Inflexibility and Stock Returns of International Firms

by Melita Kalczynska

(Under the Direction of Daniel Rettl)

Abstract

Firm operating leverage is a well-known determinant of risk and return. However, this relationship is not straightforward. In theory, firms with greater operating leverage are expected to have greater risk, but recent literature has suggested that the level of scale flexibility, or the ability of a firm to adjust to changing productivity, plays a role in determining the strength of the positive relationship between operating leverage and risk. Combining methods from previous literature, this study leverages international data to further explore the effect of firm inflexibility on risk. Furthermore, this study investigates possible factors that make certain firms more flexible than others by examining cross-country differences in several candidate drivers of inflexibility. The results suggest that the relationship between scale flexibility and risk holds in the international sample, and differences in institutional environments across countries may have an effect on average firm inflexibility.

Keywords: Flexibility, Labor Leverage, Operating Leverage, Risk and Return

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Introduction

Scale flexibility is defined as the ability of firms to adapt to changes in the market and adjust their operations accordingly. In recent years, several studies have attempted to measure and analyze flexibility, as the ability to respond to productivity shocks can have implications on a firm's profitability and risk level. One such study is Gu, Hackbarth, and Johnson (2017) (hereafter GHJ), who propose a novel measure which can be used to explore the interaction effect of flexibility and operating leverage on firm risk. GHJ find that while risk rises with operating leverage for all firms, the gap is wider for less flexible firms. With this finding, the authors argue that scale flexibility is an important factor in the conditional response of firm risk to shifts in operating leverage.

While the relationship of scale flexibility and risk has been studied in the U.S. sample, there is a need to validate these findings on the global scale. The current study aims to contribute to existing literature by first replicating the findings of GHJ using U.S. data, and then extending the analysis to non-U.S. data. This study also aims to leverage international data to investigate potential drivers of scale flexibility.

Following GHJ, firms are sorted into quintile portfolios based on proxy measures for their flexibility and operating leverage, and average excess returns of the resultant portfolios are computed. Consistent with the findings from GHJ, the U.S. results show that the return spread between firms in the highest and lowest quintiles of operating leverage is wider for the most inflexible firms. The patterns for inflexibility, operating leverage, and profitability from GHJ, which used only U.S. data, also hold in the international sample.

Next, this study seeks to identify what makes some firms more flexible than others by first examining labor costs as a possible source of inflexibility. To accomplish this, the GHJ proxy measure for operating leverage is replaced with a labor leverage proxy from Donangelo et al.

(2019). The resulting portfolio sorts support the findings of Donangelo et al. (2019) that returns are higher for firms with a larger labor share, and provide some evidence that this effect is stronger for more inflexible firms, a pattern that mimics the sorts using the GHJ operating leverage measure.

In addition to labor costs, this study also examines the impact of institutional characteristics, specifically those that relate to the strength of the capital market, on firm flexibility. Using methods from Öztekin and Flannery (2012), portfolio sorts are compared across countries with different institutional characteristics. Firms in countries with stronger capital markets are found to be less flexible. The results suggest that firms which operate in riskier markets seek to reduce their in-house risk by staying more flexible, while firms in countries with stronger protections can afford more inflexibility.

This study contributes to existing literature on scale flexibility by replicating and extending GHJ, and exploring possible institutional determinants of scale flexibility.

1.1 Literature Review

A firm with high flexibility has, by definition, lower costs associated with adjusting. In times of declining productivity and the resulting increase in operating leverage relative to sales, a flexible firm can contract, decreasing risk (Lev, 1974). However, complexity arises because flexible firms are able to adjust their scale either upwards or downwards. GHJ point out that in times of increasing productivity, a flexible firm can expand more easily, taking on more risk. To test their hypothesis, they create two measures: one that acts as a proxy for firm inflexibility and one that captures operating leverage (described in detail in the *Data and Methods* section). The novel inflexibility measure from GHJ scales the width of a firm's "inaction region", or range of profitability, by the volatility of its productivity shock. The range of the inaction region is wider for less flexible firms, which the authors suggest may stem from forces such as the ability to alter factor intensity, product mix, pricing, or technology. The drivers of scale flexibility are not entirely clear, but there is a growing literature that directs attention to potential sources. The current

study applies the methods of GHJ to international data to investigate factors that could affect firm flexibility, and to further explore the effect of firm inflexibility on risk.

Donangelo et al. (2019) study a firm-level measure of labor leverage as a possible source of firm risk. The authors argue that labor costs are less variable than other firm costs. They present empirical evidence that expected returns rise with increased labor share due to the risk associated with higher labor costs in relation to other costs. However, literature on the substitutability of labor and capital has found that in certain industries, a firm with a lower labor share may have a higher share of capital (Arrow et al., 1961). This could lead to greater fixed costs, thus increasing operating leverage and risk. Exploring how scale flexibility factors into this relationship could help gauge the extent to which labor costs are a possible source of inflexibility. In addition, using international data on employment can help gauge the impact of labor costs on firm flexibility. International data has a greater frequency of reporting for the variables used to construct the labor leverage measure from Donangelo et al. (2019).

Other international data on labor markets can serve to foster a cross-country comparison of inflexibility. Literature suggests that increased labor regulations may result in lower efficiency (Squire and Suthiwart-Narueput, 1997). The OECD reports an employment protection index, defined as "synthetic indicators of the strictness of regulation on dismissals and the use of temporary contracts" for 37 countries and spanning 34 years (OECD, 2021). Countries with a higher score have more stringent employee protections, which signals more regulated labor markets. This index can be used to characterize countries based on how easily the resident firms can expand or contract their labor force, and study the implications on efficiency and firms' scale flexibility.

Studies like Donangelo et al. (2019) investigate the labor market to identify candidate drivers of inflexibility, but another possible source of firm inflexibility could lie in the institutional structure of the countries in which firms are based, specifically as it relates to the capital markets. Öztekin and Flannery (2012) find evidence that firms differ in capital adjustment speeds across countries, and these differences can be attributed to the institutional environments in which they operate. The legal and financial characteristics of international capital markets have implications

on the transaction costs associated with adjusting firm leverage and how easily firms can access capital. The authors construct an index for firms' adjustment speed-to-target leverage and discover that firms in countries with an "ease of access" score above the median value for countries in the sample have lower transaction costs and higher adjustment speeds than those with lower ease of access.

Specific measures found in Öztekin and Flannery (2012) can be used to group countries by features of their capital markets. Two such measures are "Bankruptcy efficiency" and "Contract enforcement." Bankruptcy efficiency is "the present value of the terminal value of the firm after bankruptcy costs" (Djankov et al., 2008). This measure could be used to divide countries based on the the stability and riskiness of their capital markets. Contract enforcement is "the relative degree to which contractual agreements are honored" (Djankov et al., 2008). Contracts facilitate the sale and purchase of assets, and the level of contract enforcement is an important distinguishing factor in global capital markets. These two institutional characteristics can serve as a basis for comparing the relative flexibility of firms operating in different markets across the world.

The next sections detail the data and methods used in this study. The following sections present the main results and robustness tests. The *Robustness* section suggests an alternative way of analyzing the relationship between scale flexibility and risk in order to limit the impact of extreme values and skewness in excess return data.

Data and Methods

This section describes the data and methods used to generate portfolio sorts and conduct cross-country comparisons of the joint effect of firm inflexibility and operating leverage on excess returns (Cattaneo et al., 2020). International excess return data for this project was extracted with custom Python code (Python, 2023). All processing was done in Matlab and R environments (R, 2023; MATLAB, 2023).

2.1 Data

The data used to construct the inflexibility, operating leverage, and labor share measures are from Compustat Fundamentals (Compustat, 2023). U.S. data were found in the "North America" subsection, and international data were found in the "Global" subsection. GHJ uses all available U.S. quarterly data, which begin in the first quarter of 1975 in Compustat. International Compustat data begin in June of 1987. In this study, "year 0" is set to 1975 for the initial sorts. In robustness tests, "year 0" is changed to 1987 to match international data. Additionally, regulated utilities and financial firms, as well as U.S. stocks with price less than $1, are excluded.

To calculate excess returns, risk-free rates for the U.S. and for "developed" countries were obtained from the Kenneth French Data Library (French, 2023). The risk-free rate used to calculate international firms' excess returns is available for the 22 countries listed in Table 2.1. [1] Returns of U.S. stocks were found on CRSP (CRSP, 2023). [2] International monthly stock data on the "developed" countries were downloaded from Refinitiv Datastream using the "TR.TotalReturn1M"

[1] Following an analysis of per-country average INFLEX, an outlier (Australia) was omitted from this study.
[2] Per convention, only data with share codes 10 and 11 were included in the sample.

TABLE 2.1: Countries included in the Kenneth French Library's Developed Markets Factors and Returns

Countries	
Australia	Italy
Austria	Japan
Belgium	Netherlands
Canada	New Zealand
Denmark	Norway
Finland	Portugal
France	Singapore
Germany	Spain
Greece	Sweden
Hong Kong	Switzerland
Ireland	United Kingdom

instrument (Refinitiv, 2023). These data begin in January of 1992.

The "strictness of employment protection" index can be found on the Organisation for Economic Co-operation and Development website, under the section containing Indicators of Employment Protection (OECD, 2021). The remaining indices for institutional characteristics that are used in this study can be found in Table 5 of Öztekin and Flannery (2012).

2.2 Measures

The current study makes use of the following measures: the GHJ inflexibility and quasi-fixed costs measures, return on assets (ROA), excess returns, and the Donangelo et al. (2019) labor share measure. The methods used to calculate each measure are described in the following sections.

2.2.1 Inflexibility Measure

For a given year t, the firm-level inflexibility measure developed by GHJ is defined as the range of a firm's operating costs over sales (OPC/Sales) (Compustat item (XSGAQ + COGSQ)/SALEQ) from year 0 to year t, divided by the standard deviation of the quarterly change in the log of

sales-over-assets (Compustat item SALEQ/ATQ).[3] INFLEX scales the width of a firm's "inaction region", a proxy for adjustment speed, by a measure of productivity shock. More inflexible firms, or firms with higher adjustment costs, have a wider inaction region because they cannot easily alter their scale to adjust to changes in productivity.

$$INFLEX_{i,t} = \frac{max_{i,0,t}(\frac{OPC}{Sales}) - min_{i,0,t}(\frac{OPC}{Sales})}{std_{i,0,t}(\Delta log \frac{Sales}{Assets})} \tag{2.1}$$

This study calculates the INFLEX measure using both U.S. and international data to further study the joint effect of INFLEX and QFC on firm risk and return.

2.2.2 Operating Leverage Measure

Constructing the measure for operating leverage, denoted "quasi-fixed costs" (QFC), is a two-step process. GHJ define operating leverage as a ratio of quasi-fixed production costs (Compustat item XSGAQ + COGSQ) to sales (Compustat item SALEQ). They utilize values for sales and costs from both the current and previous quarter, since quasi-fixed costs do not scale with current sales, and run regressions to estimate the next period's expected costs. Using three of the resulting coefficients and the mean values of sales and costs from the previous year, they construct a quarterly measure for QFC.[4]

$$Cost_{i,q} = a_i + b_i Cost_{i,q-1} + c_i Sales_{i,q} + d_i Sales_{i,q-1} + \epsilon_{i,q} \tag{2.2}$$

$$QFC_{i,t} = \frac{a_i + b_i Costmean_{i,t-1} + d_i Salesmean_{i,t-1}}{Salesmean_{i,t-1}} \tag{2.3}$$

[3]The INFLEX measure is constructed using an expanding window from Quarter 1 of 1975 to Quarter 4 of 2016, following GHJ. For U.S. data, there are firms that exist over the whole timeframe. However, international data is only available from Quarter 3 of 1987. In robustness tests, U.S. INFLEX is recalculated to match the first available date of international data.

[4]The QFC measure is constructed using a 5-year (20 quarter) rolling window from Quarter 1 of 1975 to Quarter 4 of 2016, following GHJ.

QFC measures the level of operating leverage scaled by sales. A firm with higher QFC has lower productivity, or higher fixed costs relative to sales. This study calculates the QFC measure using both U.S. and international data to further explore the joint effect of INFLEX and QFC on firm risk and return.

2.2.3 Returns on Assets (ROA)

ROA is defined as earnings before income and taxes (EBIT) divided by lagged total assets. EBIT is constructed for each firm by computing the sum of Compustat items NIQ (Net Income), XINTQ (Interest and Related Expense), and TXTQ (Total Income Taxes). Lagged total assets is the previous quarter's Compustat item ATQ (Total Assets).[5]

$$ROA_{i,q} = \frac{NI_{i,q} + XINT_{i,q} + TXT_{i,q}}{ATi, q-1} \tag{2.4}$$

This study calculates ROA using both U.S. and international data to further explore the joint effect of INFLEX and QFC on firm profitability.

2.2.4 Excess Returns

Excess returns in month m are found by subtracting the monthly risk-free rate (obtained from Kenneth French's website) from each firm's monthly return (French, 2023).

$$ExcessReturn_{i,m} = TotalReturn_{i,m} - Risk - FreeRate_m \tag{2.5}$$

The same risk-free rates are used to calculate excess returns for all of the countries listed in Table 2.1. Excess returns of U.S. firms are calculated using the U.S. risk-free rate (French, 2023).

[5]GHJ used Compustat item EBIT for this computation. However, this measure was not found in Fundamentals Quarterly.

2.2.5 Labor Share Measure

The labor share measure created by Donangelo et al. (2019) to proxy for labor leverage is constructed using Compustat annual data on items XLR (Staff Expense - Total), OIBDP (Operating Income Before Depreciation), and INVFG (Inventories Finished Goods).

$$LS_{i,t} = \frac{XLR_{i,t}}{OIBDP_{i,t} + \Delta INVFG_{i,t} + XLR_{i,t}} \tag{2.6}$$

Firms with higher labor share have a higher labor-expense-to-value-added ratio.

2.3 Methods

To examine the relationship between inflexibility and quasi-fixed costs and their joint effect on excess returns, this study uses methods from GHJ to conduct portfolio sorts. GHJ show that the difference in excess returns between firms with higher operating leverage and lower operating leverage monotonically rises from the most flexible to least flexible firms, and the result for the most inflexible firms is significant. [6] Following GHJ, in June of each year t, firms are sorted into quintile portfolios based on their inflexibility measure. Separately, firms are assigned quintile portfolios based on their estimated QFC and a cross product of the two sets of quintiles is used to determine portfolios. Average INFLEX, QFC, ROA, and monthly excess returns are calculated on each of the 25 resulting portfolios from July of year t to June of year t+1. To limit the effect of outliers and in a departure from the methods employed by GHJ, the portfolio sorts report mean values of each measure after removing the top and bottom 1.5% of INFLEX and QFC values. [7]

The labor leverage analysis employs the same sorts as outlined above, with two differences. First, QFC is replaced with the LS measure in order to specifically focus on labor costs' impact on

[6] The original INFLEX, QFC, and ROA sorts can be found in Table 8 of GHJ. The original excess return sorts and t-tests can be found in Table 9 of GHJ.

[7] GHJ require that quarterly growth rates of assets, costs, and sales do not exceed +/- 75%.

firm return. Second, the data used is combined U.S. and International Data to increase the number of sample points.

For cross-country analysis, only non-U.S. data is used. Following the methods in Öztekin and Flannery (2012), the mean of the OECD "strictness of employment protection" index is calculated for each of the included countries over the sample period. The data from Table 5 in Öztekin and Flannery (2012), which contains countries' scores for "Bankruptcy efficiency" and "Contract enforcement" is already composed of averages. The median of the included countries is computed for these indeces and countries are sorted into two groups on either side of the median. Then, portfolio sorts are calculated and compared between the groups above and below the median, for each of the three indeces.

Following GHJ, for all of the portfolio sorts on excess returns in the *Results* section, the returns of firms with the highest and lowest QFC are compared for each level of INFLEX using the Welch two-sample t-test. The *Robustness* section reports the medians, first quartiles, and third quartiles of INFLEX and excess returns of each of the 25 portfolios, for U.S. and international firms.

Results

3.1 Part 1: Portfolio Sorts

3.1.1 U.S. Firms

Table 3.1 shows the results of double portfolio sorts on U.S. firms' inflexibility, quasi-fixed costs, ROA, and excess returns. The patterns in Panels A-C resemble the patterns in GHJ, confirming that the INFLEX and QFC measures were correctly replicated. As seen in Panel C, ROA worsens as QFC increases, which is consistent with the inverse relationship of quasi-fixed costs with profitability.

Panel D shows average excess returns for each of the 25 portfolios. Just like in GHJ, these results show that the difference in excess returns between the highest and lowest QFC quintile is monotonically increasing from the most flexible firms to the least flexible firms. However, only one of the differences in means is significant after conducting a t-test [8]. The most inflexible firms with the highest level of operating leverage have higher excess returns than those with lower operating leverage.

The U.S. portfolio sorts are recalculated in the *Robustness* section using the median, first quartile, and third quartile of excess returns. The results of the robustness tests indicate that the level of excess returns is a possible third factor in the joint effect of firm inflexibility and operating leverage on risk.

[8] '**': p-value < 0.001, '*': p-value < 0.01, '.': p-value < 0.1

TABLE 3.1: Portfolio sorts, U.S. data

	QFC					QFC					
	L	2	3	4	H	L	2	3	4	H	H-L
	A. Inflexibility					*B. QFC*					
INFLEX(L)	0.67	0.78	0.88	0.95	1.15	0.03	0.09	0.17	0.28	0.56	
2	1.74	1.72	1.75	1.80	1.91	0.03	0.09	0.17	0.30	0.54	
3	3.25	3.24	3.21	3.23	3.38	0.03	0.10	0.17	0.30	0.62	
4	6.73	6.73	6.55	6.41	6.51	0.03	0.09	0.17	0.30	0.80	
INFLEX(H)	23.12	22.83	22.93	23.54	27.60	0.03	0.09	0.17	0.29	1.50	
	C. Return on Assets					*D. Excess Returns*					
INFLEX(L)	0.03	0.02	0.02	0.02	0.01	0.92	0.50	0.54	0.44	-0.01	-0.93
2	0.03	0.02	0.02	0.02	0.00	1.12	0.65	0.66	0.88	0.79	-0.33
3	0.02	0.02	0.01	0.01	-0.01	1.01	0.99	1.12	0.60	0.65	-0.36
4	0.02	0.02	0.02	0.01	-0.03	1.04	0.87	1.09	1.29	1.39	0.52
INFLEX(H)	0.03	0.03	0.02	0.02	-0.03	0.54	0.46	0.72	0.89	1.27	0.81*

The year range is January 1980-December 2016. The sorts are performed on 4,942 U.S. firms.

3.1.2 International Firms

Table 3.2 shows the results of double portfolio sorts on non-U.S. firms' inflexibility, quasi-fixed costs, return on assets, and excess returns. The patterns in Panels A-C once again closely resemble those found in GHJ, thus providing evidence for the existence of an interaction between firm inflexibility and operating leverage not only for U.S. firms, but also for international firms. Panel D suggests that the effect of having lower operating leverage on firm risk may be stronger for international firms that are more flexible. This result for non-U.S. firms mirrors the results from GHJ. Returns fall with operating leverage for the most flexible firms, but the decrease generally weakens with inflexibility, suggesting that inflexibility may be a determinant factor in how risk conditionally responds to operating leverage shifts. However, none of the differences in means are significant, suggesting a need for additional studies on the interaction effect of firm inflexibility and operating leverage on returns. The international excess return results are also examined more

closely in the *Robustness* section.

TABLE 3.2: Portfolio sorts, International data

	QFC					QFC					
	L	2	3	4	H	L	2	3	4	H	H-L
	A. Inflexibility					*B. QFC*					
INFLEX(L)	0.52	0.57	0.64	0.69	0.84	0.03	0.08	0.17	0.30	0.77	
2	1.15	1.15	1.17	1.21	1.34	0.03	0.09	0.18	0.32	0.62	
3	1.89	1.90	1.91	1.94	2.01	0.03	0.09	0.18	0.32	0.66	
4	3.44	3.41	3.50	3.47	3.81	0.02	0.09	0.18	0.33	0.80	
INFLEX(H)	15.61	15.14	13.65	13.97	19.17	0.02	0.09	0.18	0.34	1.66	
	C. Return on Assets					*D. Excess Returns*					
INFLEX(L)	0.02	0.02	0.02	0.01	0.00	0.31	0.03	-0.07	-0.79	-1.13	-1.44
2	0.02	0.02	0.02	0.01	0.01	0.89	0.70	0.07	0.70	0.08	-0.81
3	0.02	0.02	0.02	0.01	0.00	0.98	1.22	0.37	0.99	0.06	-0.92
4	0.02	0.02	0.02	0.01	-0.01	-0.17	0.69	0.46	0.28	-0.54	-0.37
INFLEX(H)	0.02	0.01	0.02	0.01	-0.03	0.22	0.68	0.78	0.17	-0.41	-0.63

The year range is December 1999-December 2016. The sorts are performed on 1,651 non-U.S. firms.

Discovering similar patterns in INFLEX and QFC in international data provides support to findings from GHJ that operating leverage and inflexibility are related, not only on the U.S. but on a global scale.

The following portion of this study extends the results from GHJ by examining factors that could make some firms more flexible than others. To study labor leverage as a possible sources of firm inflexibility, the next section replaces the QFC measure with the LS measure from Donangelo et al. (2019).

3.1.3 Labor Leverage

The next part of this study aims to identify potential drivers of firm flexibility by first examining the labor market. Table 3.3 shows double portfolio sorts on INFLEX and excess return,

substituting the QFC measure for the LS measure. The results of Panel A suggest that firms with a lower labor share are more inflexible.

TABLE 3.3: INFLEX and LS portfolio sorts

	LS					LS					
	L	2	3	4	H	L	2	3	4	H	H-L
	A. Inflexibility					*B. Excess Return*					
INFLEX(L)	0.63	0.65	0.65	0.60	0.59	0.21	0.69	0.70	0.18	-0.41	-0.62
2	1.39	1.36	1.33	1.35	1.31	1.03	1.08	1.49	0.79	-0.91	-1.94
3	2.18	2.24	2.18	2.18	2.25	0.03	1.28	0.60	0.78	-0.95	-0.98
4	3.94	4.16	3.91	4.13	4.03	-1.78	-0.26	1.06	0.07	-1.44	0.34
INFLEX(H)	27.98	15.66	14.68	10.44	14.22	-1.84	0.81	-0.05	-1.54	0.76	2.60***

The year range is June 1992-December 2016. The sorts are performed on 1,293 U.S. and non-U.S. firms.

The substitutability of labor and capital may potentially play a role in the relationship between inflexibility and labor share. A firm with less labor costs in relation to its value added could take on more inflexibility in its capital, resulting in a higher "inaction region". If the INFLEX measure is more heavily driven by the ability of the firm to expand and contract its capital rather than its workforce, this could explain why the average INFLEX among the most inflexible firms is much higher for those with a lower labor share.

The result in Panel B for the most inflexible firms, supports the findings of both Donangelo et al. (2019) and GHJ. For the most inflexible firms, returns are higher for firms with a higher labor share. This result shows with significance that a higher labor share exposes (inflexible) firms to more risk.

3.2 Part 2: Cross-Country Comparison

In Part 2 of the Results, countries' portfolio sorts are compared across different institutional settings. The focus of this section is on the sorts on inflexibility and excess return.

3.2.1 Employment Protection

Table 3.4 shows the average inflexibility and excess return of firms in countries that have an average environmental protection index higher than the median score for included countries (Group 1). When contrasted with Table 3.5, which shows the firms in countries below the median (Group 2), average inflexibility is higher for Group 2.

This result appears to contrast with the literature findings that more labor market regulation may lead to greater inefficiency. Here, firms in countries with more strict labor protection laws are actually more flexible than firms in countries with less labor protection. Together with the labor leverage result, this seems to suggest that in the context of the INFLEX measure developed by GHJ, differences in labor flexibility have an ambiguous effect on overall firm scale flexibility.

TABLE 3.4: Group 1 (Higher employment protection)

	QFC					QFC					
	L	2	3	4	H	L	2	3	4	H	H-L
	A. Inflexibility					*B. Excess Returns*					
INFLEX(L)	0.54	0.58	0.64	0.71	0.67	0.17	0.16	-0.06	-0.90	-2.90	-3.07
2	1.17	1.16	1.17	1.22	1.19	0.16	0.42	-0.70	0.24	-0.91	-1.07
3	1.82	1.82	1.84	1.83	1.85	0.43	0.53	0.50	0.39	-0.42	-0.85
4	2.98	3.12	3.03	3.13	3.26	-0.35	1.62	-0.85	-0.06	-0.51	-0.16
INFLEX(H)	9.69	10.04	9.65	9.33	12.38	0.60	1.25	-0.44	-0.21	-0.42	-1.02

The year range is December 1999-December 2019. The sorts are performed on 1,958 non-U.S. firms.

Panel B results appear to show a reversal to the pattern seen in GHJ. However, these results are not statistically significant. Additional research on the impact of labor protection laws on firm inflexibility and risk could reveal more about this relationship.

TABLE 3.5: Group 2 (Lower employment protection)

	QFC					QFC					
	L	2	3	4	H	L	2	3	4	H	H-L
	A. Inflexibility					*B. Excess Returns*					
INFLEX(L)	0.60	0.69	0.78	0.81	0.76	-0.41	-0.30	0.45	-0.91	0.20	0.61
2	1.51	1.45	1.48	1.50	1.72	0.62	1.17	0.38	0.32	2.21	1.59
3	2.56	2.58	2.62	2.62	2.72	0.23	-0.46	1.19	-0.88	-0.53	-0.76
4	5.40	5.79	5.62	5.43	5.84	-0.82	-0.74	0.82	0.52	-1.13	-0.31
INFLEX(H)	24.69	27.96	22.68	21.13	36.05	0.97	-0.44	-0.26	-1.65	-2.16	-3.13

The year range is December 1999-December 2019. The sorts are performed on 1,371 non-U.S. firms.

3.2.2 Bankruptcy Efficiency and Contract Enforcement

Tables 3.6 and 3.7 show the results of portfolio sorts for countries with different institutional features that affect their capital markets.

TABLE 3.6: Group 1 (Higher bankruptcy efficiency)

	QFC					QFC					
	L	2	3	4	H	L	2	3	4	H	H-L
	A. Inflexibility					*B. Excess Returns*					
INFLEX(L)	0.61	0.66	0.72	0.75	0.68	-0.10	-0.87	0.25	-1.00	0.72	0.82
2	1.34	1.37	1.38	1.39	1.54	0.89	1.15	0.06	0.71	1.62	0.73
3	2.17	2.21	2.24	2.31	2.33	1.30	0.57	0.99	-0.29	0.20	-1.10
4	4.12	4.47	4.29	4.24	4.66	0.59	-1.32	0.32	0.42	-1.41	-2.00
INFLEX(H)	17.16	19.18	18.89	18.03	20.83	-0.01	0.43	0.84	-0.69	-1.70	-1.69

The year range is December 1999-March 2019. The sorts are performed on 719 non-U.S. firms.

Countries with bankruptcy efficiency scores above and below the sample median are assigned to Group 1 and Group 2, respectively. The larger INFLEX values for firms that operate in countries with higher bankruptcy efficiency could possibly be due to lower market risk. Firms in such countries may be able to afford higher "inaction regions". In contrast, countries with lower bankruptcy efficiency may have higher market risk, which would lead firms to attempt to reduce

their in-house risk by maintaining greater flexibility. Panel B of Table 3.7 reveals a pattern that closely follows the GHJ results. However, once again, the lack of statistical significance in the results suggest the need for further research.

TABLE 3.7: Group 2 (Lower bankruptcy efficiency)

	QFC					QFC					
	L	2	3	4	H	L	2	3	4	H	H-L
	A. Inflexibility					*B. Excess Returns*					
INFLEX(L)	0.54	0.59	0.68	0.73	0.62	0.19	0.51	-1.18	-0.61	-3.57	-3.76
2	1.21	1.18	1.19	1.19	1.25	0.44	1.17	0.17	-0.36	-1.39	-1.86
3	1.80	1.79	1.84	1.80	1.80	1.10	0.45	0.80	0.20	-0.07	-1.17
4	2.75	2.76	2.80	3.04	2.95	-0.95	0.61	-0.05	-0.52	-0.12	0.83
INFLEX(H)	8.76	7.69	8.18	8.60	11.48	-0.42	-1.14	-1.22	0.28	0.01	0.43

The year range is December 1999-March 2019. The sorts are performed on 681 non-U.S. firms.

Tables 3.8 and 3.9 present the results of a comparison between firms in countries with higher and lower contract enforcement relative to the sample median.

TABLE 3.8: Group 1 (Higher contract enforcement)

	QFC					QFC					
	L	2	3	4	H	L	2	3	4	H	H-L
	A. Inflexibility					*B. Excess Returns*					
INFLEX(L)	0.58	0.67	0.73	0.80	0.92	-0.14	0.13	-0.74	-1.32	-0.53	-0.39
2	1.29	1.33	1.34	1.39	1.53	1.09	0.50	0.26	0.27	0.58	-0.51
3	2.23	2.27	2.25	2.37	2.36	-0.05	-0.18	1.18	0.08	-1.03	-0.98
4	4.23	4.31	4.23	4.18	4.49	-0.85	-0.30	-0.23	0.38	-1.11	-0.26
INFLEX(H)	16.61	19.80	19.07	19.00	22.46	-0.70	0.56	-0.40	0.63	-0.93	-0.23

The year range is December 1999-March 2019. The sorts are performed on 751 non-U.S. firms.

The results show that firms in countries with more contract enforcement are in fact less flexible. This result coincides with the bankruptcy efficiency result. In a market in which contracts

are more strictly enforced, firms may be able to afford greater inflexibility than in markets where there is more systematic risk.

TABLE 3.9: Group 2 (Lower contract enforcement)

	QFC					QFC					
	L	2	3	4	H	L	2	3	4	H	H-L
	A. Inflexibility					*B. Excess Returns*					
INFLEX(L)	0.58	0.61	0.68	0.75	0.70	-0.87	-1.00	0.61	-1.10	-3.78	-2.91
2	1.20	1.21	1.21	1.25	1.28	0.82	0.18	-0.26	0.31	-1.91	-2.73
3	1.81	1.80	1.80	1.84	1.88	0.98	0.57	0.88	0.57	0.72	-0.26
4	2.91	3.01	3.00	3.08	3.17	-0.97	0.25	0.46	0.14	-0.40	0.57
INFLEX(H)	9.30	13.37	8.83	10.32	13.54	-1.07	-0.77	0.18	0.23	-0.58	0.49

The year range is December 1999-March 2019. The sorts are performed on 565 non-U.S. firms.

The differences in mean excess returns between firms with the highest and lowest QFC appear to follow the patterns from GHJ more closely than firms in Group 1. However, the differences are not statistically significant in terms of the t-test.

For a majority of this section, there is little statistical significance in the excess return results when the mean is used as the measure of central tendency. Further analysis of excess return data shows that for both the U.S. and international data, excess returns appear to be heavily skewed. The next section describes a possible avenue of further research on inflexibility and stock returns, which involves deeper analysis of excess returns in each of the 25 portfolios formed by sorting firms according to their INFLEX and QFC measures.

Robustness

4.1 Time Frame Modification

In analyzing the INFLEX measure, it was observed that since one of its inputs is the difference between the maximum and minimum cost-to-sales ratio over an expanding window (year 0 to year t), the measure could change if the starting year is modified. For U.S. data, firm data is available in 1975, but international data is only available after Quarter 2 of 1987. For robustness, Table 3.1 is recalculated using data starting in Quarter 3 of 1987, to match international data. Table 4.1 shows the results of the portfolio sorts for U.S. firms.

TABLE 4.1: Portfolio Sorts, U.S. Data (June 1987-July 2016)

	QFC					QFC				
	L	2	3	4	H	L	2	3	4	H
	A. Inflexibility					*B. Quasi-Fixed Costs*				
INFLEX(L)	0.61	0.72	0.79	0.84	0.97	0.03	0.10	0.18	0.30	0.65
2	1.42	1.42	1.46	1.52	1.59	0.03	0.10	0.18	0.31	0.56
3	2.37	2.37	2.39	2.45	2.58	0.03	0.10	0.19	0.32	0.61
4	4.24	4.19	4.19	4.16	4.27	0.03	0.10	0.19	0.32	0.68
INFLEX(H)	9.60	10.23	11.89	11.37	15.65	0.03	0.10	0.18	0.32	1.31

The year range is June 1992 to December 2016. The sorts are performed on 3,532 U.S. firms.

Panel A shows smaller values for the INFLEX measure, but the patterns hold. Panels B is virtually unchanged. This test confirms that the INFLEX measure can be a meaningful proxy for firm inflexibility, even if the starting date of the sample changes.

4.2 Modified Analysis of Excess Return Data

A potential avenue of deviation from GHJ was revealed in deeper analysis of excess return data. For U.S. and international data alike, the excess returns are positively-skewed when firms are sorted into quintiles based on the INFLEX and QFC measures, suggesting that the mean may not be an accurate measure of the patterns that excess returns take in each of the portfolios. Table 4.2 shows that this skewness causes the average to over-inflate the central tendency of excess returns in most cases. In a departure from the methods employed in GHJ, this supplemental analysis shows the results of sorts using the 25th and 75th percentile values of excess returns for both U.S. and international stocks. Table A.1 in Appendix A show sorts on the median values for each of the four measures in Tables 3.1 and 3.2.

TABLE 4.2: Difference in Median and Mean Excess Returns

	QFC					QFC				
	L	2	3	4	H	L	2	3	4	H
	A. U.S. Data					*B. International Data*				
INFLEX(L)	-0.60	-0.71	-0.86	-0.74	-0.61	-0.31	-0.20	0.06	0.54	-0.42
2	-0.68	-0.63	-0.68	-1.16	-1.17	-0.89	-0.70	-0.20	-1.23	-0.17
3	-1.18	-0.99	-1.31	-1.01	-1.30	-0.98	-1.17	-0.54	-1.00	-0.32
4	-1.04	-0.66	-0.91	-1.53	-1.88	0.14	-0.72	-0.58	-0.45	-0.04
INFLEX(H)	-0.38	-0.49	-0.73	-1.13	-1.87	-0.42	-0.69	-0.78	-0.32	-0.33

The year range is January 1980-December 2016. The sorts are performed on 4,942 U.S. firms and 1,651 non-U.S. firms. Panels A and B show the difference between median excess returns and mean excess returns for each of the 25 portfolios for U.S. and non-U.S. firms.

The results in Tables 4.3 and 4.4 suggest that there may be another component to the joint effect of flexibility and operating leverage on firm risk: the level of risk itself. The interaction effect of INFLEX and QFC on firm risk manifests differently for firms with low and high excess returns.

Panel A of Table 4.3 shows that among firms with lower excess returns, median returns are higher for firms with lower operating leverage. Panel B shows that for firms with higher excess returns, the median excess return spread between firms with the highest and lowest operating

leverage generally rises with INFLEX, and firms with higher leverage have higher median return. For international firms, Panel A of Table 4.4 shows that the first quartiles of excess returns follow a similar pattern to U.S. data. No clear effect is visible in the third quartiles.

TABLE 4.3: 1st and 3rd Quartiles of Excess Returns, U.S. data

	QFC						QFC					
	L	2	3	4	H	H-L	L	2	3	4	H	H-L
	A. Excess Returns, 1st Quartile						*B. Excess Returns, 3rd Quartile*					
INFLEX(L)	-5.80	-6.34	-6.66	-7.11	-8.85	-3.05	6.60	6.58	6.44	6.63	7.92	1.32
2	-5.84	-6.07	-6.49	-6.74	-7.29	-1.45	6.97	6.76	6.82	7.05	6.75	-0.22
3	-6.00	-6.23	-6.57	-7.56	-9.32	-3.32	6.82	6.89	7.26	7.21	7.75	0.93
4	-6.36	-6.36	-6.28	-6.80	-9.48	-3.12	6.95	6.74	7.26	7.36	8.52	1.57
INFLEX(H)	-5.18	-5.30	-5.44	-5.93	-9.03	-3.85	5.59	5.61	5.73	6.50	8.28	2.69

The year range is January 1980 to December 2016. The sorts are performed on 4,998 U.S. firms.

TABLE 4.4: 1st and 3rd Quartiles of Excess Returns, International Data

	QFC						QFC					
	L	2	3	4	H	H-L	L	2	3	4	H	H-L
	A. Excess Returns, 1st Quartile						*B. Excess Returns, 3rd Quartile*					
INFLEX(L)	-5.06	-5.34	-5.10	-5.51	-8.19	-3.13	5.27	5.17	4.86	4.00	2.93	-2.34
2	-4.99	-4.63	-5.13	-5.64	-7.02	-2.03	5.38	5.37	5.12	4.67	4.91	-0.47
3	-4.74	-4.01	-5.34	-5.33	-6.92	-2.18	5.53	5.36	4.99	5.66	5.03	-0.50
4	-5.93	-5.43	-5.56	-6.12	-7.59	-1.66	4.81	5.42	5.57	5.31	4.75	-0.06
INFLEX(H)	-6.27	-4.49	-5.22	-6.52	-8.28	-2.01	4.81	4.55	5.57	4.51	5.03	0.22

The year range is December 1999 to December 2016. The sorts are performed on 1,673 non-U.S. firms.

The results indicate that the return patterns in each of the portfolios following sorts on inflexibility and operating leverage differ depending on the excess return level. For both U.S. and non-U.S. firms, the first quartile of excess returns is higher for firms with lower operating leverage, but the opposite is true for the third quartile. This finding suggests that the level of excess returns may be a possible factor in the joint effect of inflexibility and operating leverage on risk.

Conclusion

The joint effect of firm flexibility and operating leverage on risk and return was examined in detail by Gu, Hackbarth, and Johnson (2017) (GHJ). Through portfolio sorts on measures for firm inflexibility and operating leverage, the authors present empirical evidence that firms flexibility impacts the relationship between risk and operating leverage. The current study extended the above findings to international data. Monthly excess returns on 25 portfolios formed by sorts on INFLEX and QFC support the hypothesis that less flexible firms with higher operating leverage may be riskier than their more flexible counterparts. The same is true when replacing the operating leverage measure with a measure of labor leverage. While additional research is needed, this result suggests that labor costs may factor into the relationship between firm inflexibility and risk.

The second aim of this study was to investigate possible factors that make certain firms more flexible than others by examining cross-country differences in inflexibility based on defining characteristics of labor and capital markets. Results show that firms operating in countries that score above the sample median score in employment protections are more flexible than firms in countries that score below the median, and the opposite holds for bankruptcy efficiency and contract enforcement. While it is difficult to attribute these differences solely to the specific institutional characteristics being studied, there is a strong indication that firm scale flexibility is affected by the institutional setting of the country in which it operates.

Portfolio sorts on excess returns did not yield definitive results. Robustness tests were conducted by adjusting the sorting methods, and the findings suggest that the level of excess returns is one potential avenue for further research when studying the joint effect of inflexibility and operating leverage on risk.

Bibliography

Arrow, K. J. et al. (1961). "Capital-Labor Substitution and Economic Efficiency". In: *The Review of Economics and Statistics* 43.3, pp. 225–250. ISSN: 00346535, 15309142. URL: http://www.jstor.org/stable/1927286 (visited on 04/07/2023).

Cattaneo, Matias D. et al. (July 2020). "Characteristic-Sorted Portfolios: Estimation and Inference". In: *The Review of Economics and Statistics* 102.3, pp. 531–551. ISSN: 0034-6535. DOI: 10.1162/rest_a_00883.

Compustat (2023). *Wharton Research Data Services, Compustat - Capital IQ*. Accessed on March 10, 2023. URL: https://wrds-www.wharton.upenn.edu/pages/get-data/compustat-capital-iq-standard-poors/.

CRSP (2023). *Wharton Research Data Services, The Center for Research in Security Prices, LLC*. Accessed on March 10, 2023. URL: https://wrds-www.wharton.upenn.edu/pages/get-data/compustat-capital-iq-standard-poors/.

Djankov, Simeon et al. (2008). "Debt Enforcement Around the World". In: *Journal of Political Economy* 116.6, pp. 1105–1150.

Donangelo, Andres et al. (May 2019). "The cross-section of labor leverage and equity returns". In: *Journal of Financial Economics* 132.2, pp. 497–518.

French, Kenneth (2023). *Kenneth French Data Library*. Accessed on March 10, 2023. URL: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Gu, Lifeng, Dirk Hackbarth, and Tim Johnson (Sept. 2017). "Inflexibility and Stock Returns". In: *The Review of Financial Studies* 31.1, pp. 278–321.

Lev, Baruch (Jan. 1974). "On the Association Between Operating Leverage and Risk". In: *Journal of Financial and Quantitative Analysis* 9.4, pp. 627–641.

MATLAB (2023). *version (R2022a)*. Natick, Massachusetts: The MathWorks Inc.

OECD (2021). *Strictness of employment protection – individual and collective dismissals (regular contracts)*. Accessed on March 10, 2023. URL: https://stats.oecd.org/Index.aspx?DataSetCode=EPL_OV.

Öztekin, Özde and Mark J. Flannery (Jan. 2012). "Institutional determinants of capital structure adjustment speeds". In: *Journal of Financial Economics* 103.1, pp. 88–112.

Python (2023). *Python: A dynamic, open source programming language*. Python Software Foundation. URL: https://www.python.org/.

R (2023). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing. Vienna, Austria. URL: https://www.R-project.org/.

Refinitiv (2023). *Refinitiv Datastream*. Accessed on March 10, 2023. URL: https://www.refinitiv.com/en.

Squire, Lyn and Sethaput Suthiwart-Narueput (1997). "The Impact of Labor Market Regulations". In: *The World Bank Economic Review* 11.1, pp. 119–143.

Appendix

Table A.1 shows the results of median double portfolio sorts on U.S. firms' inflexibility, quasi-fixed costs, return on assets, and excess returns. The use of medians serves to eliminate the need for arbitrary means of removing extreme values.

TABLE A.1: Median portfolio sorts, U.S. data

	QFC					QFC					
	L	2	3	4	H	L	2	3	4	H	H-L
	A. Inflexibility					*B. Quasi-Fixed Costs*					
INFLEX(L)	0.65	0.80	0.91	0.98	1.08	0.03	0.09	0.17	0.27	0.49	
2	1.71	1.68	1.72	1.79	1.93	0.03	0.09	0.17	0.29	0.50	
3	3.17	3.15	3.12	3.16	3.36	0.03	0.10	0.17	0.30	0.56	
4	6.43	6.47	6.29	6.03	6.17	0.03	0.09	0.17	0.30	0.66	
INFLEX(H)	20.09	20.25	20.30	20.40	20.10	0.03	0.09	0.17	0.29	0.80	
	C. Return on Assets					*D. Excess Returns*					
INFLEX(L)	0.03	0.02	0.02	0.02	0.01	0.30	-0.21	-0.31	-0.28	-0.59	-0.89
2	0.02	0.02	0.02	0.02	0.01	0.39	0.00	0.02	-0.30	-0.40	-0.79
3	0.02	0.02	0.02	0.02	0.00	-0.09	0.04	-0.25	-0.42	-0.67	-0.58
4	0.02	0.02	0.02	0.01	-0.01	0.00	0.17	0.08	-0.23	-0.60	-0.60
INFLEX(H)	0.03	0.03	0.03	0.02	-0.01	0.14	-0.03	-0.02	-0.23	-0.60	-0.74

The year range is January 1980 to December 2016. The sorts are performed on 4,998 U.S. firms.

Panels A and B closely resemble the patterns in GHJ despite the use of the median rather than the mean. As seen in Panel C, ROA worsens as QFC increases, which is consistent with the inverse relationship of quasi-fixed costs with profitability. Panel D shows that returns fall with operating leverage for all firms, but the gap weakly declines as inflexibility rises.