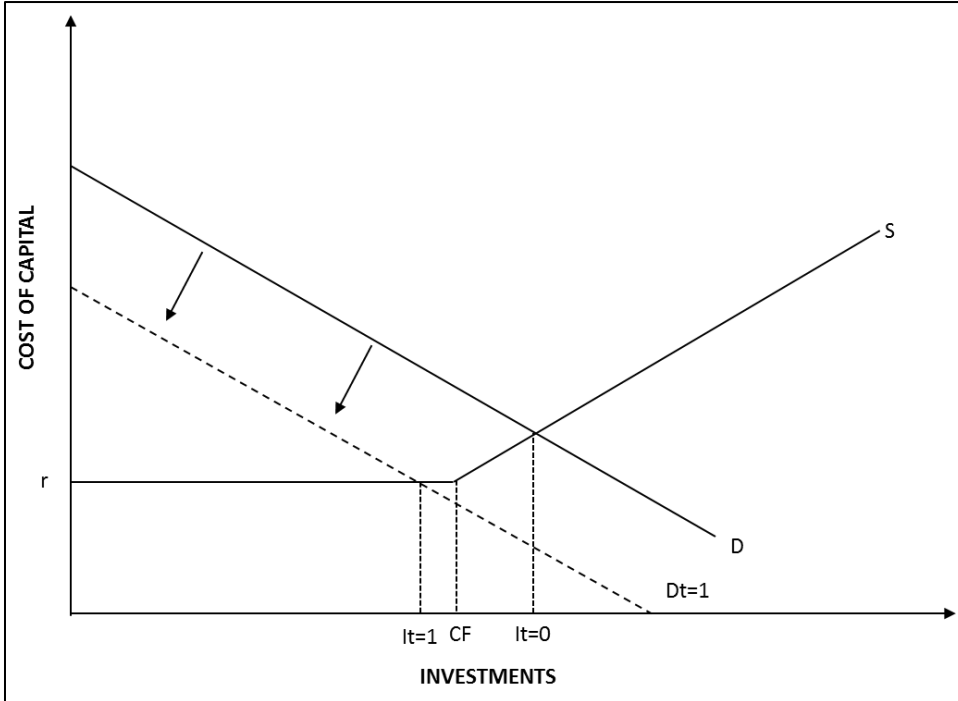


Figure 2 Reductions in demand (internal finance)

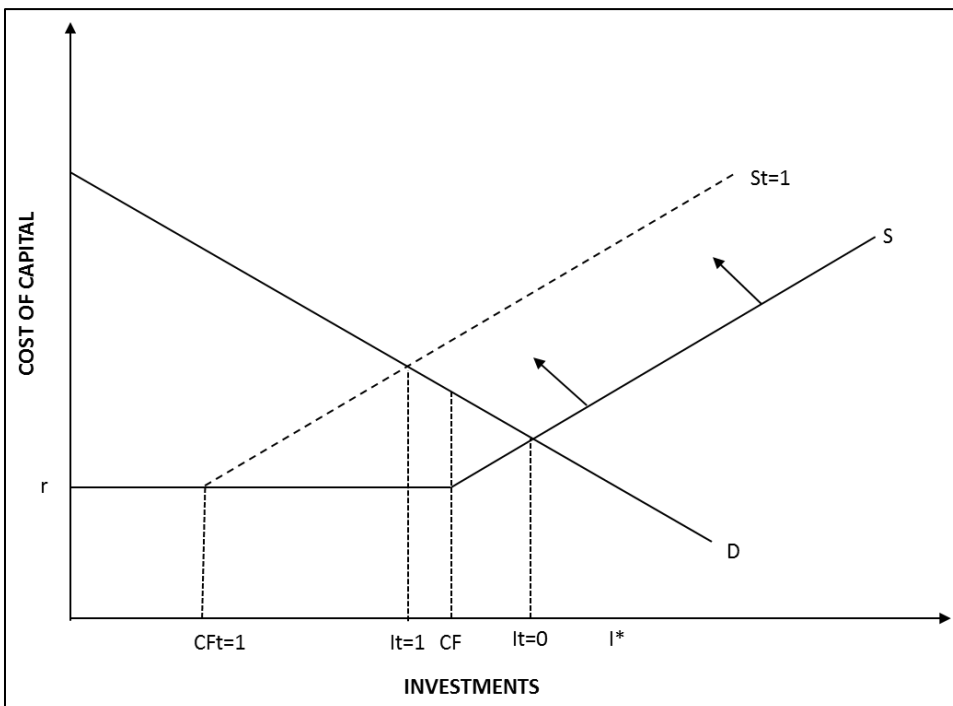


Figure 3 Reductions in access to credit (increased cost of capital)

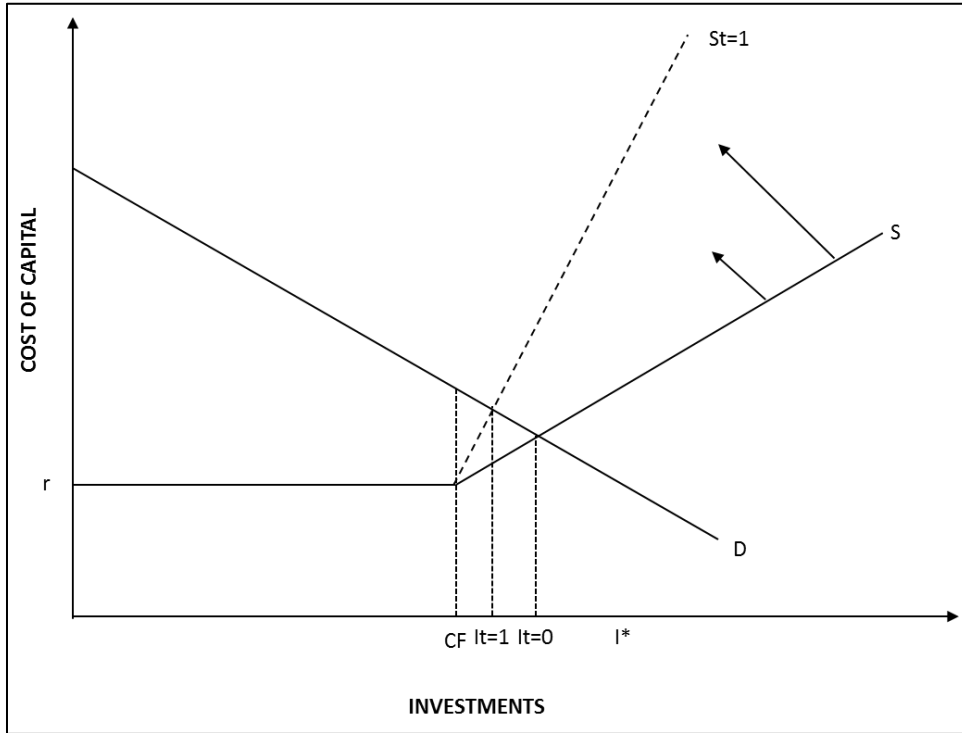


Figure 4 Net effects of demand and credit on physical investments

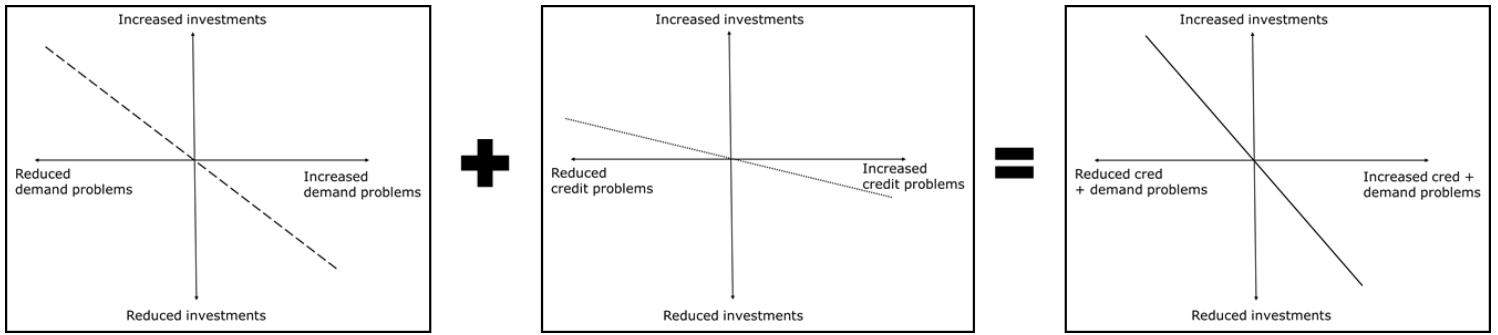


Figure 5 Net effects of demand and credit on R&D Investments

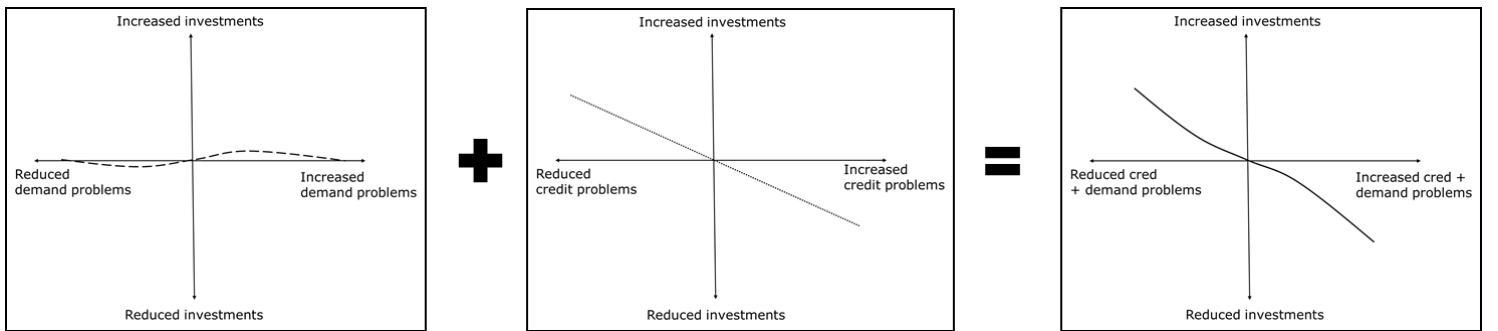
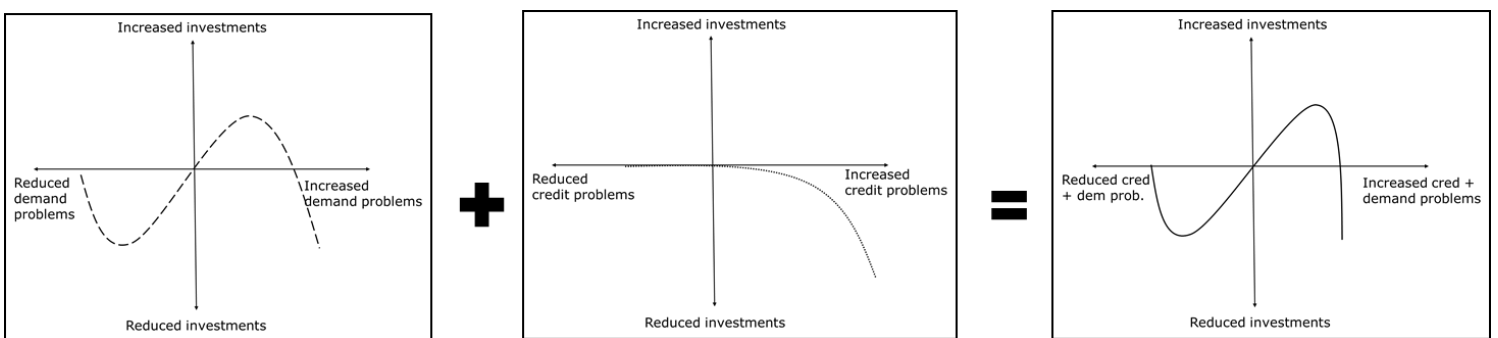


Figure 6 Net effects of demand and credit on Human Capital Investments



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SNF Report No 05/10

We argue that the strategy literature has been virtually silent on the issue of recessions, and that this constitutes a regrettable sin of omission. A key route to rectify this omission is to focus on how recessions affect investment behavior, and thereby firms stocks of assets and capabilities which ultimately will affect competitive outcomes. In the present paper we aim to contribute by analyzing how two key aspects of recessions, demand reductions and reductions in credit availability, affect three different types of investments: physical capital, R&D and innovation and human- and organizational capital. We point out that recessions not only affect the level of investment, but also the composition of investments. Some of these effects are quite counterintuitive. For example, investments in R&D are more sensitive to credit constraints than physical capital is. Investments in human capital grow as demand falls, and both R&D and human capital investments show important nonlinearities with respect to changes in demand.



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