Human Capital Relatedness and Mergers and Acquisitions

Kyeong Hun (Kyle) Lee
Tulane University
A. B. Freeman School of Business
7 McAlister Drive
New Orleans, LA 70118
klee24@tulane.edu
504-314-7559

David C. Mauer
University of North Carolina at Charlotte
Belk College of Business
9201 University City Blvd.
Charlotte, NC 28223
dmauer@uncc.edu
704-687-7707

Qianying (Emma) Xu
University of Texas at El Paso
College of Business Administration
Department of Economics and Finance
El Paso, TX 79968
qxu@utep.edu
915-747-5245

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Abstract

We construct a measure of the pairwise relatedness of firms' human capital to examine whether mergers are motivated by a desire to harvest synergies through complementarities in human capital. Mergers are more likely between firms with more similar human capital, and especially so when merging firms are not in the same industry. Consistent with synergy creation, we find that combined acquirer and target firm announcement returns and post-merger operating cash flows increase when firms have more closely related human capital. Consistent with enhanced operating efficiencies, we find a reduction in post-merger employment and salaries, and an increase in labor productivity when merging firms have high human capital relatedness. Evidence on asset sales complements our merger analysis by showing that the likelihood and gain from assets sales is increasing the lower is the correlation of the human capital of the (remaining) parent firm's assets with the human capital of the asset sold. Overall, our findings support the view that complementarities in human capital are a key determinant of restructuring activities.

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1. Introduction

The property rights theory of the firm argues that when contracts are incomplete the boundaries of the firm are determined by bringing together complementary assets under common ownership. As developed in Grossman and Hart (1986) and Hart and Moore (1990), ownership of complementary assets by a single firm can reduce opportunistic behavior and holdup problems that result from a world with incomplete contracting.[1] Rhodes-Kropf and Robinson (2008) extend this view of the firm to a theory of mergers and show that the merger of firms with complementary assets can explain why mergers pair firms with similar market-to-book ratios, i.e., like buys like. The notion that complementary assets also include complementary human capital, however, has generally been overlooked in the literature. Indeed, the focus has largely been directed at complementary real assets and associated product market synergies.[2]

This paper focuses on the human capital dimension of mergers and asks whether complementary human capital influences the likelihood of merger, combined announcement returns, and post-merger cash flows. We also examine the channels through which human capital influences the gains from merger by examining merger type (e.g., vertical, horizontal, and conglomerate), post-merger employment, wages, and labor productivity. An examination of the role of human capital in asset sales complements the merger analysis as it allows for an examination of whether *low* human capital relatedness predicts asset sales and gains from asset sales.

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[1] See Hart (1995, 1998) for syntheses of the implications of incomplete contracting and the property rights theory of the firm. Teece (1982, 1986) also argues that market imperfections can motive a theory of a diversified multiproduct firm that benefits from combining complementary assets, including infrastructure, technology, capabilities, and culture.

[2] See Andrade, Mitchell, and Stafford (2001) and Betton, Eckbo, and Thorburn (2008) for surveys of this literature. In an important recent contribution, Hoberg and Phillips (2010) show empirically that product market relatedness helps promote higher post-merger cash flows and sales growth.

We start by developing a measure of human capital relatedness between pairs of firms. Using data from the Occupational Employment Statistics (OES) of the Bureau of Labor Statistics (BLS) we construct a firm's human capital profile based on the firm's industry segments and OES industry occupation profiles that measure the scope of employment activity in an industry. A firm's human capital profile is a vector of occupation titles with elements equal to segment sales-weighted percentages of workers by occupation. We then construct a measure of human capital relatedness between merging firm pairs as the angular separation (or uncentered correlation) of their human capital profile vectors.[3] This measure of association captures the distance between merging firms' human capital profile vectors and is bounded between 0 (no association) and 1 (perfect association).

In probit regressions using a large sample of merging- and non-merging firm pairs during the period 1997 to 2012, we find that the likelihood of merger is strongly increasing in our measure of human capital relatedness. Three features of this relation are especially noteworthy. First, although asset complementarity as measured by the Hoberg and Phillips (2010, 2016) measure of product market relatedness also influences the likelihood of merger, it does not subsume the effect of human capital relatedness. Indeed, the separate effects of human capital relatedness and product market relatedness on merger likelihood are both economically strong. Second, we find evidence that human capital relatedness and product market relatedness are substitutes in that the positive effect of human capital relatedness on the likelihood of merger is attenuated when the merging firms have more similar products. Third, the influence of human capital on the likelihood of merger varies by type of merger; human capital relatedness increases the likelihood of merger between

[3] Jaffe (1986) also uses angular separation to measure the proximity of firms' technology activities.

firms in different industries (e.g., vertical and conglomerate mergers) and decreases the likelihood of merger between firms with operations in some of the same industries (e.g., horizontal mergers).

We find that the combined acquiring and target firm announcement returns (i.e., merger synergy) is strongly increasing in human capital relatedness. A one-standard deviation increase in human capital relatedness increases the combined firm announcement return by 0.56%, which is a 38% increase in the mean combined return. We also document a positive relation between human capital relatedness and post-merger operating performance. Consistent with the result that human capital relatedness is a more important predictor for diversifying acquisitions, we find that the positive relation between human capital relatedness and merger gains is much stronger when merging firms are in different industries.

To better understand the economics behind the association between human capital relatedness and the gains from merger, we examine post-merger changes in employment, labor cost, and labor productivity. We find that human capital relatedness predicts decreases in post-merger employment and total salaries (relative to the sum of merging firms' pre-merger amounts). These decreases, however, are significant only for diversifying acquisitions, where the merging firms are in different industries. Similarly, we find that human capital relatedness tends to boost post-merger labor productivity (operating cash flow divided by employees) in diversifying acquisitions, although there is some evidence that human capital relatedness also increases labor productivity in purely horizontal mergers. Overall, the evidence suggests that human capital relatedness positively impacts firm performance, primarily in diversified firms, by decreasing employees and labor cost, and improving labor productivity.

Lastly, we examine whether the possible gains from separating unrelated human capital can help explain asset sales. Although an examination of the role of human capital in asset sales is

interesting by itself, it can serve as a check on whether our human capital relatedness measure reliably captures complementarities in human capital in other transactions. We predict that the likelihood and gain from an asset sale are increasing the lower is the correlation of the human capital of the parent firm's (remaining) assets with the human capital of the asset sold. We test these predictions by computing the relatedness of the human capital profile vectors of the parent firm the year before and after the asset sale. The greater the dissimilarity of the parent's human capital with that of the asset sold, the lower the relatedness of the parent's human capital profile vectors before and after the asset sale. We predict that the likelihood and gain from asset sale should increase as the correlation of the parent's human capital profile vectors before and after the asset sale decreases.

In a large sample of asset sales during the period 1997 to 2013, we find that the likelihood of an asset sale increases the more dissimilar the human capital profiles of the parent and the asset sold, as reflected in a lower correlation of the parent's human capital profiles before and after the asset sale. We also find that the market's reaction to asset sales – as reflected in the excess equity returns of the parent around the asset sale announcement – increases significantly as the parent's and the sold asset's human capital similarity decreases. Interestingly, the parent's announcement returns are also increasing in the human capital relatedness of the asset with the acquiring firm. This effect is in addition to the positive reaction associated with selling dissimilar human capital, and suggests that the selling firm captures a portion of the benefits when the counterparty acquires complementary human capital.

Our paper contributes to the existing literature in two respects. First, we develop a measure of human capital relatedness between pairs of firms that allows for an examination of the role of human capital in merger and acquisition decisions. We further illustrate that our measure is useful

in examining the role of human capital in other types of corporate restructuring transactions such as asset sales. Second, we show how human capital relatedness contributes to our understanding of both the likelihood and benefits of restructuring transactions. Our analysis contributes to the literature that examines asset complementarity and product market relatedness (e.g., Rhodes-Kropf and Robinson (2008) and Hoberg and Phillips (2010, 2016)) by establishing that human capital relatedness is an additional important factor in mergers and acquisitions and sales of assets. As such, human capital relatedness is a key determinant of the boundaries of the firm.

Our paper complements existing literature that examines the role of labor and human capital in finance. Reviving an old topic, several recent papers examine the role of human capital in asset pricing.[4] Eisfeldt and Papanikolaou (2013) and Donangelo (2014) find that organization capital (i.e., the production factor embodied in key personnel) and labor mobility, respectively, are priced risks and significantly increase returns. The importance of human capital relative to other asset classes is supported by Palacios (2015), who estimates that the weight of human capital in aggregate wealth is over 90%. In the mergers and acquisitions literature, Gao and Ma (2016) and Ouimet and Zarutskie (2016) find evidence that firms pursue mergers and acquisitions to acquire employees.[5] Related to our paper, Tate and Yang (2016) find that inter-industry worker mobility motivates diversifying acquisitions.[6] They show that labor productivity (firm sales to employment or payroll) increases and the likelihood of divestiture decreases for firms involved in diversifying acquisitions between industries with high human capital transferability. Other papers examine the

[4] See Mayers (1972, 1973) and Fama and Schwert (1977) for the classic articles on human capital and capital asset pricing.

[5] However, John, Knyazeva, and Knyazeva (2015) find that employee-shareholder conflicts decrease gains from mergers and acquisitions. See also Kole and Lehn (2000) for an analysis of how the complexities of workforce integration can destroy value in mergers.

[6] Tate and Yang (2015) find that workers in diversified firms develop skills that transfer across multiple lines of business, allowing diversified firms to benefit from a real option to redeploy labor in response to changing opportunities.

role of human capital in corporate financing decisions (see, e.g., Berk, Stanton, and Zechner (2010), Chemmanur, Cheng, and Zhang (2013), and Agrawal and Matsa (2013)).

Our paper is also related to the literature in strategy that draws on the resource-based view of the firm developed by Wernerfelt (1984). This view argues that a motivating factor behind merger and acquisition activity is to exchange firm-specific resources that are otherwise difficult to access because of high inter-firm transaction costs. The literature examines how the relatedness of worker skills and products (Farjoun (1994, 1998)), inter-industry labor mobility (Neffke and Henning (2013)), and marketing resources (Capron and Hulland (1999)) influence acquisition decisions. Lastly, our analysis of the influence of human capital relatedness on post-merger employment and wages is related to a literature in economics that studies the employment effects of mergers.[7]

The remainder of the paper is organized as follows. Section 2 provides testable hypotheses for the impact of human capital on mergers and acquisitions. Section 3 describes the data and discusses the construction of our human capital relatedness measure. Section 4 presents empirical tests on the impact of human capital relatedness on the likelihood of merger and merger announcement returns. Section 5 presents empirical tests on the impact of human capital relatedness on post-merger operating cash flow, employment, wages, and labor efficiency. Section 6 examines whether human capital relatedness influences the likelihood and gains from asset sales. Section 7 concludes.

2. Hypotheses

[7] Papers in this literature include Shleiffer and Summers (1988), Brown and Medoff (1988), Conyon, Girma, Thompson, and Wright (2002), Krishnan, Hitt, and Park (2007), and Amess, Girma, and Wright (2014).

The property rights theory of the firm (Grossman and Hart (1986) and Hart and Moore (1990)) and in particular, the extension of the theory to a theory of mergers by Rhodes-Kropf and Robinson (2008), predicts that complementary assets should be combined under common ownership in a world with incomplete contracting. The key implication is that when there are significant pair-wise complementarities between firms' assets, then synergy gains result from a merger. Since human capital is a significant component of firms' asset portfolios, the notion that asset complementarities can be a significant factor motivating mergers extends naturally to complementarities between firms' human capital. We test two hypotheses for the role of human capital in mergers.

Hypothesis 1: The likelihood of two firms merging is increasing in the relatedness of their human capital.

Hypothesis 2: Announcement returns and future operating cash flows are increasing in the relatedness of merging firms' human capital.

The key to testing the hypotheses is obtaining a measure of the similarity of firms' labor pools, which incorporates the feature that many firms operate in more than one industry with possibly unique employment profiles. As discussed below, we construct human capital profile vectors for merging firms based on Occupational Employment Statistics (OES) of the Bureau of Labor Statistics (BLS) that are portfolios of firms' industry segment employment profiles. We then compute a measure of the distance between the merging firms' human capital profile vectors.

To ensure that the influence of human capital relatedness on the likelihood and gain from merger is not misattributed to a common correlation with real asset complementarity, it is important to control for merging firms' real asset relatedness. By the same token, it is naturally plausible that human capital and real asset complementarities jointly influence mergers and

acquisitions either as complements or substitutes. We therefore include a measure of asset complementarity in our tests developed by Hoberg and Phillips (2010, 2016) that measures product market similarity. We use many other measures for asset complementarities (e.g., same 3- or 4-digit SIC codes) in our tests, but the Hoberg and Phillips (2010, 2016) measure consistently outperforms all other measures, so we report results below using their measure only.

Closely related to asset complementarity is whether the acquisition involves the merger of firms in the same industry (related or horizontal mergers) or different industries (unrelated or conglomerate mergers). Clearly, human capital relatedness should be naturally higher in related mergers than unrelated mergers. It is not clear, however, whether human capital relatedness is a more important motive for related mergers than for unrelated mergers. On the one hand, related mergers motivated by cost savings resulting from reduction of duplication and overlap might be more attractive when human capital relatedness is high. Thus, for example, the merger of two drug companies with large sales forces might achieve substantial synergies through cost savings by keeping only one sales force. On the other hand, an unrelated merger between firms with high human capital relatedness could generate synergies through the enhancement or creation of an internal labor market where workers with common skills can move between industry segments in response to changing opportunities and industry shocks. Indeed, recent work by Tate and Yang (2015) finds that labor is more productive in diversified firms than in comparable focused firms. Overall, it is an empirical question whether human capital relatedness is a more important factor for related or unrelated mergers.

To better understand the channels through which human capital relatedness influences the gains from merger, we examine post-merger employment, wages, and labor productivity. The influence of human capital relatedness on post-merger labor outcomes should also depend on the

type of merger. Thus, related mergers motivated by cost savings should predict lower post-merger employment and/or wages relative to combined pre-merger levels, and diversifying mergers motivated to build an internal labor market should predict higher post-merger labor productivity.

Lastly, we examine the influence of human capital relatedness on asset sales. Assuming complementarities in human capital help predict mergers, it follows that the absence of complementarity should influence the decision to sell assets. We test the following hypotheses:

Hypothesis 3: The likelihood of an asset sale is increasing in the un-relatedness of the human capital of the parent's (remaining) assets and the asset sold.

Hypothesis 4: The parent's return from announcing an asset sale is increasing in the un-relatedness of the human capital of the parent's (remaining) assets and the asset sold.

The parent's stock price reaction at the announcement of an asset sale might also be influenced by the human capital relatedness of the asset sold with the acquiring firm. To the extent that the acquiring firm is willing to pay a premium for complementary human capital, the returns to the parent will be higher. Thus, we have the testable hypothesis:

Hypothesis 5: The parent's return from announcing an asset sale is increasing in the human capital relatedness of the asset sold with the acquiring firm.

3. Data and key variables

3.1. Data sources

Our sample begins with all U.S. domestic mergers and acquisitions (M&A) reported in the Thompson Financial Securities Data Company (SDC) database during the period 1997 to 2012 and completed by the end of May 2014. To be included in our sample, we require that the deal is classified as a merger, an acquisition of majority interest, or an acquisition of assets. These

requirements result in an initial sample of 29,305 M&A deals. We further require that both the acquirer and the target have financial statement data reported in Compustat and stock returns available from the Center for Research in Security Prices (CRSP). This necessitates that both the acquirer and target are publicly traded firms, and reduces the sample size to 1,474 M&A deals.

To measure human capital relatedness between merging firms, we start by constructing human capital profiles for acquirers, targets, and matching firm samples (discussed below). We do this by combining industry-level data from the Occupational Employment Statistics (OES) of the Bureau of Labor Statistics (BLS) with firm-level segment data from the Compustat Industry Segment (CIS) database. The OES data are available from 1989 to 2013 with two caveats. First, there is no data in 1996, so we use data from 1995 for the missing data in 1996. Second, the OES occupation data tends to be sparse prior to 1997, which is why we start our merger sample in 1997.[8]

The OES data define industries using three-digit Standard Industrial Classification (SIC) codes up through 2001, and four-digit North American Industry Classification System (NAICS) codes from 2002. The OES dataset includes 158 broad occupation titles based on OES taxonomy up through 1998, and 444 broad occupation titles based on the Standard Occupational Classification (SOC) taxonomy thereafter. For the years 1989 to 1998, we convert the OES taxonomy to the SOC taxonomy using the crosswalk provided by the National Crosswalk Service Center. For each 3-digit SIC code for years 1989-2001 and 4-digit NAICS code for years 2002-2013, we obtain an industry occupation profile that measures the scope of employment activity. More specifically, for each industry *i* we obtain an occupation profile vector $O_i = (O_{i1}, ..., O_{ik})$, where O_{ij} is the proportion of workers in industry *i* assigned to occupation *j*.

[8] Since we use lagged values for most variables in our multivariate analysis, we use OES data starting in 1996. All our results are stronger if we instead use OES data starting in 1997, and thereby start our merger sample in 1998.

We use the industry occupation profiles in conjunction with the industries in which a firm operates to construct a firm's human capital profile, *H*. When a sample firm is covered by the Compustat industry segment (CIS) database, we compute its human capital profile as the segment sales weighted-average of its industry occupation profiles, where a segment's weight is segment sales to total segment sales and the industry occupation profile of a segment is matched based on 3-digit SIC codes up through 2001 and 4-digit NAICS codes thereafter.[9] When a sample firm is not covered by CIS, we instead use industry segment information from SDC. The SDC dataset provides 4-digit SIC codes and 6-digit NAICS codes for all segments of merging firms. The limitation, however, is that the SDC dataset does not provide segment sales or any other information that could be used to weight a firm's industry occupation profiles.[10] For this reason, when we use SDC for industry segment information, we compute a firm's human capital profile, *H*, as the equally-weighted average of its segments' industry occupation profiles.[11]

For the 1,474 M&A deals with CRSP and Compustat information, we can compute human capital profiles for 1,322 acquirer and target pairs (i.e., 2,644 firms) at the fiscal year-end immediately prior to the merger year. We lose 152 (1,474 – 1,322) deals because none of the segments of either the acquirer or target are covered by OES data. Out of 1,322 deals, in 1,045 both the acquirer and target have CIS data, in 101 only the acquirer has CIS data, in 153 only the target has CIS data, and in 23 neither the acquirer or target has CIS data.

3.2. Human capital relatedness

[9] We exclude industry segments that are not covered by OES, and our calculation of human capital profile uses only remaining segments.
[10] Of course, this limitation is irrelevant if the firm has one segment (i.e., SDC reports a single SIC or NAICS code).
[11] Again, we exclude industries that are not covered by OES data.

We construct a measure of human capital relatedness between merging firms *i* and *j* using the angular separation (or uncentered correlation) of their human capital profile vectors H_i and H_j.[12] Specifically, human capital relatedness, HCR_{ij} is computed as the scalar product of the firms' human capital profile vectors divided by the product of their lengths:

$$HCR_{ij} = \frac{H_i H_j'}{\sqrt{(H_i H_i')(H_j H_j')}}$$

This measure is bounded between 0 and 1. It is unity for merging firms whose human capital profiles are identical, and zero for firms whose human capital profiles are orthogonal. Importantly, it is closer to unity for merging firms with more complementary human capital.

To illustrate the computation and interpretation of *HCR*, consider the acquisition of Summit American Television by E. W. Scripps Company. On December 19, 2003, an American media conglomerate, E. W. Scripps Company (EWS) announced a plan to buy Summit America Television (SAT). As shown below, the acquiring company, EWS, has four segments with different 4-digit NAICS codes. The largest segment has a NAICS code of 5151 (radio and television broadcasting) and its sales account for 47% of the firm's total sales. According to OES:

Acquirer: E. W. Scripps (EWS)			Target: Summit American TV (SAT)		
Segment NAICS	% sales	No. of job titles	Segment NAICS	% sales	No. of job titles
5151	47%	85	4541	100%	116
5111	44%	136			
5331	6%	147			
4541	3%	116			
Total	100%	160	Total	100%	116

[12] This measure of proximity has been used for example by Jaffe (1986) to measure the closeness of two firms' innovation activities.

data, this industry has 85 different occupations or "job titles." The next largest segment, NAICS code 5111 (newspaper, periodical, book, and directory publishers), accounts for 44% of total sales and has 136 job titles. The remaining segments, NAICS codes 5331 (lessors of nonfinancial intangible assets) and 4541 (electronic shopping and mail-order houses), account for only 6% and 3% of total firm sales and have 147 and 116 job titles, respectively.

The human capital profile of EWS is a segment sales weighted average of its four segments' human capital profile vectors. Consider, for example, the job title "designer" in EWS's human capital profile vector.[13] The percentage of employees working in this occupation in EWS's segments (NAICS codes 5151, 5111, 5331, and 4541) are 0.48%, 2.85%, 0.79%, and 0.76%, respectively. Using the segment sales weights, the "designer" element in EWS's human capital profile vector is computed as (0.47)(0.48%) + (0.44)(2.85%) + (0.06)(0.79%) + (0.03)(0.76%) = 1.55%. Other elements in EWS's human capital profile vector (i.e., the percentage of EWS's workers holding other occupation titles) are similarly computed.

The target company, SAT, is a single-segment company. The firm's 4-digit NAICS code 4541 has 116 different job titles. The firm's human capital profile vector is the same as the human capital profile of NAICS industry 4541, with vector elements equal to the percentage of employees working in each occupation.

The human capital relatedness (*HCR*) of EWS and SAT is the product of the merging firms' human capital profiles vectors scaled by the product of their lengths. The product is 112.51 and the lengths are 15 for EWS and 22.92 for SAT, so that *HCR* = 0.33. Note that the two firms share only one segment (NAICS 4541), and this segment represents only 3% of the acquirer's sales.

[13] Designers (Occupation code 27-1020) include commercial and industrial designers (27-1021), fashion designers (27-1022), floral designers (27-1023), graphic designers (27-1024), interior designers (27-1025), merchandise displayers and window trimmers (27-1026), set and exhibit designers (27-1027), and designers, all others (27-1029).

Thus, although the two firms appear to have minimal product market relatedness, their human capital is nontrivially related. The reason, as illustrated in the "designer" job title example above, is that different industries have considerable overlap in job titles and therefore worker skills. Appendix A has an additional example and discussion of the *HCR* measure.

3.3. Product market relatedness

When examining the impact of human capital relatedness on acquisition decisions, it is important to control for product market relatedness through asset complementarities. Indeed, it is entirely possible that the human capital of firms (e.g., the array of different jobs titles necessary to support a firm's operations) is in no small measure explainable by the goods and services produced by the firm. As such, the influence of human capital relatedness on merger and acquisition decisions could at least in part be attributable to product market relatedness.

To control for product market relatedness, we use the text-based network industry classifications developed by Hoberg and Phillips (2010, 2016). Hoberg and Phillips process the texts of product descriptions in firms' 10-K annual filings. Based on vectors of key words from these descriptions, they compute product similarity scores between all pairs of firms with 10-Ks in the SEC Edgar database and that have data in both CRSP and Compustat. The product similarity score between any two firms falls in the range from 0 to 1, with the score increasing as firms have more product description words in common. In an online data library, Hoberg and Phillips report firm pairs that have a product similarity score above a threshold established by requiring that for any randomly drawn pair of firms from the CRSP/Compustat universe the likelihood of the firms having the same 3-digit SIC code is equal to the likelihood of them having a similarity score above

the threshold.[14] We create a product market relatedness dummy variable (*PMR*) equal to one for all firm pairs reported in the Hoberg and Phillips online data library that have a product market similarity score above the threshold.

3.4. Control variables

We build on studies by Song and Walkling (1993), Harford (1999), Wang and Xie (2009), Ahern (2012), and Ishii and Xuan (2014) and control for a number of deal and merging firm characteristics in our multivariate tests. The deal characteristics we consider are relative size of the target to the acquirer, method of payment, industrial relatedness of the combination, and termination fees. The bidder and target characteristics we consider are firm size, market-to-book, leverage, free cash flow, liquidity, sales growth, prior stock returns, and return on assets. All firm characteristics, except prior stock returns, are measured at the fiscal year-end immediately prior to the acquisition announcement date. Since our analysis examines the likelihood of acquisition, stock price reaction to merger announcement, and post-merger profitability, we defer discussion of the relations between the explanatory variables and merger outcomes to Section 4. Appendix B contains the definitions of these variables.

3.5. Descriptive statistics

Panel A of Table 1 provides descriptive statistics for the sample of 1,322 acquirer and target firm pairs over the sample period from 1997 to 2012. All variables are winsorized at the 1st and 99th percentiles of their distributions except human capital relatedness (*HCR*), product market relatedness (*PMR*), industrial relatedness measures, and the stock deal and termination fee dummy variables. Thirty five percent of the merging firms in the sample have no industries in common,

[14] The Hoberg and Phillips data library can be found at http://cwis.usc.edu/projects/industrydata/. We thank them for making this data available.

based on a comparison of 3-digit SIC codes for the merging firms' segments. This includes 19% of the sample involving mergers between single segment firms in different industries (MergerType1) and 16% of the sample involving mergers where one or both acquirer and target have multiple segments (MergerType2). The remaining 65% of the sample has at least one segment in the same industry (MergerType3). Following the classification scheme developed by Fan and Goyal (2006), 12% of the acquisitions in our sample are vertical, 41% are horizontal, and 47% are conglomerate.[15]

Recalling that *HCR* is increasing in human capital relatedness and has a maximum value of 1, the mean (median) *HCR* of 0.75 (0.85) suggests that the typical merger in our sample has high human capital relatedness. In the next section, we construct three different control samples of non-merging firm pairs. The least sophisticated control sample is to randomly merge firm pairs. In samples involving one or more random firm pairs for each merging firm pair, the mean (median) *HCR* never exceeds 25% (20%). The much larger mean (median) *HCR* in our merging firm sample suggests that human capital relatedness is an important factor in mergers. Further note that more than 50% of the merger sample has high product market relatedness (*PMR*).

Average announcement returns (see Appendix B for computation details) are similar to those reported elsewhere.[16] Over the three-day period from one day before to one day after the announcement day, the mean acquiring firm return, Acquirer CAR, is negative (–1.2%), the mean

[15] Note that our merger type variables are based on Compustat segment data using 3-digit SIC (4-digit NAICS) codes to define industry. The use of segment data and 3-digit SIC codes is consistent with how we define our *HCR* measure. Alternatively, Fan and Goyal (2006) convert the primary SIC codes of bidders and targets into IO codes used by the Use Table of Benchmark Input-Output Accounts for the U.S. Economy prepared by the Bureau of Economic Analysis. The Use Table is a matrix containing commodity flows between approximately 500 IO industries. Fan and Goyal (2006) use these flows to classify whether a merger is vertically, horizontally, or unrelated (which we refer to as conglomerate). Since the merger type classification scheme is based on SIC codes for firm segments and the Fan and Goyal classifications are based on IO codes and commodity flows between industries, we use both classification in our analysis because they potentially measure different aspects of industry relatedness.

[16] See Andrade et al. (2001) and Betton et al. (2008) for surveys.

target firm return, Target CAR, is positive (25.9%), and the weighted-average acquirer and target return, Synergy, is positive (1.5%). The latter result suggests that acquisitions, on average, generate positive synergy. The remainder of Panel A reports descriptive statistics for the deals and for acquirer and target characteristics. More than 50% of the deals involve some stock financing and the average (median) relative size of the target to the acquirer is 0.24 (0.10). Relative to the target, the acquiring firm has larger mean and median market-to-book ratio, free cash flow, return on assets, and stock returns prior to the deal.

Panel B of Table 1 reports correlations between *HCR*, *PMR*, Synergy, Acquirer CAR, and Target CAR, and all other variables for the sample. As expected, the correlation between *HCR* and *PMR* is positive (0.24). This is intuitive given that firms' employment activities should map into product similarity. For example, if acquirer and target have a significant number of workers operating printing presses, we might expect them to have similar products (e.g., newspapers). However, merging firms may have complementary human capital and yet relatively low product market similarity, as illustrated in the acquisition of Summit American Television by E. W. Scripps Company discussed above. The correlations between *HCR* and *PMR* and merger Synergy are positive, but quite modest. Finally, the correlations between *HCR* and *PMR* and merger types are positive when merging firms are industrially related (MergerType3 and Horizontal), and are negative otherwise (e.g., Conglomerate mergers).

4. Merger prediction and returns

4.1. Predicting mergers

We test Hypothesis 1 that the likelihood of two firms merging is increasing in the relatedness of their human capital. Table 2 reports probit regressions of the probability of merger

using our sample of merging firm pairs (acquirer and target) and non-merging control firm pairs. In Panel A, each merging firm pair has one matching non-merging firm pair. In panel B, each merging firm pair has one matching non-merging firm pair constructed by pairing each acquiring firm with a pseudo target firm. In panel C, each merging firm pair has five randomly selected non-merging firm pairs. The algorithms used to construct the non-merging control firm pairs are described in Appendix C. In each panel, the only explanatory variables in regressions (1) and (2) are *HCR*, *PMR*, and their interaction, *HCR* × *PMR*. Our objective is to ensure that any identified effect of human capital relatedness on the probability of merger is not driven by the presence of control variables. Regression (3) and (4) include control variables, and regression (5) and (6) use *HCR_*ε which is the residual from a regression of *HCR* on *PMR* (i.e., *HRC_*ε is the orthogonalization of *HCR* against *PMR*). All right-hand-side variables are lagged one year. Coefficients, *z*-statistics (in parenthesis), and economic significance (in percent) are reported for each variable. Economic significance is the marginal effect on the probability of merger for a one standard deviation change for a continuous variable or for a change from zero to one for a dummy variable. Marginal effects and standard errors for interactions (e.g., *HCR* × *PMR*) are computed using the methods in Ai and Norton (2003). The *z*-values are computed using robust standard errors clustered by year.

Consistent with the prediction that human capital relatedness increases the likelihood of merger, we find a significantly positive effect of *HCR* and *HCR_*ε on the probability of merger in every regression reported in Table 2. Thus, with or without control variables, and robust to how we construct control samples of non-merging firms, human capital relatedness predicts acquisitions.[17] The estimated effects are economically significant. Focusing on the Panel B results

[17] Our results are robust if we use a propensity score model with a wide variety of covariates to generate non-merging firm matches for acquirers and targets. Results are available upon request.

where the control sample is the acquiring firm matched to a pseudo target, the effect of a one standard deviation increase in *HCR* on the predicted probability of merger ranges from 8.7% (0.045/0.52) in regression (4) to 30.8% (0.154/0.50) in regression (2); and the effect of a one standard deviation increase in *HCR_*ε on the predicted probability of merger ranges from 5.1% (0.027/0.53) in regression (5) to 8.3% (0.043/0.52) in regression (6). The smaller economic effects of *HCR_*ε seem reasonable, because about a quarter of the variation in HCR is attributable to PMR (i.e., the correlation between *HCR* and *PMR* is 0.24).

Product market relatedness also contributes significantly to the likelihood of merger. In each of Table 2's panels, regressions (2), (4), and (6) report positive coefficients on *PMR* with economically significant marginal effects. There is evidence, however, that *PMR* and *HCR* are to some degree substitutes, since the coefficients on *HCR* × *PMR* in regressions (2) and (4) and *HCR_*ε × *PMR* in regression (6), are negative. This suggests that human capital relatedness is less important in acquisitions with high product market relatedness. Given the high correlations between *PMR* and MergerType3 and Horizontal in Panel B of Table 1, we anticipate that the effect of *HCR* on the likelihood of these merger types is small.

Many of the control variables in the regressions are reliable predictors of mergers. Consistent with Song and Walkling (1993), Comment and Schwert (1995), and Harford (1999), acquisitions are more likely when acquirers are large and targets are small. The acquirer also tends to have high growth opportunities as reflected in the reliably positive coefficient on the acquirer's market-to-book ratio in all reported models, and the positive though less reliably significant coefficient on the acquirer's sales growth. Consistent with results in Song and Walkling (1993) and Comment and Schwert (1995), however, there is little reliable evidence that target growth

opportunities predict takeovers.[18] Lastly, higher free cash flow and lower cash balances in acquirers and targets predict mergers. Our findings of negative effects of cash balances for acquirers and targets on the likelihood of merger is partially consistent with Harford's (1999) results. He finds that the likelihood of a firm being a target is negatively related to cash balances, and conjectures that large cash balances help targets fight takeover attempts. In contrast, he finds that cash-rich firms are more likely to be bidders. Our finding that lower acquirer cash predicts mergers seems inconsistent with these results.[19]

Table 3 examines the influence of merger type on the relation between human capital relatedness and the probability of merger. In Panel A, each merging firm pair has one matching non-merging firm pair and in Panel B, each merging firm pair has one matching non-merging firm pair constructed by pairing each acquiring firm with a pseudo target firm.[20] In each panel, columns (1) and (2) report probits where *HCR* is interacted with merger type dummy variables based on acquirer and target number of segments and industry overlap, and columns (3) and (4) report probits where *HCR* is interacted with dummy variables for whether the merger is vertical, horizontal, or conglomerate. In these regressions, *MergerType*1 is a dummy variable equal to one for single-segment acquirer and target in different industries, *MergerType*2 is a dummy variable equal to one when one or both acquirer and target are multi-segment with no common industry segments, and *MergerType*3 is a dummy variable equal to one when each of the merging firms is either single- or multi-segment and have at least one segment in the same industry. The dummy

[18] Harford (1999) finds a significantly negative coefficient on market-to-book in a probit model predicting targets.
[19] However, there are some differences between our analysis and Harford's (1999) analysis that make direct comparisons difficult. First, Harford uses excess cash holdings (i.e., cash above a model of normal cash) to predict bidder likelihood, while our cash variable is simply the overall amount of cash. Second, sample period differences might explain differences in results for acquirers, as Harford's sample runs from 1977 to 1993 while our sample runs from 1997 to 2012.
[20] Results using five randomly selected non-merging firm pairs are similar and are available upon request. Appendix C discusses the construction of the control samples.

variables *Vertical*, *Horizontal*, and *Conglomerate* are equal to one for vertical, horizontal, and conglomerate mergers, respectively; and are constructed using the algorithm in Fan and Goyal (2006). All regressions are estimated without an intercept, so the coefficients on *HCR* interacted with the merger type dummy variables are the effects of *HCR* on the likelihood of merger for that merger type. Additionally, all regressions include the control variables used in Table 2.

In columns (1) and (2), the coefficients on the interactions of *HCR* and *MergerType*1 and *MergerType*2 are significantly positive, while the interaction of *HCR* with *MergerType*3 has a negative but insignificant coefficient. The implication is that human capital relatedness predicts mergers of unrelated firms, but not related firms. A similar story emerges in regressions (3) and (4); the likelihood of vertical and conglomerate mergers is increasing in *HCR*, while the likelihood of horizontal mergers is decreasing in *HCR*. These results suggest that human capital relatedness is a more important motive for diversifying acquisitions where complementary labor can move across industrial boundaries in response to industry shocks. There is no evidence that industrially related mergers (i.e., our merger type 3 and horizontal mergers) are more likely as the human capital relatedness of merger partners increases.

4.2. Merger synergy

We test Hypothesis 2 that synergy benefits from mergers derive from human capital complementarity. We measure synergy as the weighted average of the cumulative abnormal returns of acquirer and target over days –1, 0, and +1, where day 0 is the merger announcement day. The weights are based on the market values of the equity of the acquirer and target four days prior to the merger announcement day. Table 4 reports regressions of synergy on *HCR*, where models (1) and (2) include only *HCR* and *HCR* and *PMR*, respectively; and models (3) and (4) also include controls for deal, acquirer, and target characteristics. Right-hand-side variables are

measured at time $t-1$ except for relative size, stock deal dummy, and termination fee dummies. See Appendix B for variable definitions. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level.

In all regressions, *HCR* has a significantly positive effect on merger synergy.[21] Models (2) and (4) include *PMR* and the interaction between *HCR* and *PMR*. The coefficients on *PMR* are significantly positive, while the coefficients on the interaction between *HCR* and *PMR* are significantly negative. The implication is that the positive marginal effect of human capital relatedness on merger synergy is attenuated by product market relatedness. Using model (4), the marginal effect of *HCR* on synergy when $PMR = 0$ is positive, and a one standard deviation increase in *HCR* increases synergy by approximately 38% of its mean. In contrast, the marginal effect of *HCR* on synergy when $PMR = 1$ is negative. Although we do not have access to the Hoberg and Phillips (2010, 2016) continuous product market similarity scores, we may use their statistics for merger pair similarity to get a better idea of the degree to which product market similarity attenuates the positive effect of *HCR* on merger synergy. Hoberg and Phillips (2010) report in their Table 3 a mean merger pair similarity of 0.114, with a minimum of zero and a maximum of 0.310, in a sample of 6,629 mergers over the period from 1997 to 2006. Using their mean merger pair similarity (0.114) and the estimates in model (4), a one standard deviation increase in *HCR* increases merger synergy by approximately 33% of its mean.[22] Thus human

[21] Although not reported, the effects of *HCR* on the returns of acquirers and targets are positive, but not statistically significant. Results are available upon request.

[22] The marginal effect is computed as $[1.989 - (2.414)(0.114)](0.283) = 0.485$, where we use the sample standard deviation of *HCR* of 0.283. We caution, however, that this calculation is a rough approximation because the model in (4) is estimated using our dummy variable *PMR* and not the underlying continuous Hoberg and Phillips (2010) merger pair similarity score. As reported in Appendix B, the Hoberg and Phillips online data library reports only whether pair-wise similarity scores exceed a critical threshold.

capital relatedness appears to be an important driver of merger synergy even for high observed levels of product market similarity.

The coefficients on the deal and firm characteristics are consistent with results reported in the literature for combined acquirer and target returns (see, e.g., Wang and Xie (2009), Ahern (2012), and Ishii and Xuan (2014)). As expected, merger synergy is decreasing in the size of the acquirer, target market-to-book, target leverage, prior returns of the acquirer, and whether the deal is stock financed; and is increasing in the relative size of the target and acquirer leverage. The negative coefficient on target cash is consistent with the probit result that target cash decreases the likelihood of acquisition because a large cash stockpile allows the target to deter the acquisition. Lastly, we see that target termination fees have an insignificantly positive effect on merger synergy (consistent with Ahern (2012)), and acquirer termination fees significantly decrease merger synergy. To our knowledge, the significantly negative effect of acquirer termination fees on merger synergy is new to the literature, which finds that target and acquirer termination fees have no effect on target or bidder returns after controlling for deal and firm characteristics (see, e.g., Bates and Lemmon (2003) and Officer (2003)).

Table 5 reports robustness regressions. In model (1), we exclude merger pairs where the acquirer and target are single segment and from the same industry, because for these cases *HCR* = 1. Excluding these observations has no effect on our results; firms with higher human capital relatedness and product market relatedness continue to have larger merger synergy. Regressions (2) and (3) are estimated for the extreme cases where *PMR* = 0 and *PMR* = 1, respectively. As expected, the effect of human capital relatedness on merger synergy is positive for the subsample where *PMR* = 0 and zero for the subsample where *PMR* = 1. Model (4) replaces *HCR* with the orthogonalization of *HCR* against *PMR* (*HCR_*ε), and Model (5) is a robust regression that uses a

two-step procedure to reduce the impact of outliers in the regression.[23] Our results are largely unaffected; however, the size and significance of the coefficient on *PMR* are diminished in model (4) that uses *HCR_*ε. Finally, in unreported regressions, our results are robust if we use a wider event window around the merger announcement to compute merger synergy (e.g., –2 to +2 and –3 to +3).[24]

Table 6 examines the influence of merger type on the relation between *HCR* and merger synergy. Regressions (1)-(3) categorize the sample by single segment acquirer and target in different industries (*MergerType*1), multi-segment acquirer and/or target in different industries (*MergerType*2), and multi-segment acquirer and/or target with overlapping industries (*MergerType*3). Regressions (4) and (5) categorize the sample into vertical (*Vertical*), horizontal (*Horizontal*) and un-related (*Conglomerate*) mergers. All regressions are estimated without an intercept, so the coefficients on the interactions of *HCR* and merger type dummy variables are the effects of *HCR* on merger synergy by merger type.

The coefficients on the interactions in regression (1) are positive but not significantly different from zero. Excluding cases where *HCR* = 1 in regression (2), merger types 2 and 3 have significantly positive coefficients at the 10% level. However, when we estimate merger type subsample regressions, only merger type 2 (industrially unrelated mergers) has a significantly positive coefficient on *HCR* as reported in regression (3). This coefficient is highly economically significant; a one standard deviation increase in *HCR* increases merger synergy by 81% of its mean (1.52%) for type 2 merging firms. Similarly, in regressions (4) and (5), *HCR* has a significantly positive effect on merger synergy only in conglomerate mergers. Using the coefficient on *HCR* ×

[23] In the first step, we follow Bollen and Jackman (1990) and drop influential outliers with a Cook's D greater than 4/*N*, where *N* is the number of observations used to estimate the regression. In the second step, an iterative procedure following Li (2006) reduces the weight of observations with large absolute residuals.
[24] Results are available upon request.

Conglomerate in (5), a one standard deviation increase in *HCR* increases merger synergy by 66% of its mean (1.36%) for conglomerate mergers. These results provide strong evidence that complementary human capital is value-enhancing in diversifying acquisitions, and help to explain the result in Table 3 that human capital relatedness is a reliable predictor of diversifying acquisitions.

5. Post-merger outcomes

In this section, we first present results for the influence of human capital relatedness on post-merger operating performance. Then we investigate how human capital relatedness impacts post-merger employment, wages, and labor productivity.

5.1. Operating performance

We test whether human capital relatedness of merging firms influences post-merger operating performance (Hypothesis 2) in Table 7. Following Hoberg and Phillips (2010), operating performance is the change in post-merger industry-adjusted operating performance from year +1 to +2 and from year +1 to +3 (one- and two-year horizons).[25] Operating performance is measured as the ratio of operating income before depreciation to total net sales.[26] Industry-adjusted operating performance is the difference between a firm's operating performance and the median operating performance of firms in the same three-digit SIC code. Panel A (B) reports regressions of post-merger operating performance on *HCR* (*HCR* conditioned by merger type). All regressions include

[25] The Hoberg and Phillips (2010) approach examines post-merger changes in operating performance, and not the change in operating performance computed from before the merger to after the merger. They argue that this approach biases against finding significant changes due to lost power, but avoids having to measure pre-merger operating performance based on a weighted-average of the two firms' operating performances prior to merger. This is especially problematic if there are assets sales at the time of the merger as reported by Maksimovic et al. (2011), because then it may be inappropriate to compare the operating performance of the post-merger firm to a weighted-average of the operating performances of the two firms prior to merger.

[26] Our results are similar if we scale operating income before depreciation by total assets.

controls for acquirer and target characteristics (defined in Appendix B) that are measured at time $t-1$. We report t-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level.

The coefficients on *HCR* in Panel A are significantly positive, confirming that human capital relatedness predicts post-merger operating performance. The coefficients on *PMR* and the interaction between *HCR* and *PMR*, however, are never significantly different from zero. Analysis of merger type in Panel B confirms that the positive relation between *HCR* and post-merger operating performance is largely driven by unrelated acquisitions (*MergerType*2 and *Conglomerate*), which is consistent with the results in Section 4 that both the likelihood of merger and merger synergy are significantly higher when merging firms from different industries have high human capital relatedness. We next examine channels through which human capital relatedness can help explain improved post-merger operating performance

5.2. Changes in employment and wages

The positive impact of human capital relatedness on post-merger operating performance could be explained by a decrease in post-merger employment and/or wages (i.e., mergers motivated by cost reduction).[27] Although data in Compustat on firm employment (EMP) is generally complete, data on labor expense (XLR) is sparse. This lack of data on labor expense is especially severe in our merger sample, where only 14 out of our original sample of 1,322 deals have the necessary data on labor expense to compute the change in post-merger labor expense. We instead use selling, general, and administrative expense (SG&A) as a proxy for labor expense.[28]

[27] We examine post-merger labor efficiency in the next section.

[28] SG&A includes the wages and salaries of employees in selling and administrative functions. However, it does not include wages and salaries of employees involved in production, which are included in cost of goods sold. As such, SG&A might be a poor proxy for firms in manufacturing industries.

Of the 215,960 firm-year observations in the Compustat Industrial Annual database between 1996 and 2012, 135,981 (63%) have SG&A, 49,723 (23%) have labor expense, and 26,442 (12.24%) have both SG&A and labor expense. The Pearson (Spearman rank) correlation coefficient between labor expense and SG&A is 0.82 (0.95), suggesting that SG&A is a reasonable proxy for labor expense. For our original sample of 1,322 deals from 1997 to 2012, 950 have employment data and 829 have SG&A for both acquirer and target in the year before the deal through two years after the deal.

Table 8 reports regressions of the post-merger change in employment on *HCR*. The dependent variable is the average post-merger industry-adjusted number of employees in years +1 and +2 (or +1, +2, and +3) minus the pre-merger industry-adjusted number of employees in year −1, where year 0 is the merger announcement year. The pre-merger industry-adjusted number of employees is the sum of the acquirer and target industry-adjusted number of employees. Industry-adjusted number of employees is the difference between a firm's number of employees and the median number of employees for firms in the same three-digit SIC code. Panel A (B) reports regressions of post-merger change in employment on *HCR* (*HCR* conditioned by merger type). All regressions include controls for acquirer and target characteristics (defined in Appendix B) that are measured at time *t*−1. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level.

The coefficients on *HCR* in all regressions reported in Panel A are significantly negative, indicating that post-merger employment is decreasing in human capital relatedness. This relation is stronger when the regressions include *PMR* and when we exclude mergers where *HCR* = 1.[29]

[29] The coefficients on *PMR* are also negative, and the coefficients on *HCR* interacted with *PMR* are positive. Thus, product market relatedness decreases post-merger employment, and the negative effect of human capital relatedness on post-merger employment is attenuated in mergers with a high degree of product market relatedness.

We see in Panel B, however, that the negative relation between the change in post-merger employment and *HCR* is significant only for type 2 (*MergerType*2) and unrelated (*Conglomerate*) mergers. This negative effect is also economically significant. Using model (4) in Panel B, we compute for conglomerate mergers (*Conglomerate* = 1) that a one standard deviation increase in *HCR* decreases post-merger industry-adjusted employment by approximately six thousand jobs when *PMR* = 0 and two thousand jobs when *PMR* = 1.

Table 9 examines the influence of *HCR* on the post-merger change in industry-adjusted selling, general, and administrative expense (SG&A). Like the effect of *HCR* on employment, we see in Panel A that *HCR* predicts lower post-merger labor expense. As shown in Panel B, however, this effect is significant for unrelated mergers only (i.e., *MergerType*2 and *Conglomerate*). Thus, in model (4) we see that for *Conglomerate* = 1 a one standard deviation increase in *HCR* decreases post-merger industry-adjusted SG&A by 475 million for *PMR* = 0 and 246 million for *PMR* = 1. The effect of HCR on post-merger SG&A appears to be very economically significant.

5.3. Change in labor productivity

The evidence in Tables 8 and 9 suggests that cost reduction is a driver of the positive relation between human capital relatedness and post-merger operating performance documented in Table 7 for unrelated mergers. We would like to investigate, however, whether human capital relatedness also improves labor productivity.

Table 10 reports regressions of post-merger change in labor productivity on *HCR*, where labor productivity is computed as the ratio of operating cash flow to employment in Panel A, and operating cash flow to selling, general, and administrative expense in Panel B. The coefficients on *HCR* are positive in Panels A and B, and 3 out of 4 coefficients are statistically significant at the 10 percent level. We find evidence of a significant influence of *HCR* on labor productivity in both

unrelated (*MergerType*2) and related (*Horizontal*) mergers, although like the overall effect of *HCR* on labor productivity, the merger type results are not always significant. Overall, there is some evidence that human capital relatedness enhances post-merger labor productivity. Combined with the evidence on employment and labor cost reductions, the positive influence of human capital relatedness on post-merger operating performance likely reflects both cost savings synergies and improved labor efficiency.

6. Asset sales

We first briefly review our hypotheses for why human capital relatedness might influence the likelihood and return from asset sales. We then describe the asset sale sample and formulate a measure of human capital relatedness to test our hypotheses. This is followed by results.

6.1. Human capital relatedness and asset sales

We conjecture that a factor motivating the sale of an asset is the lack of complementarity between the asset's workers and the workers of the parent firm's other assets. This lack of complementarity could be associated with job titles, skills, or the fluidity of the work force within the parent's internal labor market. In Section 2, we specify in Hypothesis 3 and Hypothesis 4, respectively, that the likelihood of an assets sale and the parent firm's return from an asset sale are increasing in the un-relatedness of the human capital of the parent's (remaining) assets with the asset sold. To the extent that competition in the market for human capital induces the acquirer to pay a premium for the asset, we also conjecture in Hypothesis 5 that the parent's returns from asset sale are increasing in the human capital relatedness of the asset sold with the acquiring firm.

6.2. Sample and variable construction

We collect all divestiture and spin-off transactions in the U.S. from the SDC Mergers and Acquisitions and Global New Issues databases during the period 1997 to 2013, and which are completed by the end of December 2014. Requiring that the seller is publicly traded, not from the financial industry, and that the transaction has a value of at least $75 million (as in Bates (2005)) gives us an initial sample of 2,553 asset sales. We then require that the announcement date of the transaction is available in SDC, the parent has stock return data from CRSP, and the immediate and/or ultimate parent has coverage in the Compustat Industrial Segment database in years −1 and +1, where year 0 is the announcement year of the transaction. This gives us our final sample of 1,225 asset sales.

A straightforward way to capture the effect of the asset sale on the parent's portfolio of human capital is to compute the angular correlation of the parent's human capital profile vector immediately prior to the asset sale (*H*) with the parent's human capital profile vector immediately after the completion of the asset sale (*H*^). As defined in Appendix B, we construct *H* at the fiscal year-end immediately prior to the year of the asset sale, and *H*^ at the fiscal year-end immediately after the year of the asset sale, and compute the angular correlation, *HCR*^, between the two vectors. Using the idea that *HCR*^ should be decreasing the more dissimilar the human capital of the asset sold with the human capital of the parent's remaining assets, Hypotheses 3 and 4 predict, respectively, that the likelihood and returns from an asset sales are *inversely* related to *HCR*^. As defined in Appendix B, we also compute the angular correlation between the human capital profile vector of the asset sold with the human capital profile vector of the acquirer, HCR_a, and test Hypothesis 5 that parent returns are increasing in HCR_a.

Table 11 reports descriptive statistics for *HCR*^, HCR_a, the parent's equity return over the three-day window centered on the asset sale announcement day, and transaction and parent firm

characteristics. All variables are defined in Appendix B. From Panel A, we see that mean *HCR^* and HCR_a are 0.904 and 0.645, respectively. The relatively high value for mean *HCR^* (maximum possible value is 1) suggests that the average asset sale has a small effect on the parent's portfolio of human capital. The mean HCR_a is comparable to the mean *HCR* of our merger sample (0.752), suggesting that human capital complementarity is an important factor for acquirers in asset sales. The transaction and parent firm characteristics are similar to those reported in the asset sale literature (e.g., Bates (2005), Clayton and Reisel (2013), and Zhang and Wang (2013)). For the mean parent, the three-day asset sale announcement return is approximately 2%, the relative ($ amount) transaction size is 0.124 ($658 million), prior returns and free cash flow are zero, and cash holdings are 13% of assets. Panel B reports correlations between the variables. The asset sale announcement return and *HCR^* and HCR_a correlations are not significantly different from zero.

6.3. Results

Panel A in Table 12 reports probit regressions of the probability of asset sale as a function of *HCR^* with and without controls for parent firm characteristics. All variables in the regression are defined in Appendix B, and all variables are winsorized at the 1st and 99th percentiles, except *HCR^*. Each parent firm in the sample has one pseudo parent firm as a control. Columns (1) and (2) report probit regressions using control sample 1 and columns (3) and (4) report probit regressions using control sample 2. The algorithms used to construct the control samples are described in Appendix C. Coefficients, *z*-statistics (in parenthesis), and economic significance are reported. Economic significance is the marginal change in probability of asset sale for a one standard deviation change in the variable, holding all other variables constant at their means. The *z*-statistics are computed using robust standard errors clustered at the year level.

Consistent with Hypothesis 3, the coefficients on *HCR^* are significantly negative in all regressions in Panel A, suggesting the likelihood of asset sale is increasing in the un-relatedness of the human capital of the asset and the parent's remaining assets. This effect is economically significant. A one-standard deviation increase in *HCR^* on the predicted probability of asset sale ranges from −6% (-0.030/0.50) in model (2) to −10.4% (-0.052/0.50) in model (3). The significant control variables in models (2) and (4) indicate that the likelihood of asset sale is increasing in the size and leverage of the parent, and decreasing in parent return on assets.

Panel B in Table12 reports regressions of asset sale announcement returns on *HCR^*, HCR_a, and dummy variables constructed from *HCR^* and HCR_a. The dependent variable is the parent's cumulative abnormal return over days −1, 0, and +1, where day 0 is the asset sale announcement day. In columns (3)-(5), *DHCR^* is a dummy variable equal to one if *HCR^* is less than or equal to the 25th percentile of *HCR^*, and zero otherwise; and $DHCR_a$ is a dummy variable equal to one if HCR_a is greater than or equal to median HCR_a, and zero otherwise. All control variables in the regression are defined in Appendix B, and all variables are winsorized at the 1st and 99th percentiles, except *HCR^*, HCR_a, *DHCR^*, and $DHCR_a$. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level.

Consistent with Hypothesis 4, the coefficients on *HCR^* in columns (1) and (2) are significantly negative, suggesting that parent returns are increasing in the un-relatedness of the human capital of the asset sold and the parent's remaining assets. The coefficient on HCR_a in column (2) is positive as predicted by Hypothesis 5, but is not significantly different from zero. The regressions in columns (3)-(5) use the dummy variables *DHCR^* and $DHCR_a$ to test whether parent returns are larger for low versus high *HCR^* asset sale transactions and high versus low HCR_a asset sale transactions. As reported in columns (3) and (4), this is indeed the case; all else

being equal, parent returns are about 1.5 percentage points larger when $HCR^{\wedge}$ is in the lowest quarter of the $HCR^{\wedge}$ distribution, and parent firm returns are about 0.7 percentage points larger when HCR_a is in the upper half of the HCR_a distribution. Finally, column (5) reports a regression assessing the impact on parent returns of $DHCR^{\wedge} = 1$ and/or $DHCR_a = 1$, relative to the case $DHCR^{\wedge} = DHCR_a = 0$ (i.e., the left-out or baseline group). An asset sale transaction with high acquirer human capital relatedness generates an additional 0.7 percentage point return for the parent (coefficient on $(1 - DHCR^{\wedge}) \times DHCR_a$), while an asset sale transaction with low parent human capital relatedness generates an additional 1.7 percentage point return for the parent (coefficient on $DHCR^{\wedge} \times (1 - DHCR_a)$). A transaction attractive to both parent and acquirer generates an additional return of approximately 2.3 percentage points for the parent (coefficient on $DHCR^{\wedge} \times DHCR_a$). Overall, the regressions provide strong support for Hypothesis 4 that parent returns are increasing when the asset sold and the parent's remaining assets have low human capital complementarity. There is also moderate support for Hypothesis 5 that parent firm returns are larger when HCR_a is high.[30]

Few control variables are reliably significant in the parent return regressions. Consistent with the recent literature (e.g., Clayton and Reisel (2013) and Zhang and Wang (2013)), we find that parent returns are increasing in the relative size of the transaction, and are decreasing in parent size and return on assets. No other variables are significant in the parent return regressions.

7. Conclusions

We draw from the property rights theory of the firm and its extension to mergers by Rhodes-Kropf and Robinson (2008) to argue that human capital complementarities can motivate

[30] In unreported regressions, we find that acquirer announcement period returns are significantly positively related to HCR_a.

mergers and acquisitions. Developing a measure of the relatedness of firms' human capital, we test the hypotheses that the likelihood of merger and the synergy benefits deriving from merger are increasing in the relatedness of the merging firms' human capital. Consistent with our hypotheses, we find strong evidence that the likelihood of merger is increasing in human capital relatedness, and that announcement returns and post-merger operating performance are higher when merging firms have closely related human capital. Our analysis shows that the benefits from combining firms with complementary human capital accrue primarily to diversifying acquisitions. This suggests that the merger of unrelated firms with a high degree of human capital relatedness generates synergies through the enhancement or creation of an internal labor market where workers with common skills can move between industry segments in response to changing opportunities and industry shocks.

An investigation into the channels through which labor complementarities drive higher post-merger profitability finds that the merger of firms with high human capital relatedness predicts a reduction in post-merger employment and labor costs, and modest increases in labor productivity. Again, these post-merger outcomes largely accrue to diversifying acquisitions where the merging firms have high human capital complementarity. We also examine asset sales to further our understanding of the mechanisms through which human capital complementarities influence the boundaries of the firm. We find that a lack of human capital relatedness between the asset being sold and the parent's remaining assets increases both the likelihood and returns from asset sales. The parent also earns a larger return when there are high complementarities between the human capital of the asset sold and the acquiring firm's assets.

Appendix A: Example of the computation of human capital relatedness

We provide a simple example to illustrate the calculation of our human capital relatedness (*HCR*) measure. Consider an economy with three occupations (*A*, *B*, and *C*), two industries, and three firms (*X*, *Y*, and *Z*). In Industry 1, 50% of the work force is in Occupation *A*, 20% is in Occupation *B*, and 30% is in Occupation *C*. In Industry 2, 70% of the work force is in Occupation *B* and 30% is in Occupation *C*. The occupation profile vectors for Industries 1 and 2 are (0.5, 0.2, 0.3) and (0, 0.7, 0.3), respectively.

A firm's human capital profile vector is the weighted average of its industry segment occupation profile vectors, where the weights are industry segment sales to total segment sales. For our example, assume that 60% of Firm *X*'s sales come from Industry 1 and 40% comes from Industry 2. Thus, Firm *X*'s human capital profile vector is H_X = (0.6)(0.5, 0.2, 0.3) + (0.4)(0. 0.7, 0.3) = (0.3, 0.4, 0.3). Similarly, assume Firm *Y* generates all its sales from Industry 1, and Firm *Z* generates 20% of its sales from Industry 1 and 80% from Industry 2. The human capital profile vectors of Firms *Y* and *Z* are H_Y = (0.5, 0.2, 0.3) and H_Z = (0.1, 0.6, 0.3), respectively.

We compute the human capital relatedness of Firms *X* and *Y* as the angular separation or uncentered correlation of the vectors H_X and H_Y:

$$HCR_{XY} = \frac{H_X H_Y'}{\sqrt{(H_X H_X')(H_Y H_Y')}} = 0.89$$

Thus HCR_{XY} is simply the scalar product of the firms' human capital profile vectors divided by the product of their lengths. Note that the human capital relatedness measure is bounded between 0 and 1, unity for firms whose human capital profiles are identical, and zero for firms whose human capital profiles are orthogonal. Repeating the calculation for Firms *X* and *Z* and Firms *Y* and *Z*, we obtain $HCR_{XZ} = 0.91$ and $HCR_{YZ} = 0.62$, respectively. Note that although Firm *X* appears more

similar to Firm *Y* than to Firm *Z* (i.e., the sales of Firms *X* and *Y* depend more on Industry 1, whereas Firm *Z*'s sales are more heavily weighted toward Industry 2), Firm *X* is more closely related to Firm *Z* with respect to human capital.

Appendix B: Variable definitions

Variable	Description
HCR	Human capital relatedness between merging firms in the fiscal year prior to the deal announcement date. For merging firms *i* and *j*, HCR_{ij} is computed as the scalar product of the firms' human capital profile vectors, H_i and H_j, divided by the product of their lengths, i.e., $$HCR_{ij} = \frac{H_i H_j'}{\sqrt{(H_i H_i')(H_j H_j')}}$$ A firm's human capital profile vector is constructed as the weighted average of its industry segment occupation profile vectors where the weights are segment sales to total segment sales. Industry occupation profile vectors are from the Occupational Employment Statistics (OES) of the Bureau of Labor Statistics. For each 3-digit SIC code for years 1989-2001 and 4-digit NAICS code thereafter, OES reports an industry occupation profile vector where the elements are the number of industry workers assigned to an occupation divided by the total number of workers in the industry. The OES dataset includes 158 occupation titles based on the OES taxonomy up to 1998, and 444 occupation titles based on the Standard Occupational Classification (SOC) thereafter. When a firm does not have data in the Compustat segment database, we use industry segment information from the Securities Data Corporation (SDC) database. The SDC database reports SIC codes and NAIC codes for a firm's segments but it does not provide segment sales. We therefore compute a firm's human capital profile vector as the equally weighted average of its segment OES occupation profile vectors. *HCR* is bounded between 0 and 1. It is unity for merging firms whose human capital profiles are identical, and zero for merging firms whose human capital profiles are orthogonal.
HCR^	Human capital relatedness of the parent in an asset sale the year before and after the sale. Thus, *HCR*^ is the scalar product of the parent firm's human capital profile vectors *H* and *H*^, divided by the product of their lengths, where *H* is the parent firm's human capital profile vector the year before the asset sale and *H*^ is the parent firm's human capital profile vector the year after the asset sale.
DHCR^	Dummy variable equal to one if *HCR*^ is less than or equal to the 25th percentile of *HCR*^, and zero otherwise.
HCR_a	Human capital relatedness between the unit sold in an asset sale and the acquiring firm. Thus, HCR_a is the scalar product of the human capital profile vector of the unit sold with the acquiring firm's human capital profile vector, divided by the product of their lengths.
$DHCR_a$	Dummy variable equal to one if HCR_a is greater than or equal to the median HCR_a, and zero otherwise.
PMR	Dummy variable equal to one if two firms are identified as product market related by Hoberg and Phillips (2010), and zero otherwise. Hoberg and Phillips compute product market similarity scores between firms using text-based analysis of 10-K product descriptions, and define firms with similarity scores above a certain threshold as product market related.

(*continued*)

Appendix B – *continued*

Variable	Description
Synergy	The weighted-average cumulative abnormal stock returns of acquirer and target from one day before to one day after the merger announcement date (i.e., days –1, 0, and +1, where day 0 is the merger announcement day). The weights are computed using the market values of equity of the merging firms 4 days before the merger announcement date. Using CRSP equally-weighted market returns, we estimate market model parameters over the period from 210 days before to 11 days before the merger announcement date. Abnormal stock return is computed as a firm's raw stock return minus the predicted return from the market model.
Acquirer (target) CAR	Acquirer (target) firm cumulative abnormal stock returns from one day before to one day after the merger announcement date (i.e., days –1, 0, and +1, where day 0 is the merger announcement day). Using CRSP equally-weighted market returns, we estimate market model parameters over the period from 210 days before to 11 days before the merger announcement date. Abnormal stock return is computed as a firm's raw stock return minus the predicted return from the market model.
Parent CAR	Cumulative abnormal stock returns of the parent firm from one day before to one day after the announcement of the asset sale (i.e., days –1, 0, and +1, where day 0 is the asset sale announcement day). Using CRSP equally-weighted market returns, we estimate market model parameters over the period from 210 days before to 11 days before the asset sale announcement date. Abnormal stock return is computed as a firm's raw stock return minus the predicted return from the market model.
Relative size	The ratio of the target firm's market value of equity to the acquiring firm's market value of equity 4 days before the merger announcement date.
Relative transaction size	The ratio of the transaction value (from SDC) to the parent firm's book value of total assets at the fiscal year-end immediately before the asset sale announcement date.
Stock deal dummy	Dummy variable equal to one if the deal is at least partially financed with stock, and zero otherwise.
MergerType1	Dummy variable equal to one for single-segment acquirer and target firms in different industries based on 3-digit SIC (4-digit NAICS) code, and zero otherwise.
MergerType2	Dummy variable equal to one when one or both acquirer and target are multi-segment firms with no common industries based on 3-digit SIC (4-digit NAICS) code, and zero otherwise.
MergerType3	Dummy variable equal to one when each of the merging firms is either single- or multi-segment and have at least one segment in the same industry based on 3-digit SIC (4-digit NAICS) code, and zero otherwise.
Vertical	Dummy variable equal to one for a vertical merger, and zero otherwise. Vertical mergers are determined according to the algorithm described in Fan and Goyal (2006) based on the Input-Output table from the Bureau of Economic Analysis. Merging firms are vertically integrated if they are from different industries and their vertical relatedness measure as defined by Fan and Goyal (2006) is greater than or equal to 1%.
Horizontal	Dummy variable equal to one for a horizontal merger, and zero otherwise. Horizontal mergers are determined according to the algorithm described in Fan and Goyal (2006) based on the Input-Output table from the Bureau of Economic Analysis. Horizontal mergers are mergers between firms in the same industry and exhibit no vertical relatedness (i.e., a Fan and Goyal (2006) vertical relatedness measure less than 1%).

(*continued*)

Appendix B – *continued*

Variable	Description
Conglomerate	Dummy variable equal to one for a conglomerate merger, and zero otherwise. Conglomerate mergers are determined according to the algorithm described in Fan and Goyal (2006) based on the Input-Output table from the Bureau of Economic Analysis. Conglomerate mergers are mergers between firms in different industries and exhibit no vertical relatedness (i.e., a Fan and Goyal (2006) vertical relatedness measure less than 1%).
Total assets	Natural logarithm of total book assets (AT) at the fiscal year-end immediately prior to the merger (asset sale) announcement date.
Market-to-book	The market-to-book ratio of a firm's assets at the fiscal year-end immediately prior to the merger (asset sale) announcement date, where the market value of assets is estimated as the book value of assets plus the difference between the market and book values of equity (AT + PRCC_F × CSHO – CEQ).
Leverage ratio	Ratio of long-term debt (DLTT) plus short-term debt (DLC) to total book assets (AT) at the fiscal year-end immediately prior to the merger (asset sale) announcement date.
Free cash flow	Ratio of operating income before depreciation (OIBDP) minus interest expense (XINT) minus income taxes (TXT) minus capital expenditures (CAPX) to total book assets (AT) at the fiscal year-end immediately prior to the merger (asset sale) announcement date.
Cash holdings	Ratio of cash equivalents (CHE) to total book assets (AT) at the fiscal year-end immediately prior to the merger (asset sale) announcement date.
Sales growth	Sales (SALE) in fiscal year t–1 minus sales in fiscal year t–2, scaled by sales in fiscal year t–2, where fiscal year t is the year of the merger announcement.
Prior returns	Buy-and-hold abnormal stock returns during the period from 210 days before to 11 days before the merger (asset sale) announcement date. Abnormal stock return is computed as the difference between a firm's raw stock return and the CRSP value-weighted market return.
Return on assets	Ratio of operating income before depreciation (OIBDP) to total book assets (AT) at the fiscal year-end immediately prior to the merger (asset sale) announcement date.
Termination fee	Dummy variable equal to one if the acquirer (target) termination fee reported by SDC is greater than zero, and zero otherwise.

Appendix C: Control samples for merger and asset sale probit regressions

C1. Merger control samples

Control sample 1. Non-merging firm pair – pseudo acquirer and pseudo target: The matching pair of non-merging firms is based on vertical relation, product market similarity, number of segments, total assets, and market-to-book ratio according to the following steps.

Step 1. For each merging firm pair (real acquirer and real target) in year *t*, we use the Compustat Segment Database to identify all possible pairs of firms in year *t* in which the Fan and Goyal (2006) merger relation (i.e., vertical, horizontal, or conglomerate) between the pair is the same as that between the merging firms. Candidate pseudo merging firm pairs must not engage in M&A activity in years *t*–1 and *t*. (See Appendix B for descriptions of the Fan and Goyal (2006) merger relations vertical, horizontal, and conglomerate.)

Step 2. Among the candidate pseudo merging firm pairs, we identify pairs in which the pseudo acquirer (pseudo target) belongs to the same product market as the real acquirer (real target) according to the product market relatedness classification of Hoberg and Phillips (2010).

Step 3. Among the pseudo merger pairs, we identify five pairs that have the closest number of segments to the merging firm pair, where "closest is defined by minimum Euclidean distance, computed as the *square root of* [(# segments real acquirer – # segments pseudo acquirer)^2 + (# segments real target – # segments pseudo target)^2].

Step 4. Among the five pairs, we identify the three pairs having the closest total assets to the merging firm pair, where "closest" is defined by minimum Euclidean distance, computed as the *square root of* [(total assets of real acquirer – total assets of pseudo acquirer)^2 + (total assets of real target – total assets of pseudo target)^2]

Step 5. Of these three pairs, we select the pair with the closest market-to-book ratio (M/B) to the merging firm pair, where "closest" is defined by minimum Euclidean distance, computed as the *square root of* [(M/B of real acquirer – M/B of pseudo acquirer)^2 + (M/B of real target – M/B of pseudo target)^2].

Control sample 2. Non-merging firm pair – real acquirer and pseudo target: The matching pair of firms is based on vertical relation, product market similarity, number of segments, total assets, and market-to-book ratio according to the following steps.

Step 1. For each merging firm pair (real acquirer and real target) in year *t*, we use the Compustat Segment Database to identify all pairs of the real acquirer and firms in year *t* in which the Fan and Goyal (2006) merger relation (i.e., vertical, horizontal, or conglomerate) between the real acquirer and pseudo target is the same as that between the real merger pair. Candidate pseudo target firms must not engage in M&A activity in years *t*–1 and *t*. (See Appendix B for descriptions of the Fan and Goyal (2006) merger relations vertical, horizontal, and conglomerate.)

Step 2. Among the candidate merging firm pairs (real acquirer and pseudo targets), we identify pairs in which the pseudo target belongs to the same product market as the real target according to the product market relatedness classification of Hoberg and Phillips (2010).

Step 3. Among the real acquirer – pseudo target merger pairs, we identify five pairs where the pseudo target and real target have the same number of segments.

Step 4. Among the five pairs, we identify the three pairs where the total assets of the pseudo target are closest to the total assets of the real target.

Step 5. Of these three pairs, we select the pair where the market-to-book ratio of the pseudo target is closest to the real target.

Control sample 3. Non-merging firm pair – random pair of firms: Each merging firm pair has five randomly matched non-merging firm pairs from the Compustat Segment Database in year *t*. We require these firms do not engage in M&A activity in year *t* and *t*–1.

C2. Asset sales control samples

Control sample 1: For each parent firm in the sample, we identify one matching firm (i.e., pseudo parent) from the Compustat Segment (CIS) database that meets the following criteria. If the parent is single segment, then candidate pseudo parents are single segment with the same 3-digit SIC (4-digit NAICS) code. From this group, we choose the pseudo parent with the closest total book value of assets to the sample parent. The pseudo parent's *HCR^* (i.e., human capital relatedness with and without the asset sale) is set equal to 1. If the parent is multi-segment, then candidate pseudo parents are multi-segment and have a segment whose 3-digit SIC (4-digit NAICS) code is the same as the primary industry code of the divested unit. From this group, we choose one pseudo parent satisfying the following criteria: (1) the same-SIC (NAICS) code segment has at least $75 million book value of assets, and (2) the ratio of segment book assets to total firm book assets is closest to the parent's relative transaction value. For the pseudo parent, we calculate the weighted average of the segment human capital profile vectors with and without the pseudo asset sale segment (i.e., *H* and *H^*), where the weights are based on segment sales. We then compute *HCR^* for the pseudo parent using *H* and *H^*.

Control sample 2: The steps to generate this control sample are identical to those for control sample 1, except we use a different procedure to calculate the pseudo parent's *HCR^* when the actual parent and the pseudo parent have multiple segments. We first compute the pseudo parent's human capital profile vector, *H*, in the year before the asset sale as the sales weighted average of the segments' human capital profile vectors. We then compute the pseudo parent's human capital profile vector after the asset sale using the following procedure. Using the primary 3-digit SIC (4-digit NAICS) code for the asset sale, we calculate for the real parent the change in segment sales

weight (%Δ) for the segment with this SIC/NAICS code from the year before the asset sale to the year after the asset sale. We then decrease the corresponding segment's weight in the pseudo parent by %Δ, and allocate %Δ to the remaining segments in the pseudo parent in proportion to the segments' relative contributions to firm sales. We use these adjusted segment weights for the pseudo parent to calculate a post asset sale weighted-average human capital profile vector $H^{\wedge}$. Finally, we compute $HCR^{\wedge}$ for the pseudo parent using H and $H^{\wedge}$.

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Table 1

Descriptive statistics and correlations for the merger sample

The table reports descriptive statistics (Panel A) and Pearson correlation coefficients (Panel B) for the sample of mergers and acquisitions announced during the period 1997 to 2012. All variables are defined in Appendix B, and all variables are winsorized at the 1st and 99th percentiles of their distributions except *HCR*, *PMR*, and dummy variables. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Descriptive Statistics

Variable	Mean	Std. Dev.	25th Pctl.	Median	75th Pctl.	Obs.
Merger relatedness measures						
HCR	0.752	0.283	0.565	0.854	0.905	1,322
PMR	0.503					1,322
Merger returns (%)						
Synergy	1.477	7.594	–2.155	0.933	5.105	1,322
Acquirer CAR	–1.227	7.649	–5.272	–0.823	2.388	1,322
Target CAR	25.865	26.653	8.356	21.009	37.642	1,322
Deal Characteristics						
Relative size	0.238	0.357	0.025	0.101	0.310	1,322
Stock deal dummy	0.519					1,322
MergerType1	0.191					1,322
MergerType2	0.160					1,322
MergerType3	0.649					1,322
Vertical	0.123					1,322
Horizontal	0.405					1,322
Conglomerate	0.472					1,322
Acquirer characteristics						
Total assets	7.709	2.016	6.256	7.700	9.287	1,235
Market-to-book	2.660	2.675	1.381	1.877	2.826	1,235
Leverage ratio	0.208	0.183	0.053	0.179	0.312	1,235
Free cash flow	0.023	0.158	0.007	0.055	0.092	1,252
Cash holdings	0.304	0.319	0.060	0.193	0.462	1,260
Sales growth	0.297	0.758	0.024	0.124	0.316	1,247
Prior returns	0.165	0.593	–0.154	0.044	0.297	1,322
Return on assets	0.108	0.137	0.077	0.122	0.171	1,133
Termination fee	0.222					1,322
Target characteristics						
Total assets	5.357	1.748	4.073	5.177	6.540	1,240
Market-to-book	2.139	1.747	1.159	1.562	2.385	1,241
Leverage ratio	0.208	0.235	0.003	0.138	0.344	1,240
Free cash flow	–0.070	0.258	–0.096	0.016	0.063	1,255
Cash holdings	0.418	0.418	0.058	0.279	0.698	1,264
Sales growth	0.314	0.822	–0.004	0.114	0.329	1,249
Prior returns	0.068	0.654	–0.329	–0.049	0.281	1,322
Return on assets	0.023	0.262	–0.020	0.098	0.160	1,255
Termination fee	0.688					1,322

(*continued*)

Table 1 – *continued*

Panel B. Pearson correlation coefficients

	HCR	*PMR*	Synergy	Acq. CAR	Trg. CAR
HCR	1.000				
PMR	0.243***	1.000			
Synergy	0.032	0.046*	1.000		
Acquirer CAR	–0.007	–0.003	0.845***	1.000	
Target CAR	0.016	–0.028	0.280***	0.122***	1.000
Relative size	0.052*	0.068***	0.165***	–0.020	–0.262***
Stock deal dummy	0.049*	0.072***	–0.190***	–0.242***	–0.226***
MergerType1	–0.460***	–0.038	–0.037	–0.020	0.013
MergerType2	–0.386***	–0.201***	0.003	0.037	0.008
MergerType3	0.675***	0.185***	0.028	–0.012	–0.017
Vertical	–0.075***	–0.085***	–0.014	–0.002	0.071***
Horizontal	0.410***	0.303***	0.024	–0.030	–0.062**
Conglomerate	–0.354***	–0.242***	–0.015	0.031	0.014
Acquirer total assets	–0.042	–0.173***	–0.082***	0.028	0.067**
Acquirer M/B	0.078***	0.031	–0.137***	–0.079***	–0.019
Acquirer leverage ratio	–0.019	–0.047*	0.094***	0.061**	–0.053*
Acquirer free cash flow	–0.049*	–0.011	0.033	0.075***	0.071***
Acquirer cash holdings	0.111***	0.110***	–0.106***	–0.105***	0.022
Acquirer sales growth	0.052*	0.015	–0.106***	–0.096***	–0.108***
Acquirer prior returns	0.023	0.001	–0.145***	–0.112***	–0.066**
Acquirer ROA	–0.040	–0.064**	0.039	0.121***	0.037
Acquirer term. fee	0.020	0.079***	0.010	–0.106***	–0.155***
Target total assets	0.101***	0.070***	0.029	–0.084***	–0.137***
Target *M/B*	0.029	–0.015	–0.152***	–0.112***	–0.110***
Target leverage ratio	0.034	0.044	0.040	0.033	–0.071***
Target free cash flow	–0.030	–0.045	0.046	–0.023	–0.063**
Target cash holdings	0.068**	0.026	–0.154***	–0.103***	0.055**
Target sales growth	0.030	–0.014	–0.057**	–0.040	–0.046*
Target prior returns	–0.005	0.042	–0.047*	–0.024	–0.063**
Target *ROA*	–0.016	–0.039	0.061**	–0.007	–0.091***
Target term. fee	0.028	0.004	0.062**	0.039	–0.020

Table 2

The effect of human capital relatedness on the probability of merger

The table reports the results of probit regressions of the probability of merger. The sample includes merging firm pairs (acquirer and target) announced during the period from 1997 to 2012, and non-merging control firm pairs. Columns (1) and (2) present results for the effects of human capital relatedness (*HCR*) and product market relatedness (*PMR*) on the probability of merger when the regression does not include control variables, columns (3) and (4) include control variables, and columns (5) and (6) report results using the orthgonalization of *HCR* against *PMR*, where *HCR_ε* is the residual from a regression of *HCR* on *PMR*. All variables are defined in Appendix B. In panel A, each merging firm pair has one matching non-merging firm pair. In panel B, each merging firm pair has one matching non-merging firm pair constructed by pairing each acquiring firm with a pseudo target firm. In panel C, each merging firm pair has five randomly selected non-merging firm pairs. The algorithms used to construct the non-merging control firm pairs are described in Appendix C. All independent variables are lagged one year. Coefficients, z-statistics (in parenthesis), and economic significance are reported. Economic significance is the marginal effect on the probability of merger for a one standard deviation change for a continuous independent variable or for a change from zero to one for a dummy variable, holding all other variables at their means. Marginal effects and standard errors for interactions are computed using the methods in Ai and Norton (2003). The z-statistics are computed using robust standard errors clustered at the year level. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Control sample is non-merging firm pair – pseudo acquirer and pseudo target						
HCR	0.590***	0.850***	0.803***	0.786***		
	(6.59)	(6.58)	(6.72)	(4.45)		
	0.074	0.108	0.102	0.108		
HCR_ε					0.322***	0.786***
					(2.59)	(4.45)
					0.037	0.091
PMR		1.463***		1.430***		0.873***
		(8.67)		(6.53)		(10.79)
		0.525		0.525		0.338
HCR × PMR		–1.362***		–0.907***		
		(–6.56)		(–3.36)		
		–0.163		–0.115		
HCR_ε × PMR						–0.907***
						(–3.36)
						–0.105
Total assets of acquirer			0.198***	0.245***	0.184***	0.245***
			(8.20)	(9.56)	(7.81)	(9.56)
			0.155	0.192	0.144	0.192
Total assets of target			–0.094***	–0.141***	–0.071**	–0.141***
			(–3.38)	(–4.82)	(–2.61)	(–4.82)
			–0.066	–0.099	–0.049	–0.099
Market-to-book of acquirer			0.162***	0.171***	0.161***	0.171***
			(6.94)	(7.07)	(7.04)	(7.07)
			0.123	0.130	0.122	0.130
Market-to-book of target			–0.036	–0.040*	–0.035	–0.040*
			(–1.61)	(–1.71)	(–1.55)	(–1.71)
			–0.027	–0.030	–0.026	–0.030
Leverage ratio of acquirer			–0.528**	–0.570**	–0.546**	–0.570**
			(–2.38)	(–2.49)	(–2.49)	(–2.49)
			–0.042	–0.045	–0.043	–0.045

(*continued*)

Table 2 – *continued*

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Leverage ratio of target			0.389*	0.296	0.434**	0.296
			(1.85)	(1.37)	(2.10)	(1.37)
			0.035	0.026	0.038	0.026
Free cash flow of acquirer			9.611***	9.764***	9.564***	9.764***
			(15.98)	(15.81)	(16.07)	(15.81)
			0.515	0.524	0.512	0.524
Free cash flow of target			5.924***	5.827***	5.883***	5.827***
			(13.21)	(12.75)	(13.22)	(12.75)
			0.570	0.561	0.566	0.561
Cash holdings of acquirer			–0.558***	–0.649***	–0.504***	–0.649***
			(–3.68)	(–4.08)	(–3.39)	(–4.08)
			–0.070	–0.081	–0.063	–0.081
Cash holdings of target			–0.805***	–0.836***	–0.757***	–0.836***
			(–6.65)	(–6.70)	(–6.38)	(–6.70)
			–0.134	–0.140	–0.126	–0.140
Sales growth of acquirer			0.137**	0.130**	0.131**	0.130**
			(2.29)	(2.12)	(2.21)	(2.12)
			0.034	0.033	0.033	0.033
Sales growth of target			0.044	0.064	0.039	0.064
			(0.92)	(1.29)	(0.84)	(1.29)
			0.014	0.021	0.013	0.021
Return on assets of acquirer			–10.880***	–11.078***	–10.767***	–11.078***
			(–19.16)	(–18.90)	(–19.21)	(–18.90)
			–0.642	–0.655	–0.635	–0.655
Return on assets of target			–6.112***	–5.904***	–6.073***	–5.904***
			(–13.56)	(–12.88)	(–13.58)	(–12.88)
			–0.647	–0.626	–0.643	–0.626
Constant	–0.424***	–0.779***	–0.473**	–0.861***	0.034	–0.406*
	(–6.02)	(–8.85)	(–2.23)	(–3.60)	(0.17)	(–1.93)
Pseudo R-squared	0.02	0.07	0.45	0.48	0.44	0.48
Observed prob. merger	0.50	0.50	0.50	0.50	0.50	0.50
Predicted prob. merger	0.50	0.50	0.50	0.51	0.52	0.51
No. of observations	1,978	1,978	1,978	1,978	1,978	1,978
Panel B. Control sample is acquiring firm paired with pseudo target firm						
HCR	0.375***	0.397***	0.482***	0.371**		
	(3.88)	(2.96)	(4.39)	(2.46)		
	0.045	0.154	0.059	0.045		
HCR_ε					0.234**	0.371**
					(2.06)	(2.46)
					0.027	0.043
PMR		0.819***		0.700***		0.557***
		(4.92)		(3.64)		(7.93)
		0.318		0.273		0.219
HCR × *PMR*		–0.553***		–0.259		
		(–2.64)		(–1.09)		
		–0.214		–0.032		

(*continued*)

Table 2 – *continued*

Variable	(1)	(2)	(3)	(4)	(5)	(6)
HCR_ε × PMR						–0.259
						(–1.09)
						–0.030
Total assets of acquirer			0.009	0.034	0.006	0.034
			(0.45)	(1.62)	(0.29)	(1.62)
			0.007	0.027	0.005	0.027
Total assets of target			0.026	0.000	0.033	0.000
			(1.05)	(0.02)	(1.32)	(0.02)
			0.018	0.000	0.023	0.000
Market-to-book of acquirer			0.033*	0.044**	0.033*	0.044**
			(1.76)	(2.28)	(1.72)	(2.28)
			0.029	0.037	0.028	0.037
Market-to-book of target			0.012	0.005	0.013	0.005
			(0.54)	(0.22)	(0.58)	(0.22)
			0.008	0.003	0.009	0.003
Leverage ratio of acquirer			–0.079	–0.091	–0.075	–0.091
			(–0.34)	(–0.39)	(–0.33)	(–0.39)
			–0.005	–0.006	–0.005	–0.006
Leverage ratio of target			0.321	0.210	0.360*	0.210
			(1.64)	(1.06)	(1.84)	(1.06)
			0.027	0.018	0.030	0.018
Free cash flow of acquirer			–1.492**	–1.302**	–1.525***	–1.302**
			(–2.92)	(–2.49)	(–3.00)	(–2.49)
			–0.062	–0.054	–0.063	–0.054
Free cash flow of target			8.667***	8.804***	8.624***	8.804***
			(18.69)	(18.69)	(18.65)	(18.69)
			0.841	0.855	0.837	0.855
Cash holdings of acquirer			–0.209	–0.337**	–0.162	–0.337**
			(–1.41)	(–2.21)	(–1.10)	(–2.21)
			–0.024	–0.039	–0.019	–0.039
Cash holdings of target			–0.410***	–0.450***	–0.397***	–0.450***
			(–3.89)	(–4.21)	(–3.78)	(–4.21)
			–0.069	–0.075	–0.066	–0.075
Sales growth of acquirer			0.071	0.071	0.071	0.071
			(1.04)	(1.03)	(1.04)	(1.03)
			0.015	0.015	0.015	0.015
Sales growth of target			0.070*	0.080*	0.065	0.080*
			(1.68)	(1.89)	(1.57)	(1.89)
			0.022	0.026	0.021	0.026
Return on assets of acquirer			0.842*	0.655	0.869**	0.655
			(1.94)	(1.47)	(2.01)	(1.47)
			0.042	0.033	0.043	0.033
Return on assets of target			–9.090***	–9.199***	–9.048***	–9.199***
			(–19.50)	(–19.40)	(–19.47)	(–19.40)
			–0.963	–0.975	–0.959	–0.975
Constant	–0.275***	–0.472***	–0.120	–0.266	0.199	–0.030
	(–3.58)	(–4.92)	(–0.56)	(–1.24)	(1.07)	(–0.16)

(*continued*)

Table 2 – *continued*

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Pseudo R-squared	0.01	0.03	0.26	0.28	0.26	0.28
Observed prob. merger	0.50	0.50	0.50	0.50	0.50	0.50
Predicted prob. merger	0.50	0.50	0.52	0.52	0.53	0.52
No. of observations	1,824	1,824	1,824	1,824	1,824	1,824
Panel C. Control sample is five randomly-selected non-merging firm pairs for each merging firm pair						
HCR	3.029***	2.559***	3.078***	2.628***		
	(42.93)	(28.87)	(28.14)	(18.24)		
	0.140	0.087	0.070	0.040		
HCR_ε					1.132***	2.628***
					(12.41)	(18.24)
					0.035	0.034
PMR		3.832***		4.117***		3.757***
		(15.92)		(11.21)		(25.66)
		0.421		0.202		0.184
HCR × PMR		–2.413***		–2.198***		
		(–8.34)		(–5.04)		
		–0.082		–0.033		
HCR_ε × PMR						–2.198***
						(–5.04)
						–0.009
Total assets of acquirer			0.341***	0.252***	0.317***	0.373***
			(19.44)	(17.13)	(22.95)	(17.33)
			0.066	0.049	0.099	0.049
Total assets of target			0.014	–0.022	0.039***	–0.024
			(0.80)	(–1.07)	(2.76)	(–1.07)
			0.003	–0.003	0.011	–0.003
Market-to-book of acquirer			0.088***	0.056***	0.092***	0.106***
			(6.55)	(6.49)	(8.53)	(6.49)
			0.022	0.018	0.037	0.018
Market-to-book of target			–0.041**	–0.022*	–0.033**	–0.037*
			(–2.36)	(–1.72)	(–2.33)	(–1.72)
			–0.014	–0.009	–0.018	–0.009
Leverage ratio of acquirer			–0.300	–0.226	–0.370**	–0.103
			(–1.60)	(–0.45)	(–2.44)	(–0.45)
			–0.009	–0.002	–0.018	–0.002
Leverage ratio of target			–0.382**	–0.182**	–0.246**	–0.494***
			(–2.55)	(–2.71)	(–2.04)	(–2.71)
			–0.015	–0.013	–0.015	–0.013
Free cash flow of acquirer			10.111***	0.627***	10.133***	11.579***
			(19.85)	(18.46)	(23.86)	(18.46)
			0.453	0.348	0.728	0.348
Free cash flow of target			4.653***	0.360***	5.055***	4.531***
			(14.69)	(12.58)	(17.99)	(12.58)
			0.224	0.146	0.390	0.146

(*continued*)

Table 2 – *continued*

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Cash holdings of acquirer			–0.424***	–0.150***	–0.271***	–0.631***
			(–3.66)	(–4.20)	(–2.92)	(–4.20)
			–0.012	–0.012	–0.012	–0.012
Cash holdings of target			–0.250**	–0.126***	–0.138*	–0.371***
			(–2.43)	(–2.94)	(–1.69)	(–2.94)
			–0.007	–0.007	–0.006	–0.007
Sales growth of acquirer			0.087**	0.046	0.074**	0.053
			(2.43)	(1.15)	(2.47)	(1.15)
			0.006	0.002	0.008	0.002
Sales growth of target			–0.028	–0.043	0.003	–0.056
			(–0.76)	(–1.31)	(0.11)	(–1.31)
			–0.002	–0.003	0.000	–0.003
Return on assets of acquirer			–9.814***	–0.581***	–9.830***	–11.071***
			(–20.29)	(–19.07)	(–24.48)	(–19.07)
			–0.380	–0.288	–0.611	–0.288
Return on assets of target			–4.531***	–0.356***	–5.032***	–4.262***
			(–14.35)	(–11.97)	(–17.98)	(–11.97)
			–0.192	–0.121	–0.341	–0.121
Constant	–2.342***	–2.436***	–3.620***	–3.762***	–2.276***	–3.048***
	(–53.79)	(–47.6)	(–20.62)	(–17.03)	(–17.41)	(–14.74)
Pseudo R-squared	0.30	0.39	0.47	0.52	0.39	0.52
Observed prob. merger	0.17	0.17	0.17	0.17	0.17	0.17
Predicted prob. merger	0.17	0.17	0.17	0.17	0.17	0.17
No. of observations	6,762	6,762	6,762	6,762	6,762	6,762

Table 3

The influence of merger type on the effect of human capital relatedness on the probability of merger

The table reports the results of probit regressions of the probability of merger. The sample includes merging firm pairs (acquirer and target) announced during the period from 1997 to 2012, and non-merging control firm pairs. Columns (1) and (2) interact human capital relatedness (*HCR*) with merger type dummy variables, *MergerType*1-*MergerType*3, based on acquirer and target firm number of segments and industry overlap, and Columns (3) and (4) interact human capital relatedness (*HCR*) with dummy variables for whether the merger is vertical (*Vertical*), horizontal (*Horizontal*), or conglomerate (*Conglomerate*). *MergerType*1 is a dummy variable equal to one for single-segment acquirer and target in different industries, *MergerType*2 is a dummy variable equal to one when one or both acquirer and target are multi-segment with no common industry segments, and *MergerType*3 is a dummy variable equal to one when each of the merging firms is either single- or multi-segment and have at least one segment in the same industry. The dummy variables *Vertical*, *Horizontal*, and *Conglomerate* are equal to one for vertical, horizontal, and conglomerate mergers, respectively; and are constructed using the algorithm in Fan and Goyal (2006). All regressions are estimated without an intercept so there is not a left-out or baseline merger group. All variables are defined in Appendix B. In panel A, each merging firm pair has one matching non-merging firm pair. In panel B, each merging firm pair has one matching non-merging firm pair constructed by pairing each acquiring firm with a pseudo target firm. The algorithms used to construct the non-merging control firm pairs are described in Appendix C. All independent variables are lagged one year. Coefficients, z-statistics (in parenthesis), and economic significance are reported. Economic significance is the marginal effect on the probability of merger for a one standard deviation change for a continuous independent variable or for a change from zero to one for a dummy variable, holding all other variables at their means. Marginal effects and standard errors for interactions are computed using the methods in Ai and Norton (2003). The z-statistics are computed using robust standard errors clustered at the year level. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

Variable	(1)	(2)	(3)	(4)
Panel A. Control sample is non-merging firm pair – pseudo acquirer and pseudo target				
HCR × *MergerType*1	1.105***	1.127***		
	(3.85)	(3.59)		
	0.140	0.143		
HCR × *MergerType*2	0.753**	0.860***		
	(2.44)	(2.63)		
	0.096	0.109		
HCR × *MergerType*3	–0.479	–0.594		
	(–1.53)	(–1.59)		
	–0.061	–0.076		
HCR × *Vertical*			1.507***	1.413***
			(4.00)	(3.42)
			0.192	0.180
HCR × *Horizontal*			–1.121***	–1.067***
			(–3.51)	(–2.70)
			–0.143	–0.136
HCR × *Conglomerate*			1.209***	1.053***
			(6.51)	(4.97)
			0.154	0.134
PMR		1.215***		1.017***
		(5.40)		(4.40)
		0.228		0.389
HCR × *PMR*		–0.620**		–0.336
		(–2.19)		(–1.16)
		–0.079		–0.037

(*continued*)

Table 3 – *continued*

Variable	(1)	(2)	(3)	(4)
*MergerType*1	–0.493**	–0.863***		
	(–2.01)	(–3.20)		
	–0.082	–0.144		
*MergerType*2	–0.809***	–1.127***		
	(–3.11)	(–4.02)		
	–0.129	–0.180		
*MergerType*3	0.736**	0.401		
	(2.03)	(1.00)		
	0.145	0.079		
Vertical			–1.080***	–1.342***
			(–3.26)	(–3.73)
			–0.140	–0.174
Horizontal			1.262***	0.715*
			(3.58)	(1.77)
			0.248	0.141
Conglomerate			–0.779***	–0.969***
			(–3.42)	(–3.91)
			–0.155	–0.193
Controls	Yes	Yes	Yes	Yes
Pseudo R-squared	0.46	0.48	0.46	0.49
Observed prob. merger	0.50	0.50	0.50	0.50
Predicted prob. merger	0.52	0.51	0.52	0.52
No. of observations	1,978	1,978	1,978	1,978
Panel B. Control sample is acquiring firm paired with pseudo target firm				
HCR × *MergerType*1	0.652***	0.610**		
	(2.62)	(2.31)		
	0.059	0.054		
HCR × *MergerType*2	0.404*	0.424*		
	(1.65)	(1.66)		
	0.037	0.038		
HCR × *MergerType*3	–0.110	–0.414		
	(–0.38)	(–1.24)		
	–0.010	–0.037		
HCR × *Vertical*			0.636**	0.620*
			(1.96)	(1.74)
			0.061	0.058
HCR × *Horizontal*			–0.222	–0.328
			(–0.77)	(–0.95)
			–0.021	–0.031
HCR × *Conglomerate*			0.713***	0.569***
			(4.56)	(3.27)
			0.069	0.053

(*continued*)

Table 3 – *continued*

Variable	(1)	(2)	(3)	(4)
PMR		0.584***		0.558***
		(2.96)		(2.75)
		0.178		0.170
HCR × *PMR*		–0.093		–0.017
		(–0.38)		(–0.07)
		–0.008		–0.002
*MergerType*1	–0.133	–0.298		
	(–0.60)	(–1.25)		
	–0.018	–0.038		
*MergerType*2	–0.293	–0.419*		
	(–1.21)	(–1.65)		
	–0.036	–0.050		
*MergerType*3	0.428	0.439		
	(1.29)	(1.22)		
	0.066	0.066		
Vertical			–0.256	–0.440
			(–0.83)	(–1.33)
			–0.026	–4.4%
Horizontal			0.481	0.241
			(1.53)	(0.68)
			0.074	3.6%
Conglomerate			–0.262	–0.333
			(–1.27)	(–1.52)
			–0.041	–5.1%
Controls	Yes	Yes	Yes	Yes
Pseudo R-squared	0.27	0.29	0.27	0.29
Observed prob. merger	0.50	0.50	0.50	0.50
Predicted prob. merger	0.51	0.51	0.51	0.51
No. of observations	1,824	1,824	1,824	1,824

Table 4

The effect of human capital relatedness on the gains from merger

The table reports regressions of merger announcement returns on human capital relatedness (*HCR*), product market relatedness (*PMR*), and the interaction between the two. The sample includes deals announced during the period 1997-2012. The dependent variable, *Synergy*, is the weighted average of the cumulative abnormal returns of acquirer and target firms over days –1, 0, and +1, where day 0 is the merger announcement day. The weights are based on the market values of equity of acquirer and target four days prior to the merger announcement day. All variables are defined in Appendix B, and all variables are winsorized at the 1st and 99th percentiles except *HCR*, *PMR*, and dummy variables. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

Variable	(1)	(2)	(3)	(4)
HCR	1.275**	2.290**	1.079**	1.989***
	(2.09)	(2.42)	(2.47)	(3.43)
PMR		2.855**		2.455*
		(2.32)		(1.86)
HCR × *PMR*		–2.805**		–2.414**
		(–2.09)		(–1.97)
Relative size			3.237***	3.292***
			(3.43)	(3.50)
Stock deal dummy			–2.804***	–2.850***
			(–4.68)	(–4.91)
Total assets of acquirer			–0.646**	–0.590**
			(–2.30)	(–1.99)
Total assets of target			1.80	0.146
			(0.82)	(0.64)
Market-to-book of acquirer			0.161	0.165
			(1.00)	(1.02)
Market-to-book of target			–0.365***	–0.381***
			(–3.40)	(–3.56)
Leverage ratio of acquirer			3.191**	3.273**
			(2.01)	(2.05)
Leverage ratio of target			–1.931**	–1.948**
			(–2.00)	(–2.07)
Free cash flow of acquirer			0.286	0.322
			(0.19)	(0.21)
Free cash flow of target			–1.328	–1.230
			(–1.17)	(–1.08)
Cash holdings of acquirer			–1.647	–1.626
			(–1.63)	(–1.56)
Cash holdings of target			–1.924**	–1.900**
			(–2.46)	(–2.42)
Sales growth of acquirer			–0.654	–0.655
			(–1.17)	(–1.18)

(*continued*)

Table 4 – *continued*

Variable	(1)	(2)	(3)	(4)
Sales growth of target			0.248	0.266
			(0.65)	(0.70)
Prior returns of acquirer			–1.111**	–1.055**
			(–2.02)	(–1.96)
Prior returns of target			–0.082	–0.114
			(–0.26)	(–0.36)
Termination fee for acquirer			–1.220**	–1.285**
			(–2.32)	(–2.35)
Termination fee for target			0.443	0.497
			(0.79)	(0.86)
Year fixed effects	Yes	Yes	Yes	Yes
Adjusted R-squared	0.04	0.05	0.16	0.16
No. of observations	1,127	1,127	1,127	1,127

Table 5

Robustness regressions of the effect of human capital relatedness on the gains from merger

The table reports regressions of merger announcement returns on human capital relatedness (*HCR*), product market relatedness (*PMR*), and the interaction between the two. The sample includes deals announced during the period 1997-2012. The dependent variable, *Synergy*, is the weighted average of the cumulative abnormal returns of acquirer and target firms over days –1, 0, and +1, where day 0 is the merger announcement day. The weights are based on the market values of equity of acquirer and target four days prior to the merger announcement day. Model (4) uses the residual from a regression of *HCR* on *PMR* for the human capital relatedness measure. Model (5) is a robust regression that uses a two-step procedure to reduce the impact of outliers in the OLS regression. In the first step, we follow Bollen and Jackman (1990) and drop influential outliers with a Cook's D greater than $4/N$, where N is the number of observations used to estimate the regression. In the second step, an iterative procedure following Li (2006) reduces the weight of observations with large absolute residuals. All variables are defined in Appendix B, and all variables are winsorized at the 1st and 99th percentiles except *HCR*, *PMR*, and dummy variables. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

Variable	Excluding *HCR* = 1 (1)	Only *PMR* = 0 (2)	Only *PMR* = 1 (3)	Orthogonal *HCR* (4)	Robust regression (5)
HCR	2.447***	2.243***	0.086	1.916***	1.257***
	(3.30)	(3.70)	(0.09)	(3.12)	(3.08)
PMR	2.488**			0.747*	1.686***
	(2.07)			(1.65)	(2.62)
HCR × *PMR*	–2.150*			–1.753*	–1.627**
	(–1.70)			(–1.85)	(–2.46)
Controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.16	0.23	0.17	0.16	0.38
No. of observations	827	493	634	1,127	893

Table 6

The influence of merger type on the effect of human capital relatedness on the gains from merger

The table reports regressions of merger announcement returns on human capital relatedness (*HCR*) interacted with merger type, product market relatedness (*PMR*), and the interaction between *HCR* and *PMR*. The sample includes deals announced during the period 1997-2012. The dependent variable, *Synergy*, is the weighted average of the cumulative abnormal returns of acquirer and target firms over days −1, 0, and +1, where day 0 is the merger announcement day. The weights are based on the market values of equity of acquirer and target four days prior to the announcement day. *MergerType*1 is a dummy variable equal to one for single-segment acquirer and target in different industries, *MergerType*2 is a dummy variable equal to one when one or both acquirer and target are multi-segment with no common industry segments, and *MergerType*3 is a dummy variable equal to one when each of the merging firms is either single- or multi-segment and have at least one segment in the same industry. The dummy variables *Vertical*, *Horizontal*, and *Conglomerate* are equal to one for vertical, horizontal, and conglomerate mergers, respectively; and are constructed using the algorithm in Fan and Goyal (2006). All regressions are estimated without an intercept so there is not a left-out or baseline merger group. All variables are defined in Appendix B, and all variables are winsorized at the 1st and 99th percentiles except *HCR*, *PMR*, dummy variables. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

Variable	Full sample (1)	Excluding *HCR* = 1 (2)	Only *MergerType*2 (3)	Full sample (4)	Only *Conglomerate* (5)
HCR × *MergerType*1	1.957	2.031			
	(1.06)	(1.11)			
HCR × *MergerType*2	2.254	2.443*	4.665**		
	(1.49)	(1.69)	(2.58)		
HCR × *MergerType*3	2.397	2.724*			
	(1.50)	(1.67)			
HCR × *Vertical*				1.178	
				(0.88)	
HCR × *Horizontal*				1.405	
				(0.68)	
HCR × *Conglomerate*				2.720***	2.983***
				(3.36)	(2.96)
PMR	2.626*	2.552**	5.764*	2.353*	3.335**
	(1.95)	(2.00)	(2.50)	(1.67)	(2.53)
HCR × *PMR*	–2.631*	–2.208	–7.317***	–2.272	–3.099**
	(–1.90)	(–1.54)	(–2.59)	(–1.51)	(–1.99)
*MergerType*1	8.345***	7.612***			
	(4.11)	(4.10)			
*MergerType*2	8.491***	7.978***			
	(4.74)	(5.34)			
*MergerType*3	8.234***	7.518***			
	(3.28)	(2.88)			
Vertical				8.656***	
				(4.78)	
Horizontal				9.085***	
				(3.49)	
Conglomerate				8.226***	
				(4.64)	
Controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.20	0.20	0.37	0.20	0.17
No. of observations	1,127	827	175	1,127	525

Table 7

The effect of human capital relatedness on post-merger operating performance

The table examines the effect of human capital relatedness (*HCR*) on post-merger operating performance. The sample includes deals announced during the period 1997-2012. The dependent variable is the change in post-merger industry-adjusted operating performance from year +1 to +2 and from year +1 to +3 (one- and two-year horizons), where year 0 is the merger announcement year. Operating performance is measured as the ratio of operating income before depreciation to total net sales. Industry-adjusted operating performance is the difference between a firm's operating performance and the median operating performance for firms in the same three-digit SIC code. Panel A regressions do not condition *HCR* by type of merger. Regressions (3) and (6) exclude mergers between single segment firms in the same industry (i.e., cases where *HCR* = 1). Panel B regressions condition *HCR* by type of merger. *MergerType*1 is a dummy variable equal to one for single-segment acquirer and target in different industries, *MergerType*2 is a dummy variable equal to one when one or both acquirer and target are multi-segment with no common industry segments, and *MergerType*3 is a dummy variable equal to one when each of the merging firms is either single- or multi-segment and have at least one segment in the same industry. The dummy variables *Vertical*, *Horizontal*, and *Conglomerate* are equal to one for vertical, horizontal, and conglomerate mergers, respectively; and are constructed using the algorithm in Fan and Goyal (2006). All Panel B regressions are estimated without an intercept so there is not a left-out or baseline merger group. Regressions (2) and (7) exclude mergers between single segment firms in the same industry (i.e., cases where *HCR* = 1), regressions (3) and (8) are estimated using type 2 mergers only, and regressions (5) and (10) are estimated using conglomerate mergers only. The control variables are those used in Panel A. All variables are defined in Appendix B and all variables are winsorized at the 1st and 99th percentiles except *HCR* and *PMR*. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A. All merger types

	Dependent variable is change in post-merger industry-adjusted operating performance					
	From year +1 to +2			From year +1 to +3		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
HCR	0.027*	0.028**	0.041***	0.016	0.019*	0.029**
	(1.90)	(2.16)	(3.01)	(1.29)	(1.86)	(2.55)
PMR	0.017	0.009	0.014	0.023	0.018	0.002
	(0.72)	(0.54)	(0.63)	(0.72)	(0.62)	(0.05)
HCR × PMR	–0.020	–0.017	–0.037	–0.019	–0.026	–0.006
	(–0.76)	(–0.83)	(–1.44)	(–0.60)	(–0.93)	(–0.16)
Relative size		0.015	0.004		0.032*	0.004
		(0.89)	(0.92)		(1.94)	(1.03)
Total assets of acquirer		–0.003	–0.007*		0.000	–0.008
		(–0.82)	(–1.69)		(0.08)	(–1.52)
Total assets of target		0.001	0.005		–0.002	0.002
		(0.29)	(1.61)		(–0.45)	(0.65)
Market-to-book of acquirer		–0.010***	–0.008***		–0.006***	–0.005
		(–7.69)	(–3.06)		(–2.95)	(–1.54)
Market-to-book of target		–0.001	–0.001		–0.005	–0.002
		(–0.43)	(–0.42)		(–1.45)	(–0.58)
Leverage ratio of acquirer		0.004	0.016		0.029	0.047
		(0.11)	(0.39)		(1.02)	(1.38)
Leverage ratio of target		–0.004	–0.002		0.040	0.043
		(–0.20)	(–0.09)		(1.60)	(1.46)
Cash holdings of acquirer		0.023	0.032		0.083**	0.097***
		(0.59)	(0.81)		(2.25)	(2.69)
Cash holdings of target		0.012	0.028		0.020	0.038
		(0.70)	(1.16)		(0.68)	(1.17)
Adjusted R-squared	0.002	0.04	0.04	0.001	0.04	0.07
No. of observations	964	964	709	878	878	642

(*continued*)

Table 7 – *continued*

Panel B. Mergers grouped by type

	Dependent variable is change in post-merger industry-adjusted operating performance									
	From year +1 to +2					From year +1 to +3				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
HCR × *MergerType*1	0.048	0.058				0.001	–0.011			
	(0.95)	(1.07)				(0.03)	(–0.18)			
HCR × *MergerType*2	0.062**	0.069**	0.076***			0.063*	0.059*	0.080***		
	(1.96)	(2.14)	(2.81)			(1.94)	(1.85)	(3.00)		
HCR × *MergerType*3	0.020	0.030				–0.003	0.012			
	(0.83)	(1.19)				(–0.11)	(0.36)			
HCR × *Vertical*				–0.034					0.020	
				(–0.86)					(0.40)	
HCR × *Horizontal*				0.057**					0.057	
				(2.22)					(1.44)	
HCR × *Conglomerate*				0.027**	0.041***				0.015	0.032**
				(1.96)	(3.08)				(1.01)	(2.41)
PMR	0.003	0.011	0.047*	0.012	0.039	0.012	0.000	0.046**	0.023	0.036
	(0.13)	(0.47)	(1.75)	(0.58)	(1.46)	(0.41)	(0.01)	(2.44)	(0.72)	(0.89)
HCR × *PMR*	–0.006	–0.032	–0.092**	–0.022	–0.063**	–0.018	–0.002	–0.088***	–0.030	–0.067*
	(–0.25)	(–1.20)	(–2.40)	(–0.91)	(–2.40)	(–0.56)	(–0.04)	(–2.74)	(–0.94)	(–1.68)
*MergerType*1	–0.001	–0.006				–0.031	–0.004			
	(–0.03)	(–0.16)				(–0.84)	(–0.09)			
*MergerType*2	–0.030	–0.030				–0.058	–0.020			
	(–0.95)	(–0.98)				(–1.65)	(–0.53)			
*MergerType*3	–0.004	–0.006				–0.021	0.005			
	(–0.11)	(–0.15)				(–0.44)	(0.09)			
Vertical				0.043					–0.024	
				(0.96)					(–0.55)	
Horizontal				–0.022					–0.080*	
				(–0.67)					(–1.71)	
Conglomerate				–0.001					–0.036	
				(–0.04)					(–1.18)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.04	0.05	0.19	0.04	0.09	0.04	0.08	0.24	0.05	0.10
No. of observations	964	709	150	964	446	878	642	137	878	415

Table 8

The effect of human capital relatedness on post-merger change in employment

The table reports regressions of the change in number of employees on human capital relatedness (*HCR*), product market relatedness (*PMR*), and the interaction between *HCR* and *PMR*. The sample includes deals announced during the period 1997-2012. The dependent variable is the average post-merger industry-adjusted number of employees in years + 1 and +2 (or +1, +2, and +3) minus the pre-merger industry-adjusted number of employees in year –1, where year 0 is the merger announcement year. The pre-merger industry-adjusted number of employees is the sum of the acquirer and target industry-adjusted number of employees. Industry-adjusted number of employees is the difference between a firm's number of employees and the median number of employees for firms in the same three-digit SIC code. Panel A regressions do not condition *HCR* by type of merger. Regressions (3), (4), (7), and (8) excluded mergers between single segment firms in the same industry (i.e., cases where *HCR* = 1). Panel B regressions condition *HCR* by type of merger. *MergerType*1 is a dummy variable equal to one for single-segment acquirer and target in different industries, *MergerType*2 is a dummy variable equal to one when one or both acquirer and target are multi-segment with no common industry segments, and *MergerType*3 is a dummy variable equal to one when each of the merging firms is either single- or multi-segment and have at least one segment in the same industry. The dummy variables *Vertical*, *Horizontal*, and *Conglomerate* are equal to one for vertical, horizontal, and conglomerate mergers, respectively; and are constructed using the algorithm in Fan and Goyal (2006). All Panel B regressions are estimated without an intercept so there is not a left-out or baseline merger group. Regressions (2) and (7) exclude mergers between single segment firms in the same industry (i.e., cases where *HCR* = 1), regressions (3) and (8) are estimated using type 2 mergers only, and regressions (5) and (10) are estimated using conglomerate mergers only. The control variables are those used in Tables 4-6. All variables are defined in Appendix B and all variables are winsorized at the 1st and 99th percentiles except *HCR* and *PMR*. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

	Dependent variable is average post-merger industry-adjusted employment minus pre-merger industry-adjusted employment							
	Average of years +1 and +2 versus –1				Average of years +1, +2, and +3 versus –1			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. All merger types								
HCR	–6.538*	–16.306**	–12.211**	–21.333**	–6.846	–18.584**	–12.784**	–24.405***
	(–1.68)	(–2.05)	(–2.31)	(–2.44)	(–1.44)	(–2.20)	(–1.99)	(–2.72)
PMR		–9.973**		–11.502**		–11.130**		–13.978***
		(–2.01)		(–1.97)		(–2.13)		(–2.58)
HCR × *PMR*		17.663**		19.882*		20.842***		25.566***
		(2.17)		(1.88)		(2.71)		(3.04)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.08	0.09	0.10	0.11	0.07	0.09	0.10	0.11
No. of observations	921	921	676	676	838	838	614	614

(*continued*)

Table 8 – *continued*

	Dependent variable is average post-merger industry-adjusted employment minus pre-merger industry-adjusted employment									
	Average of years +1 and +2 versus –1					Average of years +1, +2, and +3 versus –1				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel B. Mergers grouped by type										
HCR × *MergerType*1	–8.989	–10.817				–12.300***	–16.022**			
	(–1.55)	(–1.44)				(–1.99)	(–2.23)			
HCR × *MergerType*2	–64.711**	–64.858***	–55.756***			–66.746**	–67.150***	–56.755***		
	(–2.51)	(–2.66)	(–2.60)			(–2.44)	(–2.62)	(–2.68)		
HCR × *MergerType*3	–9.693	–15.734				–13.274	–19.845			
	(–0.84)	(–1.08)				(–1.06)	(–1.26)			
HCR × *Vertical*				–19.441					–15.102	
				(–0.94)					(–0.60)	
HCR × *Horizontal*				–3.533					–8.218	
				(–0.57)					(–1.39)	
HCR × *Conglomerate*				–21.875**	–29.649***				–25.075***	–32.403***
				(–2.44)	(–2.68)				(–2.69)	(–2.78)
PMR	–7.753	–9.745	–14.442	–7.167	–17.912***	–8.418	–11.855*	–11.831	–8.495*	–19.642***
	(–1.33)	(–1.43)	(–1.11)	(–1.57)	(–2.86)	(–1.37)	(–1.72)	(–0.87)	(–1.80)	(–3.06)
HCR × *PMR*	12.517	15.292	9.042	12.997	32.948***	15.067	20.647*	8.021	16.427**	35.774***
	(1.25)	(1.19)	(0.29)	(1.63)	(3.06)	(1.50)	(1.74)	(0.21)	(2.23)	(3.33)
*MergerType*1	34.864***	44.065***				37.126***	47.434***			
	(3.71)	(4.09)				(3.66)	(4.30)			
*MergerType*2	55.308***	64.121***				56.542***	65.989***			
	(3.22)	(3.61)				(3.04)	(3.53)			
*MergerType*3	35.883***	48.469***				39.363***	52.504***			
	(2.94)	(3.52)				(2.81)	(3.37)			
Vertical				43.317**					41.854*	
				(2.28)					(1.87)	
Horizontal				30.266***					34.260***	
				(3.09)					(3.17)	
Conglomerate				40.514***					42.411***	
				(3.22)					(3.11)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.12	0.14	0.29	0.09	0.14	0.13	0.15	0.32	0.10	0.16
No. of observations	921	676	140	921	424	838	614	128	838	391

Table 9

The effect of human capital relatedness on post-merger change in selling, general, and administrative expense

The table reports regressions of the change in selling, general, and administrative expense (SG&A) on human capital relatedness (*HCR*), product market relatedness (*PMR*), and the interaction between *HCR* and *PMR*. The sample includes deals announced during the period 1997-2012. The dependent variable is the average post-merger industry-adjusted SG&A in years + 1 and +2 (or +1, +2, and +3) minus the pre-merger industry-adjusted SG&A in year –1, where year 0 is the merger announcement year. The pre-merger industry-adjusted SG&A is the sum of the acquirer and target industry-adjusted SG&A. Industry-adjusted SG&A is the difference between a firm's SG&A and the median SG&A for firms in the same three-digit SIC code. Panel A regressions do not condition *HCR* by type of merger. Regressions (3), (4), (7), and (8) excluded mergers between single segment firms in the same industry (i.e., cases where *HCR* = 1). Panel B regressions condition *HCR* by type of merger. *MergerType*1 is a dummy variable equal to one for single-segment acquirer and target in different industries, *MergerType*2 is a dummy variable equal to one when one or both acquirer and target are multi-segment with no common industry segments, and *MergerType*3 is a dummy variable equal to one when each of the merging firms is either single- or multi-segment and have at least one segment in the same industry. The dummy variables *Vertical*, *Horizontal*, and *Conglomerate* are equal to one for vertical, horizontal, and conglomerate mergers, respectively; and are constructed using the algorithm in Fan and Goyal (2006). All Panel B regressions are estimated without an intercept so there is not a left-out or baseline merger group. Regressions (2) and (7) exclude mergers between single segment firms in the same industry (i.e., cases where *HCR* = 1), regressions (3) and (8) are estimated using type 2 mergers only, and regressions (5) and (10) are estimated using conglomerate mergers only. The control variables are those used in Tables 4-6. All variables are defined in Appendix B and all variables are winsorized at the 1st and 99th percentiles except *HCR* and *PMR*. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

	Dependent variable is average post-merger industry-adjusted SG&A minus pre-merger industry-adjusted SG&A							
	Average of years +1 and +2 versus –1				Average of years +1, +2, and +3 versus –1			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. All merger types								
HCR	–0.703***	–1.345**	–0.917***	–1.619**	–0.735***	–1.449***	–1.019***	–1.773***
	(–2.69)	(–2.48)	(–2.80)	(–2.53)	(–2.62)	(–2.65)	(–3.01)	(–2.90)
PMR		–0.595		–0.746		–0.607		–0.785
		(–1.36)		(–1.53)		(–1.23)		(–1.46)
HCR × *PMR*		1.128*		1.460*		1.229*		1.586**
		(1.83)		(1.92)		(1.95)		(2.11)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.09	0.09	0.10	0.11	0.07	0.08	0.09	0.10
No. of observations	798	798	592	592	729	729	537	537

(*continued*)

Table 9 – *continued*

	Dependent variable is average post-merger industry-adjusted SG&A minus pre-merger industry-adjusted SG&A									
	Average of years +1 and +2 versus –1					Average of years +1, +2, and +3 versus –1				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel B. Mergers grouped by type										
HCR × *MergerType*1	–0.653	–0.780				–0.841	–1.034			
	(–1.26)	(–1.23)				(–1.50)	(–1.56)			
HCR × *MergerType*2	–5.379**	–5.382**	–4.506**			–5.276**	–5.251**	–3.886**		
	(–2.38)	(–2.50)	(–2.54)			(–2.32)	(–2.44)	(–2.28)		
HCR × *MergerType*3	–1.314	–1.360				–1.529*	–1.777			
	(–1.62)	(–1.14)				(–1.82)	(–1.45)			
HCR × *Vertical*				–1.349					–1.333	
				(–0.98)					(–0.85)	
HCR × *Horizontal*				–0.404					–0.592	
				(–0.79)					(–1.06)	
HCR × *Conglomerate*				–1.678***	–2.105***				–1.831***	–2.212***
				(–3.07)	(–3.46)				(–3.21)	(–3.53)
PMR	–0.549	–0.661	–1.339	–0.387	–0.410	–0.574	–0.737	–0.670	–0.421	–0.427
	(–1.50)	(–1.52)	(–1.15)	(–0.82)	(–0.71)	(–1.47)	(–1.61)	(–0.58)	(–0.80)	(–0.69)
HCR × *PMR*	0.842	1.082	1.033	0.807	1.549**	0.967*	1.282*	–0.057	0.915	1.617**
	(1.51)	(1.41)	(0.35)	(1.26)	(2.15)	(1.76)	(1.75)	(–0.02)	(1.40)	(2.23)
*MergerType*1	2.969***	3.311***				2.766***	3.201***			
	(4.22)	(4.09)				(3.84)	(4.13)			
*MergerType*2	4.202***	4.435***				3.859***	4.181***			
	(3.48)	(3.60)				(3.15)	(3.54)			
*MergerType*3	3.379***	3.626***				3.242***	3.720***			
	(4.03)	(3.44)				(3.73)	(3.35)			
Vertical				3.054**					2.739*	
				(2.23)					(1.81)	
Horizontal				2.526***					2.412**	
				(2.66)					(2.42)	
Conglomerate				3.334***					3.125***	
				(3.96)					(3.68)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.14	0.16	0.35	0.10	0.11	0.13	0.15	0.36	0.09	0.11
No. of observations	798	592	119	798	383	729	537	110	729	354

Table 10

Human capital relatedness and post-merger labor productivity

The table examines the effect of human capital relatedness (*HCR*) on post-merger labor productivity. The sample includes deals announced during the period 1997-2012. The dependent variable is the average post-merger industry-adjusted labor productivity in years + 1 and +2 (or +1, +2, and +3) minus the pre-merger industry-adjusted labor productivity in year –1, where year 0 is the merger announcement year. In Panel A (B), labor productivity is the ratio of operating cash flow to employment (selling, general, and administrative expense). Pre-merger industry-adjusted labor productivity is the ratio of the sum of acquiring and target industry-adjusted operating cash flow to the sum of industry-adjusted employees or selling, general, and administrative expense. Industry adjusted values are net of the corresponding median value for firms in the same three-digit SIC code. All regressions exclude mergers between single segment firms in the same industry (i.e., cases where *HCR* = 1). In Panels A and B, the intercept is not reported in regressions (1) and (4) and regressions (2), (3), (5), (6) are estimated without an intercept. The control variables are those used in Tables 4-6. All variables are defined in Appendix B and all variables are winsorized at the 1st and 99th percentiles except *HCR* and *PMR*. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

	Dependent variable is average post-merger labor productivity minus pre-merger labor productivity					
	Average of years +1 and +2 versus –1			Average of years +1, +2, and +3 versus –1		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Labor productivity is ratio of operating cash flow to employment						
HCR	20.012			23.222*		
	(1.43)			(1.70)		
HCR × *MergerType*1		–8.131			–15.230	
		(–0.62)			(–0.91)	
HCR × *MergerType*2		25.864*			33.140**	
		(1.81)			(2.15)	
HCR × *MergerType*3		0.068			–13.945	
		(0.00)			(–0.34)	
HCR × *Vertical*			23.401			33.110
			(0.93)			(1.03)
HCR × *Horizontal*			54.700*			51.240
			(1.79)			(1.46)
HCR × *Conglomerate*			4.238			5.578
			(0.38)			(0.48)
PMR	34.499**	32.719**	40.704**	50.363***	45.233***	55.055***
	(2.06)	(2.04)	(2.27)	(2.63)	(2.65)	(2.97)
HCR × *PMR*	–52.744**	–50.799**	–64.324***	–74.505***	–67.899***	–85.455***
	(–2.48)	(–2.36)	(–2.68)	(–2.62)	(–2.67)	(–3.08)
*MergerType*1		–12.068			–19.027	
		(–0.95)			(–0.95)	
*MergerType*2		–31.524*			–41.797	
		(–1.76)			(–1.59)	
*MergerType*3		0.104			7.906	
		(0.00)			(0.24)	
Vertical			–25.664			–45.693
			(–1.17)			(–1.40)
Horizontal			–45.943**			–49.241*
			(–2.09)			(–1.78)
Conglomerate			–21.892*			–33.218
			(–1.70)			(–1.40)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.04	0.06	0.06	0.04	0.06	0.06
No. of observations	597	597	597	536	536	536

(*continued*)

Table 10 – *continued*

	Dependent variable is average post-merger labor productivity minus pre-merger labor productivity					
	Average of years +1 and +2 versus –1			Average of years +1, +2, and +3 versus –1		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Panel B. Labor productivity is ratio of operating cash flow to selling, general, and administrative expense						
HCR	0.348*			0.389*		
	(1.74)			(1.83)		
HCR × *MergerType*1		0.217			0.268	
		(0.73)			(0.72)	
HCR × *MergerType*2		0.155			0.197	
		(1.19)			(1.24)	
HCR × *MergerType*3		0.514			0.351	
		(1.28)			(0.81)	
HCR × *Vertical*			0.275			0.377
			(1.07)			(1.30)
HCR × *Horizontal*			1.448**			1.325
			(2.38)			(1.54)
HCR × *Conglomerate*			0.174			0.197
			(1.23)			(1.22)
PMR	0.267*	0.297*	0.471**	0.348*	0.350*	0.507**
	(1.73)	(1.93)	(2.50)	(1.71)	(1.79)	(2.12)
HCR × *PMR*	–0.113	–0.169	–0.386	–0.247	–0.262	–0.482
	(–0.49)	(–0.67)	(–1.42)	(–0.72)	(–0.77)	(–1.35)
*MergerType*1		0.095			–0.032	
		(0.21)			(–0.06)	
*MergerType*2		0.165			0.057	
		(0.43)			(0.12)	
*MergerType*3		–0.032			0.048	
		(–0.07)			(0.08)	
Vertical			0.118			–0.086
			(0.31)			(–0.18)
Horizontal			–0.785			–0.754
			(–1.10)			(–0.83)
Conglomerate			0.171			0.033
			(0.47)			(0.07)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.03	0.03	0.05	0.03	0.03	0.04
No. of observations	523	523	523	470	470	470

Table 11

Descriptive statistics and correlations for the asset sale sample

The table reports descriptive statistics (Panel A) and Pearson correlation coefficients (Panel B) for the sample of asset sales announced during the period 1997 to 2013. All variables are defined in Appendix B, and all variables are winsorized at the 1st and 99th percentiles of their distributions except *HCR^* and HCR_a. We use a, b, and c to denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Descriptive Statistics

Variable	Mean	Std. Dev.	25th Pctl.	Median	75th Pctl.	Obs.
*HCR^*	0.904	0.155	0.895	0.968	0.988	1,225
HCR_a	0.645	0.312	0.341	0.747	0.914	1,161
Parent CAR (%)	1.987	7.270	–1.445	0.568	3.591	1,225
Relative transaction size	0.124	0.202	0.012	0.043	0.142	1,223
Transaction value ($millions)	657.95	1,310.87	130.00	233.00	540.00	1,225
Prior returns of parent	0.004	0.365	–0.208	–0.030	0.160	1,225
Total assets of parent	8.947	1.732	7.668	8.956	10.248	1,223
Market-to-book of parent	1.658	0.968	1.120	1.341	1.804	1,210
Leverage ratio of parent	0.332	0.198	0.193	0.313	0.426	1,222
Return on assets of parent	0.114	0.075	0.077	0.108	0.157	1,216
Free cash flow of parent	–0.001	0.107	–0.022	0.021	0.054	1,216
Cash holdings of parent	0.130	0.168	0.021	0.067	0.171	1,223

Panel B. Pearson correlation coefficients

	1	2	3	4	5	6	7	8	9	10	11	12
1. *HCR^*	1.00											
2. HCR_a	0.01	1.00										
3. Parent CAR (%)	–0.03	–0.01	1.00									
4. Relative transaction size	–0.07[b]	–0.12[a]	0.21[a]	1.00								
5. Transaction value ($millions)	–0.05[c]	–0.07[b]	0.03	0.25[a]	1.00							
6. Prior returns of parent	0.01	–0.06[b]	–0.09[a]	0.12[a]	0.02	1.00						
7. Total assets of parent	0.02	0.06[b]	–0.18[a]	–0.57[a]	0.26[a]	–0.08[a]	1.00					
8. Market-to-book of parent	–0.08[a]	–0.01	–0.03	0.23[a]	0.07[b]	0.16[a]	–0.09[a]	1.00				
9. Leverage ratio of parent	0.02	–0.02	0.07[b]	0.02	–0.07[a]	–0.01	–0.09[a]	–0.20[a]	1.00			
10. Return on assets of parent	–0.03	0.03	–0.11[a]	–0.12[a]	0.10[a]	0.04	0.13[a]	0.34[a]	–0.29[a]	1.00		
11. Free cash flow of parent	–0.02	–0.09[a]	–0.04	–0.12[a]	0.09[a]	0.03	0.15[a]	0.17[a]	–0.29[a]	0.61[a]	1.00	
12. Cash holdings of parent	–0.16[a]	–0.07[b]	0.07[b]	0.27[a]	–0.02	0.09[a]	–0.23[a]	0.38[a]	–0.24[a]	–0.11[a]	0.07[b]	1.00

Table 12

The effect of human capital on the probability of asset sales and returns from asset sales

Panel A reports probit regressions of the probability of asset sale as a function of the correlation of the parent firm's human capital profile vector in the year before the asset sale (*H*) with the parent firm's human capital profile vector the year after the asset sale (*H*^). Thus, *HCR*^ is the scalar product of the parent firm's human capital profile vectors, *H* and *H*^, divided by the product of their lengths. All variables in the regression are defined in Appendix B, and all variables are winsorized at the 1st and 99th percentiles except *HCR*^. Each parent firm in the sample has one pseudo parent firm as a control. Columns (1) and (2) report probit regressions using control sample 1 and columns (3) and (4) report probit regressions using control sample 2. The algorithms used to construct control samples 1 and 2 are described in Appendix C. Coefficients, *z*-statistics (in parenthesis), and economic significance are reported. Economic significance is the marginal change in probability of asset sale for a one standard deviation change in the variable, holding all other variables constant at their means. The *z*-statistics are computed using robust standard errors clustered at the year level. Panel B reports regressions of asset sale announcement returns on *HCR*^ and HCR_a, where *HCR*^ is defined above and HCR_a is the scalar product of the divested unit's and acquiring firm's human capital profile vectors, divided by the product of their lengths. The dependent variable is the parent firm's cumulative abnormal return over days –1, 0, and +1, where day 0 is the asset sale announcement day. In columns (3)-(5), *DHCR*^ is a dummy variable equal to one if *HCR*^ is less than or equal to the 25th percentile of *HCR*^, and zero otherwise; and $DHCR_a$ is a dummy variable equal to one if HCR_a is greater than or equal to the median of *HCRa*, and zero otherwise. All variables are defined in Appendix B, and all variables are winsorized at the 1st and 99th percentiles except *HCR*^, HCR_a, *DHCR*^, and $DHCR_a$. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered at the year level. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Probit regressions of the probability of asset sale on human capital relatedness

	Control sample 1		Control sample 2	
Variable	(1)	(2)	(3)	(4)
HCR^	–0.537***	–0.503***	–0.896***	–0.827***
	(–3.21)	(–2.99)	(–5.05)	(–4.67)
	–0.033	–0.030	–0.052	–0.047
Total assets of parent		0.085***		0.082***
		(5.39)		(5.20)
		0.058		0.055
Market-to-book of parent		0.039		0.038
		(1.38)		(1.36)
		0.017		0.016
Leverage ratio of parent		0.271*		0.265*
		(1.94)		(1.89)
		0.022		0.021
Return on assets of parent		–1.062**		–1.044**
		(–2.36)		(–2.31)
		–0.034		–0.033
Free cash flow of parent		–0.388		–0.382
		(–1.17)		(–1.15)
		–0.016		–0.015
Cash holdings of parent		–0.204		–0.216
		(–1.20)		(–1.27)
		–0.015		–0.015
Constant	0.491***	–0.286	0.824***	0.040
	(3.16)	(–1.21)	(4.99)	(0.16)
Pseudo R-squared	0.003	0.02	0.01	0.03
Observed prob. asset sale	0.50	0.50	0.50	0.50
Predicted prob. asset sale	0.50	0.50	0.50	0.50
No. of observations	2,476	2,476	2,476	2,476

(*continued*)

Table 12 – *continued*

Panel B. Regressions of parent firm cumulative abnormal returns from asset sale on human capital relatedness

	(1)	(2)	(3)	(4)	(5)
*HCR^*	–3.118**	–3.282**			
	(–1.97)	(–2.19)			
HCR_a		0.859			
		(0.99)			
*DHCR^*			1.438**	1.601**	
			(2.20)	(2.53)	
$DHCR_a$				0.693*	
				(1.72)	
$(1 - DHCR^{\wedge}) \times DHCR_a$					0.733*
					(1.72)
$DHCR^{\wedge} \times (1 - DHCR_a)$					1.677**
					(2.05)
$DHCR^{\wedge} \times DHCR_a$					2.247**
					(2.57)
Relative transaction size	8.202***	8.538***	8.066***	8.411***	8.414***
	(4.01)	(3.87)	(3.89)	(3.75)	(3.75)
Prior returns of parent	–2.460	–2.394	–2.430	–2.371	–2.368
	(–1.56)	(–1.51)	(–1.56)	(–1.51)	(–1.51)
Total assets of parent	–0.361**	–0.371*	–0.386**	–0.393**	–0.393**
	(–1.98)	(–1.95)	(–2.21)	(–2.24)	(–2.21)
Market-to-book of parent	–0.027	–0.027	–0.021	–0.021	–0.021
	(–0.13)	(–0.12)	(–0.10)	(–0.09)	(–0.09)
Leverage ratio of parent	1.018	0.924	0.968	0.860	0.863
	(0.80)	(0.72)	(0.75)	(0.67)	(0.68)
Return on assets of parent	–9.467**	–10.250**	–9.022**	–9.962**	–9.973**
	(–2.28)	(–2.41)	(–2.21)	(–2.38)	(–2.39)
Free cash flow of parent	3.844	4.460	3.502	4.225	4.240
	(1.21)	(1.35)	(1.13)	(1.32)	(1.32)
Cash holdings of parent	0.602	0.515	0.690	0.666	0.665
	(0.36)	(0.29)	(0.41)	(0.38)	(0.38)
Constant	7.893***	7.876***	4.985***	4.993***	4.965**
	(2.79)	(3.00)	(2.68)	(2.68)	(2.57)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.11	0.11	0.11	0.12	0.12
No. of observations	1,203	1,159	1,203	1,159	1,159