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Testing the relevance of the asset acquisition hypothesis on a sample of cross-border M&As between UK and US firms

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Abstract

This thesis investigates the relevance of the asset acquisition hypothesis for developed economies in light of the unprecedented integration of economic markets around the world. The asset acquisition hypothesis proposes that a depreciation of the domestic currency will stimulate foreign acquisitions of domestic targets that possess transferable firm-specific assets. The crucial assumption is that a sufficient degree of market segmentation exists, so that a foreign company enjoys a competitive advantage in its foreign market relative to companies from the domestic country. Foreign firms should thus have more opportunities to generate returns from the acquired asset. The implication is that a depreciation of the domestic currency will increase the investment's NPV for foreign firms, while leaving domestic firms' NPV for the same investment unchanged.

Existing research finds evidence for an exchange rate effect as proposed by the asset acquisition hypothesis; however, the samples used by these studies are outdated. Foreign direct investment has risen dramatically since the 1990s, leading to increased market integration in today's world, particularly among developed countries. Using a contemporary sample of bilateral cross-border acquisitions between UK and US companies, this study fails to find any support for the asset acquisition hypothesis. The exchange rate exhibits no significant impact on the number of cross-border M&As in any of the models analyzed. The results suggest that the assumption of sufficient market segmentation is not applicable to the examined sample any longer, rendering the asset acquisition hypothesis irrelevant in the context of the studied country pair and time interval.

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1. Introduction

1.1 Background

Conventional economic theories have typically tried to explain the long-run determinants of foreign direct investment (hereafter FDI), focusing on inherent transaction costs of trade and differences in factor prices. These theories, however, proved to be inapplicable to explain the short-term swings in FDI and particularly cross-border mergers and acquisitions (hereafter M&As). Several economists have thus turned towards alternative explanations with a substantial number of papers in the 1980's and 1990's investigating the effects of exchange rate movements on FDI.

A unanimous relationship does not appear to exist, however. Some papers find empirical evidence in favor of an exchange rate effect on FDI (Froot and Stein 1991, Klein and Rosengren 1994), arguing that the depreciation of a country's currency should result in increased inflows of FDI as the country's assets become cheaper to foreigners. Others fail to find evidence for such a relationship. Using the same sample as Froot and Stein, Stevens (1998) cannot establish a significant link between the exchange rate and FDI, supporting the traditional view which argues that exchange rate movements do not exert any influence on FDI flows. Since the price paid for a foreign asset is denominated in the same currency as the revenues that it generates, the advantages of a depreciated foreign currency should cancel out at repatriation of those revenues.

The asset acquisition view proposed by Blonigen (1997) argues that this need not be the case in the context of acquisition FDI. When transferable firm-specific assets are at stake, they can be used to generate revenues in multiple markets at the same time. Assuming a sufficient degree of market-segmentation, a domestic firm should enjoy substantial advantages in generating returns from a foreign asset in its domestic market relative to foreign firms. The potential profits to be reaped by a domestic firm are thus larger than for a foreign firm, which should be resembled in the valuation of the foreign asset. According to this reasoning, a depreciation of a foreign currency should render the purchase of firm-specific assets in that country increasingly profitable and hence stimulate cross-border M&As in that country.

Studying Japanese M&As of US firms between 1975-1992, Blonigen (1997) finds a significant exchange rate effect as predicted by the asset acquisition hypothesis. He shows, however, that the Japanese and American economies are characterized by a substantial degree of market segmentation. In order to test whether the asset acquisition hypothesis holds more generally or only in the case of very pronounced market segmentation, Georgopoulos (2008) uses a sample of bilateral M&A data between the US and Canada from the period 1985-2001. His results also lend support for an asset acquisition effect in high R&D industries. While Georgopoulos' (2008) study takes Blonigen's approach one step further, in that it applies his theory to two countries whose markets are likely to be more integrated than Japan and the US, it still focuses on a period of substantial FDI growth. The degree of market integration at the start of Georgopuolos' observation period is likely to be considerably smaller than at the end of it. He thus investigates a sample that exhibits substantial differences in the degree of market integration over time.

Considering the increased market integration among developed countries, the question arises whether the asset acquisition still holds. Contemporary research on this topic is very scarce and the purpose of this thesis is to fill this gap, therefore. More precisely, this study aims to examine the relevance of the asset acquisition hypothesis in light of the increased market integration across developed economies by employing a sample of cross-border M&As between the United States and United Kingdom for the period 2004-2010.

1.2 Problem statement and research questions

As indicated above, this thesis investigates the relevance of the asset acquisition hypothesis for the UK-US country pair during the interval 2004-2010. The following research questions are examined to assess the problem statement:

- *Does an increase in the industry-specific USD/GBP real exchange rate have a positive impact on the number of UK M&As in high R&D manufacturing industries in the US from 2004 to 2010?*

- *Does an increase in the industry-specific GBP/USD real exchange rate have a positive impact on the number of US M&As in high R&D manufacturing industries in the UK from 2004 to 2010?*
- *Do industry-specific real exchange rate movements have significant explanatory power over the variation in the number of cross-border M&As in low R&D manufacturing industries between the UK and US from 2004 to 2010?*

1.3 Contribution to existing empirics and research

This study extends research on the link between exchange rates and acquisition FDI in a number of areas, where existing research falls short. First of all, while most research in this field focuses on the factors that make certain countries popular destinations for FDI, this paper examines the factors that drive changes in FDI for a given pair of countries. Second o all, existing studies on the asset acquisition hypothesis investigate data samples from the 1970s, 1980s, and 1990s. This study uses a contemporary sample of M&As, which is characterized by a very consistent stock of inward FDI in developed economies and a degree of market integration that is higher than in any period prior to it. The sample further includes observations from the global financial crisis. Third of all, no previous paper has researched the asset acquisition hypothesis in the context of the UK-US country pair. Finally, in contrast to Blonigen's (1997) original paper, this work studies bilateral cross-border M&As between these countries. This means that two sets of regressions are estimated, one involving UK acquisitions of US targets and one involving US acquisitions of UK targets.

1.4 Delimitations

This study focuses exclusively on cross-border M&As between the UK and US that involve a target company operating in a manufacturing sector as defined by the industry classification systems NAICS 2007 or UK SIC 2007. The tables in Appendix 1 provide an illustration of manufacturing the industries that these classification systems define. The main objective of this

study is to investigate the relationship between exchange rate movements and acquisition FDI when technology-related firm-specific assets are involved. Companies that possess such assets are most likely to operate in highly R&D intensive industries and R&D intensity is easily measured in manufacturing industries. The objective of this study also implies that we do not test for alternative explanations of a potential exchange rate – FDI link or for other drivers of cross-border M&As besides the ones included as control variables in our models.

1.5 Outline

The remainder of this thesis is organized as follows. Section 2 briefly outlines the research methodology this thesis is built upon. Section 3 reviews relevant theories and existing literature on FDI and its link to the exchange rate. Section 4 contains a review of the most relevant empirical research relating to the problem statement and specifies the hypotheses to be tested in this thesis. Section 5 illustrates developments in cross-border M&As between the UK and US as well as global trends in FDI. Section 6 presents and discusses the data sample and econometric methodology. Section 7 analyzes descriptive statistics on the data sample, presents the regression results and robustness checks, and discusses the findings regarding the hypotheses of the thesis. Section 8 examines the implications of those findings and section 9 concludes.

2. Research methodology

The structure of this thesis generally follows the deductive approach to business research methodology as formalized by Bryman and Bell (2011). Unlike inductive research, which aims to explain observed phenomena using theory, deductive research uses theory to set up hypotheses and then usually applies statistical methods to test these. Bryman and Bell also label the process of testing the specified hypotheses as the process of falsification.

Because this study aims to investigate the relevance of the asset acquisition hypothesis, a deductive approach appears to be the natural choice. Moreover, the econometric applied

econometric approach follows the lines of Blonigen (1997) and Georgopoulos (2008). To be able to compare results with these studies, a quantitative approach is chosen in this paper.

3. Theoretical review

The World Bank (2013a) defines an FDI as an international transaction in which at least 10% of voting stock is acquired. FDI can take place in the form of a greenfield investment, an M&A, or a joint venture. Each of these investment modes are driven by different factors. Common literature generally distinguishes among four different motives that drive the decision to serve a foreign market through FDI. The market seeking motive describes foreign investment that is intended to substitute prior export activities with local production. Resource seeking FDI takes place when a company invests abroad in an attempt to exploit foreign natural resources. Efficiency seeking investments are generally characterized by cost reductions as their major driving force since companies usually try to take advantage of lower labor costs in a certain country. While the market seeking motive eventually also targets increasing profits, the main difference is that market seeking investments aim to serve the local market. Efficiency seeking investments, on the other hand, do not necessarily produce for the market the investments are made in, but mainly focus on the cost advantage of a given location. Finally, strategic asset seeking FDI describes investments that aim to acquire assets that may be pivotal to the long-run performance of the company. This may be an asset that improves the firm's current strengths, builds new ones or, alternatively, weakens a competitor (Dunning 1981).

Various economic theories have arisen in the past decades that try to explain not only the motives of FDI, but rather the direction of FDI flows. Core trade theory based on Ricardo and Heckscher-Ohlin-Samuelson centered their argumentation around the efficiency seeking motive as they focused on relative factor endowments and the concept of comparative advantage to explain international trade and production decisions. These theories were very limited in their scope however and did not match the actual happenings in the real world. In consequence new international trade theories arose that put their focus on the firm itself rather than the endowments

of a country. The essential characteristics of these theories were considerations of imperfect competition, economies of scale, and technological diffusion as well as strategic considerations (Ethier and Markusen 1996). Dunning (1981) was one of the first to conceptualize these ideas and set up his ownership-location-internalization framework (hereafter OLI).

Markusen (1984) and Helpman (1984) take this idea a step further and develop a horizontal and vertical model of FDI, respectively. Finally, Carr et al. (2001) combine those frameworks and construct the "knowledge caital model" of FDI. This section will take a look at those general equilibrium models of FDI and then continue with partial equilibrium models, discussing the most important theories on the link between the exchange rate and FDI, particularly M&As.

3.1 General equilibrium models

3.1.1 OLI

Dunning (1981) sets up a dynamic framework that aims to describe the foreign direct investment positions of countries focusing on a combination of enterprise and country specific factors. He synthesizes concepts rooted in industrial organization, location and market failure theory to formalize the so-called eclectic theory of foreign direct investment which focuses on the interplay between enterprise-specific advantages and the three main modes of foreign involvement.

An enterprise can choose to service a foreign market by either exporting, licensing or direct investment, which can be in the form of greenfield or acquisition. Its decision on which entry to choose will depend on the set of ownership, location and internalization advantages that this enterprise possesses or would possess choosing that entry mode. Ownership advantages mean assets that an enterprise possesses or can get access to and foreign companies do not have or cannot get access to. These assets are only available to the company and are assumed to be transferable across facilities and countries (Dunning 1981). Ownership advantages can be intrinsic to the firm, meaning that they have arisen from within the company, or they can be acquired, for instance via an acquisition of a patent or the acquisition of a whole company and the

assets that come with it. Internalization advantages arise when a company finds it more profitable to internalize the use of those assets rather than license it to a foreign subcontractor. Location specific advantages refer to assets that are not transferable across countries and are specific to one particular location. These advantages determine whether companies will decide to locate abroad. Taken together, the OLI framework suggests that companies in possession of transferable assets will generally find it more profitable to internalize them. If they can be employed more efficiently or cheaper in a country abroad, the company will probably set up foreign subsidiaries and involve itself with foreign direct investment (Dunning).

Ownership advantages are a necessity for FDI, exports and licensing. If internalization advantages exist, licensing drops out as an option since it would be more profitable to pursue one of the two other strategies. FDI takes place when a company brings together ownership and internalization factors and finds a foreign location that enables it to exploit those advantages in a better way than possible domestically (Dunning 1981). The degree to which these factors will affect a company's decision to locate abroad will also depend on structural factors however, which require some extensions to the basic model outlined above.

As every enterprise is different, OLI related advantages are affected by different factors. More specifically, the factors are affected by structural factors like the country an enterprise operates in, the industry it is part of and characteristics of the firm itself (Dunning 1981). For example, country characteristics affect ownership advantages through factor endowments or proprietary control. Transfer pricing policies can affect internalization advantages. Quotas, tariffs or the sheer geographical distance influence the location decision.

Those structural characteristics constitute a particularly important factor when it comes to deciding how to serve a foreign market. Ethier and Markusen (1996) point out that when ownership advantage is in the form of transferable knowledge, the protection of proprietary rights becomes a substantial factor in the location decision, particularly when dealing with developing countries. His survey also finds that protection in those countries differs among industries, suggesting that industry characteristics also play into the location decision.

Ethier and Markusen (1996) construct a two period model to examine under what circumstances a firm will choose what mode of entry. They assume that protection of intangible knowledge is not possible when producing abroad or using a subcontractor. Among other things, they also find that a company will choose FDI when transferable knowledge is of rather high importance.

3.1.2 Horizontal model of FDI

Based on the OLI framework and on the motives for FDI conceptualized by Dunning (1981), Markusen (1984) sets up a model to explain international investments by companies which focuses particularly on the relationship between transferable assets and FDI. In an earlier study Caves (1974) concludes on the basis of his empirical evidence that the degree of multinationality in an industry strongly correlates with the importance of transferable assets in that particular industry. Those transferable assets are not location-specific, but can be used simultaneously as a joint-input across many plants of a firm. They can basically take the form of anything from certain R&D or patents to advertising, marketing, distributional or managerial skills. The implication of Caves' finding is that companies which heavily rely on these assets to get a competitive advantage over their competitors will engage in foreign direct investment to a much larger extent than companies of other industries. This becomes necessary since transferable assets enable a company to exploit economies of multi-plant operations (Scherer 1980). Whereas a regular company might find it beneficial to focus production on one facility to create economies of scale, companies employing transferable assets may find it more cost-efficient producing at different locations, because the intangible asset can be transferred at no or little cost (Markusen).

In light of the empirical observations just outlined, Markusen (1983) formalizes an approach commonly termed the horizontal model of FDI that aims to explain the interaction of intangible assets and multinational corporations. He puts the characteristics of the technologies used by MNEs to the center stage of his theory. Since transferable assets comprise a public goods characteristic with regards to its different production plants, MNEs are able to centralize firm-specific activities like, for instance, R&D, marketing or advertising. Its ability to bypass the

duplication of such activities which would be a vital component of a single-plant production process constitutes the paramount efficiency advantage of the multi-plant corporation. The horizontal model hence implies that a corporation sets up its headquarters (hereafter HQ) at one location and one or more production plants at other locations. The HQ, which is characterized by high fixed costs will be performing firm-specific tasks that create transferable assets and the plants will utilize those assets in the process of physical manufacturing of the product (Hanson et al. 2001). The structure of such an MNE explains why the model is coined the horizontal model of FDI. It expresses the fact that the company is undertaking the same activities across each of its facilities in every country.

In spite of the obvious efficiency advantage of operating multiple production facilities that use the same transferable inputs, however, the question arises when it becomes profitable for a company to engage in horizontal FDI. Assuming the existence of economies of scale in any production plant, a company could realize considerable savings producing at a single location and exporting to foreign markets. According to the horizontal model of FDI, multinational enterprises therefore arise because of the existence of trade barriers and transaction costs in association with exporting (Hanson et al. 2001). In an environment characterized by low trade barriers, the economy will comprise of national firms serving foreign markets through simple exporting. With high trade barriers, however, companies will find it more profitable to exploit the public goods aspect of their intangible assets and set up production plants in foreign countries, leading to the emergence of horizontal type MNEs. Companies that take on the structure of horizontal-type MNEs hence substitute local manufacturing for costly imports and in doing so follow the market seeking motive of foreign direct investment.

3.1.3 Vertical model of FDI

A different approach in the pursuit of explaining the emergence of MNEs focuses on the efficiency seeking motive of foreign direct investment. Contrary to the horizontal model, MNEs in the vertical model of FDI do not arise due to high trade barriers, but in response to

international differences in factor prices. This idea is rooted in two novel features that mark the wave of globalization in the last decades of the 20th century. Not only did it exhibit sharp rises in general flows of FDI, but it also showed a steep increase in the trade of intermediate inputs. Whereas this kind of trade only played a small part of overall trade in the United States in the beginning of the 20th century, it is now fundamental part of it (Hanson et al. 2005).

Helpman (1984) recognized the increasingly important role of US MNEs in international trade of the 1970s and attributed it to vertical production networks where each facility belonging to the same firm performs one or several stages of the complete production process, but never the whole process. The parent and affiliates are then linked with each other by intra-firm flows of inputs and outputs (Hanson et al. 2005). No one facility duplicates the activities of another plant and hence, every facility is uniquely specialized.

Similar to the horizontal model of FDI, the vertical model distinguishes a firm's operations into HQ and production activities. The first set is assumed to be capital intensive whereas the latter set of activities is said to be labor intensive (Hanson et al. 2001). Further, the model assumes the existence of economies of scale and transferable assets that originate in the headquarters but are not location-specific. In the absence of any transport costs, trade barriers or tax advantages, firms in this environment aim to maximize their profits by making cost-minimizing location decisions for the different stages of their production (Helpman 1984).

The decisive factor that induces the creation of multinational enterprises in such a set-up is the difference in factor prices across countries which results from a different distribution of factor endowments. In the presence of such cross-country differences, a company can maximize its profit by locating manufacturing activities in countries with relatively low unskilled labor costs and headquarter activities in countries with relatively low skilled labor costs (Helpman 1984). In its simplest form, a vertical-type MNE would comprise of two plants, a headquarter in a skilled-labor abundant country and a production facility in an unskilled-labor abundant country from which the company would serve all its other markets by means of exports. In a global economy with equal factor prices, vertical integration would take place on a single-plant basis. In the

absence of any form of trade costs, companies would be best off integrating the complete production process at one location and exporting from there rather than creating a network of integrated facilities at different locations.

The vertical and horizontal models of FDI share many of the same features. First of all, in both models MNEs are formed to avoid the duplication of HQ activities and second of all, in both models they raise global welfare by making production more efficient. However, the two models also exhibit considerable differences in the way this welfare is distributed within and across countries. Vertical FDI might potentially narrow the gap between less- and more-skilled labor abundant countries and also change its relative distribution within the countries. While horizontal FDI is more likely to raise income in both countries without necessarily adjusting its distribution among less- and more-skilled workers (Hanson et al. 2001). Both models exhibit favorable and unfavorable aspects and it is hard to judge which one exemplifies a better representation of the real world. Helpman (1984) argues that a framework combining the horizontal and vertical models of FDI would do a much better job of describing foreign direct investment as it really takes place. Appendix 2 provides a brief discussion of the most relevant empirical research undertaken on the horizontal and vertical models of FDI.

3.1.4 Knowledge-capital model

The knowledge capital model combines the ideas of the vertical and horizontal models into a single framework while correcting for two major weaknesses in their assumptions. The vertical model of FDI as proposed by Helpman (1984) assumes away any form of trade or transport costs. Given the reasonable assumption of economies of scale on the plant-level, a company operating in this environment would see no incentive to involve itself in horizontal FDI, which would mean locating production facilities abroad to serve the foreign market (Carr, Markusen, and Maskus 2001). Likewise, the horizontal model as outlined by Markusen (1984) doesn't differentiate between required factor intensities across different activities of the firm. HQ tasks were therefore assumed to consume the same relative amount of skilled and unskilled labor as production tasks.

Differences in factor prices that drive the formation of vertical production networks beyond country borders hence do not exist in such an environment. The knowledge capital model therefore assumes the simultaneous existence of both trade costs and differences in factor intensities, which allows vertical and horizontal firms to emerge endogenously in this framework. The overall objective of the knowledge capital model is to explain one country's total foreign affiliate sales in another country on the basis of both countries' structural factors and characteristics (Carr, Markusen, and Maskus).

The model is based on three crucial assumptions. First, knowledge generating activities and production don't need to be situated at the same geographical location and intangible assets resulting from knowledge generating activities can be transferred to production plants at relatively low cost. Second, knowledge generating activities are skilled labor intensive, while production activities are unskilled labor intensive. Third, transferable assets exhibit a public goods feature in that they can be used by several production facilities at the same time (Markusen et al 1996). Whereas the second assumption incentivizes vertical integration of MNEs, the final assumption permits the formation of horizontal enterprises to take place. Assumption number one on the other hand is a necessary condition for both modes of foreign direct investment.

The knowledge capital model relies on a large number of input variables and thus reliable testing of it proves very difficult. As Carr et al. (2001) point out for example, the percentage chosen for the ad valorem trade cost or corporate taxation can have significant impacts on the outcome of the model's predictions. Nevertheless, they perform the first empirical estimation of the knowledge capital model. Appendix 3 provides a summary of their results.

3.2 Partial equilibrium models

The theoretical frameworks examined in the previous section aim to derive general equilibrium models of FDI behavior. They try to explain to what extent and in which form FDI takes place taking into considerations many different variables related to the structural features of a country

and the production process of a good. This research paper models FDI using a partial equilibrium framework where the focus lies on the impact of the exchange rate. The next sections will outline the most important economic concepts regarding the FDI – exchange rate link and finally examine the theoretical centerpiece of this study, the asset acquisition hypothesis.

3.2.1 Traditional view

The traditional view in economics has generally emphasized that there cannot be a meaningful link between the exchange rate and FDI. Under the assumption of purchasing power parity (hereafter PPP), exchange rate changes are simply neutralizing differences in inflation across currencies. If the price and the return of an asset are denominated in the same currency, earnings in the acquiring firm's home currency will stay constant, which implies that the valuation of that asset by a domestic and a foreign firm will be the same, ceteris paribus (Dewenter 1995). No particular advantage for foreign firms should hence exist in the bidding process for an asset.

This traditional view assumes perfect capital markets and PPP to work flawlessly. In reality, however, there can be significant short- and long-term deviations from PPP which form the foundation for two theories that attempt to explain the impact of the exchange rate on FDI. On the one hand Cushman (1985) argues that long-run deviations from PPP can potentially affect a company's decision on where and how much to produce. This idea provides the groundwork for the relative wage hypothesis. On the other hand, Froot and Stein (1991) make the point that even short-run PPP adjustments can already have a significant impact on FDI, since such adjustments alter the relative financial powers of foreign and domestic firms. This argument is the basis for the relative wealth hypothesis.

3.2.2 Relative wage hypothesis

The relative wage hypothesis puts a focus on relative labor costs. The theory argues that capital seeks cheap labor, meaning that, all else equal and in the absence of trade cost, a company prefers

to produce in the location with the cheapest labor costs, as long as the lower factor prices are not matched by lesser productivity or an overvalued currency. To be precise therefore, companies prefer locations with lower unit labor costs (Culem 1988). A long-term deviation from PPP can considerably affect the price of domestic labor for a foreign company. A depreciation of the home currency would make production for foreigners cheaper and should therefore attract outside investment. Cushman (1985 and 1987), as well as Culem, finds that the depreciation of a country's currency is indeed joined by increasing inward foreign direct investment and vice versa, establishing some empirical foundation for their argument. Furthermore, high unit labor costs appear to constitute a serious deterrent to inward FDI even in industrialized economies. Labor costs are seldom the reason for FDI in those countries, however. Rather, they only become important once the decision to locate abroad has been made. Unit labor costs are hence an important explanatory factor when analyzing the direction of FDI, but not the reasons for it (Culem).

3.2.3 Relative wealth hypothesis

Contrary to the relative wage hypothesis, the relative wealth hypothesis focuses on the purchase price of an asset rather than factor prices when explaining the exchange rate FDI relationship. The intuition behind the hypothesis is that a depreciation of the home currency makes foreigners who hold their funds in a foreign currency relatively wealthier. Domestic assets hence become cheaper to foreigners than to domestic investors. Focusing exclusively on cross-border M&As, Froot and Stein (1991) set up a model in which increases in wealth provide an incentive for companies to invest. A crucial assumption is that investors in general do not possess the means to acquire an asset solely with their own funds, but need to borrow a significant share of the purchase price. Capital markets in this model are imperfect in the sense that lenders cannot easily observe the output generated by the acquired asset. Since they incur a cost in monitoring the investor, lenders in this model will never lend an amount equal the full purchase price (Dewenter 1995).

In the presence of such informational asymmetries that limit a firm's leverage ratio, the amount a firm can offer for an asset is intrinsically determined by its net wealth. The more funds a firm possesses, the lower will its cost of capital be. Exchange rates thus play a paramount role in this setting, because exchange rate movements alter the relative wealth of investors across countries (Klein and Rosengren 1993). As foreign investors generally hold their wealth in a foreign currency, a depreciation of the domestic currency, which the asset to be acquired is denominated in, will lower a foreigner's cost of capital and thus improve his wealth position relative to a domestic investor. Since the investor with the highest amount of wealth as denominated in domestic currency wins the bid for an asset, all else equal, this will lead to a surge in foreign investors winning bids as the domestic currency depreciates (Froot and Stein 1991). The crucial feature of this model is the information intensity of an asset. The higher it is, the larger will be the impact of exchange rate movements on FDI flows. On the other hand, for assets whose returns are freely observed, an investor's net wealth should not play any role in the case of cross-border M&As (Froot and Stein).

Empirical evidence on the relative wage and wealth hypotheses is mixed. Klein and Rosengren (1994) find some significant support in favor of the relative wealth hypothesis, while they fail to identify any significant link between the cost of labor and FDI flows. In fact, they argue most previous studies that happened to find evidence of the relative wage effect were really just picking up relative wealth effects instead. Their argument highlights the difficulty in telling apart the different effects that are really working on FDI flows.

3.2.4 Asset acquisition hypothesis

Blonigen (1997) suggests an alternative theory to explain the mechanism through which exchange rate movements impact FDI flows. In doing so he picks up an argument put forward by various economists who represent the traditional view towards the FDI exchange rate relationship, but gives the story an entirely different twist. Hymer (1960), for instance, claims

that FDI does not take place as a result of cost of capital advantages, but due to the fact that some domestic assets are simply of greater value under foreign control.

The major shortcoming of the traditional view, as Blonigen (1997) points out, is that it assumes the price and return of an asset to be denominated in the same currency, which does not need to be the case with acquisitional FDI. Blonigen puts two crucial points to the center of his framework. First, he only considers acquisitions of already existing transferable firm-specific assets that can be used as a joint-input across countries. Second, he makes the assumption of imperfect goods markets, which implies that a domestic firm's access to foreign markets will be severely constricted. This may be due to foreign firms' better distributional networks or buyer and seller relationships abroad, for instance (Georgopoulos 2008). If a firm, in the presence of such market segmentation, can purchase a firm-specific and transferable asset, this asset has the potential of generating returns in various markets and currencies at the same time. Due to imperfect goods markets, however, this potential will be considerably greater when the asset gets under foreign control. Assuming that domestic and foreign firms have equal access to financing for the acquisition, but different opportunities to realize returns from it, exchange rate movements can seriously impact a valuation of that asset in opposing ways (Bloningen).

Considering the acquisition of a domestic target that owns a transferable asset, a depreciation of the domestic currency will lower a foreign firm's cost of acquiring the target, which would in turn raise the NPV of this project. On the other hand, due to imperfect goods markets and a domestic firm's limited ability to generate returns abroad, its valuation of the target will stay more or less unchanged. The asset acquisition hypothesis thus predicts that following a depreciation of the domestic currency, foreign firms will be able to bid more aggressively on domestic assets which should lead to an increase in inward acquisition FDI to the domestic country.

The asset acquisition hypothesis rests upon the strategic asset seeking motive of FDI. It assumes that foreign investments are driven by the objective to exploit or build new ownership advantages through the acquisition of transferable assets that are unavailable in the company's domestic

market. Blonigen (1997) intrinsically assumes that a parent can exploit such an ownership advantage more or less instantaneously. Empirical research on this issue by McFetridge (1987) and Caves (1996) among others indeed yields support for this assumption, as they find that MNEs do indeed adapt newly acquired technologies in a very timely fashion.

Contrary to the relative wealth hypothesis by Froot and Stein (1991) which focuses on imperfections in the capital markets, Blonigen (1997) emphasizes the impact of imperfect goods markets on acquisition FDI. Moreover, while the relative wealth hypothesis aims to explain various forms of FDI, the asset acquisition hypothesis only attempts to explain acquisition FDI that involves transferable assets.

4. Review of empirical research

4.1 General exchange rate link with FDI and cross-border M&As

Froot and Stein (1991) published one of the most influential papers on the relationship of the exchange rate with FDI. They regress the value of FDI inflows in the US against the real value of the US dollar using quarterly data for the period 1973-1988. Their results suggest that a depreciation of the dollar stimulates inward FDI. Klein and Rosengren (1994) establish the same relationship using a sample from 1979-1991. Other research, however, argues that an unambiguous exchange rate – FDI link does not exist; rather the effect of a depreciating currency can turn out to be of any kind whatsoever and therefore impossible to predict. Stevens (1998) re-runs the regression of Froot ad Stein (1991) and finds that although a cheap dollar is associated with increasing inward FDI for the sample period as a whole, no significant relationship can be attested for the major part of the observation period when run on subsamples. Goldberg (1993) also emphasizes that the real exchange rate effects change over time, which counters the proposition of a definite relationship.

In line with results by Froot and Stein (1991) on aggregate FDI, Erel et al. (2012) constitute that currency movements exert significant influence on the pattern of international M&A trends. According to their results, a depreciation of a country's currency indeed leads to increased

inflows of acquisition FDI. Klein and Rosengren (1994) even find that the effect of the real exchange rate on cross-border M&A's is greater than on overall FDI. However, empirical research on the exchange rate – M&A link is as controversial as on the link with aggregate FDI. Healy and Palepu (1993) examine completed cross-border deals between eleven of the leading industrial nations during the period 1985-90 and fail to find significant results in favor of a real exchange rate effect. Surprisingly, Reed and Babool (2003) even find results suggesting an inverse FDI – M&A link where currency depreciations lead to a drop in the number of acquisitions by foreign companies. Appendix 4 provides a more detailed discussion of the empirical research on the exchange rate link with FDI and cross-border M&As. Empirical evidence on the real wage and wealth hypotheses in the context of the exchange rate are also presented.

4.2 Asset acquisition hypothesis

According to Blonigen (1997) a company's motivation to engage in cross-border M&A is not rooted in differences in relative wealth or wages, but in the desire to acquire firm-specific transferable assets that might not be available at home. In a first test of this hypothesis, he focuses on Japanese acquisitions of US targets in the period 1975-1992, choosing the number of M&A's in a given industry sector and year as the dependent variable. Further, the United States – Japan pair provides an advantage in studying the asset acquisition hypothesis for two particular reasons. First, the markets are relatively isolated from each other, which meets the assumption of segmented markets; and second, Japanese acquisitions in the US are concentrated on companies that involve transferable assets (Blonigen). In order to avoid the same shortcomings that many other studies exhibit, Blonigen includes a set of control variables in addition to the real exchange rate. Supply-side factors adjust for the availability of acquisition opportunities in the United States, while demand-side factors capture Japan's "hunger" for acquisitions. As Dewenter (1995) points out, it is important to study the effect of the exchange rate on foreign investment over and above domestic investment changes. The demand-side factors take into account this particular consideration.

As will be done in this study, Blonigen (1997) splits his data set into high and low R&D samples. R&D intensity is measured as domestic expenditure on R&D relative to domestic sales. High R&D industries are defined as industries with R&D-to-sales ratios above the manufacturing average. Since the asset acquisition hypothesis aims to explain the exchange rate – FDI link for cross-border M&As that involve the acquisition of transferable and firm-specific assets, this constitutes a crucial step in the analysis. It distinguishes such industries that possess a great number of firm-specific assets from such that don't.

The regression results provide substantial evidence for the asset acquisition motive of FDI. While real dollar depreciation attracts Japanese acquisitions in R&D-intensive manufacturing sectors, it appears to have no such impact on acquisitions in less R&D-intensive sectors. Specifically, a real depreciation of the US dollar by 10% leads to an 18-32% increase in the number of Japanese acquisitions in high R&D manufacturing industries (Blonigen 1997).

Georgopoulos re-runs Blonigen's model for bilateral M&A's of the United States and Canada for the period 1985-2001. Although his results are less precise and somewhat mixed compared to Blonigen's study, the overall conclusion with respect to the real exchange rate is that the asset acquisition hypothesis seems to be holding bilaterally. In both countries a depreciation of the real exchange rate is associated with an increasing number of foreign acquisitions in R&D intensive manufacturing sectors, whereas no significant results can be found for the less R&D intensive sectors. Additionally, Georgopoulos finds that there is no observable exchange rate effect on bilateral greenfield investments, which is further support for the asset acquisition hypothesis as exchange rate movements only seem to affect acquisitions in which transferable assets are involved.

4.3 Research hypotheses of this thesis

The review on previous empirical studies of the asset acquisition hypothesis results in the specification of two sets of hypotheses to be tested in this thesis. Since this thesis investigates

bilateral M&As in manufacturing industries between the UK and the US for the period 2004-2010, four sub-hypotheses arise.

1. ***Real exchange rate movements have no explanatory power over the variation in acquisition FDI flows in low R&D manufacturing industries.***
    a. *Movements in the USD/GBP real exchange rate have no explanatory power over the variation in the number of UK M&As in low R&D manufacturing industries in the US from 2004 to 2010.*
    b. *Movements in the GBP/USD real exchange rate have no explanatory power over the variation in the number of US M&As in low R&D manufacturing industries in the UK from 2004 to 2010.*
2. ***A real depreciation of the domestic currency results in an increase of acquisition FDI inflows into domestic high R&D manufacturing industries.***
    a. *An increase in the USD/GBP real exchange rate has a positive impact on the number of UK M&As in high R&D manufacturing industries in the US from 2004 to 2010.*
    b. *An increase in the industry-specific GBP/USD real exchange rate has a positive impact on the number of US M&As in high R&D manufacturing industries in the UK from 2004 to 2010.*

5. Cross-border M&A trends

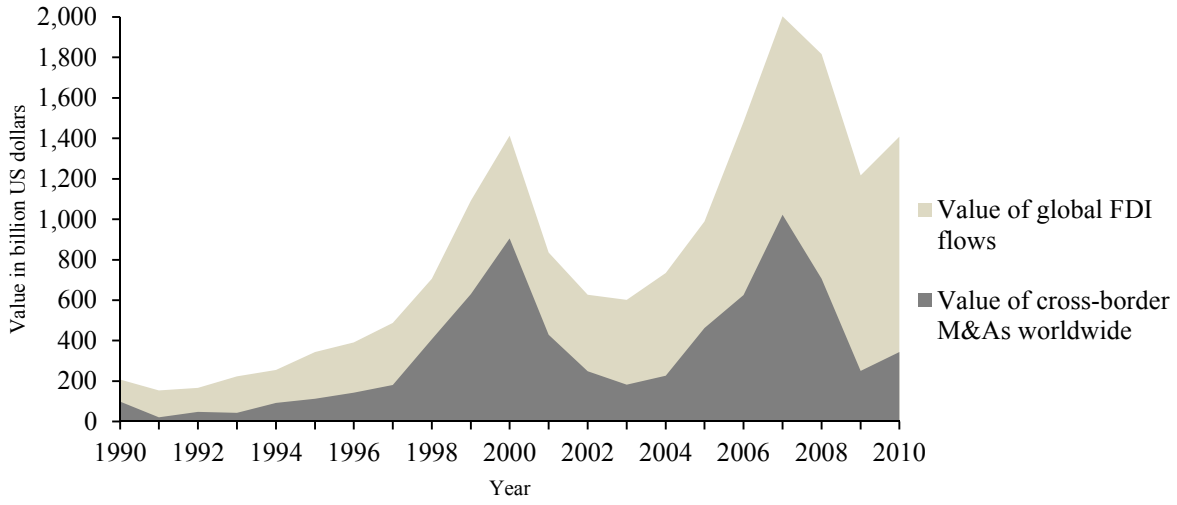
The value of cross-border mergers and acquisitions around the world rose dramatically during the late 1990s and powered global FDI levels to a preliminary peak in the year 2000. The World Investment Report (UNCTAD 2000) argues that cross-border M&As were the major driver for the considerable increase in FDI in that decade. In 2000, the value of international takeovers reached approx. USD 905 billion and comprised almost two thirds of aggregate foreign direct investment. Figure 1 presents the development of both total FDI and cross-border M&As around the world. Following the sudden end of the dot-com boom at the turn of the millennium both

international M&As and FDI experienced a substantial drop and did not recover until 2004, when both indices increased again for the first time since. Global FDI reached an all-time high in 2007, just breaking through the USD 2,000 billion ceiling. Although it happened to be a record year for cross-border M&As as well, amounting to USD 1,022 billion, they only made up 51% of aggregate FDI, therefore losing in importance as its driving force. In consequence of the emerging global financial crisis in the second half of 2007, FDI around the world experienced a significant drop. Interestingly, the effects of the crisis were more dramatic for cross-border M&As than for FDI as a whole. At the end of this study's sample period in 2010, cross-border M&As only accounted for approx. 24% of aggregate FDI.

Table 1 presents two-way M&A data on the United States and United Kingdom, along with an annual average of the USD/GBP nominal exchange rate for the interval of our sample. The data are presented as an aggregate of all manufacturing industries as well as split by R&D intensity. An interesting pattern emerges from the data. In both data sets, M&As in the UK and the US, the number of takeovers in the high R&D sectors is always higher than in the low R&D sectors. This is particularly surprising when considering that the number of sectors in the low R&D samples is many times higher. Georgopoulos (2008) uses the same definition of R&D intensity as we do and finds that for US acquisitions in Canada, low R&D industries exhibit more international M&A activity than high R&D industries on aggregate. Furthermore, M&As in the record-breaking year of 2007 were almost exclusively driven by acquisitions of highly R&D intensive targets. The level of M&As in less R&D intensive industries stayed at a relatively consistent level in both countries.

During the sample period the value of the dollar was the lowest in 2007, trading at more than two for one relative to the Pound Sterling. Consistent with the asset acquisition hypothesis, the number of UK acquisitions of UK high R&D firms in that year was higher than in the remaining sample period. On the other hand, and contradicting Blonigen's (1997) theory, also the number of US acquisitions of UK firms reached a local maximum that year. As it seems that other factors than the exchange rate play into the cross-border M&A process, the regression models in this study will include variables to control for factors other than the exchange rate.

Figure 1: Global FDI trends (Source: UNCTAD 2013)



Panel A and panel B in figure 2 illustrate the relationship between cross-border M&As and the real exchange rate computed using aggregate manufacturing producer price indices for the UK and US. The same pattern we outlined in the previous paragraph emerges. Further, we notice a dramatic drop in the level of M&As in the year 2009 for cross-border M&As in the US and UK, most probably an aftershock of the global financial crisis.

Appendix 5 presents the UK manufacturing industries listed according to the number of US M&As they experience. Appendix 6 presents equivalent data for US manufacturing industries. Interestingly, eight out of the top ten target industries in both countries are identical, with computer, chemical, and machinery manufacturing ranked as the top three in exactly this order. Also, high R&D industries are generally ranked in the top half of the list. With regard to UK acquisitions of US firms, the four high R&D industry sectors in the US are listed in the top four seeds. Established industries that involve a lot of actual manufacturing work, such as apparel of leather manufacturing, only experience a handful of M&As during the complete sample period.

Additionally, Appendix 6 also reports the number of establishments per US industry in 2004 and 2010. Consistent data on UK establishments were not available on an industry level,

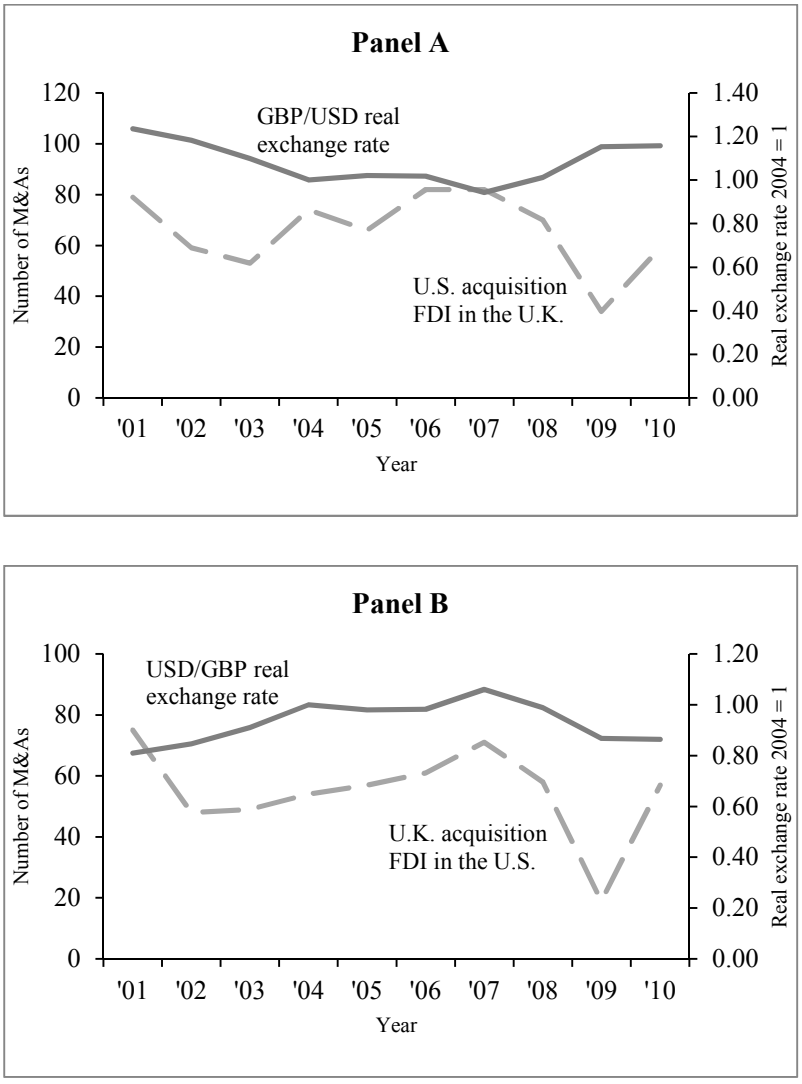
unfortunately. Comparing 2004 to 2010 data, we see that beverage manufacturing is the only industry that exhibited growth in its number of establishments. This does not mean that all industries are shrinking, however. Rather this points towards substantial consolidation within US manufacturing sectors as an analysis of industry value-added shares showed . Moreover, the data in Appendix 6 show that the number of establishments is not the only driver of M&A activity. Computer and electronic product manufacturing were acquired most frequently during our observation period, albeit it is only the 6th largest sector by number of establishments. On the very contrary, the sector with the fewest number of businesses, chemical manufacturing, counts the second most number of international takeovers. However, the overall relationship between the

Table 1: Cross-border M&As of manufacturing targets between the US and UK, 2004-2010

		Number of US M&As in the UK			Number of UK M&As in the US		
Year	USD/GBP Exchange rate[a]	All mfg industries	High R&D[b]	Low R&D	All mfg indsutries	High R&D[c]	Low R&D
2004	1.831	74	44	30	54	35	19
2005	1.818	66	36	30	57	40	17
2006	1.840	82	43	39	61	39	22
2007	2.001	82	61	21	71	49	22
2008	1.838	70	41	29	58	42	16
2009	1.558	34	18	16	19	14	5
2010	1.545	59	31	28	57	42	15

a Data on the nominal exchange rate are retrieved from the World Bank (2013b)
b High R&D manufacturing industries in the UK are Petroleum & Coal Products (19 SIC), Basic Pharmaceuticals (21 SIC), Computers & Electronics (26 SIC), Electrical Equipment (27 SIC), Motor Vehicles (29 SIC), and Other Transport Equipment (30 SIC). SOURCE: Business Enterprise Research and Development Survey, Office for National Statistics
c High R&D manufacturing industries in the US are Chemicals (325 NAICS), Machinery (333 NAICS), Computers & Electronics (334 NAICS), and Transportation Equipment (336 NAICS). SOURCE: Business R&D and Innovation Survey, National Science Foundation
NOTE: M&A data are retrieved from the Thomson One Banker database

Figure 2: Panel A - US M&As in the UK | Panel B - UK M&As in the US (Sources: Thomson One Banker, The World Bank 2013b, Bureau of Labor Statistics 2013, and Office for National Statistics 2013a)



number of establishments and cross-border M&As in an industry is still positive. The correlation between both variables is approx. 39%. Other variables, including the exchange rate, are likely to be important determinants of cross-border M&A activity as well, however.

Finally Appendix 7 presents a ranking of the industries that acquire manufacturing firms in the US and Appendix 8 presents a ranking of the industries acquiring firms in the UK. The top three

acquiring industries in both countries are identical to the top three target industries that we've seen before in tables 2 and 3. Furthermore, more than 75% of the targets in our sample are acquired by other manufacturing companies and approx. 55% of M&As take place on an intra-industry level.

Most interestingly, the table shows that a significant amount of M&As are undertaken by companies operating in the financial industry. The NAICS code 523 also comprises hedge funds. Obviously, financial institutions or funds might pursue other goals when acquiring a manufacturing target than other companies. Analyzing the companies they acquire does not reveal any particular pattern, however. Rather, their targets are evenly distributed across all manufacturing industries. Since this paper aims to analyze the differential effect the real exchange rate has on M&As in low and high R&D industries, the substantial number of financial acquirers can result in misleading conclusions. For instance, unlike the asset acquisition hypothesis proposes, there would be no point of a financial institution acquiring a high R&D target because of its technology-related firm specific asset. This means that the real exchange rate link we expect to observe under regular circumstances would not hold. After all, a financial institution is unlikely to have abilities superior to foreign manufacturing firms when it comes to leveraging a certain asset in order to generate returns in its domestic market. Because the number of M&As undertaken by companies operating in the financial industry is quite substantial, it amounts to almost 8% of all observed deals, and this study wants to gain insights on the drivers of the whole population of M&As, these observations are not excluded from the data set. However, the results have to be interpreted with particular caution in light of these considerations.

6. Data and methodology

6.1 Data samples

The data on M&As between the US and UK have been drawn from Thomson One Banker (hereafter TOB). TOB collects its data based on public information and provides documentation of transactions on the basis of SEC and company filings and the like. The final data set comprises all completed cross-border deals available in TOB which have been announced in the period 2004-2010 and involved a manufacturing target. Since this study assumes the real exchange rate prevailing at the time of deal announcement to be the decisive factor for the intention to acquire rather than the prevailing rate at completion, every deal is classified according to the year it was announced in. In any case, year of announcement and completion only differ in a handful of cases in the whole sample.

To arrive at the final samples of cross-border deals, the following selection criteria have been applied:

1. Only cross-border transactions are considered involving the US-UK country pair. This means that the acquirer must be based in one of these countries and the target firm in the other country.
2. The target firm must be operating in a manufacturing sector as defined by either NAICS 2007 or SIC 2007, irrespective of the sector of the acquiring company, which may possibly be from outside the manufacturing sectors. The focus here is on target firms, because this study is trying to measure real exchange rate effects on acquisitions of companies that possess firm-specific and transferable assets. Since the industry code of the bidding company does not imply anything about the kind of target it wants acquire, this information is irrelevant for this purpose. However, as the discussion in section 5 showed, approx. 8% of acquirers are firms of financial nature, which might have incentives different from other firms. This can potentially bias the final regression outcome of this study.
3. All deals must have been completed.

4. The final stake of the acquirer in the target company must be greater than 50% after the acquisition. Because such a share usually gives majority control rights to a company, this mark serves as a natural threshold. Also, it is meant to exclude small scale investments that are less likely to be driven by exchange rate considerations. In some cases, where an acquirer happens to own previous stock in a company, it will be enough for such an investor to acquire a little share in order to cross the 50% threshold. As noted above, smaller investments can be thought of being less affected by the exchange rate than larger investments. However, we assume such cases to be very small in number.

Applying these selection criteria leaves a total sample of 844 cross-border M&As. Of those transactions, 467 constitute US M&As of UK target firms and 377 constitute UK firms taking over US companies.

6.1.1 Theoretical considerations

6.1.1.1 Why does this thesis focus on manufacturing industries?

As pointed out earlier, the asset acquisition hypothesis focuses on transferable firm-specific assets. Since manufacturing companies are actually producing physical outputs, they are expected to be more R&D intensive than service industries. Manufacturing firms are more likely to have R&D departments and thus R&D expenditure is more easily quantified.

6.1.1.2 Why the UK-US pair?

The country-pair of the UK and US was chosen for a number of reasons. First of all, this study wants to examine the asset acquisition hypothesis in the context of developed economies. Second of all, no comparable study is known of that investigates the asset acquisition hypothesis in the context of bilateral M&As between the UK and US. Third of all, both countries have very large financial and capital markets. Fourth of all, the economic ties between both countries are expected to be quite substantial due to their cultural proximity. This should result in a decently

sized sample of cross-border deals can be collected. Finally, both countries publish a significant amount of data, which is a particularly important factor for the quantitative analysis in this thesis.

6.1.2 Variable identification and measurement

The methodological set-up of this study is heavily based on Blonigen's (1997) paper about the real exchange rate's impact on Japanese acquisitions of US companies between 1975 and 1992. The set of included variables in this paper generally follows the same pattern; however, several adjustments were made which were thought to benefit the research process. While the dependent variable stays unchanged to Blonigen's paper, the adjustments are found in the set of control variables. Most importantly growth of stock market capitalization and the time trend have been excluded in the study at hand, whereas a real interest differential and number of industry establishments in the foreign country are added to the model. The intuition behind these changes will be clarified later in this chapter.

6.1.2.1 Measurement of the dependent variable – Cross-border M&As

The dependent variable is defined as the number of domestic acquisitions of foreign companies in a certain industry sector in a given year. Industry sectors are defined according to three-digit NAICS 2007 codes for US targets and its equivalent of two-digit SIC 2007 codes for UK targets. With 22 manufacturing sectors over seven years, this results in 154 observations in each of the two data sets. The 844 cross-border deals identified above hence do not show up as individual observations, but rather feed in to the dependent variable of the model. As an example to illustrate its definition, let's consider US acquisitions of UK manufacturing companies. In the year 2004, US companies acquired twelve UK companies operating in the "chemicals manufacturing" sector which is classified as 325 and 20 under NAICS 2007 and UK SIC 2007, respectively. The value of the dependent variable in this case is twelve, therefore.

6.1.2.2 Measurement of independent variables

The real exchange rate constitutes the most important regressor in this study. In order to account for effects arising from factors other than exchange rate movements, a number of control variables is added to the model.

6.1.2.2.1 Real exchange rate

The real exchange rate (hereafter RER) measures the relative purchasing power between two currencies. Using current nominal exchange rates and prices, it tells us how many units of a foreign good one can buy for one unit of domestic goods, when selling the domestic good in the domestic market, exchanging the currency and purchasing that same good in the foreign market (Oudiz et al. 2005). Mathematically it is defined as follows:

$$Real\ exchange\ rate = E * \frac{P(domestic)}{P(foreign)} \quad (1)$$

The term *E* gives the nominal exchange rate with units of foreign currency necessary to buy one unit of domestic currency. *P(domestic)* is the price of one unit of the domestic good in domestic currency, whereas *P(foreign)* denotes the price of the foreign good in the foreign currency. Following this definition, an increase in the real exchange rate indicates a real appreciation of the domestic currency, implying that one domestic good is worth more units of the foreign good now. The same is true the other way around, meaning that a decreasing real exchange rate is equivalent to a real depreciation of the domestic currency, as the number of foreign units it can buy falls. A real exchange rate equal to one indicates that PPP holds, which means that no arbitrage could be made by selling domestic goods and purchasing them abroad.

In light of this paper's research objectives, it is necessary to use the real rather than the nominal exchange rate. The asset acquisition hypothesis implies that relative price advantages exist for domestic firms when purchasing certain foreign assets in light of domestic currency appreciation. A nominal exchange rate appreciation in itself does not imply that a foreign asset has become

cheaper, however. Nominal price movements of the asset also need to be taken into consideration and that is exactly what the real exchange rate does.

In line with the approach of Blonigen (1997), RERs are constructed on an industry-specific basis in order to estimate the impact on cross-border M&As within certain industries. This is meant to provide greater precision as compared to using an overall RER for the whole manufacturing sector. For this purpose, industry-specific producer price indices (hereafter PPIs) at the three-digit NAICS 2007 and two-digit UK SIC 07 level are employed. PPIs are unit-less indices that indicate relative price changes, just like the CPI. To be able to use the indices in equation 1, the PPIs are modified so that the RER is equal to 1 in the year 2004.

Data on nominal exchange rates were obtained from the World Bank (2013b) database and constitute simple yearly averages. PPIs of US manufacturing industries were retrieved from the Bureau of Labor Statistics (2013), whereas equivalent data on UK industries were drawn from the UK's Office for National Statistics (2013a).

6.1.2.2.2 Tariffs

Tariffs put foreign products at a disadvantage compared to domestic ones. FDI, however, provides an effective means to circumvent such barriers. In general, domestic tariffs can therefore be expected to be positively correlated with acquisition FDI inflows into the domestic economy. However, in the specific context of highly R&D intensive industries no significant tariff effect should be observable, since the acquisition of firm-specific assets is unlikely to be motivated by the tariff-jumping argument (Georgopoulos 2008). Tariff rates are included according to three-digit NAICS and two-digit SIC respectively and denote the effective tariff rate, which is the duties that domestic companies really pay when exporting to the foreign country. The following equation illustrates this relationship:

$$Tariff_{jt} = \frac{total\ value\ of\ duties\ collected\ by\ target\ country\ on\ imports\ from\ acquiring\ country\ in\ industry\ j\ and\ t}{total\ value\ of\ imports\ from\ acquiring\ to\ target\ country\ in\ industry\ j\ and\ year\ t} \quad (2)$$

The data are obtained from the World Integrated Trade Solution software provided by the World Bank (2013c).

6.1.2.2.3 Demand side variables – Real GDP growth and industry value-added share

The number of foreign M&As can further be explained by a number of demand side variables. These variables do not only affect demand for acquisitions abroad, but they shift the demand curve for all acquisitions, be it foreign or domestic. In order to capture these effects, real GDP as well as industry value-added shares of the domestic country are included in the model. Real GDP growth is added as annual growth rates of the acquiring country and it is expected to exhibit a positive coefficient as part of the regression model. As intuition suggests, higher real GDP growth should be linked to more M&As at home as well as abroad. The causal relationship here can be twofold. Either a growing economy results in a rise in the number of acquisitions, or it happens to be the result of such an increase. Most probably, however, both effects are playing into this relationship. Industry value-added share is defined along the lines of Blonigen (1997) as the value of output produced in industry *j* in year *t* as a share of the acquiring country's total nominal GDP. Industries that generate a larger share of an economy's output should generally be subject to larger volumes of investments, ceteris paribus. Industry value-added share is thus expected to be positively correlated with cross-border M&As.

Data on real GDP are obtained from the OECD (2013a), while data on industry value-added share for the US are obtained from the Bureau of Economic Analysis (2013) and equivalent data for the UK are retrieved from its Office for National Statistics (2012).

6.1.2.2.4 Supply-side variables – Target country M&As and number of businesses

Supply-side variables aim to adjust for the supply there is for companies of a particular industry in the country of the target. To account for such factors, the number of businesses and local acquisitions in the target country are included in the model. Businesses are measured as the

average number of existing establishments in industry *j* and year *t* for the US and, due to data unavailability, as an average total for all manufacturing industries in year *t* for the UK. Likewise, the number of national M&As in the target country is measured per industry *j* and year *t* for both countries. Industry *j* is once again defined according to three-digit NAICS or the equivalent of two-digit SIC. The target M&As variable represents which industries are of particular demand in the target country. It can therefore be regarded as a reliable indicator of which industries will be of demand for foreign companies that want to invest abroad (Blonigen 1997). A positive correlation with the dependent variable is thus expected.

Contrary to Blonigen (1997), who does not include the number of businesses in his variable set, Georgopoulos (2008) finds the variable to be highly significant in his models. His rationale is that more M&As will take place in those industry sectors that comprise more companies, simply because they offer a greater number of potential targets. US data on businesses are retrieved from the United States Census Bureau (2013), while the same data for the UK are retrieved from the Office for National Statistics (2013b). M&A data are obtained from the TOB database.

6.1.2.2.5 Real interest rate differential

Finally, since growth in market capitalization is cut from the sample, an extra variable is included in order to capture volatility in cross-border M&A activity that is unrelated to the real exchange rate. David Cushman, who published several papers on FDI determinants in the United States, includes real interest rates as control variables in his studies to account for companies' financing costs of FDI. He shows that an increase in the source country's real interest rate stimulates FDI outflows, while an increase in the host country's real interest rate discourages FDI outflows. A higher rate in the acquiring country raises financing costs at home and therefore stimulates FDI and vice versa (Cushman 1987). This study captures this effect by including the real interest differential between the host and the source country. It is defined as the real interest rate of the target country in year *t* less the real interest rate of the acquiring country in the same year. The same approach of using one instead of two separate variables is chosen by Erel et al. (2012). A

positive real interest rate differential indicates that financing in the target country is more expensive than in the domestic country, which should result in fewer acquisitions. A negative coefficient for the real interest rate is therefore expected in the model. Data on real interest rates for the US and UK are obtained from the World Bank (2013d).

6.1.2.2.6 Excluded control variables

Compared to the original model by Blonigen (1997), two variables that have been shown to add significant power to regression models explaining cross-border M&A activity have been introduced in this study. On the other hand, two variables from the original model have been dropped as they failed to add explanatory power or yielded questionable results.

Blonigen (1997) included yearly growth rates of domestic market capitalization in his model in order to adjust for effects arising from the speculative bubble in the Japan of the late 1980's and early 1990's. An increase in Japanese acquisitions of US firms as a result of wealth effects rooted in this bubble were supposed to be separated from possible real exchange rate effects. In his estimations, the coefficient of this variable was positive and significant in most cases, as intuition would suggest. Countering common sense, however, growth in market capitalization exhibited a significantly negative correlation with the number of foreign acquisitions for the sample of UK M&As in the US. The extreme swings of the capital market environment probably lead the data to establish a correlation between these variables that is likely to be entirely random. Including growth in market capitalization lagged by one year gave consistently positive coefficients over all estimated regressions, yet these coefficients were insignificant due to extreme correlation with another variable, growth in real GDP. These two variables exhibited a correlation of approx. 90% in the US and 83% in the UK implying that an economic recession was preceded by a decline in stock markets the year before, and vice versa. To avoid problems with multicollinearity, growth in market capitalization was excluded from the list of regressors completely. Negative Binomial regression results including growth in market capitalization in the country of the acquirer are included in Appendix 15.

Moreover, the time trend included in Blonigen (1997) is disregarded in this paper. Although, it was found to be positive and extremely significant in his study, the rapid growth in FDI flattened out considerably after the turn of the millennium, as shown in section 5. A time tend would hence be unlikely to capture the increase in the general level of FDI that it used to capture in Blonigen's model.

6.1.3 Final samples

In order to test the asset acquisition hypothesis along the lines of Blonigen (1997) it will be necessary to split the complete data set according to two dimensions. First of all, one set of samples comprises all observations of UK M&As in the US and the other set comprises US M&As in the UK. Second of all, each of these sets is further divided according to R&D intensity which eventually results in six samples, including the two full samples:

1. ***UK M&As in the US***
    a. *High R&D manufacturing targets*
    b. *Low R&D manufacturing targets*
    c. *All manufacturing targets (full sample)*
2. ***US M&As in the UK***
    a. *High R&D manufacturing targets*
    b. *Low R&D manufacturing targets*
    c. *All manufacturing targets (full sample)*

R&D intensity is measured as domestic expenditure on R&D relative to domestic sales. High R&D industries are thus defined as industries with R&D-to-sales ratios above the manufacturing average. Data on R&D intensity for the United States are reported in the *Business R&D and Innovation Survey*, which is published by the National Science Foundation (2013). Equivalent data for the UK are reported in the *Business Enterprise Research and Development Survey* published by the Office for National Statistics (2011).Using 2010 data, the average R&D

intensity of UK manufacturing firms was 3.3%. The resulting above average industries were Petroleum & Coal Products (19 SIC), Basic Pharmaceuticals (21 SIC), Computers & Electronics (26 SIC), Electrical Equipment (27 SIC), Motor Vehicles (29 SIC), and Other Transport Equipment (30 SIC). For the US, average R&D intensity in manufacturing in 2010 was 4.1% and the more R&D intensive industries hence were Chemicals (325 NAICS), Machinery (333 NAICS), Computers & Electronics (334 NAICS), and Transportation Equipment (336 NAICS).

6.1.4 Data quality and shortcomings

The data sample used in this paper is significantly smaller compared to similar studies, which constitutes a considerable shortcoming of the chosen approach. Blonigen (1997) for instance collects M&A's over a period of 18 years, while Georgopoulos (2008) collects M&A's over 17 years. Although the limited number of observations in our data set might be an apparent shortcoming, the decision to only use very recent data was central to the methodological approach of this study.

Regarding the sample that is used in this study, some assumptions and adjustments had to be made with respect to tariffs and the number of establishments, since data at the desired level of precision was unavailable. Whereas data on effective tariff rates on US imports from the UK is publicly available, no such data is accessible for the inverse relationship. As part of the European customs union, effective tariff rates on UK imports from the US are only reported on an EU-wide level. For the purpose of the research at hand, we assume that these rates are reasonably close approximations of the effective import charges on US exports to the UK.

Furthermore, accurate data on the number of establishments in manufacturing sectors was not available over the chosen sample period as a result of several methodological inconsistencies. First, reports in a number of years exhibit considerably fragmented data. Second, reports changed their industry classification system from SIC 03 to SIC 07 in 2010; and finally, a methodological change in how establishments were counted was implemented in the year 2010, rendering collection of consistent data on an industry-level impossible. The decision was therefore made to

include the number of establishments as a manufacturing total into the model. This number was reported in the 2010 report of the Department for Business Innovation and Skills for several years back.

As a final qualitative shortcoming of the sample, the precision of the industry-specific variables can be identified. In contrast to Blonigen (1997), who used industry-specific data at the three-digit SIC (equivalent to four-digit NAICS), we only had access to three-digit NAICS data in most cases. We still believe, however, that an industry breakdown at divisional level, as done in this paper, is accurate enough to achieve meaningful results in our estimations. Overall, the adjustments made in our data set are small and should at most have a rather negligible impact on the regression outcomes.

6.2 Econometric methodology

This study performs a panel analysis on the effect of the real exchange rate on cross-border acquisitions using multiple regression. A specialty of our data set is the dependent variable, which can only take non-negative integer values. In line with previous research by Blonigen (1997) and Georgopoulos (2008), a count model approach is thus pursued in this paper. Although count data can be modeled using simple or multiple linear regression models, there are several reasons why more sophisticated models perform better than regular OLS on these data (Greene 2008). The biggest disadvantage of an OLS model is that the dependent variable can take any real value, whereas count data can only be non-negative integers. Contrary to a normal distribution therefore, the mean of a count distribution is always greater than zero. Count models account for this feature and only return predictions of zero or higher (Greene).

Blonigen (1997) runs his estimations using Negative Binomial (hereafter NegBin) and Random Effects Negative Binomial (hereafter RENegBin) models. Due to the different data that are used in this study, also the simple Poisson regression is used to estimate the specified models. The

remainder of this cestion will first describe the rationale behind the various count regression models and finally explain the model specifications that are estimated in this paper.

6.2.1 Poisson model

The Poisson distribution is a popular method for studying count data in empirical research. It expresses the probability of a given number of events occurring in a fixed interval of time, based on the assumption that those events occur with a known average rate and independently of one another (Hausman, Hall, and Griliches 1984). The probability density function of the Poisson distribution is defined by the following equation:

$$\mathrm{P}\left\{y_{jt} = y \middle| x_{jt}\right\} = \frac{exp\{-\mu_{jt}\}\mu_{jt}^{y}}{y!}, \qquad y = 0,1,2, \ldots, \tag{3}$$

where y_{jt} represents the number of cross-border acquisitions in industry j and time period t. For mean $\mu_{jt} > 0$, this function therefore gives the probability that y_{jt} assumes non-negative integer values $y = 0,1,2\ldots$. The Poisson regression model can then be derived from the Poisson distribution by making the mean μ_{jt} a function of the set of covariates x'_{jt}. Although it can be formulated as a simple linear model, the most common formulation for μ_{jt} as a function of x'_{jt} is through the log-linear model, which can be expressed mathematically as

$$log\{\mu_{jt}\} = x'_{jt}\,\beta + u_{jt}. \tag{4}$$

Taking the logarithm of μ_{jt} assures that the mean of the Poisson distribution is a positive number, which is a necessary condition for the sample dealt with in this paper (Greene 2008). u_{jt} is a simple error term that is uncorrelated over time with mean zero. By exponentiating both sides, the Poisson regression can be rewritten into the multiplicative form, given by the following equation:

$$\mu_{jt} = exp\{x'_{jt}\,\beta + u_{jt}\}. \tag{5}$$

Given this definition, an increase in the regressor x_{jt} by one unit results in an increase of μ_{jt} by the factor *exp(β)*, all else equal. Contrary to simple additive effects in linear models, the regression coefficients in this log-linear model imply multiplicative effects on the dependent variable. In such a setting β represents the semi-elasticity of the mean to the set of covariates x'_{jt} (article 2). Changes in x'_{jt} will therefore have small effects for small counts and large effects for large counts, which is exactly what is typically observed for count data (Greene 2008).

The Poisson regression model is best estimated using maximum likelihood estimation (MLE), which is particularly well suited for count data samples. MLE maximizes a likelihood function by computing the parameter estimates for the regression model that would result in the highest probability of observing the particular sample at hand. Those parameter estimates are called maximum likelihood estimators (Greene 2008). With the Poisson regression in place, μ_{jt} can then be estimated using equation 5 and then be plugged in to the probability distribution function given in equation 3. Now, choosing any non-negative integer value for *y*, the probability that we observe that exact value *y* in reality can be estimated. By design, the integer value closest to μ_{jt} will naturally be the most probable outcome.

The major advantage of the Poisson distribution is its pretty simple set-up, which makes the model easy to work with. On the downside, however, this simplicity provides the model with some very restrictive properties. By design, the probability distribution function implies that mean and variance of the distribution are equal at all times, a phenomenon called equidispersion (Gujarati 2003). Yet, this is rarely the case with count data. The normal distribution, on the contrary, allows both factors to move independently from each other. As can be seen in tables 2 and 3 in section 7.1, the unconditional variance of the dependent variable in this study's samples exceeds the mean many times over, a property which is labeled overdispersion in count data. Since overdispersion results in downward biased standard errors and inflated t-statistics, regression results would convey a misleading impression about the significance of the covariates (Greene 2008). These problems can be resolved by applying a Negative Binomial model.

Comparing unconditional means and variances is certainly not the full story, though. The Poisson regression model actually assigns a distribution to the count variable y_{jt} conditional upon a set of covariates x'_{jt},. The distribution of y_{jt} therefore varies with the characteristics of x'_{jt}. In the unconditional distribution, however, all observations of y_{jt} are pooled regardless of the x'_{jt} they are conditioned upon. Still, Verbeek (2012) notes that given clear overdispersion in the unconditional count distribution the inclusion of conditioning covariates is unlikely to eliminate the dispersion completely.

6.2.2 Negative Binomial model

The NegBin model overcomes the problem of overdispersion because it does not impose the condition of equal mean and variance on the data set. Unlike Poisson, the Negative Binomial distribution is defined as having conditional mean μ_{jt} and conditional variance $\mu_{jt} + \alpha*\mu_{jt}^2$, where α represents a dispersion parameter that captures cross-sectional heterogeneity (Cameron and Trivedi 1986). The NegBin regression can thus be described as a generalized and less restrictive form of the Poisson regression. If α is equal to zero, variance and mean are both μ_{jt} and the distribution becomes Poisson again. Since the Poisson and NegBin models are nested, a likelihood ratio test can be applied to test which model provides more efficient estimates. At the same time this provides an intrinsic test of overdispersion and the null hypothesis that $\alpha = 0$. If the null hypothesis is rejected, overdispersion does exist and the NegBin model is better suited than Poisson to model the given data.

6.2.3 Random Effects Negative Binomial model

The regular NegBin model is also called a pooled model since it treats all observations the same and estimates a constant dispersion parameter across all individual observations in the data set. This model is particularly applicable to cross-sectional data studying individuals' behavior at one point in time. The data set in this paper is of panel nature however, as it observes M&A activity both across time and industries. Panel data potentially give rise to unobserved heterogeneity

across industries, which is not accounted for in a regular pooled model. To be precise, some unobserved effect δ_j might exist which is specific to an industry and not captured by the regression model. δ_j is a group-specific effect that causes the residuals of observations belonging to the same industry move into the same direction, indicating the way this industry differs from the average industry (Verbeek 2012). Econometric literature distinguishes between fixed and random effects in this context. Whereas fixed effects models assume that δ_j is correlated with the set of covariates x'_{jt}, random effects models assume δ_j to be distributed independently of the regressors. This study will capture group-specific effects by estimating the Random Effects Negative Binomial model as proposed by Hausman et al. (1984). The model can be mathematically expressed as

$$log\{\mu_{jt}\} = x'_{jt}\,\beta + \delta_j + u_{jt}, \tag{6}$$

where $\delta_j + u_{jt}$ are the two components that make up the error term. In this context the component δ_j is time-invariant and group-specific, whereas u_{jt} can vary with time but is uncorrelated over it.

Verbeek (2012) suggests that random effects are particularly appropriate when trying to make inferences about characteristics of an entire population. Fixed effects on the other hand allow making inferences about particular industries. Since this study aims to examine the effect of the real exchange rate on a population of manufacturing industries rather than just one particular industry, the random effects approach seems very reasonable. Nevertheless, Verbeek proposes to apply the Hausman test to distinguish between the fixed and random effects models. Although this test is typically applied in OLS models, Hausman et al. (1984) suggest its applicability for count models. The Hausman test investigates the null hypothesis that x'_{jt} and δ_j are uncorrelated with each other by testing whether the fixed effects and random effects estimators are significantly different. An insignificant test statistic usually implies that the random effects model should be preferred (Verbeek).

6.2.4 Tested models

The regressions in this study will be estimating three specified models. Model 1 is the main model to test the two hypotheses at the core of this thesis. Model 2 and Model 3 constitute robustness checks which account for possible effects arising from the global financial crisis that go beyond what is captured by the control variables in Model 1. All three models will be estimated applying the Poisson, NegBin, and RENegBin regression models. Furthermore, each of the models will be estimated on the high R&D, low R&D, and full sample of UK M&As in the US as well as US M&As in the UK.

Model 1: *Prob (cross-border M&As) = f (real exchange rate $_{jt}$, tariff $_{jt}$, real GDP growth $_{jt}$, industry value-added share $_{jt}$,,target country M&As $_{jt}$, businesses $_{jt}$, real interest rate differential $_{jt}$)*

Model 2: *Prob (cross-border M&As) = f (real exchange rate $_{jt}$, tariff $_{jt}$, real GDP growth $_{jt}$, industry value-added share $_{jt}$,,target country M&As $_{jt}$, businesses $_{jt}$, real interest rate differential $_{jt}$, Crisis)*

Model 3: *Prob (cross-border M&As) = f (real exchange rate $_{jt}$, tariff $_{jt}$, real GDP growth $_{jt}$, industry value-added share $_{jt}$,,target country M&As $_{jt}$, businesses $_{jt}$, real interest rate differential $_{jt}$)*

"Crisis" in Model 2 is a dummy variable that takes the value 1 for all observations in the year 2009. The difference between Model 1 and Model 3 is the sample period used. Whereas Model 1 uses data from 2004-2010, Model 2 excludes all observations from the year 2009. The rationale behind the decision to identify 2009 as the crisis year is explained in section 7.1. Although results on the full model will also be presented, the major focus certainly lies on the comparison between the high and low R&D results.

7. Results

This section will first present the most important descriptive statistics of the data set. After that, the regression results of model 1 will be analyzed in the context of the two hypotheses at the core of this study and results of models 2 and 3 will be discussed. Section 7.2.1 will cover results of the data set comprising UK acquisitions of US targets, while section 7.2.2 will deal with US acquisitions of UK targets.

7.1 Descriptive statistics

Tables 2 and 3 present the most important descriptive statistics with respect to the samples. Particularly striking is that the average number of cross-border M&As is considerably higher in more R&D intensive industries than in less R&D intensive ones. The same is true for the variance of the dependent variable, which is extremely high for the R&D intensive sectors, indicating substantial variations in the number of foreign acquisitions across industries. On the other hand, cross-border M&As in low R&D industries appear to be closely clustered around very low numbers. To examine the impact of global financial crisis on the dependent variable, a break-down according to "Crisis" and "No Crisis" is presented. The year 2009 is chosen as the crisis year, since cross-border M&As did not experience a substantial decline in the years 2007 or 2008, but in 2009, as figure 2 shows. As expected, the mean in the crisis year is substantially lower across all samples. The Appendices 9 to 12 provide more descriptive statistics and histograms on the unconditional distribution of the dependent variable across the samples.

Table 2: Summary statistics for the dependent variable from the data set corresponding to UK acquisitions of US firms 2004-10 split by R&D and Crisis

Sample Specification	Mean	Std. Dev.	Variance	Obs
Total sample[a]	2.45	4.20	17.62	154
High R&D[b]	9.32	5.72	32.67	28
Low R&D	0.92	1.26	1.58	126
Crisis[c]	0.86	1.86	3.46	22
No crisis	2.71	4.42	19.53	132
High R&D & crisis	3.50	3.32	11.00	4
High R&D & no crisis	10.29	5.48	30.04	24
Low R&D & crisis	0.28	0.57	0.33	18
Low R&D & no crisis	1.03	1.31	1.71	108

a Total sample includes all observations of the variable "MA" in the data set
b High R&D manufacturing industries are Chemicals (325 NAICS), Machinery (333 NAICS), Computers & Electronics (334 NAICS), and Transportation Equipment (336 NAICS)
c Crisis includes observations from the year 2009
SOURCES: *Business R&D and Innovation Survey*, National Science Foundation (2011), M&A data retrieved from the Thomson One Banker database

Table 3: Summary statistics for the dependent variable from the data set corresponding to US acquisitions of UK firms 2004-10 split by R&D and Crisis

Sample Specification	Mean	Std. Dev.	Variance	Obs
Total sample[a]	3.03	5.39	29.01	154
High R&D[b]	7.83	8.94	79.97	35
Low R&D	1.62	2.40	5.75	119
Crisis[c]	1.55	1.97	3.88	22
No crisis	3.28	5.73	32.83	132
High R&D & crisis	3.60	2.70	7.30	5
High R&D & no crisis	8.53	9.44	89.15	30
Low R&D & crisis	0.94	1.25	1.56	17
Low R&D & no crisis	1.74	2.52	6.37	102

a Total sample includes all observations of the variable "MA" in the data set
b High R&D manufacturing industries are Petroleum & Coal Products (19 SIC), Basic Pharmaceuticals (21 SIC), Computers & Electronics (26 SIC), Electrical Equipment (27 SIC), Motor Vehicles (29 SIC), and Other Transport Equipment (30 SIC)
c Crisis includes observations from the year 2009
SOURCE: *Business Enterprise Research and Development Survey*, Office for National Statistics (2011), M&A data are retrieved from the Thomson One Banker database

7.2 Regression results

This section presents the results on Model 1, estimated using the Poisson, NegBin, and RENegBin regression models. In order to account for minor violations of the equidispersion assumption, the Poisson model uses robust standard errors which enable the model to yield consistent estimators even if the Poisson distribution is invalid for the given sample (Verbeek 2012). NegBin results are reported to adjust for significant overdispersion in the sample and RENegBin results account for heterogeneity across industries as explained in section 6.2.3. Table 4 reports regression results to all those model specifications for UK M&As of US firms and table 6 reports equivalent results for US M&As of UK firms. In line with Blonigen (1997) and

Georgopoulos (2008), the 5% level of significance is used as a threshold when examining the regression outcomes.

At the bottom of tables 4 and 6 various statistics are reported that help comparing the different models. The log-likelihood statistic helps to compare the performance of different variations of a model, where values closer to zero imply a better overall fit. Maximum likelihood estimation, which is used to compute the regression estimators, aims at maximizing the probability of observing the data that we do by adjusting the parameters of the model. That probability is computed using a likelihood function and loglikelihood is the natural logarithm of that value. Loglikelihood serves as the major component in calculating the likelihood ratio test statistics which tests the specified models against their constant-only counterparts. The likelihood ratio test is further used to compare nested models. It provides a test of whether the difference in loglikelihood values is significantly different from zero (Verbeek 2012). The test statistic with respect to the likelihood ratio test of the specified versus the constant-only model is not reported; it is significant at 1% across all estimated models in this study.

Dispersion in the data sample is measured by the Alpha parameter which is reported as part of the NegBin estimation. A positive value for Alpha implies overdispersion in the sample. A likelihood ratio test comparing the NegBin with the Poisson estimators intrinsically tests the hypothesis that Alpha is indifferent from zero. A significant test statistic thus implies that thedata is overdispersed the model is better estimated assuming a NegBin distribution. Also reported are the Hausman test statistics. However, they show to be insignificant across all specifications of this study, which provides further support to prefer a random effects to a fixed effects model. Nonetheless, regression results applying fixed effects are reported in Appendix 16.

7.2.1 UK M&As of US targets

Table 4 presents the estimation outcomes with regard to Model 1a, 1b, and 1c. While Model 1a revolves around the high R&D sample, Model 1b deals with the low R&D sample. Model 1c reports the results on the full sample of manufacturing industries, which are of lesser importance

in the context of this study, however. The likelihood ratio test, which tests each specification against its constant-only counterpart, indicates that all specifications across the three models are overall significant, having at least one parameter that is statistically different from zero. However, the likelihood-ratio test comparing the RENegBin to the Pooled NegBin model is only significant for Model 1c, implying that the full sample is best estimated using the RENegBin model. With regard to the high and low R&D samples, the dispersion parameter Alpha, as show in columns 2 and 5 is not statistically different from zero, suggesting that both samples are not overdispersed. This implies that of the three estimated specifications, the Poisson model thus yields the most efficient estimators for Model 1a and 1b. The p-values of the estimated coefficients in these models emphasize this conclusion. Comparing them across the three specifications each, the Poisson estimators show to be most precise.

It is interesting to note that for the individual samples of high and low R&D industries the Poisson model provides the best results, while the RENegBin specification works best for the full model of manufacturing industries. Further, while the results show that the high and low R&D samples are not significantly overdispersed, the estimated α of the full model is significantly positive, which implies overdispersion. A reasonable explanation for why different specifications provide the most efficient estimators for different samples may lie in the characteristics of these samples. The distribution of the dependent variable is very different across the two sub-samples, but rather homogenous within them, which results in heterogeneity once the two samples are combined. By splitting the complete sample according to R&D intensity we thus eliminate a substantial part of that heterogeneity that is inherent in the full sample. As the dispersion parameter α in columns 2 and 5 indicates, overdispersion in the high and low R&D samples is much lower than in the full sample and statistically indifferent from zero.

The histograms in Appendix 11 illustrate the unconditional count distribution of the dependent variable in the full as well as high and low R&D samples. It becomes apparent that dispersion in the two sub-samples is substantially smaller compared to the full model. As the figures in the Appendix indicate, the R&D intensive sample exhibits a higher mean matched with greater variance, while the less R&D intensive sample has low mean and low variance. When both

samples are combined, the mean becomes small due to the high number of low R&D industries while the variance increases, resulting in overdispersion. The full model therefore exhibits a positive dispersion parameter.

Although Appendix 11 only presents an unconditional distribution, whereas the Poisson distribution is based on a conditional set of covariates x'_{jt} assuming all identical individual characteristics, it still gives a very good impression of the true conditional dispersion in the data. Verbeek (2012) notes that given clear overdispersion in the unconditional count distribution the inclusion of conditioning covariates is unlikely to eliminate the dispersion completely.

When the dispersion parameter α is equal to zero, the Negative Binomial model becomes identical to the Poisson model (Verbeek 2012). In this case the NegBin and Poisson models should yield similar results. The estimations for the low R&D sample fit right in this picture. The α in Model 1b is equal to zero and the coefficients in columns 5 and 6 indeed reveals that both estimations give almost identical results. Regarding the R&D intensive sample, the results in columns 2 and 3 are also extremely similar; however, the differences with respect to some coefficients or p-values are slightly bigger compared to the low R&D sample. Albeit the estimated dispersion parameter is statistically indifferent from zero as the likelihood ratio test of α=0 suggests, the NegBin regression model still fits a Negative Binomial distribution to the sample assigning a positive α of 0.04 to it. For this reason, the results of the NegBin regression are marginally different from the Poisson regression.

To summarize, with regard to the high R&D model 1a and the low R&D model 1b, the Poisson model yields the most efficient estimators. In order to test the specified hypotheses, this study will thus focus on the results given under the Poisson estimations in columns 3 and 6. Nevertheless, comparing the estimators and their significance levels reveals that the different specifications provide very similar results, which points towards the robustness of our models.

7.2.1.1 Hypothesis testing

In the following, the regression results of table 4 will be analyzed in the context of hypotheses 1 and 2. With regard to the samples at hand which revolve around UK M&As in the US, this section will focus on hypotheses 1a and 2a.

7.2.1.1.1 Hypothesis 1a

Hypothesis 1a states that exchange rate movements have no explanatory power over the variation in acquisition FDI in low R&D manufacturing industries. It implies that neither a real depreciation nor appreciation of the US dollar relative to the Pound Sterling has an impact on the number of UK acquisitions of US targets operating in low R&D manufacturing industries. We test this hypothesis by checking the slope and significance of the real exchange rate coefficients in model 1b of table 4.

The Poisson estimation in column 6 finds the real exchange rate coefficient to be positive. The extremely high p-value implies, however, that the coefficient is far from reaching any statistical significance. The RENegBin and NegBin estimations in columns 4 and 5 yield exactly the same results, which suggests that no correlation between the real exchange rate and the number of cross-border acquisitions in low R&D manufacturing industries exists. Since this is just what the asset acquisition hypothesis predicts, hypothesis 1a is therefore supported.

1.1.1.1.1 Hypothesis 2a

Hypothesis 2 states that a real depreciation of the domestic currency results in an increase of acquisition FDI inflows into domestic high R&D manufacturing industries. It implies that a real depreciation of the US dollar relative to the Pound Sterling leads to an increase in UK acquisitions of US high R&D manufacturing targets. We test this hypothesis by checking the slope and significance of the real exchange rate coefficients in model 1a of table 4.

Table 4: Determinants of number of UK acquisitions in the US, 2004-2010; dependent variable: number of UK acquisitions of US firms; separate estimates for full sample, high R&D sample, and low R&D sample

	High R&D Manufacturing			Low R&D Manufacturing			All Mfg Industries		
	Model 1a			Model 1b			Model 1c		
Variables	RE NegBin	NegBin	Poisson	RE NegBin	NegBin	Poisson	RE NegBin	NegBin	Poisson
Constant	2.86	2.07	2.37	13.99	-1.06	-1.05	3.82	1.51	3.14
	(0.36)	(0.49)	(0.24)	(0.98)	(0.45)	(0.38)	(0.01)	(0.23)	(0.01)
Real exchange rate	-2.77	-2.52	-2.79	0.16	0.58	0.57	-1.57	-0.94	-2.12
	(0.28)	(0.30)	(0.16)	(0.90)	(0.63)	(0.61)	(0.16)	(0.38)	(0.06)
Tariff	0.05	-0.03	0.00	-0.18	-0.18	-0.18	-0.33	-0.34	-0.41
	(0.93)	(0.96)	(0.99)	(0.05)	(0.02)	(0.01)	(>0.01)	(>0.01)	(>0.01)
Real GDP growth	0.13	0.12	0.13	0.09	0.08	0.08	0.13	0.12	0.14
	(0.12)	(0.13)	(0.04)	(0.10)	(0.11)	(0.10)	(>0.01)	(>0.01)	(>0.01)
Ind. value-added	0.79	0.73	0.74	0.35	0.32	0.32	0.36	0.18	0.23
	(>0.01)	(>0.01)	(>0.01)	(0.14)	(0.07)	(0.05)	(0.20)	(0.24)	(0.10)
Target M&As	-0.00	-0.00	-0.00	0.01	0.01	0.01	0.00	0.01	0.00
	(>0.01)	(>0.01)	(>0.01)	(>0.01)	(>0.01)	(>0.01)	(>0.01)	(>0.01)	(>0.01)
Businesses	0.03	0.04	0.04	-0.00	-0.00	-0.00	0.01	0.01	0.01
	(0.57)	(0.46)	(0.44)	(0.86)	(0.93)	(0.93)	(0.27)	(0.06)	(0.05)
Real interest diff.	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.02	-0.01	-0.03
	(0.94)	(0.95)	(0.86)	(0.82)	(0.90)	(0.89)	(0.70)	(0.91)	(0.53)
Alpha[a]		0.04			0.00			0.23	
Hausman test[b]	12.7			6.8			6.6		
Log-likelihood[c]	-72.9	-74.0	-74.5	-135.5	-136.1	-136.1	-222.6	-229.0	-238.6
LR test vs. Pooled	>0.1			1.1			14.0***		
LR test of Alpha = 0[d]		1.0			>0.1			19.2***	
Observations	28	28	28	126	126	126	154	154	154

NOTES: P-values for coefficients are in parantheses; Poisson models are estimated using robust standard errors; for a list of high R&D industries, see: table 1; * denotes 10% significance; ** denotes 5% significance; *** denotes 1% significance.

a Alpha denotes the estimated dispersion parameter in the NegBin model

b The Hausman test tests the null hypothesis that industry-specific effects are uncorrelated with the covariates

c The likelihood ratio test is significant at 1% across all models

d A significant test statistic implies that the RENegBin model is preferred to the NegBin model

e A significant test statistic implies that overdispersion exists, hence preferring the NegBin model to the Poisson

Surprisingly, the results of the Poisson model in column 3 suggest that a statistically significant link between the real exchange rate and the level of UK acquisitions in the US does not exist in high R&D manufacturing industries. The p-value of 0.167 is far from the 5% significance criterion that this study imposes on its results. Interestingly, the real exchange rate coefficient does not even exhibit a positive sign. Quite the contrary, the coefficient, albeit insignificant, is substantially negative. The RER estimator in the Poisson model implies that a 0.1 unit increase in the USD/GBP real exchange rate will result in a 100[1-exp(-2.79)]=94% decline in the level of UK acquisitions of US firms. This is the very opposite of what the asset acquisition hypothesis argues. Taking together these results, absolutely no support is thus found for hypothesis 2a in the data.

1.1.1.2 Model robustness

The descriptive analysis in section 7.1 has shown that the global financial crisis has had a significant effect on the level of acquisition FDI for the US-UK country pair. In order to check the robustness of the results presented in table 4 in light of this extreme economic phenomenon, models 2 and 3 are estimated on the high and low R&D samples. For convenience, columns 1 and 4 in table 5 repeat the Poisson regression results from table 4. Columns 2 and 5 add a crisis dummy to the model, which takes the value of 1 in the year 2009 and 0 otherwise. Columns 3 and 6 run the same regression as in model 1, but exclude the crisis year 2009 from all samples. Although economic factors are taken into consideration through real GDP growth in model 1, a crisis dummy might capture some effects over and above what is accounted for by this variable. Consistent with the findings of table 4, all reported results assume a Poisson distribution as it yields the most precise estimators for models 1a and 1b.

First of all, a likelihood ratio test is manually applied to test models 2a and 2b with the crisis dummies against the standard models 1a and 1b. With regard to the high R&D model, the two-sided chi-squared statistic with one degree of freedom is 8.4, which is significant at the 1% level. For low R&D industries, the likelihood ratio test only yields a chi-squared statistic of 2.8 which

Table 5: Robustness models - Determinants of number of UK acquisitions in the US, 2004-2010; dependent variable: number of US acquisitions of UK firms; separate estimates for full sample, high R&D sample, and low R&D sample

	High R&D Manufacturing			Low R&D Manufacturing		
	Model 1a	Model 2a	Model 3a	Model 1b	Model 2b	Model 3b
Variables	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson
Constant	2.37	1.66	1.96	-1.05	-0.69	-0.87
	(0.24)	(0.35)	(0.26)	(0.38)	(0.55)	(0.45)
Real exchange rate	-2.79	-2.05	-2.19	0.57	0.41	0.58
	(0.16)	(0.27)	(0.22)	(0.61)	(0.69)	(0.58)
Tariff	0.00	0.24	0.26	-0.18	-0.18	-0.18
	(0.99)	(0.54)	(0.59)	(>0.01)	(>0.01)	(>0.01)
Real GDP growth	0.13	-0.01	-0.00	0.08	0.00	-0.01
	(0.04)	(0.94)	(0.98)	(0.10)	(0.97)	(0.89)
Industry value-added	0.74	0.80	0.72	0.32	0.32	0.34
	(>0.01)	(>0.01)	(0.02)	(0.04)	(0.04)	(0.03)
Target M&As	-0.00	-0.00	-0.00	0.01	0.01	0.01
	(>0.01)	(>0.01)	(>0.01)	(>0.01)	(>0.01)	(>0.01)
Businesses	0.04	0.02	0.01	-0.00	-0.00	-0.01
	(0.44)	(0.68)	(0.78)	(0.93)	(0.82)	(0.50)
Real interest diff.	-0.01	0.02	0.02	-0.01	-0.01	-0.01
	(0.86)	(0.72)	(0.80)	(0.89)	(0.88)	(0.90)
Crisis		-1.12			-1.02	
		(0.01)			(0.09)	
Log-likelihood[a]	-74.5	-70.3	-62.8	-136.1	-134.7	-122.6
LR test vs. model 1[b]		8.4***	23.4***		2.8*	27.0*
Observations	28	28	24	126	126	108

NOTES: P-values for coefficients are in parantheses; Poisson models are estimated using robust standard errors; for a list of high R&D industries, see: table 1; * denotes 10% significance; ** denotes 5% significance; *** denotes 1% significance

a The likelihood ratio test is significant at 1% across all models

b A significant test statistic implies that the specified model is preferred to model 1

fails to be significant at 5%. These results suggest that regarding high R&D industries, model 2a is superior to the standard model 1a, whereas the restricted model 2b provides the better estimation for low R&D industries. Equivalent tests of models 3a against 1a and 3b against 1b yield exactly the same results with respect to the explanatory power of the financial crisis. While it has significant effects on the high R&D sample, it does not significantly affect the low R&D sample. Accounting for the crisis thus only improves the results of high R&D models.

The crisis dummy estimators in columns 2 and 5 are consistent with this conclusion. The crisis factor in model 2a adds significant explanatory power to the model, while it does not for model 2b. Nevertheless, the dummies exhibit the correct sign for both high and low R&D samples and are even similar in size. The crisis estimator in model 2a suggests that, all other variables fixed, the mean number of UK acquisitions in the US for high R&D industries was approx. 100[1-exp(-1.1)]=67% less in the year 2009 than prior to the crisis. Table 2 shows that the mean of cross-border M&As across all high R&D industries was approx. 66% lower than in the remaining year. The crisis coefficient is thus reasonable in size.

The results of the robust models with regard to hypotheses 1a and 2a are consistent with the previous findings. For above average R&D intensive industries its correlation with the dependent variable is negative, but insignificant. For below average R&D intensive industries results on the sign of the real exchange rate coefficient are slightly positive, yet entirely insignificant. This supports the previously drawn conclusion which suggested that an RER-M&A link of the kind proposed by the asset acquisition hypothesis does not exist for the given sample.

1.1.2 US M&As of UK targets

Table 6 reports regression results of model 1a applied to US M&As in the UK. An analysis similar to the one seen in section 7.2.1 shows that the data set of US acquisitions in the UK exhibits some different properties compared to the data set of UK acquisitions in the US. While the high R&D sample is not marked by significant overdispersion as the insignificant α in column 2 indicates, the low R&D sample I clearly overdispersed. The dispersion parameter α in model 1b

is equal to 0.39 and significant at 1% as the likelihood ratio test estimates. Moreover, the likelihood ratio test comparing the Pooled NegBin estimators with the RENegBin estimators concludes that the sample is better estimated using the RENegBin specification. The Poisson specification stays the preferred model for the high R&D sample, however. Regarding the full sample of manufacturing industries, the results in table 6 suggest that the observed data are most probable when modeled with a RENegBin specification.

1.1.2.1 Hypothesis testing

In the following, the regression results of table 6 will be analyzed in the context of hypotheses 1 and 2. With regard to the data set at hand, this section focuses on hypotheses 1b and 2b.

1.1.2.1.1 Hypothesis 1b

Hypothesis 1b states that exchange rate movements have no explanatory power over the variation in acquisition FDI in low R&D manufacturing industries. Specifically, it implies that neither a real depreciation nor appreciation of the Pound Sterling relative to the US dollar has an impact on the number of US acquisitions of UK targets operating in low R&D manufacturing industries. This hypothesis is tested by checking the slope and significance of the real exchange rate coefficient in model 1b of table 6.

The real exchange rate coefficient in column 4 exhibits a p-value of 0.98 which indicates that it is statistically indifferent from zero. This suggests that no correlation with between exchange rate movements and the number of US acquisitions in UK low R&D manufacturing industries exists. The results of the Pooled NegBin and Poisson models in columns 5 and 6 support this conclusion. There, too, the real exchange rate does not show to be a significant predictor of cross-border M&A activity in low R&D industries. The data therefore supports hypothesis 1b.

Table 6: Determinants of number of US acquisitions in the UK, 2004-2010; dependent variable: number of US acquisitions of UK firms; separate estimates for full sample, high R&D sample, and low R&D sample

	High R&D Manufacturing			Low R&D Manufacturing			All Mfg Industries		
	Model 1a			Model 1b			Model 1c		
Variables	RE NegBin	NegBin	Poisson	RE NegBin	NegBin	Poisson	RE NegBin	NegBin	Poisson
Constant	2.29	1.29	1.13	16.66	-0.40	0.56	3.99	2.59	1.01
	(0.52)	(0.72)	(0.72)	(0.98)	(0.95)	(0.91)	(0.19)	(0.48)	(0.72)
Real exchange rate	-0.84	-0.82	-0.92	-0.05	1.44	1.01	-1.10	-0.52	-0.48
	(0.45)	(0.47)	(0.30)	(0.97)	(0.43)	(0.54)	(0.25)	(0.58)	(0.52)
Tariff	-0.08	-0.06	-0.09	-0.18	-0.17	-0.23	-0.17	-0.19	-0.26
	(0.38)	(0.54)	(0.36)	(0.01)	(>0.01)	(>0.01)	(>0.01)	(>0.01)	(>0.01)
Real GDP growth	-0.02	-0.02	-0.02	0.08	0.06	0.06	0.01	0.02	0.01
	(0.61)	(0.64)	(0.57)	(0.07)	(0.31)	(0.29)	(0.69)	(0.56)	(0.69)
Industry value-added	0.37	0.33	0.41	1.06	0.31	0.62	0.73	0.60	0.79
	(0.29)	(0.36)	(0.15)	(0.05)	(0.40)	(0.08)	(0.01)	(0.00)	(>0.01)
Target M&As	0.06	0.07	0.06	0.03	0.06	0.05	0.04	0.06	0.05
	(>0.01)	(>0.01)	(>0.01)	(0.07)	(>0.01)	(>0.01)	(>0.01)	(>0.01)	(>0.01)
Businesses	-0.00	-0.00	-0.00	-0.01	-0.00	-0.01	-0.00	-0.01	-0.00
	(0.87)	(0.79)	(0.85)	(0.41)	(0.77)	(0.63)	(0.55)	(0.41)	(0.74)
Real interest diff.	-0.13	-0.12	-0.13	-0.01	-0.01	-0.02	-0.08	-0.07	-0.08
	(0.03)	(0.05)	(0.04)	(0.85)	(0.91)	(0.78)	(0.06)	(0.22)	(0.11)
Alpha[a]		0.04			0.39			0.23	
Hausman test[b]	10.5			6.3			12.6		
Log-likelihood[c]	-78.2	-77.5	-78.6	-161.7	-169.8	-178.6	-247.6	-256.4	-266.2
LR test vs. Pooled[d]	>0.1			19.6***			18.4***		
LR test of Alpha = 0[e]		2.3*			17.5***			19.6***	
Observations	35	35	35	119	119	119	154	154	154

NOTES: P-values for coefficients are in parantheses; Poisson models are estimated using robust standard errors; for a list of high R&D industries, see: table 1; * denotes 10% significance; ** denotes 5% significance; *** denotes 1% significance.

a Alpha denotes the estimated dispersion parameter in the NegBin model

b The Hausman test tests the null hypothesis that industry-specific effects are uncorrelated with the covariates

c The likelihood ratio test is significant at 1% across all models

d A significant test statistic implies that the RENegBin model is preferred to the NegBin model

e A significant test statistic implies that overdispersion exists, hence preferring the NegBin model to the Poisson model

1.1.2.1.2 Hypothesis 2b

Hypothesis 2b states that a real depreciation of the domestic currency results in an increase of acquisition FDI inflows into domestic high R&D manufacturing industries. It implies that a real depreciation of the Pound Sterling relative to the US dollar leads to an increase in US acquisitions of UK high R&D manufacturing targets. This hypothesis is tested by checking the slope and significance of the real exchange rate coefficients in model 1a of table 6.

Contrary to what the hypothesis predicts, the real exchange rate coefficient in column 3 shows to be statistically indifferent from zero. The p-value of 0.3 does not meet the 5% significance criterion and suggests that the real exchange rate has no impact on cross-border M&A activity in high R&D manufacturing industries. Further, the regression outcomes of the Random Effects and Pooled NegBin models in columns 1 and 2 are consistent with the Poisson results. Besides being insignificant, the estimated sign of the coefficient is also negative, just as was observed for high R&D industries in table 4. The results clearly fail to yield support for hypothesis 2b, therefore.

1.1.2.2 Model robustness

Analogous to section 7.2.1.2, models 2 and 3 are estimated for the high and low R&D samples of US acquisitions in the UK. The results are reported in table 7. For the sample of above average R&D intensive industries is modeled applying a Poisson distribution which showed to yield best estimates. With regard to the low R&D sample, the RENegBin model showed to provide the best fit for the sample data.

The manually computed likelihood ratio test comparing the fits of models 1a to 2a suggests that the crisis dummy does not improve the fit of the model. Similar analysis yields the same result with regard to models 1b and 2b of the low R&D sample as the likelihood ratio test fails to reach 5% significance. This outcome is consistent with the crisis estimators in columns 2 and 5. Whereas the dummy coefficient is marginally significant for below average R&D intensive industries, it lacks any explanatory power in the high R&D sample. Both coefficients exhibit the

Table 7: Robustness models - Determinants of number of US acquisitions in the UK, 2004-2010; dependent variable: number of US acquisitions of UK firms; separate estimates for full sample, high R&D sample, and low R&D sample

	High R&D Manufacturing			Low R&D Manufacturing		
	Model 1a	Model 2a	Model 3a	Model 1b	Model 2b	Model 3b
Variables	Poisson	Poisson	Poisson	RE NegBin	RE NegBin	RE NegBin
Constant	1.13	1.56	2.82	16.66	18.72	18.96
	(0.72)	(0.62)	(0.47)	(0.98)	(0.97)	(0.98)
Real exchange rate	-0.92	-0.96	-1.62	-0.05	0.41	0.69
	(0.30)	(0.28)	(0.19)	(0.97)	(0.83)	(0.73)
Tariff	-0.09	-0.09	-0.18	-0.18	-0.17	-0.17
	(0.36)	(0.36)	(0.09)	(0.01)	(0.01)	(0.02)
Real GDP growth	-0.02	-0.04	-0.05	0.08	-0.00	-0.00
	(0.57)	(0.49)	(0.42)	(0.07)	(0.97)	(0.95)
Industry value-added	0.41	0.42	0.63	1.06	1.03	0.58
	(0.15)	(0.15)	(0.04)	(0.06)	(0.06)	(0.35)
Target M&As	0.06	0.06	0.06	0.03	0.03	0.03
	(>0.01)	(>0.01)	(>0.01)	(0.07)	(0.04)	(0.03)
Businesses	-0.00	-0.00	-0.00	-0.01	-0.02	-0.01
	(0.85)	(0.74)	(0.61)	(0.42)	(0.26)	(0.30)
Real interest diff.	-0.13	-0.13	-0.13	-0.01	0.02	0.03
	(0.05)	(0.05)	(0.03)	(0.86)	(0.72)	(0.67)
Crisis		-0.17			-0.83	
		(0.59)			(0.08)	
Hausman test[a]				6.33	6.95	11.43
Log-likelihood[b]	-78.6	-78.6	-68.5	-161.7	-160.2	-141.2
LR test vs. Pooled[c]				19.6***	21.2***	18.3***
LR test vs. model 1[d]		0	20.2***		3.0*	41.0***
Observations	35	35	30	119	119	102

NOTES: P-values for coefficients are in parantheses; Poisson models are estimated using robust standard errors; for a list of high R&D industries, see: table 1; * denotes 10% significance; ** denotes 5% significance; *** denotes 1% significance.
a The Hausman test tests the null hypothesis that industry-specific effects are uncorrelated with the covariates
b The likelihood ratio test is significant at 1% across all models
c A significant test statistic implies that the RENegBin model is preferred to the NegBin model
d A significant test statistic implies that the specified model is preferred to model 1

correct sign, however, suggesting a dampening impact of the global financial crisis on cross-border acquisitions. Comparing the likelihood ratios suggests that models 3a and 3b fit the data substantially better than their respective standard models 1a and 1b.

Focusing on the low R&D sample first, the real exchange rate coefficients in models 2b and 3b show to be entirely insignificant and are hence consistent with previous results of model 1b. There appears to be no significant correlation between exchange rate movements and the level of cross-border M&As, which is further support in favor of hypothesis 1b. With respect to high R&D industries, models 1a and 2a yield very similar estimators, which is not surprising in light of the insignificant crisis dummy in column 2. Also the p-values lie very close to each other and are almost identical for many variables. Our robustness checks are consistent with the standard model, therefore, as they fail to find any support for hypothesis 2b and hence the asset acquisition hypothesis.

1.1.3 Control variables

This study controls for a number of factors that have been found to affect FDI flows. The following section will briefly comment on the results. In doing so, it will refer to the results of models 1a and 1b in both table 4 and table 6. For a detailed analysis of the coefficients and their economic interpretation, please refer to Appendix 13. Furthermore, Appendix 13 also includes a detailed analysis of the control variables results in the context of the robust regression estimations in tables 5 and 7.

In general, the results with regard to the control variables are very mixed. On the one hand, their estimated signs mostly follow prior expectations, but on the other hand, they happen to be statistically insignificant in many cases. Although these results are not ideal, they are not specific to this study. Actually, they happen to confirm findings by Blonigen (1997) and Georgopoulos (2008), who also obtain mixed results for their sets of control variables, which are very much alike to the results of this study.

Of all control variables, the results with regard to tariffs are of greatest interest, since they provide some additional insight on the asset acquisition hypothesis. Just as Georgopoulos (2008) suggests in this context, the tariff variable shows to be a highly significant predictor in low R&D industries, while being insignificant in high R&D industries. Additionally, this pattern is consistent across both UK M&As in the US and US M&As in the UK. To be more precise, the coefficient is consistently significant at 5% in all low R&D specifications of tables 4 and 6, but not even close to marginal significance in any of the high R&D models. These results therefore indicate that while tariffs are a paramount factor in cross-border M&As involving low R&D targets, they do not play any role with respect to high R&D targets. This is consistent with the asset acquisition hypothesis in so far as firm-specific assets rather than trade costs should be the driving force behind M&As in R&D intensive industries. Surprisingly, however, the tariff coefficient is consistently negative, which is strong evidence against the common belief of tariff jumping as a prime motive of international M&As. Possible explanations of this phenomenon will be investigated in section 8.2.

Comparing the regression outcomes to the results of Blonigen (1997) and Georgopoulos (2008), great similarities with regard to the remaining control variables can also be recognized. Similar to the results in this study, Blonigen finds the number of local acquisitions in the target country as well as industry value added-share to be the most consistent predictor variables. They exhibit the correct signs in all specifications of tables 4 and 6 and are highly significant in many cases. The likely reason is that these two variables best capture industry-specific demand and supply factors. Industry value added share gives information on how important a particular industry sector in the acquiring country is, which makes it a good indicator of demand for M&As in that sector. Local M&As in the target country, on the other hand, give a good idea of which sectors in the target country offer a large supply of companies suitable for takeovers. The information in these variables is thus very industry-specific and relevant for the M&A activities.

On the contrary, real GDP growth in the acquiring country happens to be an insignificant predictor of international M&A activity in almost all of the specified models and the sign of its coefficients is not consistently positive. Similarly, Blonigen (1997) and Georgopoulos (2008)

find real GDP growth to be highly insignificant in most of their models when tested on high and low R&D industries. A first idea might suggest that economic growth has no impact on the level of acquisition FDI. It appears to be unlikely, however, that this is true for all manufacturing industries. More probably, economic growth affects different industries in different ways. But since real GDP growth, unlike industry value-added share or local M&As in the target country, focusses on the aggregate economy rather than individual industries, the GDP growth coefficient turns out to be statistically indifferent from zero. The global financial crisis is unlikely to be a reasonable explanation on the other hand. The results of the robustness checks in tables 5 and 7 suggest that the crisis did not exert a significantly distorting effect on the explanatory power of real GDP growth.

What is particularly surprising, however, are the consistently insignificant results with regard to the number of businesses. This might have been anticipated with respect to the sample involving US acquisitions in the UK, since the number of businesses in the total manufacturing sector of the UK is used as a proxy due to the unavailability of consistent industry-specific data. Yet, when testing UK acquisitions of US firms, the number of businesses in an industry still fails to show significant effects. A possible reason might be that the number of firms operating in manufacturing industries is generally decreasing in developed countries. In the United States between 2004 and 2010, the average number of businesses in manufacturing industries decreased by 274.5 establishments per annum. Actually, the only industry having more businesses in operation in 2010 than in 2004 was the beverage manufacturing industry. All other sectors shrunk during that interval. Because the general trend is an annual decrease in the number of manufacturing businesses, this variable does not exhibit the required volatility to gain sufficient explanatory power in the model.

Interestingly, the real interest rate differential is only significantly correlated with cross-border M&As in the high R&D sample of US acquisitions in the UK. The coefficient is statistically significant at 5% and exhibits the correct negative sign. The data series in Appendix 14 shows that the real exchange rate is lower in the UK than in the US in all years of the sample period apart from 2004. These results suggest that low real interest rates relative to the acquiring country

attract international M&As in R&D intensive industries, but high real interest rates relative to the acquiring country do not have deterring effects on the level of acquisition FDI. Hall (2002) finds that R&D investments have a higher cost of capital than regular investments, which is why established R&D firms prefer internal funding for these projects. Potentially, low interest rate countries therefore become an attractive destination for many firms that might rely on external capital markets to finance their R&D projects. It remains unclear however, why the data do not find a significant interest rate effect for UK M&As of US high R&D firms. These results should therefore be interpreted with caution.

Finally, when comparing regression results from this study's tests of UK M&As in the US with the tests of US M&As in the UK, some variables turn out to be significant in one data set, but not in the other. Although this might be a surprising result at times, it is not specific to this study. Georgopoulos (2008) also studies two-way acquisition FDI and constitutes the same phenomenon in his regression outcomes. Possibly, some variables just happen to be stronger drivers of cross-border M&As in some countries than in others relative to other variables.

1.2 Summary of findings

While the support for hypotheses 1a and 1b is very substantial, no support of any kind is evident for hypotheses 2a and 2b. The data suggest that no relationship whatsoever between the real exchange rate and the level of cross-border M&A activity exists. Therefore, international acquisitions of technology-related firm-specific assets do not appear to be motivated by movements in the real exchange rate. Furthermore, the real exchange rate coefficient exhibits a negative sign in all models involving high R&D industries, both for UK and US targets. Not even a tendency towards an exchange rate – M&A link as proposed by Blonigen (1997) is thus observable. A potential bias of these results due to the global financial crisis is rather unlikely. As the robustness checks show, even after accounting for effects arising from the crisis, the models yield exactly the same results with regard to the two hypotheses. Thus, the regression outcomes

of this study are clearly unambiguous. No evidence for the existence of a real exchange rate effect as proposed by the asset acquisition hypothesis can be established in the data of this study.

2. Discussion and implications

This section will interpret and discuss the implications of the results presented in section 7. All inferences that will be made, are naturally restricted by the sample limitations and any findings presented are only valid for the UK-US country pair and the specified time interval. This section is divided into three subsections. The first subsection will discuss the findings on the asset acquisition hypothesis. The second subsection will aim to shed some light regarding the results on the tariff variable. The third subsection will discuss potentially omitted variables. The fourth subsection will outline the limitations of the applied model and the final subsection will make recommendations for future research in this field.

2.1 Asset acquisition hypothesis

The asset acquisition hypothesis argues that when some degree of market segmentation exists, a depreciation of the domestic currency should lead to increased acquisitions of firm-specific assets by companies from abroad (Blonigen 1997). The relevance of this theoretical framework was tested by splitting the available data set of cross-border M&As into high and low R&D samples, where high R&D industries were assumed to possess a substantial amount of those technology-related firm-specific assets. Count models were then applied on the resulting samples, using the number of cross-border M&As in a given industry sector as the dependent variable and industry-specific real exchange rates as the major explanatory variable. As discussed in section 7, however, the regression results failed to find any evidence in favor of the asset acquisition hypothesis.

What's more striking than the insignificant p-values of all real exchange rate estimators, is the explicitness of these results; not even a tendency towards a positive RER effect is observable in

the data. The exact opposite is true as the real exchange rate coefficients show to be consistently negative. Both in the high R&D sample of UK M&As in the US as well as US M&As in the UK, the correlation is found to be inverse of what Blonigen (1997) proposes, suggesting that a real depreciation of the domestic currency actually results in a drop of acquisition FDI inflows. Albeit these results are not statistically significant, the consistency of the negative coefficients is eye-catching. A potentially negative RER-M&A relationship is established by the currency area hypothesis. In this framework, income streams originating in weak currency countries are subject to greater exchange rate risk, which results in higher discount rates applied to those revenues (Chakrabarti 2001). Considering UK acquisitions of US firms, a higher discount rate implies that UK companies would value the same American asset at a lower price compared to American companies. In turn, this will result in a decline in the number of cross-border acquisitions.

The evidence for the currency area hypothesis in the data is not convincing, however. Not only are the RER estimators statistically indifferent from zero, but the negative coefficients are only robust in the high R&D samples. With regard to low R&D industries the results are mixed, but mostly positive. The question arises that if the currency area hypothesis held, shouldn't the same pattern be observable in high and low R&D samples? After all, it is meant to apply generally and does not distinguish companies according to the amount of firm-specific assets they possess. Perhaps the substantially negative coefficients suggest that firms operating in high R&D industries are much more sensitive to macroeconomic shocks as compared to firms in low R&D industries. Then, however, significant estimators should also be observable for the remaining set of macroeconomic control variables in the model, which is clearly not the case. Regarding the high R&D sample for UK acquisitions in the US, mixed results are found on the effect of real GDP growth. For US acquisitions in high R&D UK industries real GDP growth is never significantly correlated with international M&A activity. Finally, comparing regression coefficients with respect to high and low R&D samples, substantial differences in the significance of macroeconomic effects between those two samples are not apparent.

Therefore, even though the data in this study do offer some indications for a real exchange rate effect as proposed by the currency area hypothesis, support in favor of it is more than lacking.

Rather, the insignificance of all real exchange rate estimators points towards the conclusion that the traditional view on the RER-M&A link, which argues that exchange rate movements should not matter in cross-border M&As, does not only hold for low, but also for high R&D industries.

Yet, this result does not mean that takeovers in high R&D industries are not motivated by the desire to acquire firm-specific assets. The tariff variable is found to be statistically insignificant at 5% across all regressions on the high R&D samples in tables 4 and 6, both for UK acquisitions in the US and vice versa. With regard to the tariff variable, this is precisely what Georgopoulos (2008) predicts in the framework of the asset acquisition hypothesis. The tariff variable can be seen as an overall indicator of the importance of trade costs in international M&As. For companies whose primary motive it is to acquire transferable and technology-related firm-specific assets, trade costs should not constitute an obstacle. The asset can be implemented at different locations at the same time and at very little cost, so that trade cost should not matter. The consistently insignificant tariff coefficients in high R&D samples imply just that, meaning that international M&A activity in R&D intensive industries is indeed driven by the desire to acquire firm-specific assets. In contrast, the tariff effect in low R&D industries is highly significant in all models of tables 4 and 6. This does not only suggest that trade costs do matter in those industries, but also that M&As are not driven by the motive to purchase firm-specific assets.

Considering the findings on the impact of trade costs, it does not necessarily mean that the asset acquisition is generally irrelevant. After all Georgopoulos (2008) established a significant RER-M&A link between the United States and Canada, two countries that are likely to be even more economically integrated due to their cultural and physical proximities. Possibly, one of the assumptions that Blonigen's (1997) hypothesis relies on does not hold in the data set of this study. A likely explanation might be rooted in the assumption of sufficient market segmentation.

Blonigen's (1997) study of Japanese acquisitions in the United States focuses on the interval 1975-1992. He refers to several papers by Belassa (1986), for instance, that report that the Japanese market is more insulated from imports and foreign direct investment than probably any

other developed country in the world. Hence, the advantage for Japanese firms to use foreign firm-specific assets in their domestic market is very large. According to the *2013 World Investment Report* published by UNCTAD (2013), Japan has the second highest FDI outflows of all countries in the world, second only to the United States. They are not even in the top 10 when it comes to FDI inflows, however, which highlights the substantial degree of market segmentation. Furthermore, the general level of FDI around the world was considerably lower during Blonigen's sample period compared to today's level. Global FDI flows amounted to USD 13.3 billion in 1975 and USD 166 billion in 1992 (UNCTAD 2000). This is just a fraction of total FDI flows in 2007, when they surpassed the USD 2.0 trillion threshold for the first time, marking the highest level recorded until today. This indicates that the general level of market segmentation around the world is probably much smaller today than it was a few decades ago when the data for Blonigen's study was recorded.

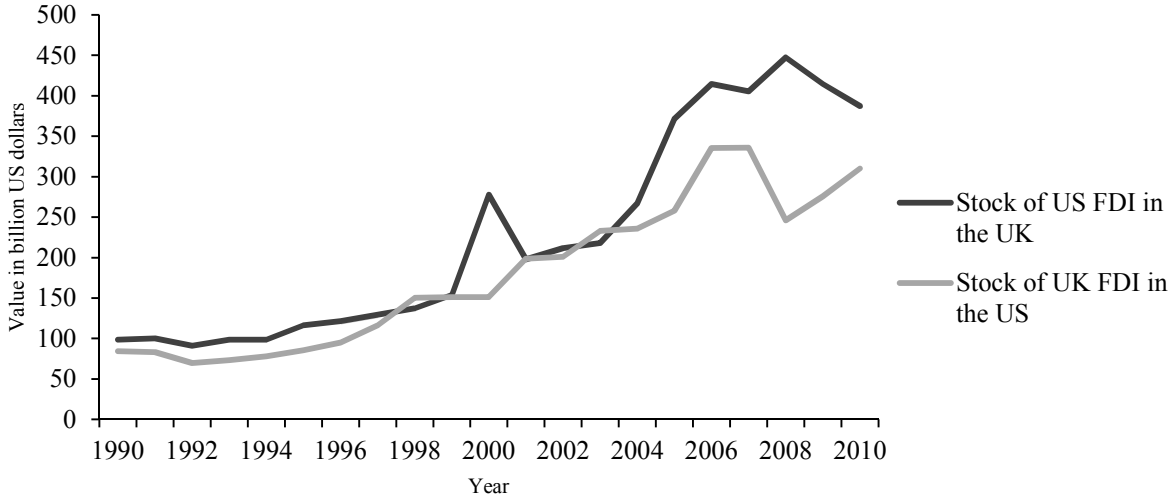
A similar argument can be made with regard to the study by Georgopoulos (2008) who investigates bilateral M&As between Canada and the United States. Albeit the degree of market segmentation is likely to be significantly smaller due to the physical and cultural proximity of those two countries, Georgopoulos still manages to find a significantly positive link between acquisition FDI and the real exchange rate in high R&D industries. His research is based on a sample that stretches from 1987 to 2001. As figure 1 showed, global FDI was at a very low level initially and grew dramatically in the late 1990s. Therefore, his sample is very mixed. While market integration is relatively low for the most part of his sample, it is very high in the end.

Unlike the sample periods in Blonigen's (1997) and Georgopoulos' (2008) studies, the interval studied in this paper does not exhibit continuously rising investments abroad. Instead the years 2004 to 2010 experience ups and downs with regard to FDI flows and are at a consistently high level when compared to Georgopoulos' study. Figure 3 depicts the evolution in the level of FDI stocks between the UK and US. A pattern similar to global FDI flows in figure 1 emerges. From 1990-2001, the stock of FDI in one country held be the other country, respectively, has been growing consistently. In the period 2004-2010 the volatility increases as the level of FDI stocks appears to have reached a preliminary upper bound. In line with this observation, market

integration in this period is most likely to be at a substantially higher level as compared to the sample periods of previous studies. If a sufficient level of segmentation between the US and UK markets is not existent anymore, companies will not possess great advantages in their respective home markets compared to foreign firms. In an extreme scenario, American companies will have the same opportunities to generate profits from firm-specific assets in the British market as will British firms.

The above analysis therefore indicates that the assumption of a sufficient degree of market segmentation quite probably does not hold in the data set applied in this study. The major difference to Georgopoulos (2008) and Blonigen (2008) is not only the studied country pair, but most importantly the studied time interval. In contrast to these two studies, market integration in this study, as proxied by FDI flows, was at a consistently high level over the entire period of observation. The results presented in this paper thus imply that the asset acquisition hypothesis did not hold for manufacturing M&As between US and UK firms in the period 2004-2010.

Figure 3: Stock of bilateral FDI flows between the UK and US, 1990-2010 (Source: OECD 2013b)



2.2 Tariffs

An interesting feature about the tariff variable in this study is that it exhibits a highly significant negative correlation with the dependent variable in the low R&D samples. This result stands in sharp contrast to the widely accepted concept of tariff jumping which suggests that an increase in US custom charges should result in UK companies acquiring more US firms in order to circumvent tariff barriers. Only few theories exist on why tariffs would actually deter FDI. However, in his study of Japanese acquisitions of US firms, Blonigen (1997) also finds a negative, but insignificant coefficient for US protection in manufacturing sectors, and Georgopoulos (2008) even finds partly negative and significant coefficients for the tariff variable. Whereas Georgopoulos cannot find a reasonable explanation for this phenomenon, Blonigen contemplates the possibility that a negative coefficient might be the result of an inverse causal relationship between protection and FDI in some industries. He argues that precisely because FDI is lower in some industries, tariffs on their products are higher, which might lead to the observed results.

Another approach is taken by Hanson et al. (2001) who find that higher trade costs substantially decrease the trade in intermediate goods. Since such trade is of particular importance for manufacturing companies, higher trade costs might indeed deter foreign investments as they would make goods produced by affiliates less competitive. Companies would thus rather look for other locations or decide to produce domestically. This concept assumes some substantial degree of market integration between two countries since FDI is not just a means to substitute local production for imports, but to create vertical production networks. As has been shown, market integration around the world has dramatically increased in recent decades. This provides some further support for the theory of Hanson et al..

Finally, Horn and Persson (2001) argue that with increasing trade costs companies will increasingly choose domestic M&As over international ones. When trade costs are high, the domestic market is more insulated from foreign competition, making domestic mergers more profitable compared to cross-border ones. With lower trade costs on the other hand, international

competition in the domestic market is fierce, making cross-border mergers more profitable as the market access motive dominates.

Summarizing, the data show no support for the commonly accepted tariff jumping hypothesis in economics. It seems that other forces are at work for the UK-US country pair. Potentially, the observed negative relationship is simply the result of a twisted causal relationship. Tariffs are higher in industries where FDI happens to be low. Alternatively, tariffs might significantly affect the profitability of domestic versus cross-border M&As. In light of the substantial increase of market integration around the world, however, it appears to be most likely that tariffs exert a deterring effect on intermediate goods trade, which in turn reduces the profitability of cross-border M&As in low R&D manufacturing industries.

2.3 Omitted variables

This study finds no sign of a real exchange rate effect in the data and also many of the control variables turn out to be insignificant. Probably some other factors exist that drive cross-border M&As. The literature on this particular topic is very limited however and does not yield a lot of insights. Further, only few studies make the distinction of different industry sectors in a country, as most papers focus on the question "To which countries does FDI flow?" rather than "What drives the level of FDI between two given countries?". This means that a heavy focus lies on the factors that make some countries more popular destinations for FDI compared to others, but not on the factors that affect FDI levels between two specific countries over time. Moreover, Chakrabarti (2001) constitutes in his survey paper on determinants of FDI flows that the overall results on individual variables are very mixed and controversial. No unambiguous drivers of FDI can hence be identified. Nevertheless, this section discusses some additional factors that might potentially drive acquisition FDI.

Erel et al. (2012) show that the volume of trade on an aggregate level has a significantly positive effect on FDI flows. When measured on an industry-specific basis trade might well be a good driver of cross-border M&As. This effect is possibly greater in low R&D industries, where

vertical integration provides substantial advantages. With regard to high R&D industries, where trade is of lesser importance and firm-specific assets are of greater importance, the impact of trade volume is likely to be smaller. Moreover, they find significant effects of market-to-book ratios on acquisition FDI flows. This indicates that higher Market-to-book ratios in the acquirer country compared to the target country are correlated with greater M&A activity (Erel, Liao, and Weisbach). Market value relative to book value might be a substantial driver of M&As particularly in high R&D sectors, since firms with higher market-to-book ratios are more likely to have firm-specific assets and the potential desire to acquire more of them.

Several studies also emphasize the importance of corporate tax rates as a determinant of M&A flows (Erel et al. 2012). The intuition is that greater corporate taxes in the target country deter FDI and thus cross-border M&As in this country. Apart from the fact that taxes are hard to measure due to significant legal rules, requirements and accounting practices, they are probably most important in low R&D industries where production and sales are involved. When a takeover is driven by technology-related firm-specific assets, tax considerations are likely to play a subordinated role in the decision process.

Furthermore, future studies of cross-border M&As or general FDI flows between two countries should consider including a variable capturing worldwide FDI trends. As figure 1 shows, the value of global FDI flows is highly correlated with the value of cross-border M&As. Adding this variable to the model might help to account for changes in cross-border M&A activity that do not originate in exchange rate movements, for example. This addition to the model has the potential to substantially improve the precision of the remaining estimators.

A final variable that should probably be discussed briefly in this context is future exchange rate expectations. Since exchange rate movements give rise to speculation and risky investment opportunities, they might potentially affect cross-border M&A activity in some way or the other, particularly when the acquiring company is of financial nature. As was noted in section 5, almost 8% of takeovers in the sample are executed by financial companies. Nevertheless, this variable is not considered in this study for two particular reasons. First of all, such a variable is hard to

capture and to put into an econometric model. And second of all, it seems reasonable to argue that it sounds unlikely that future exchange rate expectations play a role when it comes to acquiring foreign targets. If a company thinks a foreign currency will appreciate in the future, it is much simpler to just purchase foreign currency or futures instead of physical assets. This strategy is simpler and provides the same payoff.

All in all, economic literature has not yet identified one single factor that clearly drives M&As, and probably will not, either. However, the above discussion touches upon a number of factors that future research should consider testing or including as control variables.

2.4 Limitations of the model

The objective of this study was to investigate the substance of the asset acquisition hypothesis for bilateral M&As between the US and UK in recent years, since most available research on the relationship between the real exchange rate and FDI focusses on the 1970's, 80's and 90's. A considerable shortcoming of the model in this study, therefore, is the small size of the sample. Particularly the high R&D samples are very small with no one sample exceeding 35 observations.

Furthermore, the sample interval is heavily marked by the effects of the global financial crisis. Although the crisis officially takes place in the years 2007 and 2008, it can be argued that its effects are easily felt until 2009 or 2010. This study tries to control for macroeconomic side-effects in the models by including real GDP growth in the regression as well as a crisis dummy, but probably decisions during times of such financial turmoil are also influenced by other factors, like fears and expectations, that cannot be captured by any variables.

Some shortcomings also emerge in the estimation of the regression outcomes. The Poisson results reported in this thesis do not take into consideration the panel nature of the data, but rather treat them cross-sectional. The estimated coefficients and standard errors of the Random Effects Poisson and the regular Pooled Poisson models are almost identical, however. The outcomes of the panel Poisson models for high and low R&D samples are reported in Appendix 17.

The regression outcomes of the estimated models also seem to be very sensitive to the particular specification. For instance, including growth in market capitalization has dramatic effects on the estimated coefficients, standard errors and p-values as can be observed in the tables of Appendix 15. This somewhat supports the findings of Chakrabarti (2001) who concludes that empirical results on drivers of FDI are very controversial.

Finally, almost 8% of acquirers in the complete sample are financial institutions and these companies might have goals different from other firms. Therefore, interpreting the results of this thesis, it must be kept in mind that these observations might potentially bias the regression outcome. However, due to the very robust results with regard to hypotheses 1 and 2, it is assumed that the findings in this study generally apply to the whole population of M&As, irrespective of the industry of the acquirer.

2.5 Recommendations for future research

The findings of this study can only be interpreted in the context of the used sample. In order to investigate whether the established results can be generalized for developed countries as a whole, it will be important to extend the approach applied in this study to different pairs of countries. Further, it will be interesting to find out to what extent the asset acquisition hypothesis actually holds in developing countries, where market integration is relatively low. Research in this field is very sparse. If possible, future studies should also try to use a longer sample period. Due to inconsistencies in available data, this study could only use seven observation years of which only the first three can be said not to be affected by the global financial crisis with some certainty. Including a different set of control variables might improve the efficiency of the regression model. Particularly adjusting for global FDI trends appears to be a factor that could possibly adjust for a significant amount of noise around the real exchange rate. Finally, the service sector is continuously increasing in importance for developed countries. However, most research on FDI focuses on the manufacturing sector. It is up to future studies to investigate whether and how

the relationship between the real exchange rate and cross-border M&A activity in service industries differs from manufacturing industries.

3. Conclusion

This study examines the real exchange rate as a driving factor behind cross-border M&As in manufacturing industries between the United States and United Kingdom in the period 2004-2010. The primary motivation to conduct this work stems from the observation that during the late 1990s and 2000s the world has experienced an unprecedented increase in the integration of economic markets across industrialized countries. Existing literature and empirical research find highly contradicting theories and results with respect to the real exchange rate impact on FDI activity. While some papers argue that depreciation of a country's currency should lead to increasing FDI inflows, others argue that no or even an inverse link between those two variables does exist. Despite a vast number of studies providing theoretical approaches on the exchange rate – FDI link, only a handful of research investigates the asset acquisition hypothesis. It argues that in the presence of sufficient market segmentation between two economies, a depreciation of the domestic currency should increase the number of foreign acquisitions of those domestic targets possessing a great amount of transferable firm-specific assets. Empirical evidence indeed happens to find an effect as proposed by the asset acquisition hypothesis. Those studies, however, base their samples on periods where market integration was low initially and experienced a continuous increase. The paramount question arises, whether their findings are of any relevance for developed countries today. A substantial amount of research documents policy makers' fear of so-called fire sales at times of economic crises (Krugman 2000, Froot and Stein 1991, Georgopoulos 2008). The underlying assumption is that a depreciating currency makes domestic assets cheaper to foreign investors and causes an influx of foreign control over these domestic assets. I believe that an increased understanding of the actual impact the real exchange rate has on acquisition FDI flows in developed countries today, can considerably improve policy makers' decision making in times of economic instabilities.

This thesis thus investigates the relevance of the asset acquisition hypothesis for the UK-US country pair during the interval 2004-2010 focusing on manufacturing industries. Using a deductive research methodology to investigate this problem statement, two sets of hypotheses are formulated based on existing theoretical literature and empirical evidence. Hypothesis 1 suggests that industry-specific real exchange rates do not have an impact on the number of cross-border M&As of low R&D manufacturing targets in the period 2004-2010. Hypothesis 2, on the other hand, suggests that for high R&D industries, real exchange rates do have the effect proposed by the asset acquisition hypothesis. In this context, the sub-hypotheses 1a and 2a examine UK M&As of US firms, while sub-hypotheses 1b and 2b examine US M&As of UK firms. These hypotheses are tested using a total data set of 844 cross-border deals within the chosen country-pair.

Using count models to analyze the data, no significant exchange rate effect is identified for either high or low R&D industries. Whereas hypotheses 1a and 1b are hence supported, the critical hypotheses 2a and 2b are not supported. These results show to be consistent across all count regression models applied, whether it is Poisson, Negative Binomial, or Random Effects Negative Binomial. Neither do robustness checks adjusting for potentially unobserved effects from the global financial crisis yield different results.

The implications emerging for policy makers are that the real exchange rate does not have the impact proposed by the asset acquisition hypothesis. At least this is found to be true for the time period, country-pair, and industries examined in this study. In spite of the fact that all results can only be interpreted in the context of the applied sample, the findings of this thesis potentially point towards some greater implications. It appears that the increased integration of economic markets around the world has deprived domestic companies of their substantial competitive advantage in their home markets. Whereas Blonigen (1997) for Japanese M&As of American firms, and even Georgopoulos (2008) for bilateral M&As between the US and Canada, have shown that domestic firms still enjoyed that advantage in their samples, no such evidence was found in this study. Albeit, Canada and the US can be argued to be even more integrated than the UK and the US, due to their extreme cultural and geographical proximity, the asset acquisition

hypothesis holds for these countries when tested on a sample of M&As for the period 1985-2001. The data used in this study is different in that it uses a contemporary sample where markets exhibit a consistently high degree of integration stretching over the whole period. Thus, it is not the asset acquisition hypothesis that is wrong, but it is its assumption of sufficient market segmentation that, at least for the chosen country-pair, does not seem to hold any longer. This trend may not be limited to cross-border M&As between the US and UK, but probably involves most developed economies. Although, the exchange rate – FDI relationship is likely to look very different for developing countries, the findings of this study point towards the conclusion that the real exchange rate does not impact cross-border M&A activity in today's developed economies. The asset acquisition hypothesis has lost its relevance.

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5. Appendices

Appendix 1: NAICS 2007 and SIC 2007 manufacturing industries

NAICS 07	Description
311	Food mfg
312	Beverage and tobacco mfg
313	Textile mills
314	Textile product mills
315	Apparel mfg
316	Leather and allied product mfg
321	Wood product mfg
322	Paper mfg
323	Printing and related support activities
324	Petroleum and coal products mfg
325	Chemical mfg
326	Plastics and rubber products mfg
327	Nonmetallic mineral product mfg
331	Primary metal mfg
332	Fabricated metal product mfg
334	Computer & electronic product mfg
335	Electrical equipment, appliance & component mfg
333	Machinery mfg
336	Transportation equipment mfg
337	Furniture & related product mfg
339	Miscellaneous mfg

UK SIC 07	Description
10	Manufacture of food products
11	Manufacture of beverages
12	Manufacture of tobacco products
13	Manufacture of textiles
14	Manufacture of wearing apparel
15	Manufacture of leather and related products
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
17	Manufacture of paper and paper products
18	Printing and reproduction of recorded media
19	Manufacture of coke and refined petroleum products
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
22	Manufacture of rubber and plastic products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products, except machinery and equipment
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c.
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment
31	Manufacture of furniture
32	Other manufacturing

Appendix 2: A discussion of empirical results on the horizontal versus vertical models of FDI

A significant amount of research in the 1990's suggests that FDI mostly takes place in horizontal form rather than vertical. Markusen (1995) and LIpsey (1999) find that foreign direct investment by multinationals is mainly directed towards large and wealthy countries, which is in line with the horizontal view as it implies that FDI is motivated by market seeking aspects rather than efficiency seeking ones. Likewise Brainard (1997) and Eckholm (1997) find that sales of foreign U.S. affiliates are higher in countries where American products face higher import charges and transport costs. Further, Brainard also concludes that U.S. companies with large scale corporate operations are more likely to have production facilities abroad to serve foreign markets locally. All these studies support Markusen's horizontal theory of FDI where the emergence of MNEs is triggered by market access. Nevertheless, some evidence exists in favor of the vertical view and particularly for the view that FDI is not simply either or, but in most cases a synthesis of both.

The empirical FDI research of the 90's displays two particular weaknesses in its set-up. First, they exclude all or some significant amount of FDI data from that decade and second, they do not focus in enough detail on the specific roles that foreign affiliates of U.S. enterprises play abroad. Hanson, Monalatti, and Slaughter (2001) remedy those deficiencies of previous research and identify three main results that challenge previous findings.

Contrary to much of the research published during the 1990's, Hanson, Mataloni, and Slaughter (2001) find considerable evidence for FDI of the vertical form in the United States. They discover that an increasing share of intermediate goods is being moved to production locations abroad. This is particularly the case in industries that require distinct sets of skills for different steps of the production process. Thus, companies with separable high- and low-skilled activities are very likely to set up vertical production networks across borders.

Moreover, the role of U.S. affiliates abroad depends a lot on the structural factors of the host country. While affiliates' sales in well protected countries are mainly targeted towards the local markets, they are mostly targeted towards surrounding countries in less protected economies. The first case, thus, describes a classic example of horizontal integration, whereas the affiliate in the

latter case takes on the role of an export platform (Hanson, Mataloni, and Slaughter 2001). Its production is not exclusively targeted towards the host country and the affiliate therefore does not constitute FDI in the horizontal sense. The horizontal view would suggest that the MNE serves the less protected market with exports, which obviously is not the case. Rather, the MNE seems to be exploiting factor price differences or proximity to other countries when locating in less protected countries. What drives the creation of MNEs in this case is thus a blend of market- and efficiency seeking motives which hence constitutes a synthesis of vertical and horizontal FDI.

Finally, foreign affiliates of U.S. firms can also take on another role that FDI literature has not yet considered. When deciding on foreign involvement, MNEs seem to be facing choice between usual production-oriented FDI and distribution-oriented FDI (Hanson, Mataloni, and Slaughter 2001). Foreign markets are then either served by local production or by wholesale trade affiliates which sell goods produced in the MNE's home country or in other locations. The horizontal and vertical theories of FDI only focus on the choice between exporting and local production, but do not take into account the various roles besides production that an affiliate can play abroad.

Considering the findings above, it appears that a theoretical framework that only takes into account either the horizontal or the vertical mode of FDI misses the point. A realistic representation of multinational's foreign involvement must combine both ideas into a general equilibrium model. Markusen et al. (1996) aim to do just that. They combine the essential points of both ideas to establish the so-called "knowledge capital model of the multinational enterprise".

Appendix 3: A discussion of empirical results on the knowledge-capital model

A first empirical estimation of the knowledge capital model is performed by Carr, Markusen, and Maskus (2001). They construct a world with two countries, immobile factors of production and two homogenous goods X and Y where Y is unskilled labor intensive, exhibits constant returns to scale and is produced by firms operating in a perfectly competitive industry. Good X requires relatively more skilled than unskilled labor and firms manufacturing it operate in Cournot competition with free entry and exit and experience increasing returns to scale. They further assume a 25% ad valorem tax charged on imports.

Foreign affiliates' sales will be highest when one country happens to be small and abundant with skilled labor while the other is large and unskilled labor abundant. This will lead to the emergence of vertical-type multinationals that locate their knowledge-generating headquarters in the small country and outsource unskilled labor intensive manufacturing to foreign affiliates in the large country. Under the most extreme scenario the entire production of commodity X will be performed by foreign affiliates. On the other hand, total sales of foreign affiliates reach a minimum when the large country happens to be skilled labor abundant. In this case companies will locate headquarters and production facilities in that country, creating only national firms which produce X.

When both countries have equal relative endowments, total sales of foreign affiliates in both countries are found to be lowest when both countries are the same in terms of relative endowments, but considerably differ in size. With one large and small country, commodity X will be produced by national firms located in the large country with the smaller country being served through exports. Foreign affiliates will not exist and affiliate sales will thus be zero under the most extreme scenario. Given equal relative endowments, sales of foreign affiliates will reach a maximum exactly where both countries are equally large and factors of productions are precisely identically distributed. Good X will hence be entirely produced by horizontal-type MNEs with exactly half headquartered in each country.

As the knowledge capital model relies on a large number of input variables, reliable testing of it proves very difficult. For example, the percentage chosen for the ad valorem trade cost can have a significant impact on predictions. Depending on other country characteristics, raising the tax can either increase affiliate sales by encouraging horizontal production or it can reduce them by discouraging the formation of vertically integrated multinationals. Nevertheless, its predictions seem to conform to some real world observations that we can make. For instance, Carr, Markusen, and Maskus (2001) point out that countries like Sweden, Switzerland and the Netherlands fit the predictions of the model pretty well. All of them are small and skilled labor abundant countries that are home to a significant number of companies that produce abroad, like IKEA, Unilever, or Nestle just to name a few.

Appendix 4: Discussion of empirical results on partial-equilibrium models

Exchange rate and aggregate FDI link:

One of the most influential studies published on the relationship of the exchange rate and FDI was undertaken by Froot and Stein (1991) in an attempt to empirically examine their relative wealth hypothesis. To understand how the exchange rate affects capital inflows into the United States, they regress the value of different types of foreign capital inflows on the real value of the U.S. dollar using quarterly data for the period 1973-1988. Their results show that the value of the dollar has a negative effect on the value of inward FDI, meaning that a depreciation of the dollar stimulates investment from abroad. Moreover, the negative coefficient of the dollar is significant at the 5% level. These results are supported by Klein and Rosengren (1994) who also examine FDI flows from six different countries to the United States between 1979 and 1991. Over that period inward FDI originating in those source countries accounted for approx. 78% of total inward FDI of the United States. They find that a 1% real depreciation of the dollar results in a 1.89-2.27% in inward FDI as a share of U.S. GNP. Their results are found to be statistically significant at the 5% level.

A more narrow approach is chosen by Ray (1989). He as well studies inward FDI to the U.S. for a similar period, 1979-85, but focuses entirely on the manufacturing sectors. Furthermore, his regression is more accurate than previous studies, since he computes industry specific real exchange rates according to 4-digit SIC levels. Similar to Froot and Stein (1991) and Klein and Rosengren (1994), his results suggest that, overall, a depreciation of the US dollar attracts investment from abroad. Interestingly, this relationship appears to hold for FDI originating in countries of the European Community as well as Canada, but not for Japan (Ray). A possible explanation might be that the Yen was relatively undervalued during the whole sample period. While one U.S. dollar bought 260 Yen in early 1985, it would only get 125 three years later (Obstfeld, 2009). Since Ray's regression did not include large currency movements for the Yen – U.S. dollar pair, the model might not have captured a potentially existing exchange rate – FDI link.

An alternative explanation might be that the FDI exchange rate relationship just is not as stable as some economic theory suggests it is. In fact, it can be argued that the sheer amount of different and even opposing theories on this topic might suggest the possibility that a significant relationship doesn't actually exist. Further, several papers cast doubt on the robustness of those studies that happen to find evidence in favor of an FDI exchange rate link. For instance, Stevens (1998) re-runs the regression of Froot ad Stein (1991) and finds that although a cheap dollar is associated with increasing inward FDI for the sample period as a whole, no significant relationship can be attested for the major part of the observation period when run on subsamples. He argues that a clear relationship between the exchange rate and FDI does not exist, rather the effect of a depreciating currency can turn out to be of any kind whatsoever and therefore impossible to predict.

A similar line of argument is put forward by Goldberg (1993) who doesn't necessarily challenge the view of a negative exchange rate FDI link, but argues that this relationship can change over time. More specifically, she constitutes two important things. First, the exchange rate does not affect FDI flows in all parts of the economy, but mostly in durable manufacturing and non-manufacturing sectors. Second, the way it influenced inward FDI in these industries has changed from the 1970's to the 1980's. Surprisingly, while a depreciation of the U.S. dollar was associated with investment expansion in the 70's, it was associated with investment contraction in the 80's.

Various studies, thus, show that an unambiguous relationship between the exchange rate and FDI does not exist. Rather, the opposing outcomes lead to the conclusion that the results appear to be highly dependent on factors like time, industry, and country used in the model. But even if a significant negative relationship between the exchange rate and FDI exists, it is not clear through which channel the exchange rate works. The following section will investigate the most important empirical contributions to this discussion.

Exchange rate and M&A link:

Since the focus of this paper, however, lies not on total FDI, but exclusively on mergers and acquisitions, the following section will explore the most relevant research in this field.

A highly comprehensive study on M&A's is presented by Erel et al. (2012) who investigate worldwide cross-border acquisitions between 1990 and 2007. In line with results by Froot and Stein (1991) on aggregate FDI, they constitute that currency movements exert significant influence on the pattern of international M&A trends. Using CPI measures to construct real exchange rates, they find that for a given country pair, a 17% increase in the change of the real exchange rate results in a 12% increase in the number of cross-border acquisitions of targets in the country exhibiting the depreciated currency. Klein and Rosengren (1994) find that the effect of the real exchange rate on M&A's is even greater than on overall FDI. They show that a 1% depreciation of the dollar is associated with a 3.31% increase in the value of foreign acquisitions of U.S. targets relative to U.S. GNP, compared to approx. 2% for aggregate FDI. Moreover, Froot and Stein find support for this argument as their results suggest that, among the different types of FDI, the negative impact of the exchange rate is greatest for cross-border mergers and acquisitions. The impact of the dollar value on in acquisition FDI is almost six times as large as for greenfield investments and more than ten times as large as for joint ventures. They find this to be the case at least for the United States in the period 1973-88.

Despite a significant amount of literature supporting the hypothesis of an existing negative exchange rate M&A link, various papers fail to find evidence for it. Healy and Palepu (1993) examine completed cross-border deals between eleven of the leading industrial nations during the period 1985-90, among others the U.S., U.K., and West Germany, and fail to find significant results for the real exchange rate. Consistent results proposing an exchange rate – FDI link opposite of what is suggested by Froot and Stein (1991) are rare, however. In a study on cross-border M&A's in the food processing industry for the years 1987-99, Reed and Babool (2003) arrive at the surprising result that inward and outward acquisition FDI respond in similar ways to exchange rate movements. While the appreciation of a domestic currency leads to increased

acquisitions of foreign targets, it also leads to increased acquisitions by foreign companies at home. The authors suggest that companies are generally more likely to invest in countries with positive growth prospects and a strong currency might be considered a proxy for such a positive outlook. They conclude that a potentially existing price disadvantage of a strong currency is thus being dominated by the desire of foreign firms to invest in growing and economically sound economies.

A final argument against an exchange rate effect is put forward by Dewenter (1995), who studies foreign acquisitions of U.S. targets from 1975 to 1989. In her model, she controls for relative corporate wealth effects and for overall levels of investment. The results of her research make a case for the possibility that exchange rate movements do not exert any influence on foreign investment relative to domestic investment. Rather, the number of acquisitions of foreign companies tends to rise and fall with the level of domestic acquisitions. Although an appreciating exchange rate still affects the absolute level of foreign acquisitions, Dewenter's results suggest that such a trend is not driven by price advantages, but by the country's overall increasing demand for investments.

Wealth versus wage hypothesis:

Differences in relative wealth and wages across countries are the most popular factors to explain the impact of exchange rates on FDI. Most empirical research, however, appears to favor the relative wealth hypothesis. Klein and Rosengren (1994), who regress different FDI measures on the exchange rate, include explanatory variables in their model to control for international wage and wealth differences. Their results show that relative wealth is a strong determinant of U.S. inward FDI with the coefficient being significant at 5%. On the other hand the variable capturing relative wage effects exhibits a coefficient which is not significantly different from zero. In a previous study, Klein and Rosengren (1990) show that a 1% increase in the foreign currency value of foreign stock and a 1% depreciation of the dollar have the same statistical effect on FDI inflows to the U.S. The fact that both variables exert the same influence on FDI, suggests that

exchange rate movements do indeed trigger changes in relative wealth distributions which in turn impact worldwide investment patterns. Differences in factor endowments, however, do not appear to play a role when it comes to international investment decisions.

Examining stock price developments of target companies following an acquisition announcement, Harris and Ravenscraft (1991) find that target gains are higher when the acquirer's currency is relatively strong. Specifically, a 10% appreciation of the buyer's currency results in a 2.7% increase in target gains. This is consistent with the relative wealth hypothesis that implies domestic currency depreciations to spark a bidding advantage for foreign buyers.

Although both Klein and Rosengren (1990, 1994) and Harris and Ravenscraft (1991) argue that the exchange rate affects the relative distribution of wealth, neither of them examines the channel through which this process takes place. However, Froot and Stein (1991) find empirical support for their theory of imperfect capital markets. While they show the dollar value to be inversely correlated with inward FDI, portfolio inflows into stocks and bonds appear to exhibit no significant relationship with the currency's strength. This is in line with the imperfect-capital market hypothesis, which predicts no exchange rate impact on assets without informational asymmetries. Since the value of bonds and stocks is publicly available, investors and lenders have access to the same information on their payoff and hence foreigners cannot obtain an advantage in financing the investment as a result of exchange rate movements. The negative dollar impact on FDI further supports this hypothesis in that physical assets which are captured by the FDI measure are expected to be information asymmetric. Taken together, the above results suggest that imperfect capital markets enable exchange rate movements to substantially affect the relative distribution of wealth, which gives certain countries paramount advantages in acquiring foreign assets.

Appendix 5: U.S. mergers and acquisitions of U.K. firms by target industry, 2004-2010

NAICS 2007	Number of U.S. M&As	Description
334*	145	Computer & electronic product mfg
325*	84	Chemical mfg
333	54	Machinery mfg
339	31	Miscellaneous mfg
336*	26	Transportation equipment mfg
311	24	Food mfg
332	23	Fabricated metal product mfg
335*	13	Electrical equipment, appliance & component mfg
323	11	Printing and related support activities
326	11	Plastics and rubber products mfg
327	10	Nonmetallic mineral product mfg
324*	6	Petroleum and coal products mfg
331	6	Primary metal mfg
315	5	Apparel mfg
322	5	Paper mfg
337	5	Furniture & related product mfg
316	3	Leather and allied product mfg
3121	2	Beverage mfg
313	2	Textile mills
321	1	Wood product mfg
3122	0	Tobacco mfg
314	0	Textile product mills

NOTE: Asterisk denotes high R&D industries. See: table 1 or section 6.1.3 for details.
SOURCE: M&A data are retrieved from Thomson One Banker.

Appendix 6: U.K. mergers and acquisitions of U.S. firms by target industry, 2004-2010

NAICS 2007	Number of U.K. M&As	Description	No. of establishments 2004	2010
334*	96	Computer & electronic product mfg	13,236	11,717
325*	88	Chemical mfg	9,523	9,517
333*	53	Machinery mfg	24,485	21,944
336*	24	Transportation equipment mfg	10,595	9,735
339	21	Miscellaneous mfg	30,549	26,768
332	19	Fabricated metal product mfg	55,274	51,984
335	16	Electrical equipment, appliance & component mfg	5,386	5,098
311	10	Food mfg	22,320	20,673
327	10	Nonmetallic mineral product mfg	11,361	10,143
3121	9	Beverage mfg	2,692	3,965
331	7	Primary metal mfg	4,437	3,773
326	5	Plastics and rubber products mfg	11,741	10,215
313	3	Textile mills	3,051	2,244
321	3	Wood product mfg	14,921	12,597
324	3	Petroleum and coal products mfg	1,122	1,092
337	3	Furniture & related product mfg	20,832	16,881
315	2	Apparel mfg	11,989	7,105
316	2	Leather and allied product mfg	1,417	1,148
322	2	Paper mfg	3,451	2,982
3122	1	Tobacco mfg	113	94
314	0	Textile product mills	6,785	6,030
323	0	Printing and related support activities	33,649	27,762

NOTE: Asterisk denotes high R&D industries. See:table 1 or section 6.1.3 for details.
SOURCES: M&A data are retrieved from Thomson One Banker. Data on the number of businesses in the US are retrieved from the United States Census Bureau (2013).

Appendix 7: U.K. mergers and acquisitions of U.S. firms by acquirer industry, 2004-2010

NAICS 2007	Number of U.K. M&As	Description
334	84	Computer & electronic product mfg
325	40	Chemical mfg
333	33	Machinery mfg
523	28	Securities, commodity contracts, and other financial investments and related activities
336	21	Transportation equipment mfg
311	14	Food mfg
511	13	Publishing industries (except internet)
332	11	Fabricated metal product mfg
424	11	Merchant wholesalers, nondurable goods
541	10	Professional, scientific and technical services
339	9	Miscellaneous mfg
213	8	Support activities for mining and oil and gas extraction
327	8	Nonmetallic mineral product mfg
326	6	Plastics and rubber products mfg
335	6	Electrical equipment, appliance & component mfg
423	6	Merchant wholesalers, durable goods
525	6	Funds, trusts, and other financial vehicles
324	3	Petroleum and coal products mfg
621	3	Ambulatory health care services
221	2	Utilities
322	2	Paper mfg
337	2	Furniture & related product mfg
445	2	Food and beverage stores
483	2	Water transportation
486	2	Pipeline transportation
488	2	Support activities for transportation
517	2	Telecommunications
522	2	Credit intermediation and related activities
713	2	Amusement, gambling, and recreation industries
115	1	Support activities for agriculture and forestry
211	1	Oil and gas extraction
237	1	Heavy and civil engineering construction
3121	1	Beverage mfg
3122	1	Tobacco mfg
313	1	Textile mills
446	1	Health and personal care stores
451	1	Sporting goods, hobby, book, and music stores
484	1	Truck transportation
623	1	Nursing and residential care facilities

SOURCE: M&A data are retrieved from Thomson One Banker.

Appendix 8: U.S. mergers and acquisitions of U.K. firms by acquirer industry, 2004-2010

NAICS 2007	Number of U.S. M&As	Description
334	90	Computer & electronic product mfg
325	69	Chemical mfg
333	56	Machinery mfg
336	28	Transportation equipment mfg
339	27	Miscellaneous mfg
523	22	Securities, commodity contracts, and other financial investments and related activities
311	17	Food mfg
332	17	Fabricated metal product mfg
335	16	Electrical equipment, appliance & component mfg
541	16	Professional, scientific and technical services
511	13	Publishing industries (except internet)
323	5	Printing and related support activities
321	4	Wood product mfg
3121	3	Beverage mfg
326	3	Plastics and rubber products mfg
331	3	Primary metal mfg
424	3	Merchant wholesalers, nondurable goods
238	2	Specialty trade contractors
316	2	Leather and allied product mfg
327	2	Nonmetallic mineral product mfg
337	2	Furniture & related product mfg
423	2	Merchant wholesalers, durable goods
448	2	Clothing and clothing accessories stores
518	2	Data processing, hosting, and related services
524	2	Insurance carriers and related activities
525	2	Funds, trusts, and other financial vehicles
561	2	Administrative and support services
213	1	Support activities for mining and oil and gas extraction
221	1	Utilities
236	1	Construction of buildings
313	1	Textile mills
315	1	Apparel mfg
322	1	Paper mfg
446	1	Health and personal care stores
451	1	Sporting goods, hobby, book, and music stores
453	1	Miscellaneous store retailers
484	1	Truck transportation
517	1	Telecommunications
519	1	Other information services
522	1	Credit intermediation and related activities
531	1	Real estate
611	1	Educational services
621	1	Ambulatory health care services
924	1	Administration of environmental quality programs

Appendix 9: Summary statistics for the data set on US acquisitions of UK firms, 2004-2010

Variable	Mean	Std. Dev.	Variance	Minimum	Maximum
Panel A. Full Sample of Manufacturing Industries (*n* = 154)					
Cross-border M&As	3.03	5.39	29.01	0	31
RER	1.05	0.12	0.01	0.78	1.47
TARIFF (in %)	3.72	4.18	17.44	0.05	24.33
Real GDP growth (in %)	1.44	2.17	4.73	-3.07	3.47
Ind. Value-added (in %)	0.68	0.52	0.27	0.10	1.70
Target M&As	14.19	12.40	153.77	0.00	53.00
BUS (in 1,000s)	325.30	13.70	187.73	303.25	348.25
RIR (in %)	-1.94	1.53	2.35	-4.73	0.28
Panel B. High R&D Manufacturing Industries (*n* = 35)					
Cross-border M&As	7.83	8.94	79.97	0	31
RER	1.05	0.14	0.02	0.78	1.47
TARIFF (in %)	1.59	1.26	1.58	0.08	4.15
Real GDP growth (in %)	1.44	2.20	4.84	-3.07	3.47
Ind. Value-added (in %)	1.11	0.48	0.23	0.30	1.70
Target M&As	20.14	15.83	250.60	0.00	50.00
BUS (in 1,000s)	325.30	13.86	192.00	303.25	348.25
RIR (in %)	-1.94	1.55	2.41	-4.73	0.28
Panel C. Low R&D Manufacturing Industries (*n* = 119)					
Cross-border M&As	1.62	2.40	5.75	0	12
RER	1.05	0.11	0.01	0.78	1.31
TARIFF (in %)	4.35	4.52	20.40	0.05	24.33
Real GDP growth (in %)	1.44	2.18	4.74	-3.07	3.47
Ind. Value-added (in %)	0.56	0.46	0.22	0.10	1.60
Target M&As	12.45	10.66	113.59	0.00	53.00
BUS (in 1,000s)	325.30	13.71	188.09	303.25	348.25
RIR (in %)	-1.94	1.54	2.36	-4.73	0.28

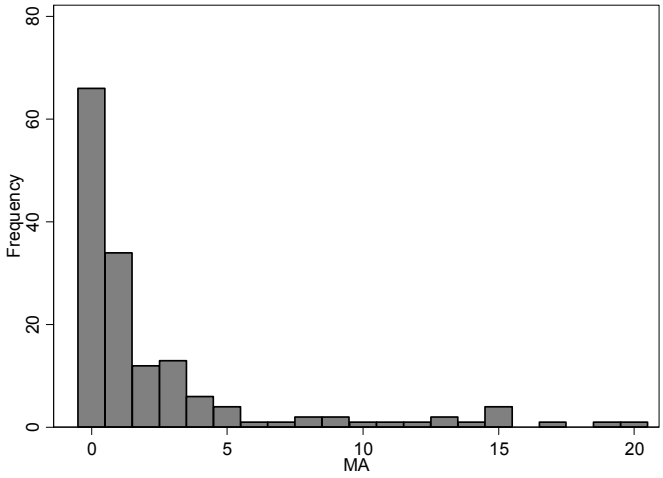
SOURCE: High R&D industries are defined along the lines of section 6.1.3.

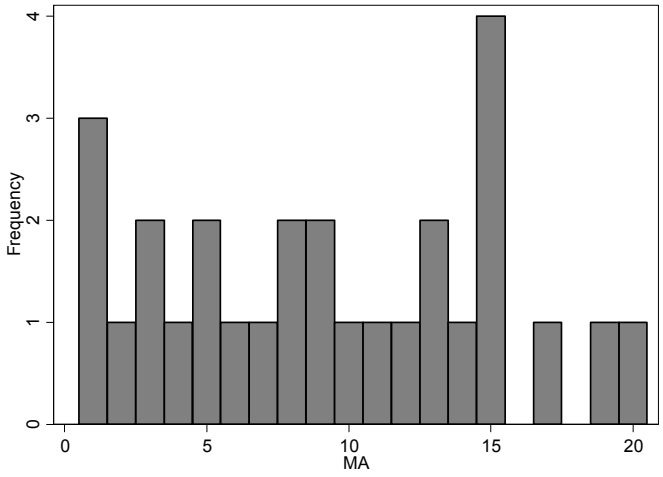
Appendix 10: Summary statistics for the data set on UK acquisitions of US firms, 2004-2010

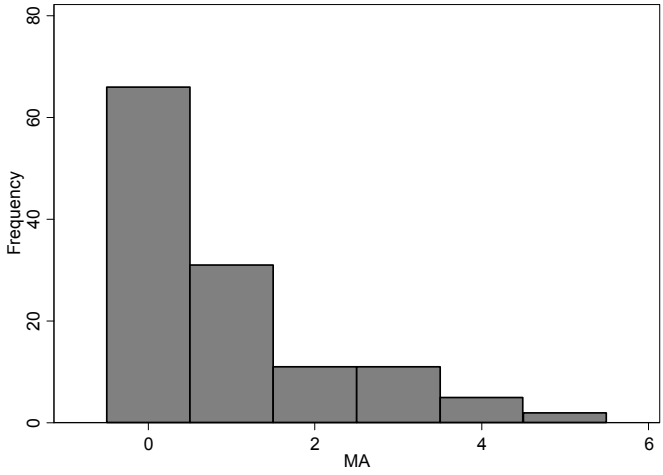
Variable	Mean	Std. Dev.	Variance	Minimum	Maximum
Panel A. Full sample of manufacturing industries (n = 154)					
Cross-border M&As	2.45	4.20	17.62	0	20
RER	0.97	0.10	0.01	0.68	1.28
TARIFF (in %)	4.16	2.15	4.60	0.62	17.89
Real GDP growth (in %)	1.25	2.55	6.48	-3.97	3.63
Ind. Value-added (in %)	1.04	0.55	0.30	0.06	2.10
Target M&As	69.79	86.84	7541.99	0.00	463.00
BUS (in 1,000s)	12.97	12.69	161.16	0.07	55.90
RIR (in %)	1.94	1.53	2.35	-0.28	4.73
Panel B. High R&D manufacturing industries (n = 28)					
Cross-border M&As	9.32	5.72	32.67	1	20
RER	0.92	0.10	0.01	0.68	1.10
TARIFF (in %)	1.68	0.71	0.50	0.62	3.18
Real GDP growth (in %)	1.25	2.58	6.68	-3.97	3.63
Ind. Value-added (in %)	1.09	0.43	0.19	0.64	1.91
Target M&As	208.96	113.69	12925.96	65.00	463.00
BUS (in 1,000s)	14.02	5.68	32.32	9.52	24.49
RIR (in %)	1.94	1.56	2.42	-0.28	4.73
Panel C. Low R&D manufacturing industries (n = 126)					
Cross-border M&As	0.92	1.26	1.58	0	5
RER	0.98	0.10	0.01	0.76	1.28
TARIFF (in %)	4.71	1.96	3.84	1.90	17.89
Real GDP growth (in %)	1.25	2.55	6.49	-3.97	3.63
Ind. Value-added (in %)	1.03	0.57	0.33	0.06	2.10
Target M&As	38.86	33.71	1136.12	0.00	166.00
BUS (in 1,000s)	12.74	13.78	189.97	0.07	55.90
RIR (in %)	1.94	1.54	2.36	-0.28	4.73

SOURCE: High R&D industries are defined along the lines of section 6.1.3.

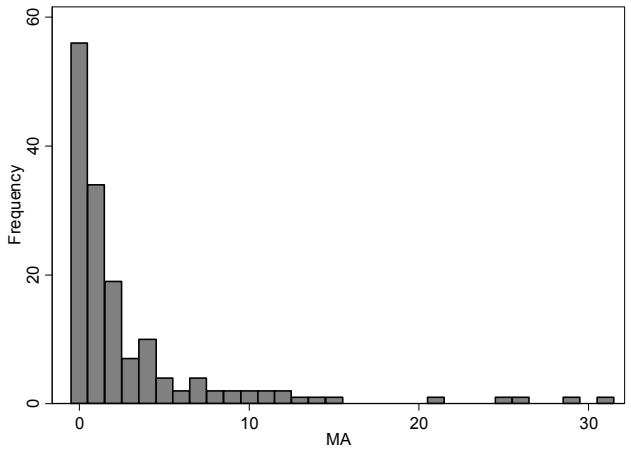
Appendix 11: Unconditional distribution of the dependent variable for UK M&As in the US
(from top to bottom: full sample, high R&D sample, low R&D sample)

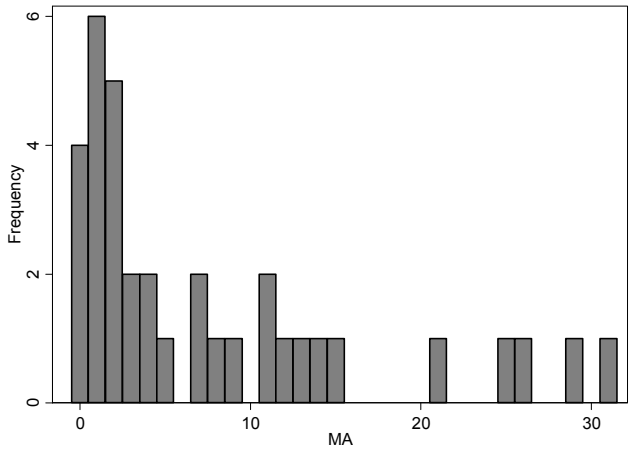


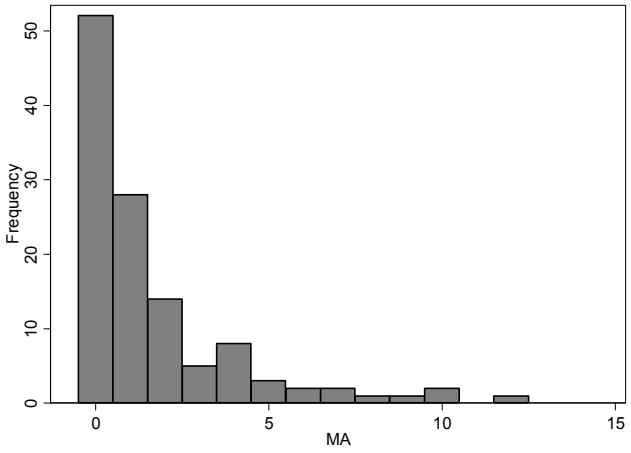




Appendix 12: Unconditional distribution of the dependent variable for US M&As in the UK
(from top to bottom: full sample, high R&D sample, low R&D sample)







Appendix 13: Analysis of control variables

To table 4:

US tariffs in low R&D industries and the overall manufacturing sector are negative and significant at 1%. Our estimate for less R&D intensive industries in column 6 suggests that an increase in US tariffs by one percentage point results in a 16% decrease in the level of UK M&As of US firms. This constitutes another surprising result, as it is the very opposite of the positive coefficient that we expected. Contrary to that however, no evidence of the tariff-jumping hypothesis can be established in our data. With regard to the high R&D sample, however, our regression results support what we expected in the context of the asset acquisition hypothesis. Focusing on column 3, the tariff coefficient is entirely insignificant implying that UK acquisitions in high R&D industries are not driven by trade costs, but by the desire to acquire firm-specific assets.

Considering all remaining control variables, most of them show the expected signs across all three models. Growth in real UK GDP is positively correlated with the level of UK acquisitions in the US. In the full manufacturing sample as well as the high R&D sample it meets the 5% significance criterion, whereas it is insignificant for less R&D intensive industries. To be more precise, the coefficient in column 3 implies that a one percentage point rise in real GDP growth leads to a 13% increase in UK acquisitions of US companies in high R&D sectors, all else equal.

The industry value added share is positive, but only significant in the high and low R&D samples. Interestingly, the Poisson estimators in column 3 and 6 are considerably different in size. The IVA effect in more R&D intensive industries is more than double of that in less R&D intensive industries. A one percentage point increase in the share of industry j as part of the UK's GDP leads to 110% rise in the level of UK acquisitions in high R&D industries compared to 37% rise in low R&D industries. This is a rather large number compared to similar studies. With respect to Canadian M&As of American firms in high R&D sectors, Georgopoulos (2008) finds that such a one percentage point increase results in a 23% increase in the number of cross-border acquisitions. Keeping in mind, however, that the mean for industry value-added share in R&D

intensive industries in the UK is about 1.09%, an increase by one percentage point implies that the size of the whole industry is doubled. In this light, the estimated coefficient might indeed seem reasonable.

Local M&As in the US is a significant explanatory variable across all three different models and it shows the expected positive correlation with the dependent variable. The coefficient in column 3, for instance, suggests that an extra acquisition in industry *j* in the US is related to a 0.4% increase in UK cross-border acquisitions targeted towards that industry. The additional explanatory power with regards to cross-border acquisitions over and above what is captured by the other covariates is very little therefore. Considering the average industry experiences only 2.45 UK M&As of US firms in a given year, it would take almost an additional 86 local acquisitions to add one extra cross-border deal, all else equal. This is a very large number seeing that the mean for local M&As in the US is just under 70 deals per year. What has to be kept in mind, however, is that this variable does not measure a causal relationship with the dependent variable, but rather some sort of correlation with it. If this was the only regressor in our model, the coefficient would certainly be much greater.

We find mixed results with regard to the number of businesses in an industry. While the variable's sign is positive for the full sample of manufacturing industries and for the high R&D sample, it is slightly negative for the low R&D sample. However, considering their respective p-values, none of the coefficients is significant at the 5% level implying that no statistically significant correlation with the dependent variable exists. The same holds for the real interest rate differential, which exhibits the correct sign across all specifications, implying that lower interest rates in the US should attract UK investors. However, none of the coefficients shows to be statistically different from zero which suggests that low interest rates do not provide a motive for acquisition FDI. Altogether, we find that the traditional determinants of FDI do well across all specifications.

To table 5:

Import charges in the UK are shown to be negatively correlated with the level of US acquisition in low R&D industries as well as in the full sample of manufacturing firms. The coefficients are negative and significant at the 1% level in these models. Regarding the high R&D sample, tariffs show to have no significant effect on the number of cross-border deals. With respect to the impact of tariffs on international M&As, we therefore observe a pattern that is very similar to the one in table 4. In the context of the asset acquisition hypothesis, this is exactly the pattern we would expect to observe. Import charges should be significant for low R&D industries and insignificant for high R&D industries.

Regarding the remaining control variables, we find that most of the estimators actually exhibit the desired signs across all three models. Some mixed results are only found with respect to UK's growth in real GDP and the number of businesses in the UK's manufacturing sector. Further, these are exactly the variables that are not found to be significantly correlated with the dependent variable at 5%. Compared to our estimations in table 4 however, these results are hardly surprising. There, too, the evidence of a real GDP growth effect was mixed, while the number of businesses showed to be entirely insignificant in explaining cross-border acquisitions.

Industry value added is positive across all models, but only significant at 5% for the full sample. Local M&As in the UK also positively correlated with the level of US acquisitions in the UK. Further, the variable's coefficient is significant at 5% for the full as well as the high R&D samples. With regard to the results on the low R&D sample in column 4, the coefficient is only marginally significant. Contrary to the data set comprising UK acquisitions of US firms, the difference in real interest rates shows to be significant for the high R&D sample and also exhibits the correct sign, implying that a lower real interest rate in the UK attracts acquisition FDI from the US. For the full sample in column 7 the regressor is marginally significant, while it has no power in predicting the cross-border activity for low R&D industries.

To table 6:

US custom charges have no significant effect across all models of the high R&D sample. For low R&D industries, however, all tariff coefficients are significant at 1%, similar in size and negative, pointing towards a constraining effect of import charges on cross-border M&A activity. Interesting to note is the discrepancy in the estimated effects of real GDP growth in the UK. While positive and significant in model 1 for high R&D industries, it turns entirely insignificant once a crisis dummy is added to the model or the crisis year is cut from the sample. Real GDP growth therefore only appears to add explanatory power to the model in the year 2009, when cross-border M&As drop dramatically. As explained above, a possible reason for the low significance of real GDP growth that we observe is that this variable refers to the aggregate economy. Unlike Industry value added share for instance, it is not specified on an industry basis. Since different industry sectors happen to react differently to real GDP growth rates, the predictive power this variable holds is very limited. Only in an extreme case like the financial crisis, it appears that all industries are affected in the same fashion. Once this year is cut or accounted for by crisis dummy, real GDP growth has no significant effect in our model. Regarding the low R&D sample, real GDP stays insignificant across all specifications, as before.

The coefficients of the remaining control variables show to be very consistent across the different models within the high and low R&D samples. Industry-value added share is positive and significant at 5% for across all models. Further, its correlation with the dependent variable is much more substantial for high R&D sectors. Likewise, domestic M&As in the US are a significant indicator for cross-border acquisitions in both high and low R&D industries. The number of businesses in the US and the real interest differential, on the other hand, also stay insignificant in the models that account for extraordinary crisis effects.

Summarizing, we can say that the robustness checks generally support the results from table 4. Our conclusion with regard to the asset acquisition hypothesis stays unchanged in that we do not find a significant interplay between the real exchange rate and the level of cross-border acquisitions, even after accounting for effects arising from the global financial crisis. Moreover, the estimations in table 6 highlight the differing impact of trade costs in the context of high and low R&D industries.

To table 7:

Considering the control variables in the low R&D models, tariffs in the UK are still significant and negatively linked to acquisition FDI inflows from the US when a crisis dummy is added or when the crisis year is cut from the sample. Regarding real GDP growth, a pattern similar to the high R&D results in table 7 becomes visible as the variable goes from marginal significance in the standard model to no significance whatsoever in models 2b and 3b. Once the observations from the year 2009 are excluded or accounted for by a crisis dummy, real GDP growth becomes expandable. Figure 2 shows the development of US M&As in the UK over time. Similar to the data set comprising US targets, a clear drop in the year 2009 is apparent.

The estimator of industry value added in model 2b is consistent with the estimator of model 1b both in size and significance. Quite surprisingly, in model 3b, the correlation however loses any significance. Exatly the opposite is true for the high R&D sample, where the coefficient goes from insignificant in models 1a and 2a to significant at 5% in model 3a. Surprisingly correlation analysis shows that the correlation between IVA and the dependent variable is practically identical in both time intervals across both samples. For high R&D industries we compute correlation coefficients in the range of 0.53-0.54 and for low R&D industries 0.27-0.28. The reason for this phenomenon must lie somewhere in the overall mix of the variables; it is not apparent to us however.

The MA_Tar coefficients are consistent for across all specifications of the high and low R&D samples, respectively. Further, the estimators are consistently significant at 1% with regard to high R&D industries. In the low R&D sample, the significance of the variable improves by accounting for crisis effects. The number of businesses in the UK as well as the real interest differential are consistently insignificant across all models of the low R&D sample.

Regarding the control variables in the high R&D sample, the tariff coefficient in model 3a proves to be quite interesting. The correlation is more negative than in the standard model and marginally significant. In general, the estimators in column 3a happen to be more extreme and

significant at the same time for all variables. We, therefore, find support for the estimators of our control variables in model 1a being robustly estimated despite the effects of the crisis.

Appendix 14: Real interest rates in the UK and US

	Real Interest Rates in %	
	UK	US
2004	1.77	1.49
2005	2.20	2.78
2006	1.69	4.58
2007	3.24	5.01
2008	1.54	2.81
2009	-0.68	1.91
2010	-2.21	2.53

Source: The World Bank (2013d)

Appendix 15: Negative Binomial regressions including market capitalization growth

Panel A: UK M&As in the US – High R&D sample (Stata 12 output)

```
Negative binomial regression                    Number of obs   =         28
                                                LR chi2(7)      =      39.90
Dispersion     = mean                           Prob > chi2     =     0.0000
Log likelihood = -67.764577                     Pseudo R2       =     0.2275
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	-3.337017	.9489833	-3.52	0.000	-5.19699	-1.477044
TARIFF_TAR	.1317545	.3362683	0.39	0.695	-.5273193	.7908283
GDP_ACQ	.1505972	.0441907	3.41	0.001	.0639851	.2372094
IVA_ACQ	.8421581	.252788	3.33	0.001	.3467028	1.337614
MA_TAR	.0039526	.0007903	5.00	0.000	.0024037	.0055015
BUS_TAR	.0282004	.0359147	0.79	0.432	-.0421911	.098592
CAP_ACQ	-.0092866	.0025483	-3.64	0.000	-.0142813	-.004292
_cons	2.650933	.93232	2.84	0.004	.8236199	4.478247
/lnalpha	-18.60894	1066.122			-2108.171	2070.953
alpha	8.28e-09	8.83e-06			0	.

```
Likelihood-ratio test of alpha=0:  chibar2(01) = 3.1e-06 Prob>=chibar2 = 0.499
```

Panel B: UK M&As in the US – Low R&D sample (Stata 12 output)

```
Negative binomial regression                    Number of obs   =        126
                                                LR chi2(7)      =      63.99
Dispersion     = mean                           Prob > chi2     =     0.0000
Log likelihood = -135.53184                     Pseudo R2       =     0.1910
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	.1624285	1.203448	0.13	0.893	-2.196287	2.521144
TARIFF_TAR	-.1827775	.073187	-2.50	0.013	-.3262214	-.0393335
GDP_ACQ	.0969617	.0558459	1.74	0.083	-.0124942	.2064177
IVA_ACQ	.3205094	.1748628	1.83	0.067	-.0222155	.6632343
MA_TAR	.0133793	.0031847	4.20	0.000	.0071374	.0196213
BUS_TAR	-.0014155	.0076797	-0.18	0.854	-.0164674	.0136363
CAP_ACQ	-.0044348	.0040658	-1.09	0.275	-.0124036	.0035341
_cons	-.6425965	1.331915	-0.48	0.629	-3.253103	1.96791
/lnalpha	-12.72589	805.4876			-1591.453	1566.001
alpha	2.97e-06	.0023948			0	.

```
Likelihood-ratio test of alpha=0:  chibar2(01) = 0.0e+00 Prob>=chibar2 = 0.500
```

Panel C: US M&As in the UK – High R&D sample (Stata 12 output)

```
Negative binomial regression                      Number of obs   =         35
                                                  LR chi2(7)      =      59.14
Dispersion     = mean                             Prob > chi2     =     0.0000
Log likelihood = -79.150635                       Pseudo R2       =     0.2720
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	-.0582298	1.126021	-0.05	0.959	-2.26519	2.14873
TARIFF_TAR	-.0259961	.099085	-0.26	0.793	-.2201991	.1682069
GDP_ACQ	-.0101589	.0539965	-0.19	0.851	-.1159901	.0956724
IVA_ACQ	.2638135	.3707481	0.71	0.477	-.4628393	.9904664
MA_TAR	.0653389	.0094908	6.88	0.000	.0467373	.0839405
BUS_TAR	-.0049615	.0104749	-0.47	0.636	-.0254919	.015569
CAP_ACQ	.0010013	.0046093	0.22	0.828	-.0080328	.0100353
_cons	1.60568	4.097303	0.39	0.695	-6.424887	9.636247
/lnalpha	-2.806482	.7570354			-4.290245	-1.32272
alpha	.0604171	.0457379			.0137016	.2664096

```
Likelihood-ratio test of alpha=0:  chibar2(01) =    4.25 Prob>=chibar2 = 0.020
```

Panel D: US M&As in the UK – Low R&D sample (Stata 12 output)

```
Negative binomial regression                      Number of obs   =        119
                                                  LR chi2(7)      =      72.57
Dispersion     = mean                             Prob > chi2     =     0.0000
Log likelihood = -169.17075                       Pseudo R2       =     0.1766
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	1.681584	1.744095	0.96	0.335	-1.73678	5.099947
TARIFF_TAR	-.1625743	.0519639	-3.13	0.002	-.2644217	-.0607269
GDP_ACQ	.0890457	.0645265	1.38	0.168	-.0374238	.2155153
IVA_ACQ	.3278115	.3659848	0.90	0.370	-.3895054	1.045128
MA_TAR	.0611698	.0138966	4.40	0.000	.033933	.0884067
BUS_TAR	-.0085038	.0158158	-0.54	0.591	-.0395022	.0224945
CAP_ACQ	-.0062	.0054604	-1.14	0.256	-.0169023	.0045022
_cons	.6045631	6.616406	0.09	0.927	-12.36335	13.57248
/lnalpha	-1.029682	.407135			-1.827652	-.2317122
alpha	.3571205	.1453962			.1607907	.7931743

```
Likelihood-ratio test of alpha=0:  chibar2(01) =   15.40 Prob>=chibar2 = 0.000
```

Appendix 16: Model 1 estimated by Fixed Effects Negative Binomial regression

Panel A: UK M&As in the US – High R&D sample (Stata 12 output)

```
Conditional FE negative binomial regression     Number of obs      =        28
Group variable: NAICS                           Number of groups   =         4

                                                Obs per group: min =         7
                                                              avg =       7.0
                                                              max =         7

                                                Wald chi2(7)       =     16.03
Log likelihood  = -56.461413                    Prob > chi2        =    0.0248
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	3.457526	3.104934	1.11	0.265	-2.628033	9.543086
TARIFF_TAR	-.0034213	.5959	-0.01	0.995	-1.171364	1.164521
GDP_ACQ	.0675824	.0791505	0.85	0.393	-.0875497	.2227145
IVA_ACQ	.2974636	.8901097	0.33	0.738	-1.447119	2.042047
MA_TAR	-.0010426	.0029064	-0.36	0.720	-.0067389	.0046538
BUS_TAR	-.3331904	.2642108	-1.26	0.207	-.8510341	.1846532
RIR_DIF	.0525311	.1198086	0.44	0.661	-.1822894	.2873517
_cons	5.782825	6.215222	0.93	0.352	-6.398786	17.96444

Panel B: UK M&As in the US – Low R&D sample (Stata 12 output)

```
Conditional FE negative binomial regression     Number of obs      =       112
Group variable: NAICS                           Number of groups   =        16

                                                Obs per group: min =         7
                                                              avg =       7.0
                                                              max =         7

                                                Wald chi2(7)       =     12.49
Log likelihood  = -90.263931                    Prob > chi2        =    0.0856
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	1.000737	1.780854	0.56	0.574	-2.489673	4.491147
TARIFF_TAR	-.1319013	.1659527	-0.79	0.427	-.4571626	.1933601
GDP_ACQ	.0964854	.0626817	1.54	0.124	-.0263684	.2193392
IVA_ACQ	2.338789	1.735815	1.35	0.178	-1.063346	5.740925
MA_TAR	.0006429	.0086736	0.07	0.941	-.0163571	.0176429
BUS_TAR	-.0041496	.1622051	-0.03	0.980	-.3220657	.3137666
RIR_DIF	.0707845	.1032597	0.69	0.493	-.1316009	.2731699
_cons	13.07271	.	.	.	.	.

Panel C: US M&As in the UK – High R&D sample (Stata 12 output)

```
Conditional FE negative binomial regression     Number of obs      =        35
Group variable: NAICS                           Number of groups   =         5

                                                Obs per group: min =         7
                                                               avg =       7.0
                                                               max =         7

                                                Wald chi2(7)       =     23.90
Log likelihood  = -59.285156                    Prob > chi2        =    0.0012
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	-2.147051	1.261664	-1.70	0.089	-4.619867	.3257648
TARIFF_TAR	-.0170069	.2862961	-0.06	0.953	-.578137	.5441231
GDP_ACQ	-.0248829	.0474961	-0.52	0.600	-.1179734	.0682077
IVA_ACQ	-.0012398	.6457459	-0.00	0.998	-1.266878	1.264399
MA_TAR	.0167762	.0180121	0.93	0.352	-.0185268	.0520792
BUS_TAR	.0085488	.0092911	0.92	0.358	-.0096615	.0267591
RIR_DIF	-.1125904	.060705	-1.85	0.064	-.23157	.0063893
_cons	3.453964	4.539935	0.76	0.447	-5.444145	12.35207

Panel D: US M&As in the UK – Low R&D sample (Stata 12 output)

```
Conditional FE negative binomial regression     Number of obs      =       105
Group variable: NAICS                           Number of groups   =        15

                                                Obs per group: min =         7
                                                               avg =       7.0
                                                               max =         7

                                                Wald chi2(7)       =     12.95
Log likelihood  = -107.77897                    Prob > chi2        =    0.0733
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	-1.480638	2.197756	-0.67	0.500	-5.788161	2.826885
TARIFF_TAR	.7853265	.7573635	1.04	0.300	-.6990787	2.269732
GDP_ACQ	.1038434	.04806	2.16	0.031	.0096475	.1980393
IVA_ACQ	2.92539	1.302228	2.25	0.025	.3730695	5.47771
MA_TAR	.0160707	.0154483	1.04	0.298	-.0142075	.0463489
BUS_TAR	-.0189137	.0145595	-1.30	0.194	-.0474498	.0096225
RIR_DIF	-.0441091	.0668426	-0.66	0.509	-.1751183	.0869
_cons	8.527058	7.522676	1.13	0.257	-6.217116	23.27123

Appendix 17: Models 1a and 1b estimated by a Random Effects Poisson regression

Panel A: UK M&As in the US – High R&D sample (Stata 12 output)

```
Random-effects Poisson regression               Number of obs      =        28
Group variable: NAICS                           Number of groups   =         4

Random effects u_i ~ Gamma                      Obs per group: min =         7
                                                               avg =       7.0
                                                               max =         7

                                                Wald chi2(7)       =     56.03
Log likelihood  = -74.456613                    Prob > chi2        =    0.0000
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	-2.791123	2.099599	-1.33	0.184	-6.906262	1.324016
TARIFF_TAR	-.0033204	.5331791	-0.01	0.995	-1.048332	1.041691
GDP_ACQ	.1264304	.0686256	1.84	0.065	-.0080734	.2609341
IVA_ACQ	.7449971	.2581412	2.89	0.004	.2390496	1.250945
MA_TAR	.0038122	.0012306	3.10	0.002	.0014002	.0062242
BUS_TAR	.0396701	.0510462	0.78	0.437	-.0603787	.1397188
RIR_DIF	-.0135922	.1056515	-0.13	0.898	-.2206653	.1934808
_cons	2.370092	2.503058	0.95	0.344	-2.535811	7.275995
/lnalpha	-24.05541	.			.	.
alpha	3.57e-11	.			.	.

```
Likelihood-ratio test of alpha=0: chibar2(01) =  4.7e-04 Prob>=chibar2 = 0.491
```

Panel B: UK M&As in the US – Low R&D sample (Stata 12 output)

```
Random-effects Poisson regression               Number of obs      =       126
Group variable: NAICS                           Number of groups   =        18

Random effects u_i ~ Gamma                      Obs per group: min =         7
                                                               avg =       7.0
                                                               max =         7

                                                Wald chi2(7)       =     50.54
Log likelihood  = -135.53096                    Prob > chi2        =    0.0000
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	.1562749	1.319961	0.12	0.906	-2.430801	2.743351
TARIFF_TAR	-.1752317	.088209	-1.99	0.047	-.3481183	-.0023452
GDP_ACQ	.0874826	.0537522	1.63	0.104	-.0178698	.192835
IVA_ACQ	.3488221	.2370807	1.47	0.141	-.1158476	.8134918
MA_TAR	.0136346	.0043711	3.12	0.002	.0050674	.0222018
BUS_TAR	-.0018678	.0108323	-0.17	0.863	-.0230988	.0193631
RIR_DIF	-.0153648	.0697745	-0.22	0.826	-.1521203	.1213907
_cons	-.7004736	1.542117	-0.45	0.650	-3.722968	2.322021
/lnalpha	-2.355175	1.267798			-4.840014	.1296634
alpha	.0948769	.1202847			.0079069	1.138445

```
Likelihood-ratio test of alpha=0: chibar2(01) =     1.17 Prob>=chibar2 = 0.140
```

Panel C: US M&As in the UK – High R&D sample (Stata 12 output)

```
Random-effects Poisson regression               Number of obs      =        35
Group variable: NAICS                           Number of groups   =         5

Random effects u_i ~ Gamma                      Obs per group: min =         7
                                                               avg =       7.0
                                                               max =         7

                                                Wald chi2(7)       =    206.74
Log likelihood  = -78.645724                    Prob > chi2        =    0.0000
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	-.9154767	.9916014	-0.92	0.356	-2.85898	1.028026
TARIFF_TAR	-.091502	.0858662	-1.07	0.287	-.2597966	.0767926
GDP_ACQ	-.02368	.0414353	-0.57	0.568	-.1048917	.0575317
IVA_ACQ	.4088998	.3130159	1.31	0.191	-.2046	1.0224
MA_TAR	.0642186	.0076524	8.39	0.000	.0492201	.0792171
BUS_TAR	-.0015289	.0074105	-0.21	0.837	-.0160532	.0129954
RIR_DIF	-.128579	.0551808	-2.33	0.020	-.2367314	-.0204265
_cons	1.134367	2.993469	0.38	0.705	-4.732725	7.001459
/lnalpha	-18.22937	1092.255			-2159.009	2122.55
alpha	1.21e-08	.0000132			0	.

```
Likelihood-ratio test of alpha=0: chibar2(01) =      0.00 Prob>=chibar2 = 1.000
```

Panel D: US M&As in the UK – Low R&D sample (Stata 12 output)

```
Random-effects Poisson regression               Number of obs      =       119
Group variable: NAICS                           Number of groups   =        17

Random effects u_i ~ Gamma                      Obs per group: min =         7
                                                               avg =       7.0
                                                               max =         7

                                                Wald chi2(7)       =     30.52
Log likelihood  = -161.71446                    Prob > chi2        =    0.0001
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RER	-.0514303	1.885131	-0.03	0.978	-3.74622	3.643359
TARIFF_TAR	-.1808161	.0652457	-2.77	0.006	-.3086953	-.0529368
GDP_ACQ	.0824349	.0456527	1.81	0.071	-.0070428	.1719126
IVA_ACQ	1.055765	.5552411	1.90	0.057	-.0324872	2.144018
MA_TAR	.0255338	.014174	1.80	0.072	-.0022467	.0533144
BUS_TAR	-.0106401	.013069	-0.81	0.416	-.0362548	.0149746
RIR_DIF	-.0111732	.0625292	-0.18	0.858	-.1337282	.1113818
_cons	3.285822	5.93219	0.55	0.580	-8.341057	14.9127
/lnalpha	-.6992325	.5156034			-1.709797	.3113316
alpha	.4969666	.2562377			.1809026	1.365242

```
Likelihood-ratio test of alpha=0: chibar2(01) =     33.70 Prob>=chibar2 = 0.000
```