



## Foreign exchange exposure and multinationality



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### ABSTRACT

We examine the relation between firms' foreign exchange exposure and the extent of their multinationality as a proxy for operational hedging. Using a sample of 953 US firms over the period 1999–2006, we show that there is a nonlinear relation between operational and financial hedging, confirming anecdotal evidence that many highly multinational firms do not hedge with derivatives. We find that operational hedging and financial hedging are significantly inversely related to firms' foreign exchange exposure, providing evidence that the two hedging techniques are complementary for all but the most highly operationally hedged firms. By comparing our findings for 1999–2006 with 1999–2009, we show that this complementarity breaks down when exchange rate volatility is high – as the effectiveness of financial hedging diminishes. An important message for firms is that operational hedges work, and they potentially provide better protection than financial hedging during times of stress.

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### 1. Introduction

Operational hedging is a key strategy for multinational firms in minimising their exposure to foreign exchange risk. The risk-reduction benefits of operational hedging arise from currency diversification effects, the offsetting of foreign currency revenues with costs in the same currency, and the operational flexibility that international operations give the firm (Kogut and Kulatilaka, 1994; Mello et al., 1995; Allen and Pantzalis, 1996; Buckley and Casson, 1998; Pantzalis et al., 2001; Bodnar and Marston, 2002). Many firms consider operational hedging to be sufficiently effective that financial hedging is not necessary; Bodnar et al. (2011) report that 5% of their non-financial survey respondent firms manage all their foreign exchange risks with operational hedges.

Given the extent of theoretical support for operational hedging to ameliorate foreign exchange exposure, it is notable that the empirical evidence on the effectiveness of operational relative to financial hedging is weak. Using various measures of the multinational dispersion of subsidiaries as proxies for operational hedging, Allayannis et al. (2001) find that exposure rises with multinationality, and Kim et al. (2006) find that financial hedges play a much

stronger risk-reduction role. Bartram et al. (2010) find that operational hedging reduces exposure by 10–15%, relative to financial hedging's 40%. These findings are surprising given that Guay and Kothari (2003) show that the use of derivatives is minimal relative to potential exposures. Pantzalis et al. (2001), in contrast, find that the breadth of a firm's international operations is strongly significant and inversely related to exposure, whereas their dummy representing financial hedging is only weakly significant, and positive.

In this paper, we address three questions relating to operational hedging, financial hedging, and foreign exchange exposure. Our *first* research question is about the relation between operational and financial hedging. It is well recognised that multinational activity and financial hedging are positively related (Allayannis and Ofek, 2001; Brown et al., 2003; Guay and Kothari, 2003). For firms with highly internationalised activities, however, operational hedging may be sufficiently effective that financial hedging is not necessary. If this is the case, an inverse U-shaped relation is possible; globally multinational firms will be less likely to use derivatives than multinationals with less diversified operations. Is the relation between operational hedging and financial hedging linear or nonlinear?

Our *second* question examines the possibility of a different inverse U-shaped relation – this time between firms' operational hedging and the extent to which they are exposed to exchange rate

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movements. Prior studies implicitly assume that the relation is linear,<sup>1</sup> and empirical samples tend to comprise multinational firms only. Domestic firms are exposed to indirect (or competitive) foreign exchange risk (Hodder, 1982; Aggarwal and Harper, 2010), and by definition they are not operationally hedged. Multinationals potentially bear both direct and indirect exposure, and range from firms with limited operational hedges (for example, those with subsidiaries in two or three countries or regions) to fully global firms. In addressing this question, we begin by discussing two possible theoretical relations between operational hedging and foreign exchange exposure. We first assume that firms are directly exposed – that is, they have existing or expected future foreign currency transactions. We then assume that firms experience only indirect (or competitive) exposure. In the former case, the predicted relation between exposure and operational hedging follows an inverse U-shape. Domestic firms have no international engagement, so exposure increases at lower levels of operational hedging and falls at higher levels. In the latter case, because all firms are potentially exposed to indirect exchange rate risk, the relation between operational hedging and exposure is downward-sloping and linear.

Using a sample of 953 US firms over the period 1999–2006 and 1999–2009, we show that the relation between operational hedging and financial hedging is indeed nonlinear; the use of foreign currency derivatives initially increases with operational hedging and then decreases. This confirms anecdotal evidence that many highly multinational firms do not use foreign currency derivatives, and it suggests that Bodnar et al.'s (2011) respondent firms that used operational hedging exclusively may well be highly internationalised. In empirically examining our second question, we find no evidence of a nonlinear relation between operational hedging and foreign exchange exposure, but rather a robust linear relation. The greater the operational hedging, the lower the firm's foreign exchange risk. This is consistent with indirect exposures dominating firms' foreign exchange exposure experience.

Our *third* question relates to whether operational and financial hedging are complements or substitutes. When we include measures of both approaches to hedging in our multivariate analysis, we find that operational hedging and financial hedging are significantly inversely related to foreign exchange exposure. However, this complementarity does not hold for the most highly operationally hedged firms, which are less likely to use derivatives than firms with moderate levels of multinationality. Our findings therefore suggest that many highly multinational firms rightly do not use financial hedges.

By comparing our main findings, in which we use data for the period 1999–2006, with estimations using a data set that encompasses the global financial crisis (1999–2009), we show that the apparent complementarity between operational and financial hedging appears to break down in times of significant stress. Importantly, while operational hedging remains strongly significant, financial hedging tends to lose its effectiveness. We suggest that this is because the heightened exchange rate volatility that accompanied the financial crisis revealed many firms' financial hedging programs to be inadequate. An important message for firms is that operational hedges work – and they can potentially provide better protection than financial hedging during times of high volatility.

The remainder of this paper is structured as follows. The next section discusses the prior literature and develops our research questions, and Section 3 presents our data and methodology. Section 4 comprises summary statistics and univariate findings, and Section 5 presents the results from our multivariate analysis. Section 6 presents our findings for the 1999–2009 period, and

further robustness analysis appears in Section 7. Section 8 summarises and concludes.

## 2. Literature review and research questions

Investigating the extent and sources of foreign exchange exposure has become one of the most challenging issues in empirical international financial management. Contrary to theory, most studies have found little significant firm-level foreign exchange exposure; this is the so-called “foreign exchange exposure puzzle”. Many explanations have been advanced for this phenomenon, including methodological issues and sample selection (Muller and Verschoor, 2006). Given that the commonly-used capital markets approach to estimating foreign exchange risk picks up the exposure that remains after hedging activities have been undertaken, hedging is an important explanation for the “puzzle.” Bartram and Bodnar (2007) argue that there is in fact no “foreign exchange exposure puzzle” and that the weak findings of prior studies are likely to be the result of firms acting rationally to reduce foreign exchange exposure via financial or operational hedging. Hutson and Stevenson (2010) suggest that a finding of significant exchange exposure for a particular firm constitutes evidence of inadequate hedging.

These assertions are difficult to reconcile with the mixed findings on the question of whether hedging creates value. The various theories of hedging (for example, Smith and Stulz, 1985; Froot et al., 1993) have been tested using derivatives holdings, or more commonly derivatives use, as the standard measure of hedging activity (Nance et al., 1993; Geczy et al., 1997; Allayannis and Ofek, 1998; Allayannis and Weston, 2001). In a critique of this literature, Guay and Kothari (2003) demonstrate that derivatives holdings are too small to have a material risk-reduction and value-creating effect. These researchers take issue with Allayannis and Weston's (2001) finding that the use of foreign currency derivatives increases firm value by 4.87%, and suggest that derivatives use may be proxying for operational hedging. If hedging activity is the appropriate explanation for the low levels of significant foreign exchange exposure in empirical studies, and there are doubts about the extent to which the use of derivatives creates value, then other approaches to hedging must be doing most of the work.

### 2.1. Operational hedging and financial hedging

It is well-established that there is a direct empirical relation between the extent of international operations and the use of foreign currency derivatives (Allayannis and Ofek, 2001; Brown et al., 2003; Guay and Kothari, 2003). However, this relation may break down for highly multinational firms. Bodnar et al. (2011) found that 5% of their surveyed firms manage all of their foreign exchange risks with operational hedges. Further, there is anecdotal evidence that many highly geographically diversified firms do not use financial hedging techniques. Allayannis et al. (2001) quote the example of the pharmaceuticals firm *Schering-Plough*, who state in their annual report that they do not use financial derivatives for hedging purposes because they operate in a large number of countries. This implies that after controlling for other factors affecting exchange rate exposure, firms that are more highly operationally hedged might be less likely to hedge using derivatives than incompletely operationally hedged firms. Our first research question is: is there an inverse U-shaped relation between operational hedging and the use of derivatives?

### 2.2. Direct and indirect foreign exchange exposure, and operational hedging

A firm's overall foreign exchange exposure comprises *direct* exposure, which arises from known and expected future foreign

<sup>1</sup> The exception is Miller and Reuer (1998), who hypothesise but fail to find a positive U-shaped relation between proportion of assets foreign and exposure.

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