PRODUCT-MARKET COMPETITION AND THE REDISTRIBUTION OF RESOURCES IN THE MULTI-BUSINESS FIRM

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ABSTRACT

This paper investigates how diversified firms allocate non scale-free resources across their business units (BUs). In particular, we exploit exogenous variations in the intensity of competition in the product-market of one of the BUs of the firm to proxy for changes in the opportunity cost of using non scale-free resources. Consistent with the hypotheses, we find that an increase in competition experienced by one of the BUs of the firm triggers a redistribution of resources in favor of the BU affected by it. Further, we find evidence that the relative resource management ability of the BU experiencing the increase in competition is a positive factor moderating the relationship. Instead, the relative size of the BU in comparison with the total size of the firm moderates the relationship negatively by affecting the ability of the firm to release non scale-free resources. Finally, we also examine how the fungibility of scale-free resources across the product-markets of a diversified firm influences resource reallocation. While in our initial analysis we obtain only partial evidence supporting the idea that scale-free resource relatedness is a negative moderator of the relationship between competition and resource reallocation, additional tests included in the paper suggest that the relationship might depend on the effect of competition on the value of the scale-free resource under consideration.

Keywords:

Non scale-free resources, opportunity cost, competition, internal capital markets

INTRODUCTION

Since its first formulation the Resource Based View (RBV) has been applied to the study of diversified firms (Penrose, 1959; Rumelt, 1974). In this area, early theoretical work by Penrose (1959) already recognized that firm's resources need to possess two characteristics for them to be the basis of a strategy of product diversification: fungibility across businesses and excess capacity. However, much of the RBV analysis of diversification that has come thereafter has focused on issues of fungibility (Bettis, 1981; Chang, 1996; Markides & Williamson, 1994; Rumelt, 1974), highlighting how factors like technology shape the direction and the performance of diversification (Miller, 2006; Pehrsson, 2006; Silverman, 1999).

While studying fungibility is essential for our understanding of product diversification, recognizing the finite nature of some of a diversified firm's productive inputs has important theoretical implications. Recent papers have started to highlight this issue (Helfat & Eisenhardt, 2004; Levinthal & Wu, 2010; Sakhartov & Folta, 2014; Wu, 2013). In particular, Levinthal and Wu (2010) make the explicit distinction between *scale-free* and *non scale-free resources*. Scale-free resources are resource like technology and brand that have the nature of public goods (Anand & Singh, 1997; Teece, 1982; Winter & Szulanski, 2001). Their exploitation in one business does not impede the exploitation in the rest of the operating sectors of the firm. Therefore, limits to their use are imposed by considerations of fungibility. Non scale-free resources instead, like facilities and human capital (Capron, 1999; Helfat & Eisenhardt, 2004), are subject to both fungibility and scarcity constraints. Therefore, their allocation to one productive use inevitably involves the comparison with the opportunity cost of all potential alternatives.

By explicitly taking into account the role of non scale-free resources in their formal analysis of diversification, Levinthal and Wu (2010) are able to demonstrate how profitmaximizing decisions might involve trade-offs between the performances of the BUs of a diversified firm. In fact, if diversifying firms internally transfer non scale-free resources from their existing BUs to the new operating product-market, it is likely that the performance of the existing BUs will be negatively affected despite the overall profitability gain. Wu (2013) confirms the relationship empirically as he finds that, for firms operating in the cardiovascular medical device industry, diversification decreases the performance in the original product-market while it increases the performance of the firm considered as a whole.

Both studies demonstrated the potential of applying an opportunity cost logic to the study of the reasons and effects of diversification moves. Our paper aims at extending their analyses further. In particular, our paper differs from Levinthal and Wu (2010) in that we address the question of how diversified firms allocate non scale-free resources to their BUs once they are diversified. Moreover, our study also differs from Wu (2013) in that we aim at directly capturing resource reallocation, while his study infers resource reallocation by the effect of diversification on performance.

We argue that studying the allocation process of scarce resource in diversified firms is important for two reasons. First, understanding whether resource allocation is consistent with an opportunity cost logic is a direct test of efficiency. Considering the mixed results obtained by studies on the diversification-performance linkage (Berger & Ofek, 1995; Santaló & Becerra, 2008; Villalonga, 2004), and the important role that resource allocation plays in value creation (Williamson, 1975), we argue that a closer look to the resource allocation process might help clarifying the contingencies in which diversification creates and destroys value. Second, the allocation of non scale-free resource in diversified firms has important competitive implications. Due to the finite nature of these inputs, an increase in allocation to one BU inevitably means a decrease in allocation to the rest of the BUs of the firm. This is susceptible to have consequences not only for the performance of the single BUs of the firm

(Levinthal & Wu, 2010; Wu, 2013), but also for overall level of competitive intensity of the firm's operating industries (Smith, Ferrier, & Ndofor, 2001).

If we assume that in equilibrium companies have resources allocated to their most productive uses, to address our research question we need to look at events that change the value of using resources in their different applications. For this purpose, in this paper we focus on exogenous increase in competition in the operating environment of one of the BUs of a diversified firm. We choose to study the effect of competition on resource allocation because the RBV recognizes the external environment as the main determinant of the value of a firm's resources (Amit & Schoemaker, 1993; Miller & Shamsie, 1996; Penrose, 1959; Teece, 1982). Competition, on the other hand, is a primary feature characterizing a firm's external environment (Porter, 1981). Therefore changes in competition are susceptible of changing the opportunity cost of using that part of a firm's resources that is fungible and scarce.

We argue that an increase in competition in the operating product-market of one of the BUs of a diversified firm should cause a reallocation of non scale-free fungible resources in favor of the affected BU. This might sound counterintuitive at first, considering that we are talking about fungible resources and that competition reduces the profitability of making investment in an industry (Xu, 2012). However, we have to keep in mind that we are not approaching the decision from the point of view of a firm deciding whether to enter in an industry or not, but from the point of view of a firm that has already invested in the industry. The difference is important as we expect diversified firms to own specialized assets that can neither be reallocated internally nor be sold on the market (Rumelt, 1982). The opportunity cost of these assets is equal to zero. Therefore, if competition causes the firm to underexploit these assets, the value generated by the unexploited capacity would be entirely lost. On the other hand, theory suggests that access to non scale-free fungible resources is of great strategic importance in confronting environmental changes as it allows the BU to alter current capabilities and create new ones (Sirmon, Hitt, & Ireland, 2007). Empirical evidence confirms this view as it shows that non-scale free fungible resources are associated with market share gains at the expenses of rivals after an increase in competition (Frésard, 2010)

While the above argument provides a rationale for why on average we expect to observe reallocation in favor of the BU subject to the increase in competition, reasoning in terms of opportunity cost inevitably involves a comparison between the different alternatives to which resources can be allocated. In the case of a diversified firm this means comparing the BU subject to the increase in competition to the rest of the BUs of the firm. Broadly speaking we argue that there are three categories of factors influencing resource reallocation: (1) Factors affecting the value of using non scale-free resources in different applications, (2) factors constraining the ability of the firm to release non scale-free resources, (3) commonalities that decrease the need for resource reallocation in confronting competition. We examine one element of each category. In particular, we argue that the resource management ability of the BU subject to the increase in competition, compared to that of the rest of the BUs of the firm is a positive moderator of resources reallocation. On the contrary, we expect both the relative size of the BU and the extent to which it shares the same scale-free resources with the rest of the BUs of the firm to moderate the relationship negatively.

In our empirical analysis we test these prediction through a two-samples difference-in-difference design that tests the effect of import tariff cuts on the allocation of financial resources. Import tariff cuts, due to their exogeneity with regards to firm's strategy, are a measure of competition that has been widely used in previous studies (e.g. Flammer, 2015; Frésard, 2010; Valta, 2012). We choose to look at financial capital reallocation because of the extreme fungibility of this type of non scale-free resource across product-markets.

Results from the analyses fully support our predictions about the main effect of competition and about the interaction of competition with resources management ability and relative size. For what concerns the predicted negative moderation of scale-free resource relatedness on resource reallocation, our baseline analysis fails to find full evidence to support the hypothesis. However, additional analyses included in the paper suggest that the relationship might be contingent on the effect that competition has on the value of the scale-free resource that is considered the basis for relatedness.

By addressing the effect of competition on resource allocation we believe that our study makes an important contribution to the strategic management literature. In fact, despite the key role that theory attributes to resource allocation (Williamson, 1975) in the determination of the competitive advantage of diversified firms, empirical evidence about how resource allocation works in reality is surprising scarce. We argue that our findings that resource allocation follows a direction consistent with our hypotheses based on opportunity cost is by itself evidence that resource allocation in diversified firms is to some extent efficient. In additional analyses included in the paper we also test whether resources reallocation in presence of a tariff cut has a positive effect on performance. While a thorough analysis of the association between resources allocation and performance is beyond the scope of this paper, the evidence that we obtain from the analyses on the firm's Market-to-Book value is consistent with this idea.

HYPOTHESES

This paper studies the effect of competitive shocks on the allocation of non scale-free resources (Levinthal & Wu, 2010; Wu, 2013) in diversified firms. Non scale-free resources are all those resources that have an opportunity cost determined by their most profitable application outside of the current use. Despite the focus on internal resources, the RBV literature has for long acknowledged that the value of resources is exogenously determined by market conditions (Amit & Schoemaker, 1993; Miller & Shamsie, 1996; Penrose, 1959; Teece, 1982). Competition is one of the exogenous factors that has been shown to significantly affect the value of resources and capabilities (e.g. Arrfelt, Wiseman, Mcnamara, & Hult, 2015). Here we argue that an increase in competition significantly changes the opportunity cost associated with non scale-free resources. This, in turn, triggers a redistribution of non scale-free resources between the BUs of the firm.

In principle, an increase in competition in one of the BUs of a diversified firm can induce the firm to take one of two decisions: Defend or Divest (Aghion & Griffith, 2008). If the firm decides to defend its BU from competition it will have to allocate new resources to confront competitors. On the contrary, if the firm decides to divest, it will have to reallocate the resources that are currently invested in the BU to new productive opportunities. In this paper we argue that firms on average should choose to defend the BUs subject to an increase in competition and therefore we expect to observe a reallocation of non scale-free fungible resources in its favor.

Considering that competition decreases the profit margin obtained by making investments in an industry (Xu, 2012) this might seem counterintuitive. However, we have to keep in mind that diversified firms approach the decision from the point of view of someone that has already invested in the industry. Under these conditions, equating the average profitability of an industry to the profits that can be obtained by investing non scale-free resources in the industry is misleading, as the firm needs to maximize also the profitability of all the resources that are already invested in the business affected by competition (Levinthal & Wu, 2010).

In particular there are resources that, due to their high level of specificity (Williamson, 1981), can generate value only if applied to the particular product-market in which they were meant to be exploited. The opportunity cost of these resources is equal to zero as they can neither be reallocated internally nor sold on the market. Competition, unless confronted, is susceptible of increasing the unexploited capacity of these resources and consequently the value that this capacity generates would be entirely lost.

The presence of assets that are valueless outside of the business affected by competition should therefore play a critical role in the decision between defending and divesting. Here we argue that if diversified firms own assets of this type. In fact, according to Rumelt (1982) product diversification should take place only if the firm owns what he calls *core factors* of production. Core factors are resources that: (1) are indivisible or provide increasing returns the larger the scale of their utilization, (2) are subject to high transaction cost, and (3) cannot be fully exploited in any single product-market. All these conditions have to be met for diversification to take place. In the absence of scale returns there would be no gain in expanded use. Without high transaction cost the resource could be acquired on the market at its marginal cost. Finally, if the firm could fully exploit the resource in a single product-market there would be no need to resort to diversification to increase input utilization.

The existence of core factors and in general of resources with a high degree of specificity provides a rationale for firms to defend a BU despite the decline in profitability caused by competition. Empirical research also supports this view as it shows that after increases in competition firms, instead of looking for other applications for their assets, pursue strategies aimed at decreasing competitive pressure (Aghion, Bloom, Blundell, Griffith, & Howitt, 2005; Fernández-Kranz & Santaló, 2010; Flammer, 2015; Pierce & Schott, 2012).

Non scale-free resources, like financial capital and employees, play a key role in allowing a BU to pursue these defensive strategies. Theory suggest that the value of non scale-free fungible resources increases with the level of environmental turbulence (Sirmon et al., 2007). Access to non scale-free resources grants to the BU a greater degree of strategic flexibility while it tries new combination of resource and invests in those resources that are more valuable in confronting competitors. In fact, firms that do have access to non scale-free resources are able to obtain market share gains at the expenses of rivals after an increase in competition (Frésard, 2010).

As a consequence of this discussion we argue that competition increases the importance of access to non scale-free fungible resources. Considering the finite nature of these inputs we then expect firms to reallocate them in favor of the BU experiencing the increase in competitive pressure. Therefore:

H1a: A Business Unit will be allocated more non scale-free fungible resources after an increase in competition in its operating product-market

H1b: A Business Unit will be allocated fewer non scale-free fungible resources after an increase in competition in the operating product-market of one of the other BUs of the firm

While we expect competition to influence reallocation in the way predicted by hypothesis 1, several factors are susceptible of changing both the magnitude and the sign of the relationship. In particular, these factors can be broadly classified into three categories: Factors affecting the value-in-use of resources and their opportunity cost, factors affecting the ability of the firm to release non scale-free resources, and commonalities that decrease the need for reallocation in pursuing the a defensive strategy. In the next sections we consider one moderator pertaining to each category.

Resource management ability

In the previous section we made a case for why firms should choose to defend a BU experiencing an increase in competition by investing more resources in it. We have argued that competition increases the value of non scale-free fungible resources, as the BU subject to it needs to make investments and experiment with new combination of resources in order to preserve profitability (Sirmon et al., 2007). However, this line of reasoning assumes that the BU subject to the increase in competition will be capable of accommodating changes in the external environment by rethinking the way it produces value. Access to non scale-free resources in fact, is only valuable to the extent that the BU knows how handle the environmental uncertainty produced by the increase in competition.

Here we argue that the resource management ability of the BU subject to the increase in competition and how it compares with that of the rest of the BUs of the firm, is a determinant of the expected value of non-scale free resources and consequently of resource reallocation. According to Teece et al. (1997) and to Sirmon et al. (2007) value capture is more a matter of resource management than of resource endowment. To capture value BUs have to organize their resource portfolio, bundle valuable resources to build capabilities, and use those capabilities to exploit market opportunities. The importance of resource management ability increases with the overall amount of environment turmoil because the optimal solution becomes less visible and the BU needs to experiment with multiple combinations of resources. Competition increases the overall level of environmental turmoil and therefore also increases the value of resource allocation ability (Arrfelt et al., 2015). Therefore, we expect non scale-free resource reallocation to be a function of resource reallocation ability. Formally:

H2a: The better the relative resource allocation ability of the Business Unit subject to the increase in competition the larger the increase in resource allocation to it

H2b: The better the relative resource allocation ability of the Business Unit subject to the increase in competition the larger the decrease in resource allocation to the rest of the BUs of the firm

Relative size

Internal resource reallocation can be a very effective mean of providing a BU with the resources that it needs to confront competitors. Compared to acquiring resources on external strategic factor markets (Barney, 1986), internal resource reallocation is both more timely (Khanna & Tice, 2001) and suffers from less asymmetry of information (Myers & Majluf, 1984). Both types of advantages are very important when confronting increased competition. Research shows that reaction timing is for market leaders a fundamental factor in preventing dethronement by competitors (Ferrier, Smith, & Grimm, 1999). Moreover, competition increases the uncertainty surrounding firm performance thereby increasing the cost of acquiring resources on external strategic factor markets (Valta, 2012).

Despite these advantages, the ability of a firm to reallocate resources across its BUs can be constrained by multiple factors, both internal, like the physical distance between BUs, and external, like legislation. Here we argue that the relative size of the BU subject to the increase in competition in comparison to the total size of the firm is one of such factor. This is essentially for two reasons. First, the investments a BU will have to make when confronting competition are likely dependent on its size. Non scale-free fungible resources like financial capital and employees are often used to invest in industry specific assets like patents and plants. Some of these assets are indivisible; therefore reallocation is useful only to the extent that the firm is able to release a critical mass of resources from the rest of its BUs. Relative size negatively affects this ability simply because the rest of the BUs neither have enough disposable resource allocated nor are able to generate them. Second, following a classical economics argument (e.g. Alchian & Demsetz, 1972), we expect the marginal value of one extra unit of non scale-free resources to decrease with size. For example, one employee does not have the same value for a firm with a total workforce thirty and for a firm with a total workforce of three thousands. This means that, if a BU is big in comparison to the rest of the

BUs, then the value of the reallocation of small amounts of non scale-free resource will likely be smaller than the opportunity cost. Therefore, as a consequence of this discussion we expect the following:

H3a: The bigger the relative size of the Business Unit subject to the increase in competition the smaller the increase in resource allocation to it

H3b: The bigger the relative size of the Business Unit subject to the increase in competition the smaller the decrease in resource allocation to the rest of the BUs of the firm

Scale-free resource relatedness

Up to this point we have conceived resource allocation in diversified firm as a zero-sum game. To defend the profitability and market share of the BU subject to the increase in competition the firm has to allocate non scale-free fungible resources to it. These resources will be used by the BU to implement strategies aimed at decreasing competitive pressure (Aghion et al., 2005; Fernández-Kranz & Santaló, 2010; Flammer, 2015; Pierce & Schott, 2012). Given the finite nature of non scale-free resources, an increased allocation for defensive purposes to the BU subject to the increase in competition necessarily means a decreased allocation for the rest of the BUs of the firm.

However, there are factors that allow the firm to pursue a defensive strategy while at the same time reducing the need for resource reallocation in pursuing it. Scale-free resource relatedness is one of such factors. We define scale-free resource relatedness as the extent to which the BU subject to the increase in competition shares the same scale-free resources with the rest of the BUs of the firm. Scale-free resource relatedness allows the firm to obtain what Sakhartov and Folta (2014) call intra-temporal economies of scope. Intra-temporal economies of scope stem from the contemporaneous sharing of productive inputs, which is possible only if the productive inputs under consideration have unlimited capacity.

If to defend the BU subject to the increase in competition the firm invests in scale-free resources that are shared across BUs it might be able to decrease the zero-sum nature of the defensive decision and produce positive externalities enjoyed also by the rest of the BUs of the firm. Let's consider the example of brand relatedness and assume that the BU subject to the increase in competition has its own line of products but shares the same umbrella brand with the rest of the BUs of the firm while it. Two things can happen. If marketing is a corporate level function than the firm will increase its investment in advertising centrally and no reallocation of non scale-free resources will take place. If instead marketing is a BU level function the need for reallocation of non scale-free resources will be decreased. In fact, in virtue of the positive externalities produced by the investment in advertising of the rest of the BUs, the firm will have to have to reallocate a smaller amount of non scale-free resources to the BU just to promote its specific line of products.

As a consequence of this discussion we argue that scale-free resource relatedness decreases the need for reallocation after an increase in competition. Therefore we predict the following:

H4a: The higher the degree of scale-free resource relatedness of the Business Unit subject to the increase in competition the smaller the increase in resource allocation to it

H4b: The higher the degree of scale-free resource relatedness of the Business Unit subject to the increase in competition the smaller the decrease in resource allocation to the rest of the BUs of the firm

DATA & METHODOLOGY

Data sources

Competition data

We use the import tariff data compiled by Feenstra (1996), Feenstra, Romalis and Schott (2002), and Schott (2010) to capture variations in the intensity of foreign competition faced by U.S. domestic firm. Each product category imported in the U.S. is identified through a ten-digit HS code (Harmonized System) as defined by the World Custom Organization (WCO). Feenstra (1996) and Schott (2010) develop mappings that allow for the aggregation of HS product data into four-digit SIC codes (Standard Industry Classification), this is our definition of industry. The resulting data is available for the period 1974–2005 only for the manufacturing SIC (SIC 2000–3999), therefore our analysis is restricted to manufacturing business units. There are originally 507 industries in the database; in 482 of these are operating diversified firms included in the COMPUSTAT Segment database.

For each of industry–year we calculate the *ad-valorem* tariff rate as the ratio between the duties collected by U.S. customs and the Free-on-Board value of imports. Tariff rates tend to fluctuate from year to year. However, the average tariff change is typically small and not economically significant (Flammer, 2015). To distinguish minor tariffs fluctuation from important tariff reductions, we compare the tariff change, as calculated for a given industry-year, with the average tariff change for the same industry calculated on the whole sample period. Specifically, we follow Frésard (2010), Frésard and Valta (2015), and Flammer (2015), and consider a negative tariff change as a tariff cut only if it exceeds by three times the average tariff variation for its industry. We ignore the tariff variations occurred between 1988 and 1989 because of a change in the coding of the imports. To ensure that what we are observing are not transitory tariff fluctuations, we further require that the tariff cuts are not preceded or followed by equivalently large tariff increases. Finally, to make sure that the identified events have some economic significance, we require the tariff rate in the year before the tariff cut to be at least one percent.

We are interested only in those events starting from 1977, as the COMPUSTAT Segment database starts in 1976 and as we require at least one year of data prior to the tariff cut. The application of these criteria produce 214 tariffs cut events, the first occurring in 1977 and the last occurring in 2005. These events pertain to 170 unique industries. Figure 1 shows that the events occur over the entire duration of the sample period. This characteristic helps to ensure that our results are not driven by time-specific confounding factors such as the economic cycle. From Figure 1 is possible to identify two large waves of trade liberalization. The first took place in the period between 1980 and 1982 and it is the direct result of the ratification of the General Agreement on Tariffs and Trade (GATT) Tokyo round, and of the implementation of the U.S. Trade Agreement Act (TAA) in 1979. The second wave occurred in the early nineties and it is produced by the ratification of the Free Trade Agreement (FTA) between the U.S. and Canada in 1989, followed by the ratification of the North American Free Trade Agreement (NAFTA) between the U.S., Canada, and Mexico in 1994. On average the tariff cuts represent a 41% reduction of the tariff rate, from an average tariff rate of 6.7% in the year prior to the event to an average tariff rate of 4.2% in the year after the event.

Insert Figure 1 about here

Firm and BU data

We obtain firm- and BU-level financial and accounting data from the Standard & Poor's COMPUSTAT database. To compute our measure of scale-free resource relatedness we use the National Bureau of Economic Research (NBER) patent database (Hall, Jaffe, & Trajtenberg, 2001). The NBER patent database covers the period 1976-2006. It contains detailed information about the patents granted to firms by the U.S. Patent and Trademark

Office (USPTO), the type of technology contained in the patents (patent class) and the changes in the ownership of the patents through time.

Methodology

To evaluate the effect of competition on the redistribution of non scale-free resources within a diversified firm we adopt a difference-in-difference design based on the 214 tariff cuts already identified.

We form two samples, each composed by treated and control BUs. In the first sample, which we term "*Competition Increase sample*", we consider as treated observations all those BUs operating in an industry that is undergoing a tariff cut. In the second sample instead, which we term "*Competition Spillover sample*", we consider as treated observations those BUs belonging to a diversified firm that is experiencing a tariff cut in one of its businesses, but that are not directly affected by a tariff cut in their industry. We match the treated observations in both samples with corresponding control BUs belonging to conglomerate firms that are not experiencing a tariff cut. Our treatment variable, Tariff Cut, is a dummy variable that takes the value of 1 when, depending on the analysis, either the firm or the BU is experiencing a tariff cut while it takes a value of 0 otherwise.

The purpose of this design is to corroborate the evidence obtained from the analysis on the Competition Increase sample with specular evidence obtained from the analysis on the Competition Spillover sample. In fact, in order for us to claim that what we are observing is a reallocation of resources, an increase in allocation to the BU subject to the tariff cut needs to be matched by a corresponding decrease in allocation to the rest of the BUs of the firm. Note that this design is particularly strict in terms of rejecting the null hypothesis. Each of our hypotheses about resource reallocation has to be tested twice in two different samples and significance has to be obtained in both the analyses. This dramatically reduces the probability of incurring in type I error way beyond the significance level of each coefficient.

Dependent Variable

For our empirical analysis we evaluate the effect of tariff cuts on the allocation of financial resources. We chose to study financial capital reallocation due to the extreme fungibility of this type of non scale-free resource across product-markets.

A tariff cut in the operating product-market of BU can have serious repercussions on its level of sales and profitability of in. Considering that likely the level of spending of a BU partially depends on its level of financial resource generation, in this paper we focus on the difference between these two elements to capture resource reallocation. In fact, just by keeping its level of investment in a BU constant despite declining sales, a firm will be left with fewer resources to allocate to the rest of its operating sectors.

We follow Billet & Mauer (2003) in the calculation of our dependent variable, Resource Allocation. In particular, Resource Allocation is defined as the difference between a BU capital expenditure and its own After-Tax Cash Flow (ATCF). Therefore, for every given sample year, we calculate Resource Allocation for BU *i* of firm *j* in year *t* as:

$$R.Allocation_{i,t} = CAPEX_{i,t} - ATCF_{i,t}$$

Where $CAPEX_{i,t}$ and $ATCF_{i,t}$ are respectively BU *i*'s reported capital expenditure and BU *i*'s after-tax cash flow in year *t*. $ATCF_{i,t}$ is calculated as follows:

$$ATCF_{i,t} = (EBIT_{i,t} - I_{i,t})(1 - T_{i,t}) + D_{i,t}$$

Where $EBIT_{i,t}$ is BU i's reported earnings before interest and taxes, $D_{i,t}$ is BU i's reported depreciation and amortization expense and, $I_{i,t}$ and $T_{i,t}$ are respectively BU i's imputed interest expense and BU i's imputed tax rate[1].

More then on the total value of Resource Allocation, we are interested in the change in Resource Allocation caused by competition. Therefore, for each treated and control BUs we compute the difference between the average Resource Allocation after the treatment minus the average Resource Allocation before the treatment. We follow Flammer (2015) in using a widow of three years for the calculation of the averages. Finally, to reduce the influence of outliers, we deflate the difference by the total segment assets calculated as the average in the three years before the treatment. Therefore, our final dependent variable is calculated as follows:

$$\Delta R.Allocation_{i,t} = \left(\sum_{x=t+1}^{t+3} \frac{R.Allocation_{i,x}}{3} - \sum\nolimits_{x=t-1}^{t-3} \frac{R.Allocation_{i,x}}{3}\right) / \sum\nolimits_{x=t-1}^{t-3} \frac{BUassets_{i,x}}{3}$$

Independent Variables

Besides from our tariff cut dummy, we include three independent variables in our study: Size, Resource Management Ability and Scale-Free Resource Relatedness.

We capture the relative size of a BU as the ratio of BU sale to total firm sales.

We capture the relative resource management ability of BU i's, in comparison with that of the rest of the BUs of the firm, through the difference between BU i's ROA and the weighted average ROA of the rest of the BUs of firm j (Billett & Mauer, 2003). While ROA

[1] The imputed interest expense, $I_{i,t}$, is calculated as the product of BU i's reported sales and the median ratio of interest expense to sales calculated on all the focused firms operating in business unit i's industry. The imputed tax rate, $T_{i,t}$, is represented by the median ratio of income taxes due to pre-tax income calculated on all the focused firms operating in BU i's industry. We define business unit i industry as the narrowest SIC grouping returning at least five focused firms (Billett & Mauer, 2003).

is a measure of profitability, theory suggests that value capture is more a matter of resource management than of resource endowment (Sirmon et al., 2007; Teece et al., 1997). Consistent with this view, we assume that the difference in profitability across BUs of the same firm is largely determined by variations in the level of resource management ability.

We calculate ROA as the ratio between a BU's EBIT and its reported total assets. Our measure of relative resource management ability is then computed as follows:

$$ROAdiff_{i,t} = ROA_{i,t} - \sum_{\substack{a=1 \\ a \neq i}}^{N} ROA_{a,t} * \frac{BUassets_{a,t}}{Fassets_{j,t} - BUassets_{i,t}}$$

Where N is the number of segments in which the firm j is operating, $BUassets_{a,t}$ and $BUassets_{i,t}$ are respectively the total assets reported by BU a and the total assets reported by BU i, and $Fassets_{j,t}$ is the total assets reported by firm j to which all the BUs belong.

We capture scale-free resource relatedness through a measure of technological relatedness. In particular, we measure the level of technological relatedness of BU i's based on the total amount of cross-citation between patents granted to companies operating in sector i and patent granted to companies active in the rest of the operating product-markets of the focus firm. As a fist step, we attribute to every patent in the NBER database a four-digits SIC code using the operating-sector of the patent owner as reported in COMPUSTAT[2]. Next, we compute a three-years rolling sum of the total amount of cross-citation between each industry pair. We assume that, the more the patents assigned to companies operating in two different four-digits SIC codes cite each other, the more the two industries are technologically related. The calculation is the following:

[2] If a patent has multiple owners we divide equally the weight of the patent between the operating sectors of the owners. If a patent belongs to a diversified firm we divide the weight of the patent proportionally between the operating sectors of the firm by segment sales.

$$CrossCit_{A,B,t} = \sum_{t-3}^{t-1} C_{A \to B} + C_{B \to A}$$

Where "$CrossCit_{A,B,t}$" is the total amount of cross-citation between the Sector "A" – Sector "B" pair as calculated in year "t", "$C_{A \to B}$" is the total number of times that patents granted in a given year to companies operating in the SIC sector "A" cite patents granted to companies operating in the SIC sector "B", and "$C_{B \to A}$" is the opposite.

Next, having estimated the level of the relatedness of each four-digits SIC pair, we calculate the level of relatedness of BU *i* by doing a weighted average by segment sales of the cross-citation between operating sector *i* and the rest of the operating sector of the firm. We take the natural logarithm of the resulting measure to reduce the influence of outliers. Therefore:

$$Tech.Relatedness_{i,t} = \ln \sum_{\substack{Y=1 \\ Y \neq i}}^{N} CrossCit_{i,Y,t} * \frac{s_{i,Y,t}}{\sum_{\substack{X=1 \\ X \neq i}}^{N} s_{i,X,t}}$$

Were $Tech.Relatedness_{i,t}$ is the estimate of BU *i*'s technological relatedness in year *t*, *N* are the sectors in which the diversified firm to which BU *i* belongs is operating, and $s_{i,Y,t}$ ($s_{i,X,t}$) is the sum of sales of operating segment *i* and operating segment *Y* (*X*) in year *t*. This measure is intended to capture the extent to which BU *i* share a common technological base with the rest of the BUs of the firm.

We calculate our independent variables on the timespan between t-1 and t-3, where t is the year of the treatment. Size and ROAdiff are averages; Technological Relatedness instead is based on the total cross-citation between patents granted by the USPTO in the same timespan.

Matching

We match each treated observation in our two samples with a control observation based on the year and based on a set of industry, firm and BU characteristics. First, we require each control observation to operate in an industry similar to that of its corresponding treated observation. The fact that our treatments are defined at the four-digits SIC level, prevents us from matching observations based on the narrowest definition of industry. Instead, we require matched observations to operate in the same two-digits SIC industry and to serve primarily the same type of customers (Business-to-Business vs Business-to-Consumer). We rely on Sharpe (Sharpe, 1982) and Lev et al. (Lev, Petrovits, & Radhakrishnan, 2010) for the partition of SIC industries according to the primary type of customer that they serve. This approach addresses two potential concerns. On one side, we need treated and matched observations to operate in industries with similar logic and similar dynamics. On the other side however, we also need to keep our pool of potential matches sufficiently large for us to select an observation based on firm and BU characteristics. Requiring control BUs to operate in the same three-digits SIC sector of the treated BU would likely affect our ability to fulfill the second requirement.

Next, out of the remaining pool of candidates, we pick the closest neighbor based on a set on firm and BU characteristics: firm's size, firm's cash, firm's number of segments, firm's leverage, BU's resource allocation, BU's size[3]. All the characteristics are measured as average in the three years before the treatment. The closest neighbor is selected based on the Mahalanobis distance calculated on the six matching characteristics[4]. We follow Flammer

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[3] We measure all these characteristics using data coming from COMPUSTAT. BU's resource allocation is the value of resource allocationover segment assets; both BU size and firm size are calculated as the log of sales; firm cash is the log of cash and short-term investments; firm leverage is the ratio of debt over total assets; number of segments is simply the count of firm segments.

[4] We avoid the same control observations to be selected multiple times using a randomization procedure. For each treated observation we calculate its three nearest neighbors using the "mahapick" command in Stata 12. Whenever the closest match is selected multiple times for different treated observations we randomize between these in order to choose which observation is going to be assigned its second closest match. The command that we use is "mahaselectunique" in Stata 12.

(2015) in requiring that treated and match observations have at least available data in the year before and the year after the treatment for them to be included in the sample.

We selected the matching variables based on their likelihood to influence the level of resource allocation received by a BU. In particular, matching observation on the pre-treatment value of resource allocation reduces the noise due to the correlation of the dependent variable with its own lagged values. Matching on the number of segments makes sure that the firms have a similar number of BUs competing for resources. Firm size and BU size influence the ability of the firm to considerably change the level of investment in the BU. Firm cash and firm leverage, capture the ability of the firm of using internal liquidity or additional debt to increase resource allocation to a BU.

Insert Table 1 about here

The application of these criteria produces a Competition Increase sample with a total of 1598 observations (799 treated BUs and 799 control BUs), and a Competition Spillover sample with a total of 2494 observations (1247 treated BUs and 1247 control BUs). Table 1 reports descriptive statistics about the matching variables and the control variables for both samples and for each group of treated and control BUs. In particular, the table reports the mean value, the median value and the value of the 25th and 75th percentile for the treatment and control groups. As is possible to see, in the two samples treated and control observations are very similar to each other, both in the mean and in the distribution, further confirming the validity of the matching procedure. We argue that similarity along these dimensions ensures that the control BUs are representative of what would have happen to our dependent variable in the absence of an import tariff cut. Figure 2 is a graphic depiction of trend in average resource allocation in the years between t-3 and t+3, where t is the year of the tariff cut, for both samples and for both the treatment and control groups. As is possible to see, the treatment and control groups had similar trends in both samples in the years between t-3 and t-1 further confirming the validity of our matching procedure. The sudden variation occurred in both samples between t-1 and t+1 instead, is evidence that the economic impact of the tariff cut is concentrated around the years immediately before and immediately after the treatment.

Insert Figure 2 about here

Estimation

To measure the effect of a tariff cut on the level of resource allocation received by those BUs that are affected by it we estimate the following regression on the Competition Increase sample:

$$\begin{aligned}\Delta R.Allocation_{i,t} &= \alpha_t + \beta_1 \times T.Cut_{i,t} + \beta_2 \times ROAdiff_{i,t} + \beta_3 \times Rel.Size_{i,t} \\ &+ \beta_4 \times Tech.Relatedness_{i,t} + \beta_5 \times T.Cut_{i,t} \times ROAdiff_{i,t} \\ &+ \beta_6 \times T.Cut_{i,t} \times Rel.Size_{i,t} + \beta_7 \times T.Cut_{i,t} \times Tech.Relatedness_{i,t} + \gamma' X_{i,t} \\ &+ \epsilon_{i,t}\end{aligned}$$

Where α_t are year fixed effects, *T. Cut* is our treatment dummy variable equal to one if the observation belongs to the treatment sample and to zero if it belongs to the control sample, *ROAdiff*, *Rel. Size* and *Tech. Relatedness* are our three independent variables calculated as described above, *X* is a vector of control variables which includes five of the six characteristics used for the matching (firm's size, firm's cash, firm's number of segments, firm's leverage and BU's size, we exclude BU's resource allocation because the depended variable is the difference between the period after and the period before the tariff cut) and ϵ is the error term.

To measure the effect of a tariff cut on the level of resource allocation received by those BUs that are not directly affected by it we estimate the following regression on the Competition Spillover sample:

$$\Delta R.Allocation_{i,t} = \alpha_t + \beta_1 \times T.Cut_{i,t} + \beta_2 \times ROAdiff\ BUTC_{i,t} + \beta_3 \times Rel.Size\ BUTC_{i,t} + \beta_4 \times Tech.Relatedness\ BUTC_{i,t} + \gamma' \mathrm{X}_{i,t} + \epsilon_{i,t}$$

Where *ROAdiff BUTC*, *Rel. Size BUTC* and *Tech. Relatedness BUTC* are defined for treated observations as the values of ROAdiff, Rel. Size and Tech. Relatedness of the BU that is affected by the tariff cut while they take a value of zero for the control group. This is because control observations are selected from firms that are not experiencing a tariff cut. A natural consequence of this is that any interaction between the three independent variables and the tariff cut dummy would be perfectly collinear with the independent variable. In this set up the main effect of the three independent variables already constitutes the test of the hypothesis.

We cluster standard errors at the two-digits SIC industry level. The coefficients of interest are β_1, β_2, β_3 and β_4. We expect them to take opposite signs in the Competition Increase sample and in the Competition Spillover sample if an increase in foreign competition triggers an exchange of resources.

Insert Tables 2A & 2B about here

RESULTS

The main results are presented in table 2A and table 2B. Table 2A reports the results from the tests of hypotheses on the Competition Increase sample; table 2B reports the results from the tests of hypotheses on the Competition Spillover sample. In all regressions, the dependent variable is the change in total resource allocation three years after compared to three years before the treatment deflated by segment assets. Each table contains fifteen models. From model 1 to model 5 the regressions include only the tariff cut dummy, the independent variables and the interactions between the independent variables and the tariff cut dummy when needed. From model 6 to model 10 we include year fixed effects. Finally, from model 11 to model 15 we also include firm and BU level controls (firm's size, firm's cash, firm's number of segments, firm's leverage, BU's size, all measured as average in the three years before the treatment). All the regressions have clustered standard errors at the two-digits SIC level.

As it can be seen the models in table 2B do not include interactions. This is because hypotheses 2b, 3b and 4b are about how the characteristic of the BU experiencing the tariff cut influence the level of resource allocation in those BUs that are not directly affected by it. Therefore, ROAdiff BUTC, Tech Relatedness BUTC and Size BUTC are for treated observation not their own values of ROAdiff, Tech. Relatedness and Size, but those of the BU of the firm that is undergoing a tariff cut in its operating product-market. Considering that control observations are selected from firms that do not experience any tariff cut, for the control group we set the corresponding value of the independent variables to zero. As a result, the estimated coefficients on those variables already constitute the test of the hypotheses and any interaction with the treatment dummy would be perfectly collinear.

Hypotheses 1a and 1b state that an increase in competition in one of the operating product-markets of a diversified firm causes a redistribution of resources toward the BU operating in the sector affected by it. The results from the estimation fully support the hypotheses. The coefficient of the tariff cut dummy at the BU level is always positive and significant in the analyses reported in table 2A. Instead, the coefficient of the tariff cut dummy at the firm level is always negative and significant in the analyses reported in table 2B. Both coefficients are extremely stable and do not look particularly affected by the inclusion of control variables and year fixed-effects. In particular, in the analyses on the Competition Increase sample, the coefficient lies between 0.031 ($p\text{-value} < 0.05$) in the model including only the tariff cut dummy, and 0.057 ($p\text{-value} < 0.1$) in the model including all the independent variables and interactions. In the analyses on the Competition Spillover sample instead, the coefficient lies between -0.016 ($p\text{-value} < 0.1$) in the model including only the tariff cut dummy, and -0.069 ($p\text{-value} < 0.01$) in the model including all the independent variables and interactions. If we consider only the models with just the main effects, this implies that on average diversified firms increase their allocation of resources to the BU directly affected by a tariff cut by 3.1% of its average segment assets. On the contrary, diversified firm correspondingly decrease the allocation of resource to the rest of the operating BUs by 1.6% of their average segment assets. As it can be seen, the reduction in subsidies in the BUs not affected by the tariff cut is less then the corresponding increase in subsidies in the BUs affected by it. This can be logically expected. Many firms have more then two BUs and as a consequence they can spread the burden of financing across more than one unit.

Hypotheses 2a and 2b state that the relative resource management ability of the BU experiencing a tariff cut in its operating product-market positively moderates the redistribution of resources toward it. The results support the hypotheses. The coefficient the interaction between the tariff cut dummy and ROAdiff in table 2A is positive and significant, both when tested alone and when tested in the full model including the other independent variables and interactions. Correspondingly, the coefficient of ROAdiff BUTC in table 2B is negative and significant in all models. Both coefficients are stable and their magnitude and significance are not particularly affected by the inclusion of control variables and year fixed effects. In particular, considering only the models including control variables and year fixed-effects, the coefficient of the interaction between ROAdiff and tariff cut ranges between 0.201 (p-value < 0.01) and 0.208 (p-value < 0.01). The coefficient of ROAdiff BUTC instead, ranges between -0.120 (p-value < 0.01) and -0.126 (p-value < 0.01). To put things into perspective, this means that if the BU experiencing the tariff cut has an average ROA that exceeds by 0.1 the average ROA of the rest of the BUs of the firm, this further increases resource allocation by 2.1% of segment assets. Correspondingly, the rest of the BUs of the firm experience a further decrease in resource allocation of 1.3% of segment asset.

Hypotheses 3a and 3b state that the relative size of the BU experiencing the increase in competition in its operating product-market, negatively moderates the redistribution of resources toward it. The results support the hypotheses. The coefficient of the interaction between the tariff cut dummy and Size in table 2A is always negative, even though it is significant only in the full models including all the interactions. The coefficient of Size BUTC in table 2B instead, is negative and significant in all models. In particular, in the full models including control variables and year fixed-effects, the interaction between size and the tariff cut dummy in table 2A has a coefficient of -0.122 (p-value < 0.05), while Size BUTC in table 2B has a coefficient of 0.135 (p-value < 0.05). This means that, if the BU undergoing the tariff cut represents 30% of firm sales like the median BU in the treatment group of the Competition Increase sample, resource allocation toward the BU decreases by 3.7% of segment assets. On the contrary, resource allocation toward the rest of the BUs of the firm increases by 4.1% of segment assets.

Hypotheses 4a and 4b state that the level of scale-free resource relatedness of the BU experiencing the increase in competition in its operating product-market negatively moderates the redistribution of resources toward it. The hypothesis in this case is only partially supported. While the coefficient of Tech. Relatedness BUTC is indeed positive and significant in table 2B (in Model 14 coefficient equal to 0.01, p-value<0.05), the coefficient of the interaction between Tech. Relatedness and the tariff cut dummy in table 2A is never significant in any of the analyses.

In the first of our complementary analyses included in the next section we explore whether these partial findings might be due to the heterogeneous impact of competition on the value of innovation.

COMPLEMENTARY ANALYSES

The effect of technological relatedness on resource reallocation depending on whether competition increases or decreases the value of innovation

In hypothesis 4 we argued that the level of scale-free resource relatedness of the BU subject to the increase in competition, is a negative moderator of the relationship between competition and resource reallocation. In our empirical test however, we have only succeeded in finding partial evidence that this is true. While the coefficient of Tech. Relatedness BUTC in table 2B is indeed positive and significant, the coefficient of the interaction between Tech. Relatedness and Tariff Cut in table 2A remains not significant.

Here we explore whether our lack of findings can be explained by the different effect that competition has on the value of innovation as a mean of differentiation. There are several possible reasons why competition may differently affect the value of innovation. As evidence of this, Aghion et al. (2005) find that the relationship between competition and innovation is an inverted U-shape. For a low starting level of competition, an increase in competitive pressure increases the investment in innovation. On the contrary, when competitive pressure is already high, a further increase in competition decreases the equilibrium level of investment in innovation. Considering that firms have several options available to achieve differentiation and reduce competitive pressure, the payoff of investing in innovation needs to be compared with that of other strategies. For example, firms could invest in advertising, in CSR, in design, or they could provide additional services attached to their products. When competition has a negative effect on the value of innovation firms will likely choose one of the other available options for differentiation. On the contrary when competition increases the value of innovation firms have further incentive for investing in it. This line of reasoning leads us to believe that the relationship predicted by hypothesis 4 might take place only when competition increases the value of innovation. If the opposite is true firms will invest into some other strategy and the predicted relationship between technological relatedness and resource allocation will not take place.

To test whether this is supported by evidence we adopt a two steps procedure. First, we separately evaluate the effect of competition on the value of innovation for every product-market. Then, we evaluate the effect of relatedness on resource reallocation depending on the whether competition increases or decreases the value of innovation.

To accomplish the first task we estimate the following regression on single-segment firms for every two-digits SIC code:

$$MktBook_{j,t} = \alpha_t + \beta_1 \times T.Cut_t + \beta_2 \times N.Patents_{j,t} + \beta_3 \times T.Cut_t \times N.Patents_{j,t} + \gamma' X_{j,t} + \epsilon_{j,t}$$

Where $MktBook_{j,t}$ is firm's j Market-to-Book value as calculated in year t, $T.Cut_t$ is a dummy variable that takes the value of one if the observation belongs to a year following the tariff cut while it takes the value of zero otherwise, $N.Patents_{j,t}$ is the logarithm of the total number of patents granted to the firm on a five years window, X is a vector of control variables (which includes the logarithm of assets, the ratio of EBIT over sales, and the ratio of CAPEX over sales), and ϵ is the error term. Each regression is estimated on a timespan of ten years (five before the tariff cut and five after the tariff cut) and it includes firm fixed-effects and clustered standard errors at the firm level. We estimate the regressions at the two-digits SIC level for two reasons. First, the sample size of each regression was in many cases too small to obtain reliable estimates at four- and three-digits SIC level. Second, estimating the effect of competition at the two-digits SIC level increases the comparability between treated and matched observation (second step).

For the purpose of our analysis we are interested in the coefficient of the interaction between tariff cut and the number of patents, β_3. If β_3 is positive, than competition increases the value of innovation as a mean of differentiation. Instead, if β_3 is negative, competition decreases the value of innovation and therefore the firm will have to leverage on other resources to differentiate from competitors.

Next, to test whether the effect of competition on the value of innovation is actually what is driving the relationship between relatedness and resource reallocation, we adopt the same difference-in-difference design that we have used this far. This time however, we split both the Competition Increase sample and the Competition Spillover sample in two depending on the effect of competition on the value of technology in the operating sector of treated observations. The fact that we have estimated the effect of competition on innovation at the two-digits SIC level serves as a guarantee that relatedness would have the same effect on the resource allocation of treated and matched observations in the absence of a tariff cut. If our argument is correct, we expect the two coefficients testing the effect of technological relatedness on resource reallocation to be consistent with the predictions of hypothesis 4a and hypothesis 4b in the samples where competition increases the value of technology. On the contrary, if technology becomes less important we would expect technological relatedness not to play a significant role in resource allocation.

Insert Table 3 about here

The results from the analysis are reported in Table 3. As it is possible to see the coefficients of model 2 and model 4 conform to the expectations of hypothesis 4. In particular, the coefficient of the interaction between Tech. Relatedness and Tariff Cut in model 2 is -0.027 (p-value < 0.05), while that of Tech. Relatedness BUTC in model 4 is 0.018 (p-value < 0.05). Instead, neither of the coefficients of interest in model 6 and model 8 are significant. From the results of the test it appears that the relationship between technological relatedness and resource reallocation depends on the heterogeneous impact of competition on the value of innovation.

The effect of resource reallocation on performance

In this section we report the results of a series of additional analyses studying the effect of resource reallocation on performance after an increase in competition. Recent evidence suggests that the internal resource reallocation process of a diversified firm plays an important role in mitigating the adverse effects of external shocks. Kuppuswamy and Villalonga (2010) for example, find that as a consequence of the 2007-2009 financial crisis the allocation of financial capital within diversified firms became more efficient and it gave them an important investment advantage. Almeida et al. (2015) find a similar positive effect of financial resource reallocation in the context of Korean firms in the aftermath of the 1997 Asian financial crisis. With regards to competition, existing evidence shows that diversified firms use their ability to reallocate resource internally to react to the entrance of a new competitor in an efficient an timely manner (Khanna & Tice, 2001). Despite a growing attention to contingencies that might influence the value of internal resource allocation however, no study has yet addressed the contribution of this process to firm performance after a tariff cut.

We perform a test of the subject matter by adopting a difference-in-difference methodology similar to the one that we have used this far. As a first step we calculate a measure of the total resource reallocation activity that took place between the period before and after the tariff cut. For every BU of a diversified firm in the COMPUSTAT database, we calculate the difference between the average resource allocation in the three years following the tariff cut minus the average resource allocation in the three years preceding the tariff cut. We calculate the measure of resource allocation for the BU as we did in the previous analyses, by computing the difference between the BU's CAPEX and the BU's after-tax cash flow. Next, for every firm we sum across BUs the square of the difference in average resource allocation. We take the square of the difference in resource allocation for two purposes. First, we want to avoid the sum to converge to zero as a consequence of some BUs receiving increasing amounts of resources while other BUs receive decreasing amounts. Considering that we are trying to capture internal resource reallocation activity, we want a measure that grows the more the BUs experience a change in resource allocation. Second, we want to avoid an automatic correlation between resource allocation and profitability. The after-tax cash flow is strongly influenced by profitability and sales. Therefore, unless we eliminate this distortion by taking the square, it is very likely that an increase in resource allocation will be negatively correlated with performance. After performing these operations, we deflate the sum of the squared resource allocation by the total firm assets to reduce the influence of outliers. The measure that we obtain is our proxy for internal resource allocation activity.

We use two dependent variables in our analysis: firm's ROA and firm's Market-to-Book value, both calculated as the difference between the average value in the three years following the tariff cut minus the average value in the three years preceding the tariff cut. We also use two definitions of tariff cut events. In our first analysis we consider a firm to be undergoing a tariff cut if it experiences a tariff cut in any of its operating product-markets. In our second analysis instead, we consider a firm to be undergoing a tariff cut only if it experiences a tariff cut in its main operating product market. We define a firm's main operating product-market as its primary four-digits SIC code as reported in the COMPUSTAT database. The purpose of the second definition of tariff cut is to make sure that the changes in tariffs affect a product-market that for the firm is important enough to have an impact on performance.

Having identified the treated observations as those firms that are undergoing a tariff cut in a given year, we proceed to the formation of control groups using a matching procedure similar to the one we used this far[5]. This leads to the formation of four samples: two per dependent variable and two per definition of treatment[6].

Finally, we estimate the following regression in order to test the effect of internal resource reallocation (IRR) activity on performance after a tariff cut:

$$\Delta Performance_{i,t} = \alpha_t + \beta_1 \times T.Cut_{i,t} + \beta_2 \times IRR\ Activity_{i,t} + \beta_3 \times T.Cut_{i,t} \times IRR\ Activity_{i,t} + \gamma' \mathrm{X}_{i,t} + \epsilon_{i,t}$$

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[5] We require observations to be from the same year, operate in the same primary two-digits SIC code and serve primarily the same type of customer in their main business (BtoB vs BtoC). Next, out of the remaining pool of candidates, we pick the closest neighbor based on a set on firm characteristics: firm's performance, firm's size, firm's cash, firm's number of segments, firm's leverage. All the characteristics are measured as average in the three years before the treatment. Firm's performance is the average value of the dependent variable in the three years before the treatment.

[6] Due to space limitations, descriptive statistics about the samples are available upon request to the authors.

Where $Performance_{i,t}$ is either ROA or Market-to-Book, α_t are year fixed effects, *T. Cut* is our treatment dummy variable equal to one if the observation belongs to the treatment sample and to zero if it belongs to the control sample, *X* is a vector of control variables[7], and ϵ is the error term.

Insert Table 4 about here

Table 4 contains the results of the estimation on the four samples. As it possible to see, the coefficient of the interaction between IRR Activity and tariff cut is consistently positive and significant in the analysis on the Market-to-Book ratio; both when the definition of tariff cut includes any of the operating product-markets of the firm and when the definition of tariff cut is based only on the main operating product-market of the firm. We fail to find significance in the analyses on ROA.

In particular, in the analysis on Market-to-Book with the definition of tariff cut including any operating product-markets, the coefficient of IRR activity is 0.0004 (p-value < 0.1) while that of the interaction with tariff cut is 0.0056 (p-value < 0.05). This means that, if a firm experiencing a tariff cut had an average IRR activity over the period (4.29 in the sample), its Market-to-Book value would have increase of 0.026 as a consequence of the activity. This is an increase of about 2.6% if we consider that the Market-to-Book ratio in the three years preceding the tariff cut is on average equal to 1. Similarly, in the analysis with the definition of tariff cut including only the main operating product-market, the coefficient of IRR activity is -0.0065 (p-value < 0.1) while that of the interaction with tariff cut is 0.0143

[7] It includes four of the five characteristics used for the matching (firm's size, firm's cash, firm's number of segments, firm's leverage)

(p-value < 0.01). Therefore, a firm with the same level of activity over the period as before would have experienced an increase in its Market-to-Book value of 0.033 or 3.3%.

DISCUSSION AND CONCLUSIONS

This paper examines the effect of changes in opportunity cost on the redistribution of non scale-free resources within diversified firms. In doing so we extend the promising stream of RBV literature studying the impact of non scale-free resources on firm behavior and performance (Helfat & Eisenhardt, 2004; Levinthal & Wu, 2010; Sakhartov & Folta, 2014; Wu, 2013). Non scale-free resources are defined as all those resources that have an opportunity cost for their application. The idea that firms have to allocate resources with limited capacity is not new, as it was already developed by Penrose (1959) in her original formulation of the RBV. Much of the subsequent literature however has neglected this feature of resources to focus the analysis on issues of fungibility (Bettis, 1981; Chang, 1996; Rumelt, 1974; Teece, 1981). In this paper we argue that the explicit consideration of non scale-free resources in the analysis of diversification is very important, as it highlights how much of the decision-making within diversified firms involves tradeoffs between BUs.

We operationalize changes in opportunity cost with exogenous changes in the intensity of competition faced by one of the BUs of the firm. In particular, our empirical strategy exploits quasi-natural experiments in the form of large import tariff cuts that occurred between 1977 and 2005 in the U.S. manufacturing sectors (SIC codes between 2000 and 3999). We argue that increases in competition in the product market of a BU should cause a reallocation of non scale-free resource its favor. Diversified firms in fact, expanded to new markets to exploit valuable resources, with a high degree of specificity, that can neither be fully exploited in a single product-market nor be sold on the external market (Rumelt, 1982).

Due their characteristics these resources cannot be reallocated internally, therefore the firm stands to lose the entire value that they generate if competition decreases their rate of exploitation. On the other hand, access to non scale-free fungible resources is very effective in preventing this from happening as it allows the BU to invest and to experiment with new ways of capturing value (Frésard, 2010; Sirmon, Hitt, & Ireland, 2007). Results from our empirical analysis confirm this prediction. We find that resource allocation after a tariff cut increases in the BU that is affected by it and decreases in the rest of the BUs of the firm.

Having established that competition causes a reallocation of non scale-free fungible resources in favor of the BU affected by it, we then look at internal factors that are susceptible of changing the magnitude and sign of the relationship. In fact, reasoning in terms of opportunity cost of resource allocation in the case of a diversified firm inevitably involves comparing the BUs to which the resources could be allocated. We argue that from this comparison there are three general types of factors affecting resource reallocation that can be identified: Factors affecting the value of resources in their different uses, factors affecting the ability of the firm to release non scale-free resources, and commonalities that decrease the need for reallocation in pursuing the a defensive strategy. We take into consideration one moderator for each category.

We argue that the value of access to non scale-free fungible resources will generally depend on the relative resource management ability of the BU experiencing the increase in competition. We operationalize resource management ability with the relative profitability under the assumption that profitability is mainly determined by the ability to organize resources to exploit market opportunities rather than by resource endowment (Sirmon et al., 2007; Teece, Pisano, & Shuen, 1997). The empirical analysis confirms the idea that the amount of resources transferred to a BU depends positively on its resource management ability.

We argue that the relative size of the BU subject to the increase in competition, in comparison to the total size of the firm, negatively affects the ability of the firm to release enough non scale-free fungible resources to make a defensive strategy possible. We measure relative size as the ratio of BU sales to total firm sales. Results from the test confirm the hypothesis that relative size is a negative moderator of resource reallocation.

Finally, we examine how scale-free resources moderate the relationship between competition and internal resource transfer. We expect scale-free resource relatedness to be a negative moderator of resource reallocation due to the positive spillovers that investments in scale-free resources generate for all the BUs of the firm. To test this idea, in our empirical analysis we focus on the effect of technological relatedness, defined as the extent to which the industry of BU subject to the tariff cut shares a common technological base with that of the rest of the BUs of the firm. Results from our baseline analysis only provide partial support for the predicted relationship. However, in the complementary analyses reported afterwards, we highlight how the relationship between relatedness and reallocation might be contingent on the effect of competition on the value of the scale-free resource under consideration. In fact, we find that the negative effect of relatedness on resource reallocation is significant only when competition increases the value of innovation as a mean of strategic differentiation. When competition decreases the value of innovation the relationship does not take place. In this scenario, firms will likely have to invest in other strategies to differentiate from competitors.

Overall, we argue that our study makes an important contribution to the literature on non scale-free resources (Helfat & Eisenhardt, 2004; Levinthal & Wu, 2010; Sakhartov & Folta, 2014; Wu, 2013). Particularly concerning the study of diversified firms, the analyses from Levinthal and Wu (2010) and Wu (2013) addressed the role of non scale-free resource in explaining diversification moves. Our study extends their analyses by examining the resource reallocation process of firms that are already diversified. Moreover, our study is also different from that of Wu (2013) in that we directly capture resource reallocation while his study infers resource reallocation from the effect of diversification on performance.

We believe that the results of this study are of interest for both the literature examining the performance consequences of diversification and the literature studying competitive dynamics. With regard to the first we argue that, considering the mixed results obtained by the literature examining the diversification-performance linkage (Berger & Ofek, 1995; Santaló & Becerra, 2008; Villalonga, 2004), our knowledge of the topic would benefit by separately considering the single value creating mechanisms that distinguish diversified firms. The internal market for resources is certainly one of the most distinctive (Williamson, 1975). To this regard, our finding that resource allocation after increases in competition follows a direction consistent with the change in the opportunity cost of using resources, points to contingencies where diversified firms could generate value. While answering to this question is beyond the scope of the paper, in the second of our additional analyses we provide some evidence supporting the idea that resource reallocation creates value.

With regard to the literature studying competitive dynamics (Smith, Ferrier, & Ndofor, 2001), our finding that diversified firms internally transfer resources across their operating sectors suggests that exogenous increases in competition in sectors populated by diversified firms could generate stronger competitive reaction from incumbents. On the other hand, sectors that are not directly affected could experience a decrease in competitive pressure due to the decreased resource allocation to BUs operating in stable market conditions.

From a methodological point of view we argue that our identification strategy is very effective in establishing causality. Our treatments based on large import tariff cuts have been previously used in a number of papers on the effects of international competition (e.g. Flammer, 2015; Frésard, 2010; Valta, 2012). Moreover, tariff cuts are arguably exogenous in respect to resource investment and resource generation at the BU level. Our matching procedure based on a set of industry's, firm's, and BU's characteristics ensures the similarity between the treatment and the control group in both of our sample. As evidence of this, Figure 2A and 2B show that both treatment and control groups are very similar in the pre-treatment values and trends in Resource Allocation. This guarantees that the control groups provide a good counterfactual of what would have happened to resource allocation absent the increase in international competition.

Finally, our strategy for documenting resource transfer based on two samples is particularly conservative. In fact, in order to confirm each of our hypotheses about internal resource reallocation we require significance with opposite signs in both of our samples of analysis. This dramatically reduces the possibility of incurring in type I error way beyond the confidence level of each of the coefficient.

Our study however also suffers from some limitations. First, we test our theory about non scale-free resource reallocation only on financial resources. Although we believe that our results should be generalizable to other fungible categories of non scale-free resources, we are unable to explicitly consider them in our empirical analysis. Also, our study does not take into account non-efficiency explanations for internal resource transfer. While this is out of the scope of our paper, we do believe that the integration of RBV explanations for internal resource transfer, with agency and behavioral explanations, would definitely enrich our knowledge of how diversified firms allocate resources.

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FIGURE 1: NUMBER OF TARIFF CUT EVENTS BY YEAR

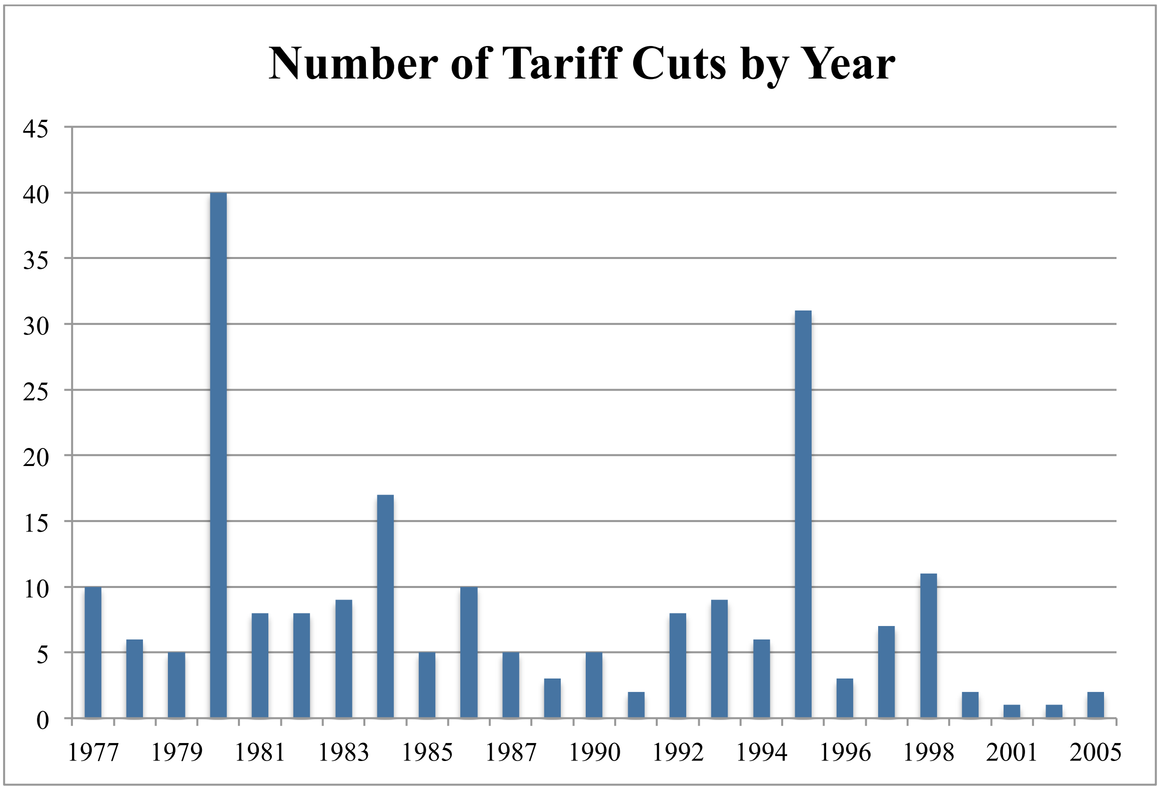

TABLE 1: SAMPLE DESCRIPTIVES

		N. Obs.	Mean	Min	Max	SD	25p	50p	75p
COMPETITION INCREASE SAMPLE									
Matching variables									
R. Allocation	Treatment	799	-0.11	-6.65	1.18	0.34	-0.17	-0.09	-0.02
	Control	799	-0.10	-1.34	0.95	0.15	-0.15	-0.09	-0.03
BU Sales (log)	Treatment	799	4.22	0.09	10.08	1.98	2.70	4.33	5.61
	Control	799	4.31	0.12	9.48	1.90	2.96	4.37	5.61
Firm Sales (log)	Treatment	799	5.51	0.91	10.99	2.04	3.92	5.56	7.16
	Control	799	5.53	0.86	10.97	1.96	4.00	5.56	6.95
Firm Cash (log)	Treatment	799	2.69	0.00	9.65	1.85	1.21	2.42	4.08
	Control	799	2.68	0.00	9.69	1.78	1.19	2.47	3.88
Firm Leverage	Treatment	799	0.56	0.08	2.26	0.21	0.44	0.55	0.65
	Control	799	0.55	0.10	1.42	0.17	0.44	0.54	0.63
Number of BUs	Treatment	799	3.31	2	10	1.35	2	3	4
	Control	799	3.21	2	10	1.24	2	3	4
Independent variables									
ROA Difference	Treatment	799	0.04	-3.38	11.58	0.65	-0.09	0.01	0.11
	Control	799	0.01	-5.36	6.52	0.37	-0.08	0.01	0.09
Relative Size	Treatment	799	0.36	0.00	1.00	0.26	0.14	0.30	0.56
	Control	799	0.37	0.01	1.00	0.25	0.16	0.31	0.55
Tech. Relatedness	Treatment	799	1.08	0.00	8.12	1.50	0.00	0.33	1.77
	Control	799	1.07	0.00	7.83	1.55	0.00	0.27	1.64
COMPETITION SPILLOVER SAMPLE									
Matching variables									
R. Allocation	Treatment	1247	-0.10	-2.50	4.44	0.22	-0.17	-0.09	-0.03
	Control	1247	-0.10	-1.77	0.87	0.14	-0.15	-0.09	-0.03
BU Sales (log)	Treatment	1247	4.63	0.06	10.91	2.00	3.15	4.72	6.01
	Control	1247	4.58	0.13	10.37	1.87	3.17	4.64	5.84
Firm Sales (log)	Treatment	1247	6.03	0.91	10.99	2.06	4.67	6.19	7.46
	Control	1247	5.86	0.45	10.65	1.91	4.41	6.09	7.27
Firm Cash (log)	Treatment	1247	3.08	0.00	9.65	1.97	1.49	2.99	4.37
	Control	1247	2.88	0.00	8.87	1.78	1.43	2.79	4.15
Firm Leverage	Treatment	1247	0.57	0.12	2.50	0.21	0.45	0.55	0.65
	Control	1247	0.56	0.13	1.73	0.17	0.45	0.55	0.64
Number of BUs	Treatment	1247	3.90	2	10	1.54	3	4	5
	Control	1247	3.57	2	10	1.34	3	3	4
Independent variables									
ROA Diff. BUTC	Treatment	1247	0.00	-4.81	7.89	0.45	-0.09	-0.01	0.09
Rel. Size BUTC	Treatment	1247	0.30	0.01	0.98	0.23	0.12	0.24	0.43
Tech. Rel. BUTC	Treatment	1247	1.23	0.00	8.12	1.56	0.02	0.57	1.95

FIGURE 2A: TREND IN R. ALLOCATION OVER ASSETS IN THE COMPETITION INCREASE SAMPLE

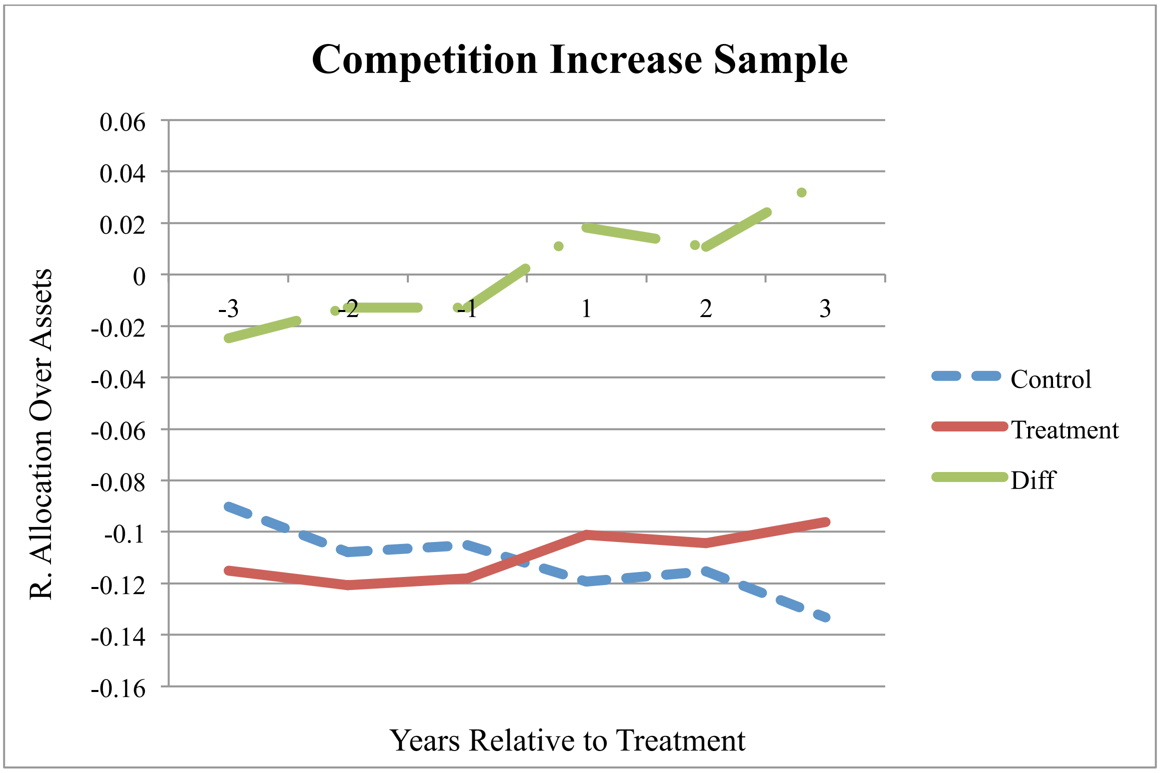

FIGURE 2B: TREND IN R. ALLOCATION OVER ASSETS IN THE COMPETITION SPILLOVER SAMPLE

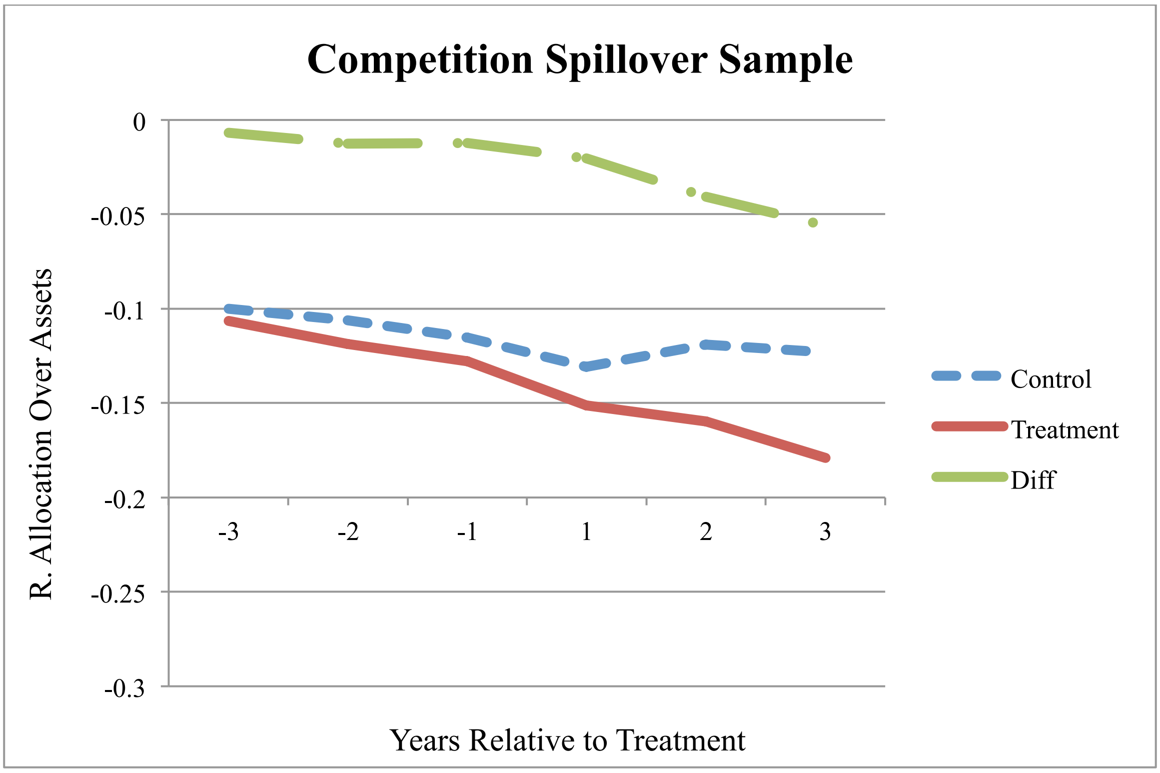

TABLE 2A: RESULTS OF REGRESSION ANALYSES ON THE COMPETITION INCREASE SAMPLE

Dependent Variable: ΔR. Allocation	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15
Tariff Cut BU	0.031*	0.021+	0.043	0.018	0.057+	0.031*	0.021+	0.044	0.019	0.057+	0.031*	0.022+	0.042	0.018	0.057+
	(2.61)	(1.91)	(1.50)	(1.45)	(1.95)	(2.59)	(1.90)	(1.53)	(1.67)	(2.01)	(2.78)	(2.05)	(1.41)	(1.55)	(2.00)
ROAdiff		0.051			0.042		0.052			0.042		0.048			0.044
		(1.30)			(0.99)		(1.36)			(1.03)		(1.18)			(1.02)
T. Cut X ROAdiff		0.205**			0.213**		0.204**			0.213**		0.201**			0.208**
		(3.96)			(3.95)		(4.03)			(4.03)		(3.71)			(3.70)
Size			0.133**		0.127**			0.139**		0.134**			0.079		0.045
			(3.87)		(3.52)			(4.19)		(3.97)			(0.80)		(0.46)
T. Cut X Size			-0.032		-0.123*			-0.033		-0.121*			-0.032		-0.122*
			(-0.37)		(-2.36)			(-0.38)		(-2.33)			(-0.37)		(-2.41)
Tech. Relatedness				-0.004	-0.006+				0.001	-0.001				0.003	-0.000
				(-1.28)	(-1.76)				(0.15)	(-0.24)				(0.42)	(-0.07)
T. Cut X Tech. Rel.				0.012	0.009				0.011	0.009				0.012	0.009
				(0.85)	(0.96)				(0.87)	(0.97)				(0.95)	(0.98)
Year Fixed Effects	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Control Variables	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
N. Observations	1598	1598	1598	1598	1598	1598	1598	1598	1598	1598	1598	1598	1598	1598	1598
Adj. R sq.	0.000	0.062	0.003	-0.001	0.062	-0.002	0.060	0.001	-0.003	0.060	0.004	0.063	0.003	0.003	0.061

Note: t-statistics in parentheses. Two-tailed tests for all the variables in the models.
+ p < .10
* p < .05
** p < .01

TABLE 2B: RESULTS OF REGRESSION ANALYSES ON THE COMPETITION SPILLOVER SAMPLE

Dependent Variable: ΔR. Allocation	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15
Tariff Cut Firm	-0.018*	-0.017*	-0.044**	-0.026*	-0.057**	-0.018*	-0.017*	-0.043*	-0.033**	-0.065**	-0.016+	-0.016+	-0.052**	-0.028*	-0.069**
	(-2.31)	(-2.27)	(-3.02)	(-2.47)	(-4.73)	(-2.30)	(-2.26)	(-2.83)	(-2.88)	(-4.96)	(-2.09)	(-1.99)	(-3.46)	(-2.64)	(-5.19)
ROAdiff BUTC		-0.117**			-0.122**		-0.121**			-0.127**		-0.120**			-0.126**
		(-3.57)			(-3.53)		(-3.78)			(-3.77)		(-3.66)			(-3.69)
Size BUTC			0.086+		0.107*			0.084+		0.106*			0.113*		0.135*
			(1.89)		(2.37)			(1.80)		(2.33)			(2.47)		(2.85)
Tech. Rel. BUTC				0.007+	0.006				0.013*	0.012*				0.010*	0.009*
				(1.76)	(1.32)				(2.79)	(2.52)				(2.79)	(2.24)
Year Fixed Effects	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Control Variables	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
N. Observations	2494	2494	2494	2494	2494	2494	2494	2494	2494	2494	2494	2494	2494	2494	2494
Adj. R sq.	0.001	0.021	0.003	0.001	0.025	0.009	0.031	0.012	0.011	0.037	0.012	0.033	0.015	0.012	0.039

Note: t-statistics in parentheses. Two-tailed tests for all the variables in the models.
+ p < .10
* p < .05
** p < .01

TABLE 3: THE EFFECT OF RELATEDNESS ON RESOURCE REALLOCATION DEPENDING ON WHETHER COMPETITION INCREASES OR DECREASES PATENT VALUE

Dependent Variable: ΔR. Allocation	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	Competition Increases Patent Value				*Competition Decreases Patent Value*			
	Comp. Increase		Comp. Spillover		Comp. Increase		Comp. Spillover	
Tariff Cut	0.021	0.054	-0.028*	-0.053**	0.005	-0.005	-0.066**	-0.085**
	(0.83)	(1.56)	(-2.48)	(-3.93)	(0.36)	(-0.24)	(-3.19)	(-3.70)
Tech. Relatedness		-0.007*		0.018*		-0.022*		0.009
		(-4.44)		(2.72)		(-4.87)		(1.10)
T. Cut X Tech. Rel.		-0.027*				0.008		
		(-3.33)				(1.24)		
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES
N. Observations	432	432	746	746	332	332	448	448
Adj. R sq.	0.043	0.062	0.028	0.033	-0.026	-0.026	0.008	0.009

Note: As with the other analyses Tech. Relatedness for the Competition Spillover sample is Tech Relatedness BUTC.
t-statistics in parentheses. Two-tailed tests for all the variables in the models.
+ $p < .10$
* $p < .05$
** $p < .01$

TABLE 4: REGRESSION ANALYSES INTERNAL CAPITAL MARKET ACTIVITY – PERFORMANCE

Dependent Variable	ΔROA			ΔMktBook			ΔROA			ΔMktBook		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
	Tariff Cut in Any Operating Product-Market						*Tariff Cut in the Main Operating Product-Market*					
Tariff Cut	0.0063*	0.0061*	0.0037	-0.0326	-0.0317	-0.0372	-0.0065	-0.0074	-0.0102	-0.1441	-0.1577	-0.1480
	(2.35)	(2.35)	(1.34)	(-1.07)	(-1.01)	(-1.14)	(-0.79)	(-0.88)	(-1.11)	(-1.11)	(-1.18)	(-1.07)
IRR Activity	0.0005+	0.0003	0.0001	0.0002*	0.0004*	0.0004+	0.0004	-0.0002	-0.0006	-0.0023	-0.0016	-0.0065+
	(1.73)	(1.19)	(0.42)	(2.53)	(2.82)	(2.08)	(0.92)	(-0.58)	(-1.58)	(-1.24)	(-1.66)	(-1.95)
T.Cut X IRR Activity	-0.0008+	-0.0007	-0.0006	0.0058**	0.0056**	0.0056*	-0.0005	-0.0000	0.0002	0.0096	0.0134*	0.0143**
	(-1.98)	(-1.66)	(-1.54)	(3.35)	(3.06)	(2.77)	(-0.98)	(-0.02)	(0.23)	(1.47)	(2.78)	(3.19)
Year Fixed Effects	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
Control Variables	NO	NO	YES	NO	NO	YES	NO	NO	YES	NO	NO	YES
N. Observations	1370	1370	1370	1252	1252	1252	398	398	398	356	356	356
Adj. R sq.	0.000	0.057	0.101	0.011	0.041	0.046	-0.006	0.071	0.114	-0.002	0.007	0.013

Note: t-statistics in parentheses. Two-tailed tests for all the variables in the models.
+ p < .10
* p < .05
** p < .01