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Global diversification and IPO returns ☆

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ABSTRACT

A large number of newly listed firms have significant involvement in international business activity. In this paper, we examine the effect of international business activity on the pricing of initial public offerings (IPOs), post-IPO performance, and survival. In a large sample of U.S. IPOs over 1981–2012, we find that firms with exports and/or foreign sales prior to going public have significantly lower underpricing than firms without international business activity. Furthermore, firms with international business activity significantly outperform purely domestic IPO firms over 3- and 5-year periods after going public and have a significantly higher survival rate. Overall, we provide strong evidence that global diversification has an economically significant effect on the valuation and subsequent performance of firms going public.

1. Introduction

With the increasing importance of market globalization, firms have become more involved in international trade and foreign direct investment. By operating in foreign markets, firms may expand their revenue base and diversify the risk of domestic cash flow shocks. Global diversification may also enhance firm value by helping to "complete the market" in the face of international capital market segmentation and/or frictions.[3] In contrast with this possible value-enhancing perspective, foreign operations entail complexities from monitoring and communication, as well as the risks of country default, exchange rate fluctuations, and unstable political regimes. The literature generally finds mixed support for the influence of international activity on firm performance. A number of studies document that firms engaged in export activity have better operating performance than do peer-firms that sell domestically only (see, e.g., De Loecker (2007), Greenaway et al. (2007), and Park et al. (2010)). Furthermore, Gande et al. (2009) find that global diversification – as measured by foreign sales – increases firm value and Reeb et al. (2001) find that global diversification promotes credit ratings and decreases the cost of debt. Other studies, however, argue that international business activity (i.e., exports and/or foreign sales) decreases firm value. For example, Denis et al. (2002) document that global diversification carries an average valuation discount of 18%.[4]

To the best of our knowledge, the literature on the costs and benefits of global diversification has focused exclusively on large publicly-traded multinational corporations. Although this is clearly an obvious and relevant group of companies to study, a large

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[3] For example, see Errunza and Senbet (1981, 1984), Errunza and Losq (1985, 1989), Merton (1987), and Mauer and Senbet (1992).

[4] From a contingent claims perspective, Doukas and Kan (2006) argue that risk-reducing global diversification should increase bondholder value and decrease shareholder value. The upshot is that global diversification may not decrease overall firm value. Consistent with their argument, they find that the global diversification discount is increasing with leverage and that globally diversified all-equity firms trade at a premium.

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number of small private (i.e., not yet publicly traded) companies are actively involved in international business activity. In our sample of 4994 IPOs from 1981 to 2012, we find that more than a quarter of the firms going public have exports and/or foreign sales in the year of and the year before the initial public offering. For this group of firms, the average amount of exports and/or foreign sales to total firm sales is 30% in the year prior to the IPO year. In this paper, we contribute to the debate on the costs and benefits of global diversification by focusing on the international business activity of private firms in the years immediately surrounding their initial public offering. We examine the effect of international business activity on the valuation, long-run performance, and survival of newly public firms.

A large body of literature documents that IPOs are underpriced as evidenced by an initial offer price below the closing price at the end of the first day of trading.[5] The literature argues that uncertainty about the firm's business, operations, strategy, and ultimately future earnings is an important determinant of underpricing because shares must be offered at a discount to compensate investors for uncertainty. A key question for this study is whether international business activity influences underpricing. On the one hand, if involvement in international markets provides a profit cushion to firms and/or diversifies domestic earnings, investors should have lower uncertainty about earnings prospects. Thus, the lower uncertainty associated with a globally diversified earnings stream could encourage firms and their investment bankers to offer the shares in the IPO at a higher offer price relative to the expected secondary market trading price and therefore IPO underpricing would be lower. On the other hand, if exports and/or foreign production bring additional risks that offset the benefits of global diversification, then we might expect globally diversified firms to face larger underpricing than domestically focused firms. We can therefore assess the relative benefits and costs of global diversification by studying whether international business activity around the time of the IPO influences IPO underpricing.

In addition to being underpriced on average, it is well documented that IPO firms underperform the market and matching firms after going public (see, e.g., Ritter (1991) and Loughran and Ritter (1995)).[6] Consistent with this long-run underperformance, a number of studies also document a low survival rate of newly listed firms (see, e.g., Jain and Kini (2000, 2008) and Fama and French (2004)). If global diversification has persistent benefits to firms going public, then we might expect less post-issue underperformance and a higher survival rate of newly listed firms with international business activity. Of course, if international business activity brings additional shocks to earnings that cannot be mitigated through diversification and/or hedging, then we would expect worse underperformance and survival of IPO firms with exports and/or foreign sales.

In this paper, we investigate the impact of global diversification on the underpricing and post-issue performance of firms going public. As noted above, 1384 or 27.7% of our sample IPO firms have exports and/or foreign sales in the year of the IPO and the year before. Relative to domestically focused IPO firms, globally diversified IPO firms tend to have higher productivity, higher investment (capital expenditures and R&D), and greater age at the time they go public. Interestingly, however, they are not always larger. While the average and median IPO firms with foreign operations tend to be roughly double the size of their purely domestic counterparts – as measured by market capitalization, assets, or sales – the average and median exporting IPO firms are significantly smaller.

Controlling for IPO and firm characteristics known to influence underpricing as well as time and industry fixed effects, we find that global diversification significantly decreases underpricing. Depending on whether the IPO firm is an exporter and/or has foreign sales, estimates from multivariate regressions show that underpricing is 2–6% lower for globally diversified IPOs in comparison to domestically-focused IPOs. Furthermore, IPO underpricing is significantly decreasing in the intensity of international business. For example, a one standard deviation increase in the ratio of exports and/or foreign sales to total firm sales decreases underpricing by approximately one percent. These results are robust when we account for the potential influences of endogeneity and selection bias on the relation between underpricing and international business activity. Overall, our analysis strongly supports the notion that global diversification reduces IPO uncertainty and thereby decreases underpricing.

We next compute calendar time abnormal returns and buy-and-hold returns to examine the long-run performance of globally diversified newly-public firms. We find that IPO firms with exports and/or foreign sales significantly outperform IPOs without international business activity over 3 and 5 year periods after the IPO. These results are robust when we use a purged eight-factor model to explain post-IPO returns,[7] when we group IPOs into size-based portfolios, when we group IPOs by post-issue acquisition activity, and when we control for selection bias using propensity score matching.

Lastly, we investigate whether global diversification affects the survival of IPO firms. Specifically, we test whether newly-public firms with international business activity have a lower probability of failure (i.e., being delisted because of bankruptcy or liquidation). Using a hazard model to estimate the influence of IPO and firm characteristics on survival, we find that globally diversified IPO firms have a lower hazard rate (i.e., higher survival rate) than domestic IPO firms. Overall, the evidence from the long-run performance and survival analysis strongly suggests that global diversification mitigates long-run underperformance and enhances long-run survival.

This paper makes four contributions to the literature. First, quite a few firms are actively involved in international business prior to going public. However, global diversification has not been explored as a factor contributing to IPO pricing and subsequent performance. Our paper is the first to document that global diversification is an economically significant determinant of IPO initial returns, long-run performance, and survival of newly public firms. Second, by studying IPO initial and long-run returns, we bring a valuation dimension to the impact of international business activity on firm performance. By comparison, the international economics literature assesses the impact of international business activity on firm performance with non-stock-market based measures of performance (e.g., productivity, capital intensity, and liquidity ratios).[8] Third, to the best our knowledge, empirical studies of global diversification focus on large, publicly-traded firms. None have focused on small firms despite their non-trivial involvement in international markets. Since firm size tends to be small at the IPO stage, our study contributes to the literature on global

[5] See Ritter and Welch (2002), Ljungqvist (2007), and Ritter (2011) for reviews of this literature.

[6] Recent studies argue that long-run underperformance exits only among certain types of IPOs. For example, Brau et al. (2012) find only newly listed firms that acquire within a year after their IPO underperform and Ritter (2011) finds that IPO long-run underperformance is present only in small firms.

[7] The eight factors include the three Fama–French (1993) factors, the Carhart (1997) momentum factor, the Cooper et al. (2008) asset growth factor, the Harvey and Siddique (2000) co-skewness factor, the Lyandres et al. (2008) investment factor, and the Pastor and Stambaugh (2003) liquidity factor. Following Loughran and Ritter (2000), we construct the factors after purging firms that have publicly issued equity in an IPO or SEO during the prior 5 years.

[8] A recent exception is Breinlich (2014), who assesses the effect of trade liberalization on firms by examining stock market reactions to the loosening of trade restrictions.

diversification by documenting the value implications of global diversification for a sample of small firms as they transition from being privately-held to publicly-traded. Lastly, our results have important strategic and investment implications for firms and investors. Specifically, firms going public that have international business activity have significantly lower underpricing and better risk-adjusted long-run returns than firms with purely domestic operations. We find that a strategy of shorting a portfolio of newly public firms with purely domestic operations and investing in a portfolio of newly public firms with international business activity generates positive risk-adjusted returns of about 50–60 basis points per month before transaction costs.

The remainder of the paper is organized as follows. Section 2 provides a brief discussion of our hypotheses. Section 3 describes the data. Section 4 presents our empirical results and Section 5 concludes.

2. Background and hypothesis development

This section draws on the literature in finance and international economics to develop testable hypotheses for the effect of global diversification on IPO underpricing, long-run performance, and survival.

2.1. Global diversification and IPO underpricing

A persistent puzzle about IPOs is that they are underpriced on average or have positive initial returns computed from the offer price to the closing price at the end of the first day of trading. For example, over the period from 1980 to 2014, underpricing of U.S. IPOs averaged 18%.[9] This suggests that on average the offer price is too low and that firms are leaving money on the table. Although a number of explanations have been advanced in the literature for why IPOs are underpriced, at its core the primary driver seems to be lack of information and/or uncertainty about the business and earnings potential of the firm going public. This is especially true for high technology firms where either the technology is so new that it is not "spanned" by existing technologies of publicly traded firms or there is a high degree of uncertainty associated with the future profitability of all firms with that type of technology. A key implication of this explanation is that underpricing is increasing in the degree of uncertainty (see, e.g., Ritter (1984)).[10]

If engaging in international business helps expand and stabilize a firm's revenue base and generally contributes to greater awareness about a firm going public, then we would expect a decrease in uncertainty about the pricing of the IPO. Based on the arguments advanced in the IPO literature, we would therefore expect that a globally diversified firm is more fully priced when it is brought public resulting in lower underpricing. From a similar although different perspective, to the extent that global diversification enhances the spanning of the firm's technology in the secondary market (i.e., where the firm trades once it goes public) or helps complete the market by providing investors access to otherwise segmented markets, we would also expect a decrease in underpricing. We recognize, however, that the additional risks associated with exports and/or foreign sales (e.g., exchange rate fluctuations) and possibly the complexity of managing operations both domestically and abroad might lead to a discount placed on globally diversified IPOs. Thus, although we predict that globally diversified IPOs will have lower underpricing than domestically focused IPOs, it is ultimately an empirical question.

2.2. Global diversification and IPO long-run performance

Another empirical result widely documented in the IPO literature is that newly public firms underperform in the years immediately after the IPO. This long-run underperformance is documented by, for example, Ritter (1991), Loughran and Ritter (1995), and Fama and French (2004). Given that the fundamental value of a firm is its discounted expected future cash flows, global diversification can enhance long-run performance and hence firm value in at least two ways. First, involvement in international business provides an additional revenue channel that may enhance and/or diversify a firm's domestic revenue stream.[11] Second, global diversification may provide a natural hedge of domestic systematic risk (e.g., an economic downturn) that may decrease a firm's discount rate. Consistent with the notion that global diversification is beneficial, recent studies by Santos et al. (2008) and Gande et al. (2009) document that global diversification enhances publicly-traded firms' values.[12] Building on these arguments, we hypothesize that globally diversified IPOs have better long-run performance than domestically focused IPOs. Similar to the prediction on underpricing, however, we recognize that the additional risks inherent in international business activity might offset the long-run benefits of global diversification. Indeed, Denis et al. (2002) argue that global diversification increases coordination and organizational costs, and may engender inefficiencies associated with building a global empire. Thus, like underpricing, it is ultimately an empirical question whether global diversification has a positive effect on long-run performance.

2.3. Global diversification and the survival of IPO firms

Jain and Kini (1994) find a significant decline in operating performance for the median IPO firm over the 3-year period after the IPO. This result and the well documented poor stock market performance over a similar period after the IPO may help explain the low survival rate of newly public firms (see, e.g., Fama and French (2004) and Jain and Kini (2000, 2008)). Studies have shown, however, that firms engaged in international business activity are more financially stable and have higher productivity rates than firms focused purely on domestic business (see, e.g., De Loecker (2007), Greenaway et al. (2007), and Greenaway et al. (2008)). In effect, global business operations provide a cushion to negative domestic economic shocks. Focusing on the experience of newly-public firms, it therefore seems reasonable to postulate that the survival rate of globally diversified IPO firms is higher than that of IPO firms with domestic operations only. Nevertheless, there are additional costs and risks associated with international business that may negatively affect IPO firm survival. For example, Melitz (2003) and Tybout (2003) note that globally diversified firms face a variety of additional costs associated with entering and operating in foreign markets that may impair a firm's ability to deal with economic shocks. Moreover, Greenaway et al. (2008) argue that global firms face more competitors and Baldwin and Yan (2011) argue that global firms are increasingly subject to tariff and exchange

[9] For data on underpricing, see Jay Ritter's website (http://bear.warrington.ufl.edu/ritter/ipodata.htm).

[10] See Ritter and Welch (2002), Ljungqvist (2007), and Ritter (2011) for reviews of explanations for underpricing of IPOs. The spanning argument is formally advanced in Mauer and Senbet (1992). Merton (1987) has a similar explanation to the spanning argument based on market segmentation caused by lack of investor awareness.

[11] See, for example, Melitz (2003) for a dynamic industry model where only the most productive firms export, which leads to a positive feedback effect on a globally diversified firm's profitability.

[12] This contrasts with the well documented empirical finding that *domestic* diversification leads to a discount in firm value. See, for example, the papers by Lang and Stulz (1994), Berger and Ofek (1995), Comment and Jarrell (1995), Servaes (1996), and Lins and Servaes (1999). A number of papers question this finding, however, including Whited (2001), Campa and Kedia (2002), Billett and Mauer (2000, 2003), and Villalonga (2004).

rate shocks. For these reasons, it is unclear whether global diversification helps or hurts the survival of newly public firms.

3. Sample and data

We construct our IPO sample from the Securities Data Corporation (SDC) New Issues database. We obtain initially 12,636 U.S. IPOs between 1981 and 2012. Merging with CRSP leaves 11,454 IPOs. We then apply the following screens:

1. delete 2618 IPOs in the financial industry with SIC codes 6000–6999 and 119 IPOs in regulated industries with SIC codes 4900–4999;
2. delete 589 IPOs with an offer price less than $5;
3. delete 935 REITS, limited partnerships, closed-end funds, ADRs, and unit IPOs; and
4. delete 671 spinoffs and carve-outs.[13]

Applying these screens to the sample of 11,454 IPOs produces a sample of 6522 IPOs. Since we need accounting data to compute many of the variables used in the study, we require that IPO firms are in the Compustat database. We implement this criterion by matching the sample of 6522 IPOs to the CRSP/Compustat Merged database and obtain a sample of 5759 IPOs. Lastly, to ensure a common sample of IPOs throughout most of the analysis, we require that IPOs have non-missing data to compute the baseline variables in our underpricing regressions (see Table 4 and the variable definitions in the Appendix). This results in a final sample of 4994 IPOs over the period from 1981 to 2012.

Following the global diversification literature (e.g., Denis et al. (2002)), we focus on exports and foreign sales. Thus, for each IPO firm in the sample, we gather data on whether the firm has exports and/or foreign sales in the year of the IPO and the year before the IPO. The distinction between exports and foreign sales is that exports are the sale of domestically manufactured products in foreign countries and/or markets, whereas foreign sales result from the sale of products manufactured in a foreign country. Foreign manufactured products may be sold in the U.S. (i.e., domestically), in the foreign country where they are produced, or in another country.[14] We obtain information on export activity from the Compustat Geographic Segment database. An IPO firm is designated as an *Exporter* if at least one business segment reports export sales (variable name *SALEXG*) in the year prior to the IPO and in the IPO year. We obtain information on foreign sales from the Compustat Industrial Fundamental database. An IPO firm is designated as having *Foreign sales* if it has pre-tax foreign income (variable name *PIFO*) in the year prior to the IPO and in the IPO year.[15]

Table 1 reports the distribution of IPOs by year (Panel A) and by industry (Panel B). The table reports four groups of globally diversified IPOs: IPOs with exports, IPOs with foreign sales, IPOs with exports and/or foreign sales, and IPOs with exports and foreign sales.[16] To gauge the intensity of international business activity, the three far right-hand columns of Table 1 report ratios of export sales to total firm sales, foreign sales to total firm sales, and export sales and/or foreign sales to total firm sales by year (Panel A) and by industry (Panel B). All sales figures are from the fiscal year-end prior to the IPO year.[17]

As seen in Panel A, about 28% of the sample has exports and/or foreign sales. For this group of IPO firms, exports and/or foreign sales are on average 30% of total firm sales. It is interesting to note that the number of IPO firms with both exports *and* foreign sales is small, which suggests that globally diversified IPO firms tend to focus on exporting domestically produced goods *or* producing goods abroad and selling them internationally (including back in the U.S.). Also note that exporting is a larger share of international business activity in the 1980s and 1990s, whereas foreign operations predominate in the 2000s.

Panel B reports the sample distribution by Fama–French industry categories. Observe that IPOs with international business activity are fairly evenly distributed across industries. Note also that when the sample is separated into high technology and non-high technology industries, a larger number of globally diversified IPO firms are in high technology industries.

Panel A of Table 2 reports descriptive statistics for the sample. In addition to the global diversification variables, the table reports descriptive statistics for IPO initial return (*Underpricing*), the Butler et al. (2014) robust controls for underpricing regressions, other IPO and firm characteristics, and a list of variables that we use as instruments for the global diversification variables. Definitions for all of these variables in the order in which they appear in Table 2 are provided in the Appendix.

As discussed above, note that a significant fraction of sample IPO firms report exports and/or foreign sales (27.7%) and for these firms the mean and median fractions of firm sales generated from international business activity are 30% and 24%, respectively. Looking at IPO sample characteristics, mean (median) underpricing is 20% (8%) and IPO proceeds are $57 ($32) million. The proportions of sample IPO firms backed by a venture capital firm and offered through a prestigious underwriter are 44% and 51%, respectively. Lastly, among the many other IPO and firm characteristics reported in the table, note that the mean (median) age of the firm at the time of going public is 15 (8) years.

Panel B of Table 2 reports correlations between IPO underpricing, international business activity variables, and the instruments for the international business activity variables.[18] The first four international business activity variables are indicator variables that are equal to one, respectively, when the IPO firm is an exporter (*Exporter*), has foreign sales (*Foreign sales*), has exports and/or foreign sales (*Exp and/or fgn sales*), or has both exports and foreign sales (*Exp and fgn sales*). The remaining variables measure the intensity of international business. They include exports to total firm sales (*Exports/sales*), foreign sales to total firm sales (*Foreign/sales*), and exports and/or foreign sales to total firm sales (*Exp and/or fgn/sales*). Consistent with the notion that global diversification has a positive effect on firm value, we see that IPO underpricing is significantly negatively correlated with all of the international business activity variables. Of course, we need to control for other determinants of underpricing before we can conclude that global diversification has a separate influence on the performance of IPOs.[19]

[13] The screens in 1, 2, and 3 are standard in the IPO literature (see, e.g., Butler et al. (2014)). The screen in 4 ensures that our sample does not include spinoffs and carve-outs of publicly-traded firms with global operations.

[14] An appendix is available on request that provides examples of sample firm IPO prospectuses (SEC S-1 Forms) reporting international business activity and the potential risks and benefits arising therefrom.

[15] Foreign sales information can also be obtained from the Compustat Geographic Segment database by identifying non-domestic segments. We are cautioned by Compustat, however, that reporting of segment foreign sales is sporadic. Instead, Compustat recommends that researchers focus on firm-wide pre-tax foreign income to determine whether a firm has foreign business operations.

[16] Note that the group of exporters includes IPO firms with foreign sales if the firm has both exports and foreign sales. Similarly, the group of foreign sellers includes IPO firms with exports if the firm has both foreign sales and exports.

[17] We compute foreign sales as the sum of the sales of non-domestic segments reported in the Compustat Geographic Segment database. As noted in footnote 15, the sum underestimates total foreign sales.

[18] A table with the correlations between all of the variables reported in Panel A of Table 2 is available upon request.

[19] We discuss the correlations between underpricing, the international business activity variables, and the instruments for the international business activity variables in Section 4.

Table 1
IPO firms with exports and/or foreign sales by year and industry.

Year	No. of IPOs	No. of IPOs				International business activity intensity		
		Exporter	Foreign sales	Exporter and/or foreign sales	Exporter and foreign sales	Exports/ sales	Foreign/ sales	Exp and/or fgn/ sales
Panel A: Sample distribution by year								
1981	110	31	0	31	0	0.187	0.000	0.187
1982	44	16	0	16	0	0.254	0.000	0.254
1983	247	70	0	70	0	0.206	0.000	0.206
1984	100	25	4	26	3	0.144	0.150	0.162
1985	98	18	8	23	3	0.137	0.197	0.157
1986	245	48	17	59	6	0.147	0.210	0.177
1987	172	32	18	46	4	0.164	0.250	0.205
1988	69	24	10	28	6	0.260	0.167	0.281
1989	63	20	10	25	5	0.213	0.145	0.240
1990	70	21	7	26	2	0.293	0.264	0.296
1991	200	44	29	59	14	0.180	0.316	0.276
1992	280	65	43	89	19	0.197	0.263	0.260
1993	349	84	58	120	22	0.218	0.264	0.262
1994	288	64	34	87	11	0.193	0.296	0.258
1995	338	115	63	153	25	0.279	0.349	0.351
1996	399	85	32	102	15	0.257	0.334	0.323
1997	328	64	38	88	14	0.289	0.283	0.339
1998	199	31	17	47	1	0.274	0.354	0.324
1999	358	14	22	34	2	0.237	0.395	0.353
2000	278	11	25	34	2	0.221	0.388	0.369
2001	47	1	8	9	0	0.251	0.578	0.552
2002	48	1	5	6	0	0.042	0.560	0.525
2003	38	1	4	4	1	0.336	0.557	0.643
2004	114	1	23	24	0	0.069	0.368	0.358
2005	99	3	21	23	1	0.218	0.396	0.395
2006	100	1	26	27	0	0.186	0.397	0.398
2007	106	2	28	29	1	0.126	0.417	0.428
2008	14	1	2	3	0	0.062	0.486	0.384
2009	32	0	14	14	0	0.000	0.436	0.436
2010	52	0	24	24	0	0.000	0.387	0.387
2011	52	0	27	27	0	0.000	0.416	0.416
2012	57	0	31	31	0	0.000	0.366	0.366
Total	4994	893	648	1384	157	0.223	0.337	0.297
Panel B: Sample distribution by industry								
Consumer nondurables	224	27	31	56	2	0.119	0.305	0.205
Consumer durables	119	33	22	49	6	0.161	0.326	0.242
Manufacturing	383	102	89	163	28	0.208	0.291	0.284
Oil, gas, and coal extraction	120	4	13	16	1	0.201	0.455	0.425
Chemicals and allied products	63	18	18	31	5	0.119	0.331	0.254
Business equipment	1737	552	301	754	99	0.231	0.365	0.307
Telephone and television	218	9	12	20	1	0.438	0.409	0.457
Wholesale and retail	678	29	42	67	4	0.157	0.257	0.217
Healthcare, medical equipment, and drugs	692	94	47	133	8	0.248	0.384	0.317
Other	760	25	73	95	3	0.296	0.271	0.302
High technology	2225	597	319	816	100	0.241	0.370	0.315
Not high technology	2769	296	329	568	57	0.188	0.305	0.270

The table reports the distribution of sample IPO firms with international business activity by year (Panel A) and by industry (Panel B). The sample includes all initial public offerings in the SDC database from 1981 to 2012 where firm accounting and stock return data are available in the Compustat and CRSP databases. The sample excludes financial and utility firms. IPOs with exports are IPO firms with export activity in the year of and the year before the initial public offering. IPOs with foreign sales are IPO firms with pre-tax foreign income in the year of and the year before the initial public offering. Data on sales derived from exports are obtained from the Compustat Geographic Segment database (variable name *SALEXG*). IPO firms with foreign sales have pre-tax foreign income reported in the Compustat Industrial Fundamental database (variable name *PIFO*). International business activity intensity is the average by year (Panel A) or industry (Panel B) of export sales, foreign sales, and export sales and/or foreign sales to net total firm sales for IPO firms with international business activity. The foreign sales component is the sum of non-domestic segment sales from the Compustat Geographic Segment database. All sales figures are from the year prior to the IPO year. In Panel B, the industry distribution follows the Fama–French 12 industry classification scheme (excluding finance and utility categories). See the Appendix for the classification of high technology IPOs.

4. Results

4.1. Univariate comparisons of IPOs with and without international business activity

We first make a comparison of the IPO and firm characteristics of globally diversified IPOs with purely domestic IPOs. Table 3 reports mean and median comparisons between IPOs with exports and/or foreign sales and IPOs without international business activity. We see that globally diversified IPOs have lower mean underpricing than purely domestic IPOs (16% versus 21%) but identical median underpricing (8%). Comparing other characteristics, observe that globally diversified IPOs are older and more likely to have venture capital support, be brought public by a prestigious underwriter, and be in a high-technology industry than purely domestic IPOs. Globally diversified IPOs, however, are not necessarily larger. In particular, in unreported results the group of exporter IPOs is significantly smaller than purely domestic IPOs.[20] Lastly, note that globally diversified IPOs are more likely to

[20] The results on separate comparisons of exporter IPOs versus domestic IPOs and foreign seller IPOs versus domestic IPOs are available upon request.

Table 2
Descriptive statistics and correlations for international business activity measures and IPO and firm characteristics.

Panel A. Descriptive statistics

Variable	Mean	Std. Dev.	1st quartile	Median	3rd quartile	*N*
Underpricing (%)	19.550	35.872	0.625	7.759	23.611	4994
Global diversification dummy variables						
Exporter	0.179					4994
Foreign sales	0.130					4994
Exporter and/or foreign sales	0.277					4994
Exporter and foreign sales	0.031					4994
Global diversification continuous variables for the subsample of IPOs with international business						
Exports/sales	0.223	0.169	0.094	0.172	0.314	893
Foreign/sales	0.337	0.225	0.139	0.297	0.502	511
Exp and/or fgn/sales	0.297	0.224	0.125	0.240	0.424	1284
Butler et al. (2014) robust controls for underpricing regressions						
Log firm sales	3.645	1.927	2.607	3.758	4.834	4994
Offer price revision (%)	−0.881	14.400	−6.667	0.000	3.704	4994
No. of analysts	2.594	2.285	1.000	2.000	4.000	4994
Analyst coverage	0.773					4994
Total liabilities/assets	0.739	0.468	0.466	0.690	0.879	4994
Investment bank mkt share (%)	5.481	7.690	0.368	2.244	7.224	4994
Avg underpricing in prv 30 days (%)	22.410	26.000	9.210	14.200	22.150	4994
Avg revision in prv 30 days (%)	1.518	11.358	−4.639	0.000	3.699	4994
Prior 30 day CRSP EW index (%)	2.187	4.261	−0.485	2.453	4.836	4994
Log(1 + shrs rtd/shrs ofrd)	1.264	0.480	0.978	1.250	1.537	4994
Offer price revision negative (%)	−4.969	9.368	−6.667	0.000	0.000	4994
Log(industry mkt value/sales)	2.280	1.695	0.923	2.097	3.530	4994
Log(price/sales)	1.472	1.824	0.205	1.148	2.404	4994
Prior 30 day industry return (%)	1.531	5.870	−2.079	1.613	4.893	4994
Prior 30 day SD of industry return (%)	1.148	0.560	0.771	1.002	1.345	4994
Prior 30 day Nasdaq return (%)	1.451	5.423	−1.652	1.630	4.722	4994
Additional controls for underpricing regressions						
Offer price	12.270	4.626	9.000	12.000	15.000	4994
Hot market dummy	0.521					4994
Cold market dummy	0.095					4994
Other IPO and firm variables (firm variables are measured at the fiscal year end immediately after the IPO)						
Issuer mkt cap	235.523	354.719	47.786	108.015	265.234	4994
Proceeds	57.460	81.620	15.000	32.000	64.400	4994
Total assets	245.093	501.197	43.522	88.364	196.048	4994
Total net sales	222.734	480.720	26.079	67.836	182.915	4994
Leverage ratio	0.156	0.202	0.004	0.057	0.258	4992
Capex/total assets	0.085	0.100	0.025	0.049	0.103	4950
R&D/sales	0.058	0.088	0.000	0.008	0.092	4994
Market-to-book	3.315	3.129	1.577	2.372	3.741	4976
Productivity	270.800	330.600	104.100	183.600	291.500	4857
Firm age	14.950	18.840	4.000	8.000	16.000	4974
Venture capital dummy	0.441					4994
Prestigious underwriter dummy	0.512					4994
Acquirer dummy	0.244					4994
High-technology dummy	0.446					4994
Internet dummy	0.077					4994
Instruments for global diversification variables						
Openness based on volume of exports	0.030	0.043	0.000	0.009	0.045	4994
Openness based on volume of foreign sales	0.192	0.189	0.012	0.138	0.335	4994
Openness based on volume of exp and/or fgn sales	0.222	0.198	0.037	0.168	0.377	4994

(*continued on next page*)

Table 2 (*continued*)

Panel A. Descriptive statistics

Variable	Mean	Std. Dev.	1st quartile	Median	3rd quartile	*N*
Openness based on volume of exp and fgn sales	0.053	0.091	0.000	0.002	0.065	4994
Openness based on number of firms with exports	0.176	0.192	0.012	0.100	0.301	4994
Openness based on number of firms with foreign sales	0.147	0.132	0.043	0.123	0.212	4994
Openness based on number of firms with exp and/or fgn sales	0.283	0.213	0.096	0.250	0.443	4994
Openness based on number of firms with exp and fgn sales	0.041	0.062	0.000	0.010	0.063	4994
Log of industry productivity	5.462	0.611	5.175	5.386	5.706	4994

Panel B. Pearson correlation coefficients between underpricing, international business variables, and instrumental variables

	Exporter	Foreign sales	Exp and/ or fgn sales	Exp and fgn sales	Exports/ sales	Foreign/ sales	Exp and/ or fgn/ sales	Openness volume exports	Openness volume fgn sales	Openness vol exp and/or fgn	Openness firms exports	Openness firms fgn sales	Openness firms exp and/or fgn	Log industry productivity
Underpricing	−0.040***	−0.049***	−0.056***	−0.039***	−0.023*	−0.029**	−0.037***	−0.036***	−0.046***	−0.034***	−0.042***	0.002	−0.013	−0.003
Exporter	1.000													
Foreign sales	0.064***	1.000												
Exp and/or fgn sales	0.754***	0.624***	1.000											
Exp and fgn sales	0.386***	0.467***	0.291***	1.000										
Exports/sales	0.767***	0.029**	0.578***	0.258***	1.000									
Foreign/sales	−0.000	0.715***	0.446***	0.233***	−0.032**	1.000								
Exp and/or fgn/ sales	0.506***	0.547***	0.715***	0.332***	0.655***	0.728***	1.000							
Openness volume exports	0.406***	0.076***	0.329***	0.195***	0.395***	0.046***	0.302***	1.000						
Openness volume foreign sales	0.055***	0.212***	0.182***	0.063***	0.056***	0.229***	0.209***	0.063***	1.000					
Openness vol exp and/or fgn sales	0.142***	0.221***	0.247***	0.103***	0.142***	0.231***	0.268***	0.282***	0.975***	1.000				
Openness firms exports	0.567***	0.088***	0.457***	0.241***	0.465***	0.044***	0.339***	0.728***	0.124***	0.280***	1.000			
Openness firms foreign sales	0.081***	0.304***	0.259***	0.100***	0.063***	0.293***	0.259***	0.146***	0.590***	0.599***	0.239***	1.000		
Openness firms exp and/or fgn sales	0.409***	0.248***	0.464***	0.187***	0.337***	0.220***	0.387***	0.535***	0.470***	0.570***	0.767***	0.775***	1.000	
Log industry productivity	0.101***	0.142***	0.092***	0.084***	0.035**	0.049***	0.030**	−0.012	0.051***	0.047***	−0.077***	0.118***	0.035***	1.000

The sample includes all initial public offerings (IPOs) in the SDC database from 1981 to 2012 where firm accounting and stock return data are available in the Compustat and CRSP databases. The sample excludes financial and utility firms. Panel A reports descriptive statistics and Panel B reports Pearson correlation coefficients. All variables are defined in the Appendix and all variables except dummy variables are winsorized at the 1st and 99th percentiles. As noted in the Appendix, variables specified in dollars (e.g., *Issuer market capitalization*, *Proceeds*, *Total assets*, and *Total net sales*) are in constant 2009 dollars. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

Table 3
Comparison of IPO and firm characteristics for IPOs with and without international business activity.

Variable	Exporter and/or foreign sales (1384 IPOs)		No exports or foreign sales (3610 IPOs)		Difference in	
	Mean	Median	Mean	Median	Mean	Median
Underpricing (%)	16.290	8.233	20.800	7.692	−4.510***	0.541
Control variables in underpricing regression						
Log firm sales	4.156	3.985	3.450	3.626	0.706***	0.359***
Offer price revision	0.112	0.000	−1.261	0.000	1.373***	0.000***
No. of analysts	2.896	3.000	2.478	2.000	0.418***	1.000***
Analyst coverage	0.814		0.757		0.057***	
Total liabilities/assets	0.692	0.636	0.757	0.710	−0.065***	−0.074***
Invt banker mkt share	6.428	3.085	5.118	1.942	1.310***	1.143***
Avg undpreg prv 30 days	17.760	13.600	24.190	14.400	−6.430***	−0.800***
Avg rvs prv 30 days	0.176	0.000	2.033	0.000	−1.857***	0.000*
Prior 30 day CRSP EW idx	1.990	2.283	2.262	2.490	−0.272**	−0.207**
Log(1 + shrs rtd/shrs ofd)	1.284	1.274	1.257	1.243	0.027*	0.031**
Offer price revision neg	−5.073	0.000	−4.929	0.000	−0.144	0.000
Log(ind mkt value/sales)	2.158	1.782	2.327	2.190	−0.169***	−0.408**
Log(price/sales)	1.122	1.088	1.606	1.183	−0.484***	−0.095***
Prior 30 day industry return	1.469	1.420	1.555	1.688	−0.086	−0.268
Prior 30 day SD ind return	1.123	1.006	1.158	1.001	−0.035**	0.005
Prior 30 day Nasdaq return	1.153	1.358	1.566	1.704	−0.413**	−0.346**
Offer price	12.740	12.000	12.090	12.000	0.650***	0.000***
Hot market dummy	0.491		0.533		−0.042***	
Cold market dummy	0.120		0.085		0.035***	
Other IPO and firm variables						
Issuer mkt cap	271.765	118.338	221.629	104.980	50.136***	13.358***
Proceeds	67.761	32.400	53.513	32.000	14.248***	0.400***
Total assets	313.432	92.591	218.886	87.382	94.546***	5.209***
Total net sales	294.730	81.241	195.109	62.612	99.621***	18.629***
Leverage ratio	0.131	0.033	0.165	0.066	−0.034***	−0.033***
Capex/total assets	0.063	0.044	0.094	0.052	−0.031***	−0.008***
R&D/sales	0.075	0.062	0.051	0.000	0.024***	0.062***
Market-to-book	3.140	2.428	3.382	2.342	−0.242***	0.086*
Productivity	296.794	222.737	260.656	160.887	36.138***	61.850***
Firm age	17.550	9.000	13.960	8.000	3.590***	1.000***
Venture capital dummy	0.480		0.426		0.054***	
Prestigious underwriter dummy	0.572		0.489		0.083***	
Acquirer dummy	0.206		0.258		−0.052***	
High-technology dummy	0.590		0.390		0.200***	
Internet dummy	0.039		0.091		−0.052***	

Firms with international business activity have exports and/or foreign sales in the year of and the year before the initial public offering. All variables are defined in the Appendix. All dollar values are in constant 2009 dollars. The significance of the difference in means is based on a *t*-test that assumes unequal variances across groups when a test of equal variances is rejected at the 10% level. The significance of the difference in medians is based on a Wilcoxon rank-sum test. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

receive analyst coverage – and by a larger number of analysts – within a year of going public and are less (more) likely to be brought public during hot (cold) IPO markets than purely domestic IPOs.

4.2. Multivariate tests of the influence of global diversification on IPO underpricing

We hypothesize that global diversification decreases underpricing by reducing value uncertainty which allows the firm and its investment bank to more fully price the IPO to investors in the market. We also note that international business activity may allow for enhanced spanning of the IPO in the market or help complete the market, which should also decrease underpricing. Given the additional risks of international business activity, however, we recognize that globally diversified IPO firms may actually trade at a discount relative to purely domestic IPO firms and that therefore underpricing may be larger for such firms.

Table 4 reports regressions of IPO initial returns (i.e., underpricing) on international business activity variables and a set of control variables documented in the literature as robust determinants of underpricing. As defined above, the international business activity variables are specified as dummy variables. Models (1) and (2) use the variable *Exporter*, Models (3) and (4) use the variable *Foreign sales*, Model (5) uses the variable *Exporter and/or foreign sales*, and Model (6) uses the variable *Exporter and foreign sales*. Models (1), (3), and (5) use the full sample. Model (2) excludes IPOs with foreign sales that do not have exports (i.e., the coefficient on the dummy variable *Exporter* measures the difference in underpricing between IPOs with exports and IPOs without any international business activity). Model (4) excludes IPOs with exports that do not have foreign sales (i.e., the coefficient on the dummy variable *Foreign sales* measures the difference in underpricing between IPOs with foreign sales and IPOs without any international business activity). Model (6) excludes IPOs that have either exports or foreign sales (i.e., the coefficient on the dummy variable *Exporter and foreign sales* measures the difference in underpricing between IPOs with exports and foreign sales and IPOs without any international business activity).

Among control variables, the regressions include the 15 variables in Table 4 of Butler et al. (2014) which they document are robust determinants of underpricing, except that we replace their "News stories" variable with "Number of analysts". Both variables are used in the literature – Cook et al. (2006) and Cliff and Denis (2004), respectively – to proxy for investment bank effort to promote an IPO. We use the I/B/E/S database for analyst information and we follow Chang et al. (2006) to define the "Number of

Table 4
The effect of international business activity on IPO underpricing.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Exporter	−2.225*	−3.097**				
	(−1.78)	(−2.15)				
Foreign sales			−3.491***	−4.249***		
			(−2.97)	(−2.85)		
Exporter and/or foreign sales					−3.075**	
					(−2.50)	
Exporter and foreign sales						−5.708**
						(−2.31)
Log firm sales	−8.874***	−9.266***	−8.586***	−8.450***	−8.676***	−9.142***
	(−5.08)	(−5.04)	(−4.97)	(−4.42)	(−5.06)	(−4.41)
Offer price revision	0.458***	0.425***	0.453***	0.424***	0.459***	0.378***
	(8.06)	(7.65)	(7.80)	(7.56)	(8.07)	(6.69)
No. of analysts	1.515***	1.521***	1.504***	1.634***	1.525***	1.662***
	(5.84)	(5.64)	(5.78)	(5.96)	(5.76)	(5.14)
Total liabilities/assets	−1.991**	−1.874*	−1.859**	−2.302**	−1.962**	−2.258**
	(−2.21)	(−1.90)	(−2.06)	(−2.42)	(−2.21)	(−2.09)
Investment bank mkt share	0.565***	0.617***	0.575***	0.574***	0.571***	0.619***
	(5.04)	(5.25)	(5.13)	(4.83)	(5.13)	(4.70)
Avg underpricing in prv 30 days	0.235***	0.242***	0.235***	0.231***	0.236***	0.239***
	(3.74)	(3.87)	(3.73)	(3.72)	(3.75)	(3.87)
Avg revision in prv 30 days	−0.044	−0.066	−0.046	−0.039	−0.046	−0.063
	(−0.68)	(−0.94)	(−0.71)	(−0.066)	(−0.70)	(−0.95)
Prior 30 day CRSP EW index	−0.640***	−0.590**	−0.629***	−0.715***	−0.644***	−0.660***
	(−3.23)	(−2.46)	(−3.13)	(−3.64)	(−3.24)	(−2.72)
Log(1 + shrs rtd/shrs ofrd)	13.26***	14.43***	13.16***	13.63***	13.20***	15.14***
	(5.96)	(5.62)	(5.90)	(5.76)	(5.97)	(5.39)
Offer price revision negative	−0.350***	−0.310***	−0.343***	−0.312***	−0.351***	−0.255***
	(−4.59)	(−4.25)	(−4.45)	(−4.16)	(−4.58)	(−3.56)
Log(Industry mkt value/sales)	−1.011	−1.320	−0.965	−0.953	−1.005	−1.305
	(−1.43)	(−1.64)	(−1.40)	(−1.17)	(−1.45)	(−1.35)
Log (price/sales)	−5.761***	−6.227***	−5.590***	−5.392***	−5.656***	−6.041***
	(−4.61)	(−4.55)	(−4.51)	(−3.91)	(−4.61)	(−3.86)
Prior 30 day industry return	0.271	0.260	0.279	0.241	0.277	0.216
	(1.60)	(1.54)	(1.64)	(1.27)	(1.64)	(1.16)
Prior 30 day SD of industry return	4.310***	5.204***	4.381***	3.995***	4.350***	4.861***
	(3.56)	(4.47)	(3.51)	(3.21)	(3.60)	(4.07)
Prior 30 day Nasdaq return	1.114***	1.074***	1.098***	1.184***	1.107***	1.155***
	(4.24)	(3.41)	(4.14)	(4.21)	(4.22)	(3.40)
Offer price	2.081***	2.231***	2.058***	2.130***	2.070***	3.324***
	(3.44)	(3.49)	(3.42)	(3.15)	(3.44)	(3.17)
Hot market dummy	−0.209	−0.065	−0.207	−0.346	−0.172	−0.245
	(−0.13)	(−0.04)	(−0.13)	(−0.19)	(−0.11)	(−0.14)
Cold market dummy	1.269	3.261	1.346	1.528	1.363	3.640
	(0.63)	(0.99)	(0.66)	(0.66)	(0.69)	(0.92)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.43	0.43	0.43	0.43	0.43	0.43
Observations	4994	4503	4994	4258	4994	3767

The dependent variable is the initial offering return (in percent) which is calculated from the offer price to the closing price at the end of the first day of trading. The international business activity variables *Exporter*, *Foreign sales*, *Exporter and/or foreign sales*, and *Exporter and foreign sales* are dummy variables which are defined in the Appendix. All other independent variables are defined in the Appendix. Models (1), (3), and (5) use the full sample. Model (2) excludes IPOs with foreign sales that do not have exports (i.e., the coefficient on the dummy variable *Exporter* measures the difference in underpricing between IPOs with exports and IPOs without any international business activity). Model (4) excludes IPOs with exports that do not have foreign sales (i.e., the coefficient on the dummy variable *Foreign sales* measures the difference in underpricing between IPOs with foreign sales and IPOs without any international business activity). Model (6) excludes IPOs that have either exports or foreign sales (i.e., the coefficient on the dummy variable *Exports and foreign sales* measures the difference in underpricing between IPOs with exports and foreign sales and IPOs without any international business activity). All regressions include year and Fama–French 48-industry fixed effects. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered by industry. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

analysts" as the maximum number of analysts who make annual earnings forecasts in any month within 1 year after the IPO issue date.[21] In addition, we use the Helwege and Liang (2004) market heat measure to construct hot and cold market dummy variables (see the Appendix for variable descriptions). Lastly, the regressions include the IPO offer price and year and Fama–French 48 industry fixed effects. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered by industry.[22]

As seen in the table, the coefficients on the international business activity variables are all significantly negative. The coefficient

[21] We assume that firms not covered by I/B/E/S have no analyst coverage. Our results are robust to using the variable "Analyst coverage", which is a dummy variable equal to one if there is at least one analyst providing an earnings forecast for the IPO firm within 1 year after the IPO issue date.

[22] Our results are robust if instead we cluster standard errors by year or by industry and year (i.e., two-way clustering). We do not report *t*-statistics based on two-way clustering, however, because it places additional restrictions on the errors that may be unrealistic. In particular, clustering at the industry-year level assumes that for a given industry, IPO firms' errors are uncorrelated over time. In purely cross-sectional databases such as ours, it is generally recommended to use one-way clustering with fixed effects to absorb common shocks (see, e.g., Baum et al. (2011) and Cameron and Miller (2015)).

estimates also appear to be economically significant. Thus, after controlling for known determinants of IPO initial returns, we see that IPO firms with exports have 3.1% lower underpricing than purely domestic IPO firms (Model (2)), IPO firms with foreign sales have 4.3% lower underpricing than purely domestic IPO firms (Model (4)), IPO firms with exports and/or foreign sales have 3.1% lower underpricing than purely domestic IPO firms (Model (5)), and IPO firms with both exports and foreign sales have 5.7% lower underpricing than purely domestic IPO firms (Model (6)). Overall, the effect of global diversification on IPO initial returns is consistent with the prediction that global diversification reduces valuation uncertainty and/or enhances spanning/completeness, thereby allowing the firm and its investment banker to more fully price the offering.

The signs of the coefficients on the control variables in the regressions are consistent with the results reported in the literature. In particular, note that the Butler et al. (2014) 15 robust control variables in Table 4 – *Log firm sales* through *Prior 30 day Nasdaq return* – have the same signs (and in general significance levels) as reported in Table 4 of Butler et al. (2014). Also note that although *Offer price* has a significantly positive coefficient, the hot and cold market variables are not significantly different from zero.[23]

Table 5 reports regressions that examine the differential effect of exporter versus foreign seller on underpricing and the impact of multiple foreign regions on underpricing. To isolate the differential effect of exporter versus foreign seller on underpricing, Models (1) and (2) include the dummy variable *exporter* and are estimated using only global IPOs with exports and/or foreign sales (Model (1)) or global IPOs with exports or foreign sales (Model (2)). As seen in the table, the coefficients on exporter are not significantly different from zero which suggests that exports and foreign sales are equally effective in reducing IPO underpricing.

Models (3) and (4) in Table 5 examine the effect on IPO underpricing of having foreign sales in multiple geographic locations.[24] We define the dummy variable *multiple regions* equal to one if an IPO with foreign sales has operations in more than one region of the world. Model (3) includes *Foreign sales* and the interaction between *Foreign sales* and *multiple regions* and is estimated using the full sample of global and domestic IPOs, and Model (4) includes the interaction of *Foreign sales* and *multiple regions* and is estimated using only global IPOs with foreign sales. As seen in the table, the coefficients on the interaction variables in both Models (3) and (4) are significantly negative which suggests that the decrease in underpricing when the IPO firm has foreign sales is larger when it has operations in more than one region.

Table 6 reports regressions that estimate the effect of international business *intensity* on IPO initial returns. In these regressions, we examine whether the proportion of total firm sales derived from exports (*Exports*/*sales*), foreign sales (*Foreign*/*sales*), and exports and/or foreign sales (*Exp and*/*or fgn*/*sales*) in the year prior to the IPO influences IPO initial returns. Models (1), (3) and (5) add these intensity variables to the baseline underpricing regression, while Models (2), (4), and (6) also include the squares of the respective international business intensity variables to check for nonlinearity in the relation between underpricing and intensity. Panel A reports regressions that use the full sample of global and domestic IPOs and sets the international business intensity variables equal to zero for purely domestic IPO firms. Panel B reports regressions using the subsample of global IPO firms (i.e., only IPO firms with exports and/or foreign operations). The control variables in the regressions are the same as those used in Table 4 and are defined in the Appendix. All regressions include year and Fama–French 48-industry fixed effects. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered by industry.

As seen in the table, there is generally a strong negative relation between underpricing and international business intensity in both Panel A and Panel B regressions. We do not, however, find evidence of a nonlinear relation, since the coefficients on the squared international business intensity variables are not significantly different from zero in either Panel A or Panel B. The relation between underpricing and intensity also appears to be economically significant. Using the coefficient estimates in Model (5), a one standard deviation increase in *Exp and*/*or fgn*/*sales* decreases underpricing by 1.024 percentage points for the full sample of global and domestic IPOs in Panel A and by 0.697 percentage points for the subsample of global IPOs in Panel B.[25]

A potential concern with the regression analysis is that our international business activity variables are endogenous which would render the underpricing regression results biased and potentially misleading. To correct for endogeneity in the Table 4 specifications, we use a two stage least squares procedure suggested by Wooldridge (2002) with a probit model to predict the

Table 5
The differential effect of exporter versus foreign seller and the effect of multiple foreign regions on underpricing.

	(1)	(2)	(3)	(4)
Exporter	1.605	2.198		
	(1.04)	(1.25)		
Foreign sales			−2.751**	
			(−2.51)	
Foreign sales × multiple regions			−7.039***	−8.109***
			(−3.14)	(−3.03)
Controls	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Adjusted R^2	0.44	0.43	0.43	0.40
Observations	1384	1227	4994	648

The dependent variable is the initial offering return (in percent) which is calculated from the offer price to the closing price at the end of the first day of trading. The international business activity variables *Exporter* and *Foreign sales* are dummy variables that are equal to one if an IPO firm reports export sales or pre-tax foreign income, respectively, in the IPO year and the year before. *Multiple regions* is a dummy variable equal to one if an IPO firm has foreign sales in more than one geographic region, where the regions are Asian and Pacific, Europe, North America, South America, and Africa and the Middle East. Model (1) is estimated using only global IPOs with exports and/or foreign sales. Model (2) excludes IPOs with both exports and foreign sales. Model (3) is estimated using the full sample of global and domestic IPOs. Model (4) is estimated using only global IPOs with foreign sales. The control variables in the regressions are the same as those used in Table 4 and are defined in the Appendix. All regressions include year and Fama–French 48-industry fixed effects. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered by industry. We use *** and ** to denote significance at the 1% and 5% levels, respectively.

[23] Including the offer price in the regression has no impact on any of the other coefficients in the regression. Booth and Chua (1996) and Fernando et al. (2004) develop liquidity-based arguments for why offer price should be related to initial return and also find a positive relation between IPO initial return and offer price.

[24] The Compustat Geographic Segment database does not provide information on the location of exports and the data for the location of foreign operations is missing for most of the sample and relatively coarse when reported (i.e., at the region level and not the country level). Thus, in our IPO sample, we have no location information for the 893 IPOs with exports and we have regional location information for only 181 of the 648 IPOs with foreign sales. The regions include Asia-Pacific, Europe, North America, South America, and Africa/Middle East. We find that 74 of the IPOs with foreign sales have foreign operations in more than one region.

[25] The computations are coefficient −5.920 × std. dev. 0.173 = 1.024 and coefficient −3.113 × std. dev. 0.224 = 0.697.

Table 6
The effect of international business intensity on IPO underpricing.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Full sample of global and domestic IPOs						
Exports/sales	−8.761*	−13.001				
	(−1.82)	(−1.43)				
Squared exports/sales		8.992				
		(0.56)				
Foreign/sales			−3.733**	−7.465**		
			(−2.22)	(−2.13)		
Squared foreign/sales				3.517		
				(1.46)		
Exp and/or fgn/sales					−5.920***	−9.863**
					(−2.84)	(−2.18)
Squared exp and/or fgn/sales						4.313
						(1.31)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.43	0.43	0.43	0.43	0.43	0.43
Observations	4994	4994	4994	4994	4994	4994
Panel B. Subsample of global IPOs						
Exports/sales	−12.071***	−3.734				
	(−3.92)	(−0.33)				
Squared exports/sales		13.74				
		(0.77)				
Foreign/sales			−2.851	−3.355		
			(−0.77)	(−0.68)		
Squared foreign/sales				0.323		
				(0.16)		
Exp and/or fgn/sales					−3.113**	−6.699**
					(−2.15)	(−2.21)
Squared exp and/or fgn/sales						2.886
						(1.23)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.48	0.48	0.43	0.43	0.45	0.45
Observations	893	893	511	511	1284	1284

The dependent variable is the initial offering return (in percent) which is calculated from the offer price to the closing price at the end of the first day of trading. The international business intensity variables *Exports/sales*, *Foreign/sales*, and *Exp and/or fgn/sales* are defined in the Appendix. Models (2), (4), and (6) include the squares of the international business intensity variables. Panel A reports regressions that use the full sample of global and domestic IPOs and sets the international business intensity variables equal to zero for purely domestic IPO firms. Panel B reports regressions using the subsample of global IPO firms (i.e., only IPO firms with exports and/or foreign operations). The control variables in the regressions are the same as those used in Table 4 and are defined in the Appendix. All regressions include year and Fama–French 48-industry fixed effects. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered by industry. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

probability of international business in the first-stage regression.[26] Thus we first estimate a probit regression for the likelihood of international business using as regressors all of the variables in the regressions of Table 4 (excluding the international business indicator variables) along with two instrumental variables. Following the international economics literature (see, e.g., Melitz (2003), De Loecker (2007) and di Giovanni and Levchenko (2009)), we use productivity and trade openness as instrumental variables for international business activity. Melitz (2003) and De Loecker (2007) establish that productivity is an important predictor of firms' global market involvement. Following standard practice, we define productivity as the natural logarithm of one plus average industry productivity, where productivity is net sales in millions of 2009 constant dollars divided by the number of employees in thousands and industry is based on four-digit SIC code. Industry trade openness is a proxy for the likelihood of international business (because of comparative advantage in technology or endowments, or increasing returns to scale) for an average firm in the industry; it is also a good proxy for frictions associated with international business such as transportation costs, tariffs, political uncertainty, and cultural barriers (see, e.g., di Giovanni and Levchenko (2009)). Again, following the international economics literature we define trade openness as either the proportion of sales derived from international business or the fraction of firms engaged in international business in an IPO firm's four-digit SIC code in the year that it goes public. While industry productivity and trade openness are highly correlated with firm-level exports and foreign sales, there is little reason to believe that they have a direct influence on the underpricing of a specific firm in the industry, other than through their association with firm-level exports and foreign sales. Indeed, as seen in Panel B of Table 2, while the correlations between productivity and trade openness and the business activity variables are large and significantly positive, the correlations between productivity and trade openness and underpricing are negative but quite small.

Table 7 reports second stage underpricing regressions using fitted probabilities for exporter, foreign sales, exporter and/or foreign sales, and exporter and foreign sales from first stage probit models.[27] Panel A reports results for the cases where the fitted probabilities are from probits using industry trade openness based on proportion of sales from international business and Panel B reports

[26] For the international business intensity variables, we use a Heckman selection model to control for endogeneity and potential selection bias. The results are robust and available upon request.

[27] The first stage probit models are available upon request.

results for cases where the fitted probabilities are from probits using industry trade openness based on fraction of firms engaged in international business.[28] The results in Table 7 confirm the regression results in Table 4. There is a negative relation between IPO underpricing and the fitted probabilities of engaging in international business. In Panel A, for example, a one standard deviation increase in the fitted probability of being an exporter and/or foreign seller decreases underpricing by 4.74%, which is the same order of magnitude of the result using indicator variables in Table 4.

While our results strongly support the hypothesis that international business activity mitigates underpricing, it is still possible that the effects we observe are at least partially attributable to selection bias. Specifically, international business activity may proxy for (possibly unobservable) firm characteristics and firms with these characteristics self-select into foreign markets and experience lower underpricing when they subsequently go public. We mitigate selection bias using propensity score matching (PSM).[29] The goal of PSM is to *statistically* replicate the undoable test of "treating" an observation (e.g., a firm going public) with an effect (e.g., international business activity) and comparing the outcome for the treated observation to what it would be if the *same* observation were untreated. PSM attempts to replicate this test by matching treated and untreated observations (i.e., two *different* observations) using a propensity score model that is based on a number of covariates and then comparing the outcome of interest (e.g., IPO initial returns) for the treatment and control samples. Presumably, the confounding characteristics – even the ones that are unobservable – are "balanced" (i.e., the same) in the treatment and control samples and therefore the difference in outcomes between the two samples is an unbiased estimate of the treatment effect.

Table 8 uses PSM to match IPO firms with international business activity (treatment sample) to those without international business activity (control sample). Panel A reports the estimated probit models used to compute propensity scores (i.e., probability of international business activity) to match treatment and control firms. We estimate four models: Model (1) predicts exporter, Model (2) predicts foreign seller, Model (3) predicts exporter and/or foreign seller, and Model (4) predicts exporter and foreign seller. Following the international economics literature on the determinants of a firm being an exporter (e.g., De Loecker (2007) and Eaton et al. (2011)) or engaging in foreign direct investment (e.g., Helpman et al. (2004)), the probit models include a measure of productivity. The models also include as covariates sales, capital expenditures, firm age, leverage, research and development, number of analysts, a prestigious underwriter dummy, a recession dummy, and industry fixed effects.[30]

We use the probit models to compute a propensity score for each IPO firm in the sample. Based on the propensity scores for the treated IPOs (i.e., those with international business activity) and candidate control IPOs (i.e., those without international business activity), we use nearest-neighbor (NN) matching with replacement to implement one-to-one and one-to-three matching of treatment and control samples (see e.g., Abadie et al. (2004)).[31] We allow for replacement because a control IPO can be a best match for more than one treatment IPO. This process produces 8 treatment and control samples (i.e., 4 treatment and control samples based on Models (1)–(4) using one-to-one propensity score NN matching and 4 treatment and control samples based on Models (1)–(4) using one-to-three propensity score NN matching).

Panel B reports a balance test for Model (1) in Panel A where we compare the means of the covariates for the treatment group to those of the one-to-one NN matched control group. This goodness of fit test assesses whether the means of the covariates in the propensity score model are statistically indistinguishable in treatment and control groups. As seen in the panel, the balance test is easily passed. Although unreported in Panel B, all treatment and control samples pass the balance test.

Panel C reports average underpricing for treatment and control groups based on one-to-one and one-to-three propensity score matching. The panel also reports *z*-statistics for the difference in average underpricing that are computed using the method in Abadie and Imbens (2006).[32] As seen in the panel, the treatment samples have significantly lower underpricing than the corresponding control samples and the *z*-statistics for the differences in average underpricing are all statistically significant at reasonable confidence levels. The large differences in average underpricing between treatment and control samples – ranging from 7.7% to 12% – strongly suggest that international business activity reduces underpricing.[33]

A number of additional tests were performed to assess the robustness of the relation between IPO underpricing and global diversification. First, since underpricing is right-skewed, we redo all of our underpricing results using the logarithm of one plus IPO initial return. All results, including using both dummy and continuous international business variables, are robust. Second, we redo all of our underpricing results for the sample sub-periods: 1981–2006, 2007–2009, and 2010–2012 (i.e., separating out the global financial crisis period from 2007 to 2009). We find a strong negative relation between underpricing and (dummy and continuous) international business variables during 1981–2006. The negative relation is weaker during the sub-periods 2007–2009 and 2010–2012, but this appears to be largely attributable to lower power due to smaller samples of IPOs and IPOs with international business during these sub-periods. Finally, we include a wide variety of additional variables to explain underpricing (e.g., IPO firm age, venture capital backing, underwriter rank, high-technology firm dummy, and internet firm dummy). Although many of these additional variables are related to IPO underpricing, they have no influence on the relation between underpricing and our international business variables. All of these results are available upon request.

[28] We use the Cragg-Donald statistic to assess whether the instruments are weak. When there is one endogenous regressor as in our 2SLS models, this statistic has an *F* distribution under the null hypothesis that the instruments have no explanatory power in the first stage regression. With one endogenous regressor and two excluded instruments, the critical value (Stock–Yogo weak ID test) for the Cragg–Donald statistic for 10% maximal size distortion is 19.93. As can be seen in Table 7, all regressions easily exceed this critical value and reject the null hypothesis of weak instruments. Since we have two instruments and one endogenous regressor, we use the Sargan test for overidentifying restrictions to assess whether the instruments are uncorrelated with the second-stage error. If the test statistic – which is distributed chi-square – exceeds the critical value we reject the null hypotheses that the instruments are uncorrelated with the structural error and conclude that at least one of the instruments is not exogenous. As can be seen in Table 7, none of the *p*-values warrants rejection of the null hypothesis.

[29] Rosenbaum and Rubin (1983) were the first to suggest this technique to mitigate problems of causality and selection bias.

[30] All variables are defined in the Appendix and are measured in the IPO year. Results are robust if we lag the variables but the sample size is substantially reduced because of incomplete Compustat information in firm-years prior to the IPO year.

[31] Our results are robust to one-to-*k* matching where $k = 1, 2, \ldots 5$. We report results for one-to-three matching because there is roughly one IPO with international business activity for every three IPOs without international business activity in the sample.

[32] Abadie and Imbens (2008) argue that bootstrapping methods should not be used for inference with matching estimators. We follow their prescription and compute a *z*-statistic using the analytical estimator of the asymptotic variance of matching estimators proposed by Abadie and Imbens (2006).

[33] For a robustness check, we require that the control IPO is issued in the same year as the treatment IPO. We continue to find significantly lower underpricing in the treatment samples. The results are available upon request.

Table 7
Two-stage IV estimation of the effect of international business activity on IPO underpricing.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Instrumental variables: Openness based on sales of firms with international business and log of industry productivity						
$\widehat{P}$(Exporter)	−20.974***	−23.111***				
	(−3.60)	(−3.41)				
	[−4.47%]	[−5.38%]				
$\widehat{P}$(Foreign sales)			−17.712***	−20.129***		
			(−3.04)	(−2.84)		
			[−3.08%]	[−4.01%]		
$\widehat{P}$(Exporter and/or foreign sales)					−20.098**	
					(−2.56)	
					[−4.74%]	
$\widehat{P}$(Exporter and foreign sales)						−17.231
						(−1.50)
						[−2.52%]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Cragg–Donald statistic	127.38***	123.60***	33.59***	36.64***	36.64***	68.85***
Sargan test *p*-value	0.534	0.549	0.257	0.424	0.424	0.745
Adjusted-R^2	0.41	0.41	0.42	0.42	0.39	0.47
Observations	4358	3994	4479	3882	4985	2215
Panel B. Instrumental variables: Openness based on number of firms with international business and log of industry productivity						
$\widehat{P}$(Exporter)	−9.717***	−10.950***				
	(−2.85)	(−2.86)				
	[−2.32%]	[−2.86%]				
$\widehat{P}$(Foreign sales)			−18.807***	−21.366***		
			(−3.43)	(−3.10)		
			[−3.31%]	[−4.32%]		
$\widehat{P}$(Exporter and/or foreign sales)					−11.298***	
					(−2.82)	
					[−2.88%]	
$\widehat{P}$(Exporter and foreign sales)						−15.330
						(−1.52)
						[−2.21%]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Cragg–Donald *F*-statistic	426.02***	424.81***	59.64***	62.76***	202.98***	114.08***
Sargan test *p*-value	0.533	0.549	0.591	0.795	0.570	0.744
Adjusted-R^2	0.43	0.44	0.42	0.41	0.42	0.47
Observations	4358	3994	4479	3882	4985	2215

The table reports the second stage of a 2SLS model where the dependent variable is the initial offering return (in percent) which is calculated from the offer price to the closing price at the end of the first day of trading. The variables $\widehat{P}$(Exporter), $\widehat{P}$(Foreign sales), $\widehat{P}$(Exporter and/or foreign sales) , and $\widehat{P}$(Exporter and foreign sales) are fitted probabilities from a first stage probit model estimated with all of the independent variables in the regressions of Table 4 including year and industry dummies plus the instrumental variables "openness" and logarithm of industry productivity. Models (1) and (2) in Panel A define "openness" as the ratio of export sales to total net sales of all firms on Compustat in the four-digit SIC code of the IPO firm in the year that it goes public. Models (3) and (4), model (5), and model (6) in Panel A analogously define "openness" using foreign sales, exports and/or foreign sales, and exports and foreign sales, respectively. Exports and foreign sales are obtained from the Compustat Geographic Segment database. Panel B computes "openness" based on the number of firms with international business activity. Thus, models (1) and (2), models (3) and (4), model (5), and model (6) in Panel B define "openness" as the ratio of the number of firms in the four-digit SIC code of the IPO firm in the year that it goes public with exports, foreign sales, exports and/or foreign sales, and exports and foreign sales, respectively, to the total number of firms in the four-digit SIC code of the IPO firm in the year that it goes public. Models (1), (3), and (5) use the full sample. Model (2) excludes IPOs with foreign sales that do not have exports. Model (4) excludes IPOs with exports that do not have foreign sales. Model (6) excludes IPOs that have either exports or foreign sales. The control variables and year and industry dummies are the same as those used in the regressions of Table 4. We use the Cragg–Donald statistic to assess whether the instruments are weak. When there is one endogenous regressor as in our models (i.e., international business activity), the Cragg–Donald statistic has an *F* distribution under the null hypothesis that the instruments have no explanatory power in the first stage regression. With one endogenous regressor and two excluded instruments, the critical value (Stock–Yogo weak ID test) for the Cragg–Donald statistic for 10% maximal size distortion is 19.93. Since we have two unique instruments and one endogenous regressor in each IV regression model, we use the Sargan test for overidentifying restrictions to assess whether the instruments are uncorrelated with the second-stage error. If the test statistic – which is distributed chi-square – exceeds the critical value we reject the null hypothesis that the instruments are uncorrelated with the structural error and conclude that the instruments are not exogenous. We report *t*-statistics in parentheses below parameter estimates that are computed using robust standard errors clustered by industry. We report the effect of a one standard deviation increase in the fitted probability on underpricing in square brackets below parameter estimates. We use *** and ** to denote significance at the 1% and 5% levels, respectively.

4.3. Long-run stock market performance

Starting with Ritter (1991), a large number of studies document long-run underperformance of newly public firms. Since that time, researchers have sought to explain this phenomenon and identify factors that influence post-issue performance.[34] As argued above, we hypothesize that international business activity should improve the post-issue performance of newly public firms by augmenting domestic cash flows and/or allowing for enhanced diversification of priced cash flow risks. In this section, we test this hypothesis by comparing the post-issue performance of IPO firms with and without international business activity.

Table 9 reports calendar time abnormal returns and buy-and-hold returns for portfolios of IPOs with and without international business activity over the period from 1981 to 2012. Panels A and B report calendar time abnormal returns. For each

[34] For a small sample of this work, see Loughran and Ritter (1995), Brav and Gompers (1997), Carter et al. (1998), Teoh et al. (1998), and recently Carter et al. (2011), Krishnan et al. (2011), and Brau et al. (2012).

Table 8
Propensity score analysis to correct for selection bias in the relation between international business activity and IPO underpricing.

Panel A. Probit model estimations used to predict international business activity for propensity score matching

	Dependent variable = 1 for			
	Exporter (1)	Foreign sales (2)	Exporter and/or foreign sales (3)	Exporter and foreign sales (4)
Log productivity	0.047***	−0.016**	0.020**	−0.003
	(5.36)	(−2.22)	(2.46)	(−0.50)
Log firm sales	0.242***	0.074***	0.058***	0.042***
	(3.81)	(14.06)	(9.49)	(8.37)
Capex/total assets	−0.089	−0.265***	−0.286***	−0.113
	(−1.10)	(−3.63)	(−3.61)	(−1.54)
Log(1 + firm age)	0.022***	0.018***	0.028***	0.011**
	(2.80)	(2.75)	(3.66)	(2.02)
Leverage ratio	−0.216***	−0.041	−0.135***	−0.048*
	(−5.26)	(−1.36)	(−3.68)	(−1.65)
R&D/sales	0.463***	0.457***	0.513***	0.372***
	(5.96)	(6.42)	(6.31)	(6.71)
No. of analysts	−0.018***	0.007***	−0.002	−0.008***
	(−5.38)	(2.83)	(−0.59)	(3.24)
Prestigious underwriter dummy	−0.017	0.008	−0.006	−0.012
	(−1.34)	(0.71)	(−0.49)	(−1.28)
Recession dummy	−0.009	−0.064**	−0.015	−0.070**
	(−0.30)	(−2.11)	(−0.52)	(−2.06)
Industry dummies	Yes	Yes	Yes	Yes
Pseudo R^2	0.21	0.25	0.20	0.27
Chi-square statistic	899.50***	882.75***	1151.56***	313.29***
Observed probability	0.22	0.15	0.28	0.06
Predicted probability	0.22	0.15	0.28	0.06
Observations	4001	4044	4786	2519

Panel B. Balance test: Mean comparison of covariates from probit Model (1)

	Treatment group	Control group	Difference	|t-Statistic|
Log productivity	5.427	5.447	−0.020	0.55
Log firm sales	4.099	4.082	0.017	0.25
Capex/total assets	0.065	0.067	−0.002	0.81
Log(1 + firm age)	2.342	2.382	−0.040	1.00
Leverage ratio	0.094	0.091	0.003	0.47
R&D/sales	0.085	0.084	0.001	0.19
No. of analysts	2.257	2.363	−0.106	1.12
Prestigious underwriter dummy	0.477	0.473	0.004	0.14

Panel C. Average IPO underpricing (in percent) for treatment and control firms

Model	Treatment group	Control group	Difference	|z-Statistic|
C1. One-to-one match				
(1) Exporter	16.453	24.688	−8.235	4.42***
(2) Foreign sales	14.986	23.891	−8.905	3.47***
(3) Exporter and/or foreign sales	16.294	24.343	−8.049	4.81***
(4) Exporter and foreign sales	11.800	23.845	−12.045	2.86***
C2. One-to-three match				
(1) Exporter	16.453	24.159	−7.706	5.01***
(2) Foreign sales	14.986	23.683	−8.697	4.78***
(3) Exporter and/or foreign sales	16.294	23.958	−7.664	5.57***
(4) Exporter and foreign sales	11.800	23.154	−11.354	4.44***

The table presents results from propensity score analysis where underpricing of IPOs with international business activity (treatment group) is compared to underpricing of IPOs without international business activity (control group). Panel A reports marginal effects from probit models estimated using IPOs with and without international business activity. The probit models are used to compute propensity scores (probability of international business activity) to match treatment and control firms. The dependent variables in Models (1), (2), (3), and (4) are the dummy variables *Exporter*, *Foreign sales*, *Exporter and/or foreign sales* and *Exporter and foreign sales*, respectively. Model (1) excludes IPOs with foreign sales that do not also have exports. Model (2) excludes IPOs with exports that do not also have foreign sales. Model (4) excludes IPOs with exports or foreign sales. All variables are defined in the Appendix. All regressions use the Fama–French 48 industry groups to control for industry fixed effects. In parentheses below the coefficient estimates are *z*-statistics computed using robust standard errors. Based on the estimated propensity scores for the treatment and control samples, we use nearest-neighbor (NN) matching with replacement to implement one-to-one and one-to-three matching of treatment and control samples. We allow for replacement because a control IPO can be a best match for more than one treatment IPO. Panel B reports a balance check for Model (1) in Panel A where we compare the means of the covariates for the treatment group (IPO firms with exports) to those of the one-to-one NN-matched control group of IPOs without international business activity. This goodness of fit test assesses whether the means of the covariates in the propensity score model (i.e., the independent variables in the probit regression of Panel A) are statistically indistinguishable in treatment and control groups. Although unreported in Panel B, all treatment and control groups examined in Panel C pass the balance test. Panel C reports average underpricing for treatment and control groups based on one-to-one and one-to-three propensity score NN matching. In the latter case, each IPO firm with international business activity is matched with three closest fit IPO firms without international business activity. We report a *z*-statistic for the difference in average underpricing that is computed using the analytical estimator of the asymptotic variance of matching estimators proposed by Abadie and Imbens (2006, 2008). We use *** and ** to denote significance at the 1% and 5% levels, respectively.

calendar month, we compute the return on equally-weighted (Panel A) and value-weighted (Panel B) portfolios of firms with and without international business activity that made initial public offerings within the last 3 years and 5 years of the calendar month. Based on the monthly time series of portfolio returns, we estimate portfolio alphas using a Fama and French (1993) three factor model

Table 9
Long-run performance of IPO firms with and without international business activity.

Type of international business activity	3-year window			5-year window		
	IPOs with international business activity	IPOs without international activity	Return difference	IPOs with international business activity	IPOs without international activity	Return difference
Panel A. Portfolio alphas in percent per month for equally weighted portfolios of IPOs with and without international business activity						
Exporter	0.427	−0.333**	0.737***	0.409*	−0.259*	0.668***
	(1.36)	(−2.14)	(2.59)	(1.66)	(−1.81)	(3.18)
Foreign sales	0.345	−0.333**	0.671***	0.418**	−0.259*	0.646***
	(1.62)	(−2.14)	(3.31)	(2.08)	(−1.81)	(3.56)
Exporter and/or foreign sales	0.285	−0.333**	0.618***	0.337**	−0.259*	0.597***
	(1.57)	(−2.14)	(3.91)	(2.02)	(−1.81)	(4.43)
Exporter and foreign sales	0.500	−0.333**	0.887	0.877*	−0.259*	1.090***
	(0.86)	(−2.14)	(1.53)	(2.13)	(−1.81)	(2.85)
Panel B. Portfolio alphas in percent per month for value-weighted portfolios of IPOs with and without international business activity						
Exporter	0.617	−2.56	0.830**	0.590*	−0.302**	0.892***
	(1.64)	(−1.61)	(2.26)	(1.75)	(−2.23)	(2.74)
Foreign sales	0.234	−0.256	0.537**	0.200	−0.302**	0.534**
	(1.03)	(−1.61)	(2.27)	(0.91)	(−2.23)	(2.41)
Exporter and/or foreign sales	0.286	−0.256	0.542***	0.306	−0.302**	0.607***
	(1.50)	(−1.61)	(2.74)	(1.58)	(−2.23)	(3.22)
Exporter and foreign sales	0.737	−0.256	1.010	0.915*	−0.302**	1.250***
	(1.16)	(−1.61)	(1.63)	(1.91)	(−2.23)	(2.66)

Panel C. Comparison of average buy-and-hold returns over 24 months (BHR24), 36 months (BHR36), 48 months (BHR48), and 60 months (BHR60) after the IPO for propensity-scored-matched samples with international business activity (treatment group) and without international business activity (control group)

Type of international business activity	Treatment group	Control group	Difference	*z*-Statistic
Exporter				
BHR24	0.374	0.078	0.296	3.64***
BHR36	0.440	0.261	0.179	1.56
BHR48	0.716	0.332	0.384	1.97**
BHR60	0.996	0.550	0.446	1.56
Foreign sales				
BHR24	0.328	0.215	0.113	1.40
BHR36	0.456	0.361	0.095	0.74
BHR48	0.706	0.405	0.301	2.05**
BHR60	0.886	0.565	0.321	1.60
Exporter and/or foreign sales				
BHR24	0.339	0.148	0.191	2.84***
BHR36	0.448	0.302	0.146	1.48
BHR48	0.686	0.360	0.326	2.30**
BHR60	0.953	0.551	0.402	1.79*
Exporter and foreign sales				
BHR24	0.493	0.172	0.321	2.03**
BHR36	0.435	0.388	0.047	0.21
BHR48	0.932	0.479	0.453	1.27
BHR60	0.960	0.556	0.404	1.16

Calendar time abnormal returns (in percent) and buy-and-hold returns are reported for IPOs with and without international business activity over the period from 1981 to 2012. Panels A and B report calendar time abnormal returns. For each calendar month, we calculate the return on equally-weighted (Panel A) and value-weighted (Panel B) portfolios of firms with and without international business activity that made initial public offerings within the last 3 years and 5 years of the calendar month. Based on the monthly time series of portfolio returns, we estimate portfolio alphas using an eight-factor model. The eight factors include the three Fama–French (1993) factors, the Carhart (1997) momentum factor, the Cooper et al. (2008) asset growth factor, the Harvey and Siddique (2000) co-skewness factor, the Lyandres et al. (2008) investment factor, and the Pastor and Stambaugh (2003) liquidity factor. For 3 and 5 year rolling time periods, the first two columns in Panels A and B report portfolio alphas (monthly excess return in percent) for IPOs with international business activity and without international business activity, respectively. The third column for each 3 and 5 year rolling time period in Panels A and B reports a portfolio alpha based on the monthly time series of the difference between the returns of IPO firms with international business activity and without international business activity. We report *t*-statistics in parentheses below portfolio alphas that are computed using robust standard errors. Panel C reports average buy-and-hold returns (in decimal) for IPO firms grouped using propensity score analysis. We use the propensity score models reported in Table 8 to estimate the likelihood that a firm going public will be engaged in international business activity. We then use the nearest-neighbor (NN) matching technique to match each IPO firm with international business activity to a firm(s) with an equal likelihood of international business activity but having no international business activity. We report in Panel C the average buy-and-hold returns (BHR) of treatment (international business activity) and control (no international business activity) firms for the 24 month (BHR24), 36 month (BHR36), 48 month (BHR48), and 60 month (BHR60) periods starting the first month after the initial public offering month. Panel C reports results based on a one-to-three propensity score NN matching scheme with replacement. The *z*-statistics for the difference in mean buy-and-hold returns for treatment and control firms are computed using the analytical estimator of the asymptotic variance of matching estimators proposed by Abadie and Imbens (2006, 2008). We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

augmented with a Carhart (1997) momentum factor, a Cooper et al. (2008) asset growth factor, a Harvey and Siddique (2000) co-skewness factor, a Lyandres et al. (2008) investment factor, and a Pastor and Stambaugh (2003) liquidity factor. For 3- and 5-year rolling time periods, the first two columns report portfolio alphas (monthly excess return in percent) for IPOs with and without international business activity. The third column for each 3- and 5-year rolling time period reports a portfolio alpha based on the monthly time series of the difference between the returns of IPO firms with and without international business activity. The *t*-statistics in parentheses below portfolio alphas are computed using robust standard errors.

Consistent with studies on IPO long-run performance, we find negative alphas for portfolios of IPOs without international

Table 10
Robustness tests of long-run performance of IPO firms with and without international business activity.

IPO firm sales	3-year window			5-year window		
	IPOs with international business activity	IPOs without international activity	Return difference	IPOs with international business activity	IPOs without international activity	Return difference
Panel A. Portfolio alphas in percent per month using a purged eight-factor model						
Exporter	0.650**	−0.082	0.715**	0.546**	−0.103	0.649***
	(1.97)	(−0.53)	(2.39)	(2.16)	(−0.74)	(2.88)
Foreign sales	0.397	−0.082	0.540**	0.377	−0.103	0.532**
	(1.60)	(−0.53)	(2.31)	(1.60)	(−0.74)	(2.50)
Exporter and/or foreign sales	0.388**	−0.082	0.470***	0.364**	−0.103	0.467***
	(2.04)	(−0.53)	(2.84)	(2.13)	(−0.74)	(3.27)
Exporter and foreign sales	0.203	−0.082	0.428	0.788*	−0.103	0.916**
	(0.32)	(−0.53)	(0.69)	(1.75)	(−0.74)	(2.17)
Panel B. Portfolio alphas in percent per month grouping IPOs by firm sales						
Sales < $50 million	0.350	−0.651***	0.978**	0.510	−0.336	0.820**
	(0.89)	(−2.68)	(2.50)	(1.54)	(−1.56)	(2.54)
Sales ⩾ $50 million	0.327*	−0.078	0.404**	0.327*	−0.151	0.478***
	(1.81)	(−0.54)	(2.46)	(1.95)	(−1.13)	(3.22)
Panel C. Portfolio alphas in percent per month grouping IPOs by acquisition activity within 1 year of IPO issue date						
Acquirer	0.185	−0.213	0.525*	0.328	−0.156	0.596**
	(0.48)	(−0.70)	(1.80)	(1.19)	(−0.77)	(2.11)
Non-acquirer	0.302	−0.355**	0.656***	0.313*	−0.225	0.538***
	(1.48)	(−1.99)	(3.16)	(1.86)	(−1.54)	(3.59)

Calendar time abnormal returns (in percent) are reported for IPOs with and without international business activity over the period from 1981 to 2012. For each calendar month, we calculate the return on equally weighted portfolios of firms with and without international business activity. In Panel A, we use the monthly time series of portfolio returns to estimate portfolio alphas using a purged eight-factor model. The eight factors include the three Fama–French (1993) factors, the Carhart (1997) momentum factor, the Cooper et al. (2008) asset growth factor, the Harvey and Siddique (2000) co-skewness factor, the Lyandres et al. (2008) investment factor, and the Pastor and Stambaugh (2003) liquidity factor. Following Loughran and Ritter (2000), we construct the factors after purging firms that have publicly issued equity in an IPO or SEO during the prior 5 years. In Panel B, IPO firms are grouped by net sales in millions of 2009 constant dollars measured at the fiscal year end immediately after the IPO. Of the 4994 IPO firms in the sample, 2057 are classified as small (sales < $50 million) and 2937 are classified as large (sales ⩾ $50 million). Of the 2057 small IPO firms, 462 (23%) have international business activity (399 with exports, 91 with foreign sales, and 28 with exports and foreign sales); and of the 2937 large IPO firms, 922 (31%) have international business activity (494 with exports, 557 with foreign sales, and 129 with exports and foreign sales). In this panel, IPOs with international business activity are IPO firms with exports and/or foreign sales in the IPO year and the year before. We use an up-purged eight-factor model to compute calendar time abnormal returns. In Panel C, IPO firms are grouped by whether they are an acquirer in an acquisition within 1 year after the IPO issue date. In this panel, IPOs with international business activity are IPO firms with exports and/or foreign sales in the IPO year and the year before. We use an up-purged eight-factor model to compute calendar time abnormal returns. For 3 and 5 year rolling time periods, the first two columns in each panel report portfolio alphas (monthly excess return in percent) for IPOs with international business activity and without international business activity, respectively. The third column for each 3 and 5 year rolling time period reports a portfolio alpha based on the monthly time series of the difference between the returns of IPO firms with international business activity and without international business activity. We report *t*-statistics in parentheses below portfolio alphas that are computed using robust standard errors. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

business activity. IPOs with international business activity, however, show positive alphas. Inspection of the coefficients in the difference columns shows that IPOs with international business activity outperform IPOs without international business activity by a wide margin. Thus, for example, for the equally-weighted portfolios (Panel A) in the 5-year window, globally diversified IPOs outperform purely domestic IPOs by 60–109 basis points per month. Also note that IPO firms with exports tend to have better long-run performance than IPO firms with foreign sales, but the best long-run performance is for IPO firms with both exports and foreign sales.

As with the analysis of IPO initial returns, we use propensity score matching (PSM) to mitigate a potential problem associated with selection bias. We use the estimated propensity score models reported in Panel A of Table 8 to construct treatment and control portfolios of IPO firms with international business activity and IPO firms without international business activity. The control portfolios are constructed using a one-to-one and one-to-three propensity score NN matching scheme with replacement. We report in Panel C of Table 9 the average buy-and-hold returns of treatment (international business activity) and control (no international business activity) firms for 24 month (BHR24), 36 month (BHR36), 48 month (BHR48), and 60 month (BHR60) periods starting from the month after the initial public offering. The *z*-statistics for the difference in mean buy-and-hold returns for treatment and control firms are computed using the analytical estimator of the asymptotic variance of matching estimators proposed by Abadie and Imbens (2006, 2008). To conserve space, the table reports only the results for one-to-three matching.[35]

As seen in Panel C, the average buy-and-hold return for the treatment portfolio is larger than that for the control portfolio for all four types of international business activity and for each holding period. Furthermore, the differences are generally economically and statistically significant. For example, focusing on the first 48 months after the IPO, we see differences of 38, 30, 33, and 45 percentage points for IPO firms with exports, foreign sales, exports and/or foreign sales, and exports and foreign sales, respectively.

Table 10 reports the results of several robustness tests. For all panels in the table, we report results only for calendar time abnormal returns of equally-weighted portfolios.[36] Loughran and Ritter (2000) argue that excluding issuing firms when constructing factors is appropriate since it guarantees that the factors are not influenced by the stocks in the sample. In Panel A, we report portfolio alphas based on a purged eight factor model (i.e., the same eight factors used in Table 9) where the factors are constructed after excluding (purging) firms that have publicly issued equity in an IPO or seasoned equity offering (SEO) during the prior 5 years. Observe that our results – IPOs with international business activity outperform

[35] Results for one-to-one matching are available upon request.

[36] For Panels B and C, we report results for the category exports and/or foreign sales only. Results for value-weighted portfolios or buy-and-hold returns, and for the categories exports, foreign sales, and exports and foreign sales, are similar and are available on request.

domestic IPOs in the long run – continue to hold using a purged eight-factor model.[37]

Ritter (2011) documents that long-run underperformance of IPO firms is present only in firms with inflation-adjusted sales less than $50 million. Since the average and median IPO firm in our sample with international business activity has inflation-adjusted sales larger than $50 million – the same is true for the sample of purely domestic IPO firms (see Table 3) – a natural question is whether the better relative long-run performance of IPOs with international business activity is confounded by size. To investigate whether size may explain our results, Panel B in Table 10 reports portfolio alphas for IPO firms grouped by whether sales in 2009 constant dollars are below or above $50 million.[38] As seen there, although IPOs with inflation-adjusted sales below $50 million tend to have worse long-run performance, IPOs with international business activity generally have economically and statistically better performance than purely domestic IPOs in both the below and above $50 million dollar sales categories. For example, in the 5-year window, globally diversified IPOs outperform purely domestic IPOs by 82 basis points per month for the below $50 million dollar sales group and by 48 basis points per month for the above $50 million dollar sales group.

Panel C of Table 10 reports portfolio alphas for IPOs grouped by post-IPO acquisition activity. In particular, Brau et al. (2012) find in their IPO sample from 1985 to 2003 that only newly listed firms that acquire within a year after their IPO have poor long-run performance. Thus we group IPO firms in the sample by whether they are an acquirer in an acquisition within 1 year after the IPO issue date and we examine performance over 3- and 5-year windows following the first year.[39] As seen in the table, we continue to find that IPO firms with international business activity outperform purely domestic IPO firms over 3- and 5-year windows in both the acquirer and non-acquirer groups.

Finally, although not reported in Table 10, we examine whether our long-run performance results are influenced by newly public firms switching from globally diversified to purely domestic or from purely domestic to globally diversified in the post IPO period. We purge the global and purely domestic IPO samples of firms that switch status in 3-year or 5-year periods after the IPO year and re-estimate our calendar time abnormal returns. In results that are available upon request, we continue to find that global IPOs outperform purely domestic IPOs over 3- and 5-year windows after the IPO for subsamples of IPO firms that do not switch.

Overall, our results show strongly and robustly that IPO firms with international business activity outperform purely domestic IPO firms after going public. An implication is that a strategy of a long position in a portfolio of IPOs with international business activity and a short position in a portfolio of IPOs with purely domestic operations can generate significant abnormal returns.

4.4. Survival analysis

Another persistent phenomenon of IPOs is the poor survival rate of newly public firms.[40] An interesting question is whether global diversification favorably influences survival. We can investigate this question by estimating a hazard model of the time until failure of our sample of IPOs from 1981 to 2012. Thus we test whether global diversification decreases the failure rate of newly public firms.

Of the 4994 firms in the sample, 1397 (28%) survive as independent standalone entities from the time of the IPO through the end of 2012, 2595 (52%) are acquired sometime after going public, and 1002 (20%) are delisted because of bankruptcy or liquidation. Following Krishnan et al. (2011), we define a "survivor" as an IPO firm that continues to operate as an independent entity through the end of the sample period or is acquired.[41] We use a Cox (1972) proportional hazard model to examine the influence of global diversification on the survival of IPO firms. In these models, the average probability of failure over a unit of time is separable into the product of a baseline hazard function that is independent of sample characteristics and a non-negative (exponential) function of a set of characteristics explaining failure. We assume that the baseline hazard function is a constant, so that the likelihood of failure is independent of the time since going public. All of our results are robust to allowing for positive or negative duration dependence. The model is estimated by maximum likelihood using a likelihood function shaped by the time to failure defined as the number of months from the IPO date to the date of delisting or the end of 2012, a dummy variable which indicates (right) censored data for IPO firms that survive beyond the end of 2012, and a set of characteristics explaining failure.

Table 11 reports results from hazard models of the effect of international business activity on IPO survival. Models (1)–(4) estimate, respectively, the effects of *Exporter*, *Foreign Sales*, *Exporter and/or Foreign Sales*, and *Export and Foreign Sales* on the hazard rate (i.e., failure rate) of IPOs. Following Krishnan et al. (2011), the control variables in the models include IPO proceeds, a dummy variable for venture capital support, a dummy variable for prestigious underwriter, offer price revision, logarithm of firm age at the IPO, logarithm of issuer market capitalization, and market-to-book, as well as year and industry fixed effects. All variables are defined in the Appendix.

Consistent with the hypothesis that global diversification enhances IPO firm survival, observe that the coefficient estimates on the international business activity variables are negative (i.e., international business activity decreases the hazard rate of IPO firms).[42] The hazard ratios – reported in square brackets below the coefficient estimates – show that the failure rates of IPO firms with exports, foreign sales, exports and/or foreign sales, and exports and foreign sales are 71%, 67%, 72%, and 57%, respectively, of those of purely domestic IPO firms.[43] The signs of the coefficients on the other variables in the models are consistent with results reported in the literature (see, e.g., Table 5 in Jain and Kini (2008) and Table 2 in Krishnan et al. (2011)). Overall, we find strong support for the hypothesis that global diversification enhances the survival of newly public firms.[44]

[37] Our results also are robust to 3-, 4-, 5-, 6-, or 7-factor models.

[38] Of the 4994 IPO firms in the sample, 2057 are classified as small (sales < $50 million) and 2937 are classified as large (sales ⩾ $50 million). Of the 2057 small IPO firms, 462 (22%) have international business activity (399 with exports, 91 with foreign sales, and 28 with exports and foreign sales); and of the 2937 large IPO firms, 922 (31%) have international business activity (494 with exports, 557 with foreign sales, and 129 with exports and foreign sales).

[39] Of the 1384 IPOs with international business activity (exporter and/or foreign sales), 285 (20.6%) are acquirers; and of the 3610 domestic IPOs, 931 (25.8%) are acquirers.

[40] For example, see Jain and Kini (2000), Fama and French (2004), and Krishnan et al. (2011).

[41] We include acquired firms in the survivor group under the assumption that being acquired means that the firm is an attractive target and therefore prospered after going public. As noted below, our results are not affected if we exclude IPO firms that are acquired from the analysis.

[42] We continue to find significantly negative coefficient estimates when we replace the international business indicator variables with continuous variables based on the proportion of sales derived from international business. Results are available upon request.

[43] Using the coefficient estimates on the international business activity dummy variables reported in Models (1)–(4), the hazard ratios (in percent) are computed as 100exp(−0.344) = 71%, 100exp(−0.397) = 67%, 100exp(−0.330) = 72%, and 100-exp(−0.571) = 57%, respectively.

[44] Our results are robust to alternative hazard model specifications such as a Weibull model or a log-logistic hazard function for the baseline hazard. Model estimates are also robust when we exclude IPO firms that are acquired and focus only on the subsamples of IPO firms that continue to operate as independent firms throughout our sample period (survivors) and that go bankrupt or liquidate (failures). All results are available upon request.

Table 11
The effect of international business activity on the survival of newly public firms.

	(1)	(2)	(3)	(4)
Exporter	−0.344***			
	(−3.49)			
	[0.709]			
Foreign sales		−0.397***		
		(−2.78)		
		[0.672]		
Exporter and/or foreign sales			−0.330***	
			(−3.58)	
			[0.719]	
Exporter and foreign sales				−0.571***
				(−2.64)
				[0.565]
Log proceeds	−0.186*	−0.272***	−0.217**	−0.241***
	(−1.88)	(−3.09)	(−2.23)	(−2.78)
Venture capital	0.052	0.012	0.038	0.029
	(0.75)	(0.16)	(0.48)	(0.39)
Prestigious Underwriter	−0.088	−0.140	−0.106	−0.121
	(−0.89)	(−1.32)	(−1.24)	(−1.16)
Offer price revision ($\times 10^{-2}$)	−0.523***	−0.477**	−0.546**	−0.454**
	(−2.81)	(−2.28)	(−2.14)	(−2.00)
Log(1 + firm age)	−0.306***	−0.288***	−0.295***	−0.297***
	(−6.48)	(−5.26)	(−7.26)	(−5.42)
Underpricing ($\times 10^{-2}$)	0.137*	0.112	0.148	0.099
	(1.82)	(1.34)	(1.05)	(1.31)
Log issuer mkt cap	−0.187*	−0.109	−0.141*	−0.159*
	(−1.94)	(−1.20)	(−1.68)	(−1.78)
Market-to-book	−0.051***	−0.047***	−0.055***	−0.043***
	(−3.21)	(−2.66)	(−3.04)	(−2.60)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Model Chi-square	467.1***	419.66***	493.23***	390.95***
Observations	4471	4224	4956	3739

This table reports estimates from a Cox proportional hazard model of the likelihood of IPO failure from the date of the IPO to failure or December 31, 2012. Failed IPOs are defined as firms that have been delisted because of bankruptcy or liquidation. The time-to-failure is the number of months between the IPO month and the month of delisting. The dependent variable is the logged hazard rate. The key independent variables in Models (1)–(4) are the dummy variables *Exporter*, *Foreign sales*, *Exporter and/or foreign sales*, and *Exporter and foreign sales*, respectively. In Model (1) the regression sample excludes IPOs with foreign sales that do not also have exports, in Model (2) the regression sample excludes IPOs with exports that do not also have foreign sales, and in Model (4) the regression sample excludes IPOs with exports or foreign sales. The other independent variables in the models are defined in the Appendix. All models include year and Fama–French 48-industry fixed effects. In parentheses below the coefficient estimates are *z*-statistics computed using robust standard errors clustered by industry. Hazard ratios for international business activity variables are reported in square brackets below coefficient estimates. We use ***, **, and * to denote significance at the 1%, 5%, and 10% levels, respectively.

5. Conclusion

In this paper, we examine the impact of international business activity on the valuation, performance, and survival of IPO firms. We find that globally diversified IPOs have lower underpricing than domestic IPOs, which suggests that global diversification mitigates valuation uncertainty and helps promote spanning of IPO firms and market completeness. We also document that globally diversified IPOs have better long-run performance than domestically focused IPOs, which indicates that international business activity contributes positively to the performance of newly public firms. Finally, we use hazard models to analyze the relation between the survival profile of IPO firms and international business activity. We find that globally diversified IPOs have a significantly lower hazard of failure in comparison to purely domestic IPOs.

The analysis makes several contributions to the literature. Ours is the first study to document the important role that global diversification plays in the pricing and subsequent performance of newly public firms. The analysis not only identifies an important new factor explaining IPO performance, it also provides a valuation dimension to the impact of international business activity on firm performance. Importantly, we also contribute to the global diversification literature that has focused on large publicly traded firms and has reached few definitive conclusions on the valuation consequences of global diversification. Overall, our results suggest that globally diversified firms going public can more fully price their shares in the market (i.e., leave less money on the table) and may have better long-run performance and survival prospects than purely domestic firms.

Appendix : Variable definitions and data sources

Variable	Description (data source)
Underpricing (%)	The return from the offer price to the first trading day's closing price. (SDC/CRSP)
Global diversification dummy variables	
Exporter	Dummy variable equal to one if an IPO firm reports export sales in the IPO year and the year before. (Compustat/Segment)
Foreign sales	Dummy variable equal to one if an IPO firm reports pre-tax foreign income in the IPO year and the year before. (Compustat/Segment)

(*continued on next page*)

Appendix (*continued*)

Variable	Description (data source)
Exporter and/or foreign sales	Dummy variable equal to one if the firm has exports and/or foreign sales in the IPO year and the year before. (Compustat/Segment)
Exporter and foreign sales	Dummy variable equal to one if the firm has exports and foreign sales in the IPO year and the year before. (Compustat/Segment)
Global diversification continuous variables	
Exports/sales	The ratio of export sales to total firm sales at the fiscal year-end immediately prior to the IPO issue date. (Compustat/Segment)
Foreign/sales	The ratio of foreign sales to total firm sales at the fiscal year-end immediately prior to the IPO issue date. (Compustat/Segment)
Exp and/or fgn/sales	The sum of exports and/or foreign sales to total firm sales at the fiscal year-end immediately prior to the IPO issue date. (Compustat/Segment)
Butler et al. (2014) robust controls in underpricing regression[1]	
Log firm sales	Natural logarithm of total firm sales at the fiscal year-end immediately prior to the IPO issue date. (Compustat)
Offer price revision (%)	The difference between the offer price and the midpoint of the filing price range. (SDC)
No. of analysts	Maximum number of analysts making annual earnings forecasts in any month within 1 year after the IPO issue date. (I/B/E/S)
Analyst coverage	Dummy variable equal to one if at least one analyst makes an earnings forecast within 1 year after the IPO issue date. (I/B/E/S)
Total liabilities/assets	The ratio of total liabilities to total assets at the fiscal year-end immediately prior to the IPO issue date. (Compustat)
Investment bank mkt share (%)	The market share of the IPO firm's lead investment bank in the year the firm went public, where market share in calendar year t is the ratio of the total IPO proceeds the investment bank underwrote (as lead investment bank) in calendar year t to overall IPO proceeds in calendar year t. (SDC)
Avg underpricing in prv 30 days (%)	Average first-day return across all IPOs in the 30 days prior to the IPO issue date. (SDC)
Avg revision in prv 30 days (%)	Average price revision across all IPOs in the 30 days prior to the IPO issue date. (SDC)
Prior 30 day CRSP EW index (%)	Average return of the CRSP equally weighted stock return index in the 30 days prior to the IPO issue date (i.e., day −31 to day −1, where day 0 is the IPO issue date). (CRSP)
Log(1 + shrs rtd/shrs ofrd)	Natural logarithm of one plus the ratio of the shares retained to the shares offered, where the shares retained is the difference between the shares outstanding and the total shares sold (including overallotment shares). The shares outstanding is CRSP shares outstanding, which is the sum of all classes of shares when the firm has multiple classes of stock. (SDC/CRSP)
Offer price revision negative (%)	Equals offer price revision if *Offer price revision* < 0, otherwise 0. (SDC)
Log(industry mkt value/sales)	Twelve-month rolling average of the industry market value to sales ratio, where industries are based on Fama–French 48 industry groups. The natural logarithm of the IPO firm's Fama–French industry ratio in month $t-1$ is matched to each IPO firm, where t is the IPO issue date. Market value is computed as fiscal year-end closing share price time common shares outstanding. (Compustat)
Log(price/sales)	Natural logarithm of offer price times shares outstanding to total firm sales, where total firm sales are from the fiscal year-end immediately prior to the IPO date. (SDC/Compustat)
Prior 30 day industry return (%)	Industry value-weighted average return in the 30 days prior to the IPO issue date (i.e., day −31 to day −1, where day 0 is the IPO issue date), where an IPO firm's industry is based on the 48 Fama-French industry groups. (CRSP)
Prior 30 day SD of industry return (%)	Standard deviation of industry return in the 30 days prior to the IPO issue date. (CRSP)
Prior 30 day Nasdaq return (%)	Average return of the Nasdaq composite index in the 30 days prior to the IPO issue date. (CRSP)
Additional controls for underpricing regressions	
Offer price	IPO offer price. (SDC)
Hot market dummy	Dummy variable equal to one for month t when at least three consecutive months have market heat greater than 38, where market heat for a given sample month is the three-month centered moving average number of IPOs and 38 is the top quartile of the monthly moving averages. (SDC)
Cold market dummy	Dummy variable equal to one for month t when at least three consecutive months have market heat less than 11, where market heat for a given sample month is the three-month centered moving average number of IPOs and 11 is the bottom third of the monthly moving averages. (SDC)

Appendix (*continued*)

Variable	Description (data source)
Other IPO, firm, and market variables[2]	
Issuer market capitalization	Offer price time total number of post-IPO shares in millions of 2009 constant dollars. (SDC/CRSP)
Proceeds	IPO offer proceeds in millions of 2009 constant dollars. (SDC)
Total assets	Book value of total assets in millions of 2009 constant dollars. (Compustat)
Total net sales	Net sales in millions of 2009 constant dollars. (Compustat)
Leverage ratio	The ratio of long-term debt plus debt in current liabilities to the book value of total assets. (Compustat)
Capex/total assets	The ratio of capital expenditures to total assets. (Compustat)
R&D/sales	The ratio of research and development expense to net sales, where R&D is set equal to zero when research and development expense is missing. (Compustat)
Market-to-book	The ratio of the market value of assets to the book value of assets, where the market value of assets is the book value of assets plus the market value of equity minus the book value of equity. (Compustat)
Productivity	Net sales in millions of 2009 constant dollars divided by the number of employees in thousands. The unit of Productivity is thousands of 2009 constant dollars per employee. (Compustat)
Firm age	The IPO year minus the firm's founding year. (Jay Ritter's website: http://bear.warrington.ufl.edu/ritter/ipodata.htm)
Venture capital dummy	Dummy variable equal to one if the IPO firm had/has venture capital support. (SDC)
Prestigious underwriter dummy	Dummy variable equal to one if an IPO firm's lead underwriter has a rank of 8 or 9 based on Jay Ritter's update of the Carter and Manaster (1990) underwriter rankings, where lowest ranking equals 1 and highest ranking equals 9. (Jay Ritter's website: http://bear.warrington.ufl.edu/ritter/ipodata.htm)
Acquirer dummy	Dummy variable equal to one if an IPO firm is a merger acquirer and the effective date of the merger is before the 1-year anniversary of the IPO issue date. (SDC)
High-technology dummy	Dummy variable equal to one if an IPO firm has SIC code 2833, 2834, 2835, 2836, 3571, 3572, 3575, 3577, 3578, 3661, 3663, 3669, 3674, 3812, 3823, 3825, 3826, 3827, 3829, 3841, 3845, 4812, 4813, 4899, 7370, 7371, 7372, 7373, 7374, 7375, 7377,7378, or 7379. (SDC)
Internet dummy	Dummy variable equal to one if the IPO is classified as an internet IPO. (Jay Ritter's website: http://bear.warrington.ufl.edu/ritter/ipodata.htm)
Recession dummy	Dummy variable equal to one if the IPO issue date falls within the dates of a recession as defined by the National Bureau of Economic Research (NBER). The NBER recessions during the sample period from 1981 to 2012 are July 1981 to November 1982, July 1990 to March 1991, March 2001 to November 2001, and December 2007 to June 2009. (SDC/NBER)
Instrument variables	
Openness based on volume of exports	The ratio of export sales to total nets sales of all firms in the four-digit SIC code of the IPO firm in the year that it goes public. (Compustat/Segment)
Openness based on volume of foreign sales	The ratio of foreign sales to total net sales of all firms in the four-digit SIC code of the IPO firm in the year that it sales goes public. (Compustat/Segment)
Openness based on volume of exp and/or fgn sales	The ratio of exports and/or foreign sales to total net sales of all firms in the four-digit SIC code of the IPO firm in and/or fgn sales the year that it goes public. (Compustat/Segment)
Openness based on volume of exp	The ratio of exports and foreign sales to total net sales of all firms with both exports and foreign sales in the four-digit SIC code of the IPO firm in the year that it goes public. (Compustat/Segment)
Openness based on number of firms with exports	The ratio of the number of firms with exports to the total number of firms in the four-digit SIC code of the IPO firm with exports in the year that it goes public. (Compustat/Segment)
Openness based on number of firms with foreign sales	The ratio of the number of firms with foreign sales to the total number of firms in the four-digit SIC code of the IPO with foreign sales firm in the year that it goes public. (Compustat/Segment)
Openness based on number of firms with exp and/or fgn sales	The ratio of the number of firms with exports and/or foreign sales to the total number of firms in the four digit SIC with exp and/or fgn sales code of the IPO firm in the year that it goes public. (Compustat/Segment)
Openness based on number of firms with exp and fgn sales	The ratio of the number of firms with exports and foreign sales to the total number of firms in the four digit SIC with exp and fgn sales code of the IPO firm in the year that it goes public. (Compustat/Segment)
Log of industry productivity	Natural logarithm of one plus average industry productivity, where productivity is net sales in millions of 2009 constant dollars divided by the number of employees in thousands and industry is based on four-digit SIC code. (Compustat)

[1]The Butler et al. (2014) variable "news stories" is replaced with the analyst variables *No. of analysts* and *Analyst coverage*.
[2]Except where noted, all firm characteristics (e.g., total assets, total net sales, etc.) are measured at the fiscal year-end immediately after the IPO issue date.

References

Abadie, A., Imbens, G., 2006. Large sample properties of matching estimators for average treatment effects. Econometrica 74, 235–267.

Abadie, A., Imbens, G., 2008. On the failure of the bootstrap for matching estimators. Econometrica 76, 1537–1557.

Abadie, A., Drukker, D., Herr, J., Imbens, G., 2004. Implementing matching estimators for average treatment effects in Stata. The Stata Journal 4, 290–311.

Baldwin, J., Yan, B., 2011. The death of Canadian manufacturing plants: heterogeneous responses to changes in tariffs and real exchange rates. Review of World Economics 147, 131–167.

Baum, C.F., Nichols, A., Schaffer, M.E. 2011. Evaluating one-way and two-way cluster-robust covariance matrix estimates, German Stat Users' Group Meeting 2011, Stata Users Group.

Berger, P.G., Ofek, E., 1995. Diversification's effect on firm value. Journal of Financial Economics 37, 39–65.

Billett, M.T., Mauer, D.C., 2000. Diversification and the value of internal capital markets: the case of tracking stock. Journal of Banking and Finance 24, 1457–1490.

Billett, M.T., Mauer, D.C., 2003. Cross-subsidies, external financing constraints, and the contribution of the internal capital market to firm value. Review of Financial Studies 16, 1167–1201.

Booth, J.R., Chua, L., 1996. Ownership dispersion, costly information, and IPO underpricing. Journal of Financial Economics 41, 291–310.

Brau, J.C., Couch, R., Sutton, N., 2012. The desire to acquire and IPO long-run underperformance. Journal of Financial and Quantitative Analysis 47, 493–510.

Brav, A., Gompers, P., 1997. Myth or reality? The long-run underperformance of initial public offerings: evidence from venture and nonventure capital-backed companies. Journal of Finance 52, 1791–1821.

Breinlich, H., 2014. Heterogeneous firm-level responses to trade liberalization: a test using stock price reactions. Journal of International Economics 93, 270–285.

Butler, A.W., Keefe, M.O., Kieschnick, R., 2014. Robust determinants of IPO underpricing and their implications for IPO research. Journal of Corporate Finance 27, 367–383.

Cameron, A.C., Miller, D.L., 2015. A practitioner's guide to cluster-robust inference. Journal of Human Resources 50, 317–372.

Campa, J.M., Kedia, S., 2002. Explaining the diversification discount. Journal of Finance 57, 1731–1762.

Carhart, M., 1997. On persistence of mutual fund performance. Journal of Finance 52, 57–82.

Carter, R., Manaster, S., 1990. Initial public offerings and underwriter reputation. Journal of Finance 45, 1045–1067.

Carter, R., Dark, F., Singh, A., 1998. Underwriter reputation, initial returns, and the long-run performance of IPO stocks. Journal of Finance 53, 285–311.

Carter, R., Dark, F., Floros, I., Sapp, T., 2011. Characterizing the risk of IPO long-run returns: the impact of momentum, liquidity, skewness, and investment. Financial Management 40, 1067–1086.

Chang, X., Dasgupta, S., Hilary, G., 2006. Analyst coverage and financing decisions. Journal of Finance 61, 3009–3048.

Cliff, M.T., Denis, D.J., 2004. Do initial public offering firms purchase analyst coverage with underpricing? Journal of Finance 59, 2871–2901.

Comment, R., Jarrell, G.A., 1995. Corporate focus and stock returns. Journal of Financial Economics 37, 67–87.

Cook, D., Kieschnick, R., Van Ness, R., 2006. On the marketing of IPOs. Journal of Financial Economics 82, 35–61.

Cooper, M.J., Gulen, H., Schill, M.J., 2008. Asset growth and the cross-section of stock returns. Journal of Finance 63, 1609–1651.

Cox, D.R., 1972. Regression models and life tables (with discussion). Journal of the Royal Statistical Society B34, 187–220.

De Loecker, J., 2007. Do exports generate higher productivity? Evidence from Slovenia. Journal of International Economics 73, 69–98.

Denis, D.J., Denis, D.K., Yost, K., 2002. Global diversification, industrial diversification, and firm value. Journal of Finance 57, 1951–1979.

di Giovanni, J., Levchenko, A.A., 2009. Trade openness and volatility. Review of Economics and Statistics 91, 558–585.

Doukas, J.A., Kan, O.B., 2006. Does global diversification destroy firm value. Journal of International Business Studies 37, 352–371.

Eaton, J., Kortum, S., Kramarz, F., 2011. An anatomy of international trade: evidence from French firms. Econometrica 79, 1453–1498.

Errunza, V.R., Losq, E., 1985. International asset pricing under mild segmentation: theory and test. Journal of Finance 40, 105–124.

Errunza, V.R., Losq, E., 1989. Capital flow controls, international asset pricing and investors' welfare: a multi-country framework. Journal of Finance 44, 1025–1037.

Errunza, V.R., Senbet, L.W., 1981. The effects of international operations on the market value of the firm: theory and evidence. Journal of Finance 36, 401–417.

Errunza, V.R., Senbet, L.W., 1984. International corporate diversification, market valuation, and size-adjusted evidence. Journal of Finance 39, 727–743.

Fama, E.F., French, K.R., 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33, 3–56.

Fama, E.F., French, K.R., 2004. New lists: fundamentals and survival rates. Journal of Financial Economics 73, 229–269.

Fernando, C.S., Krishnamurthy, S., Spindt, P.A., 2004. Are share price levels informative? IPO firms. Journal of Financial Markets 7, 377–403.

Gande, A., Schenzler, C., Senbet, L.W., 2009. Value effects of global diversification. Journal of International Business Studies 20, 1515–1532.

Greenaway, D., Guariglia, A., Kneller, R., 2007. Financial factors and exporting decisions. Journal of International Economics 73, 377–395.

Greenaway, D., Gullstrand, J., Kneller, R., 2008. Surviving globalization. Journal of International Economics 74, 264–277.

Harvey, C.R., Siddique, A., 2000. Conditional skewness in asset pricing tests. Journal of Finance 55, 1263–1295.

Helpman, E., Melitz, M.J., Yeaple, S.R., 2004. Export versus FDI with heterogeneous firms. American Economic Review 94, 300–316.

Helwege, J., Liang, N., 2004. Initial public offerings in hot and cold markets. Journal of Financial and Quantitative Analysis 39, 541–569.

Jain, B.A., Kini, O., 1994. The post-issue operating performance of IPO firms. Journal of Finance 49, 1699–1726.

Jain, B.A., Kini, O., 2000. Does the presence of venture capitalists improve the survival profile of IPO firms? Journal of Business Finance and Accounting 27, 1139–1176.

Jain, B.A., Kini, O., 2008. The impact of strategic investment choices on post-issue operating performance and survival of US IPO firms. Journal of Business Finance and Accounting 35, 459–490.

Krishnan, C.N.V., Ivanov, V.I., Masulis, R.W., Singh, A.K., 2011. Venture capital reputation, post-IPO performance, and corporate governance. Journal of Financial and Quantitative Analysis 46, 1295–1333.

Lang, L., Stulz, R.M., 1994. Tobin's Q, corporate diversification, and firm performance. Journal of Political Economy 102, 1248–1280.

Lins, K., Servaes, H., 1999. International evidence on the value of corporate diversification. Journal of Finance 54, 2215–2239.

Ljungqvist, A., 2007. IPO underpricing: a survey. In: Espen Eckbo, B. et al. (Eds.), Handbook in Corporate Finance, Volume 1: Empirical Corporate Finance. North-Holland, Amsterdam.

Loughran, T., Ritter, J.R., 1995. The new issues puzzle. Journal of Finance 50, 23–51.

Loughran, T., Ritter, J.R., 2000. Uniformly least powerful tests of market efficiency. Journal of Financial Economics 55, 361–389.

Lyandres, E., Sun, L., Zhang, L., 2008. The new issues puzzle: testing the investment-based explanation. Review of Financial Studies 21, 2825–2855.

Mauer, D.C., Senbet, L.W., 1992. The effect of the secondary market on the pricing of initial public offerings: theory and evidence. Journal of Financial and Quantitative Analysis 27, 55–79.

Melitz, M.J., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71, 1695–1725.

Merton, R.C., 1987. A simple model of capital market equilibrium with incomplete information. Journal of Finance 42, 483–510.

Park, A., Yang, D., Shi, X., Jiang, Y., 2010. Exporting and firm performance: Chinese exporters and the Asian financial crisis. Review of Economics and Statistics 92, 822–842.

Pastor, L., Stambaugh, R., 2003. Liquidity risk and expected stock returns. Journal of Political Economy 111, 642–685.

Reeb, D.M., Mansi, S.A., Allee, J.M., 2001. Firm internationalization and the cost of debt financing: evidence from non-provisional publicly traded debt. Journal of Financial and Quantitative Analysis 36, 395–414.

Ritter, J.R., 1984. The hot issue market of 1980. Journal of Business 57, 215–240.

Ritter, J.R., 1991. The long-run performance of initial public offerings. Journal of Finance 46, 3–27.

Ritter, J.R., 2011. Equilibrium in the initial public offering market. Annual Review of Financial Economics 3, 347–374.

Ritter, J.R., Welch, I., 2002. A review of IPO activity, pricing and allocations. Journal of Finance 57, 1795–1828.

Rosenbaum, P.R., Rubin, D.B., 1983. The central role of the propensity score in observational studies for causal effects. Biometrika 70, 41–55.

Santos, M.B., Errunza, V.R., Miller, D.P., 2008. Does corporate international diversification destroy value? Mergers and acquisitions. Journal of Banking and Finance 32, 2716–2724.

Servaes, H., 1996. The value of diversification during the conglomerate merger wave. Journal of Finance 51, 1201–1225.

Teoh, S.H., Welch, I., Wong, T.J., 1998. Earnings management and the long-run market performance of initial public offerings. Journal of Finance 53, 1935–1974.

Tybout, J., 2003. Plant and firm-level evidence on the "new" trade theories. In: Choi, E.K., Harrigan, J. (Eds.), Handbook of International Trade. Basil-Blackwell, Oxford, pp. 388–415.

Villalonga, B., 2004. Diversification discount or premium? New evidence from the business information tracking series. Journal of Finance 59, 479–506.

Whited, T.M., 2001. Is it inefficient investment that causes the diversification discount? Journal of Finance 56, 1667–1692.

Wooldridge, J.M., 2002. Econometric Analysis of Cross Section and Panel Data. MIT Press, Cambridge, MA.