Workforce size adjustments as a strategic response to exchange rate shocks: A strategy-tripod application to Chinese firms

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Abstract: How firms use workforce size adjustment as a strategic response to external shocks such as exchange-rate fluctuations is an important but not yet fully understood topic. To address the void in the literature, we apply the strategy tripod theoretical framework, which sees the external shocks as an industrial impact, the budget constraints as an institutional force, and the firm leverage as an organisational capability to examine the firms' strategic response in terms of workforce size adjustment in the Chinese economy context. Based on longitudinal data of Chinese manufacturing firms, our analysis finds that facing exchange rate shocks, firms with hard budget constraint are more responsive in adjusting their workforce than firms with soft budget constraint. Furthermore, highly levered firms, with hard budget constraint, will adjust their workforce more aggressively than firms with less debt in their financial structure.

Keywords: HR strategy, workforce adjustment, exchange rate shocks, soft budget constraint, Chinese firms

1 Introduction

Businesses operating in internationalised industries constantly face very uncertain and volatile shocks such as exchange rate changes and need to respond to them by taking strategic actions. One of the key strategic responses in the human resource management (HRM) domain is workforce size adjustment of firms in managing labour costs (Datta et al., 2010; Wood et al., 2018). A firm's responses are bounded both by the institutional forces around it, especially the market-support mechanisms including the financial regime, and the resources it possesses (Peng et al., 2008). Therefore, it is critical to understand the interplay of these important forces, representing the industrial conditions, institutional forces, and firm resources, and how they jointly impact firm strategic choices such as workforce sizing.

The relationship between external shocks and workforce size has already attracted attention in the HRM literature (Schenkel and Teigland, 2017; Zagelmeyer and Gollan, 2012). Studies have built up an assumption that downsizing is a uniform, natural response to negative external shocks such as macroeconomic downturns, industrial shocks (e.g., demand decline and labour-saving technological progress), and adverse institutional forces (e.g., Muñoz-Bullón and Sánchez-Bueno, 2011; Schenkel and Teigland, 2017); for a comprehensive review, see Datta et al. (2010). In the area of operations, researchers consider optimisation of workforce size based on internal factors (e.g., Ighravwe and Oke, 2014). At a more aggravated level, the economics research has documented some evidence of a link between exchange rate fluctuations and employment (Campa and Goldberg, 2001; Nucci and Pozzolo, 2010; Berman et al., 2012).

However, despite the studies above, the literature witnesses two serious gaps. First, surprisingly, previous research has paid very little attention to understanding how firms undertake workforce size adjustments, not just downsizing, as a strategic action to external shocks. Researchers have suggested that "there is a growing body of literature on the issue of

managerial choice of HRM policies and practices, also with specific reference to workforce reduction… [and] redundancies" (Zagelmeyer et al., 2012, p. 3356). Facing challenges from their external environment, firms may have to implement adjustments linked to their labour market position by changing their workforce size which can include voluntary and involuntary redundancies, freeze on or increase in recruitment, decrease or increase in the use of agency staff (Sutherland, 2019). These strategies cause increase or decrease in the flow and the stock of employment. However, the workforce size change by itself has attracted little research attention. For instance, many studies merely include workforce size or employee numbers as a proxy, often in the form of a control variable, to represent firm size or capabilities (e.g., He et al., 2013; Huang and Verma, 2018). Studies in HRM considering workforce size usually emphasise downsizing and assume it is the only outcome of negative external shocks (Datta et al., 2010) or a way for turnaround (Muñoz-Bullón and Sánchez-Bueno, 2011). They overlook the fact that number of employees can both go up and down, and that firms utilise this particular HR policy instrument as a reaction to changing operating costs, caused by external shocks (e.g., procurement costs due to floating exchange rates) through managing labour costs.

Second, the HRM literature has so far surprisingly ignored the strategy tripod perspective, a very useful systematic framework that unifies three "leading perspectives in strategic management" (Peng et al., 2009, p. 63) to jointly explain how firm strategy is shaped. The strategy tripod framework combines insights of the industry-based view, resource-based view, and institution-based view to highlight the interplay of all the important forces (industrial conditions, institutions, and firm capabilities), which, it argues, collectively drive firm strategy (Peng et al., 2008). This combination of the leading perspectives not only leads to a better and more insightful understanding of the complex phenomenon of workforce adjustment, but also overcomes some of the limitations of previous work, typically based on a

single perspective (Su et al., 2016). Recently there have been calls for more attention in HRM research to institutional contexts (e.g., Gooderham et al., 2019), one of the three dimensions of the strategy tripod, when business strategies are subject to the joint influence of the three forces, not just one (Peng et al., 2009). As a result, how the firm strategic choice of workforce size is shaped has not yet received a convincing investigation from this theoretical perspective, forming a serious void in the literature.

To address the gap, drawing on the strategy tripod framework (Peng et al., 2008; Peng et al., 2009), we analyse how firms exercise workforce adjustment in responding to the impact of shocks from exchange rate fluctuations under the financial institutions in the dual-track Chinese economy. The strategy tripod framework integrates the resource-, institution-, and industry-based views in analysing the factors that influence a firm's strategy actions. We theorise that the financial institutions impose varying budget constraints on Chinese firms that support or limit firms' resource base in their effort to react to external shocks, which in turn will influence the decision of workforce size adjustment. The three factors are particularly important in the transition, dual-track Chinese economy. China has a strong connection with the world economy as the largest exporter and the second largest investor in the world. Many businesses use imported materials and export their products which, in turn, makes them greatly exposed to exchange rate fluctuations (Feenstra and Hong, 2010; Dai and Xu, 2017). At the same time, the transitional Chinese economy features a unique institutional setting, where the state favours state-owned enterprises (SOEs) over the co-existing private firms (Lin and Tan, 1999; Cunningham, 2010) leading to the persistence of soft budget constraint (SBC) associated with SOEs (Kornai et al., 2003), alongside hard budget constraint for the rest of the economy. In this setting, the firms' financial capability, exemplified by their leverage (borrowing capabilities), is a key resource for firms to deal with economic shocks (Rizov, 2008).

This research seeks to make two contributions to the literature. First, it expands the workforce size literature by broadening our understanding of how firms use workforce size adjustments as a strategic response to external shocks - particularly the exchange rate fluctuations. Past research has singularly emphasised downsizing as a consequence of external shocks (Datta et al., 2010). In reality shocks are not necessarily always negative and causing downwards pressures and should not be assumed to cause only downsizing. Specifically, exchange rate fluctuations have complicated impact on firms, and do not just impose personnel contraction (Campa and Goldberg, 2001). Our study advances the workforce size research by disentangling the effect of exchange rate changes and examining firms' HRM workforce strategy subject to a broader range of factors which enables us to gain more detailed insights regarding firms' heterogeneous responses to external shocks.

Second, this study also adds to the strategy tripod research and the workforce size literature by providing a strategy-tripod based explanation of the workforce adjustment strategy, and by testing the notion that workforce size changes are made under the joint influence of three (sets of) forces - the industrial conditions, national institutions, and firm capabilities (Peng et al., 2009). A highly useful perspective in management and business research (Duran et al., 2016; Marquis and Raynard, 2015), the strategy tripod framework integrates three major views in strategic management to explain the complex question of what drives firm strategy (Peng et al. 2008). Surprisingly, its (non)use is still a void in HRM studies. This research adds to the workforce size literature by applying the strategy tripod framework into the firm strategic workforce-size adjustment under the impact of three forces - the industry conditions (exchange rate fluctuations), institutions (variation of budget constraint), and firm capabilities (financial leverage). In so doing, this research offers a systematic analysis of the driving forces of workforce sizing by utilising three complementary lenses.

The rest of the paper is organized as follows. Section 2 outlines the theory and develops hypotheses. Section 3 presents the estimation methodology and the longitudinal firm data. Section 4 reports the main results and findings while section 5 provides robustness checks. Section 6 offers a discussion and implications for researchers, managers, and policy makers.

2 Theory and hypotheses

2.1 The strategy tripod perspective

Recently scholars have noted the lack of awareness of institutional contexts in HRM studies and call for consideration of this important contextual factor to better reflect reality (Gooderham et al., 2019; Wood et al., 2018). To address heterogeneous firm HRM strategies, the strategy tripod perspective offers a highly useful framework which integrates the industry-, institution-, and resource-based views where the three are seen complementary to each other (Peng et al., 2008; Peng et al., 2009). The central tenet is that "strategic choices are not only driven by industry conditions and firm capabilities, but they are also a reflection of the formal and informal constraints of a particular institutional framework that managers confront" (Peng et al., 2008, p. 923).

The industry-based view, exemplified by Porter (1980), underscores the importance of the industrial structure and environment which are deemed to determine the firm's conduct and performance. In other words, it is the dependence of organisations on external factors that puts limits on their strategic choices. Firms are rather reactive to the external environment in developing and delivering strategies. Following this logic, the industry conditions are the primary determinant of a firm's workforce size. In this research, we explore exchange rate shocks as the external environment factor that can have an important impact upon workforce size.

The resource-based view (RBV) emphasises internal factors (heterogeneous tangible and intangible resources) of the firm as the origins of its competitive advantage (Barney, 1991; Barney et al., 2001). It argues that resources are heterogeneously distributed across firms which form the differences of their competitive advantage and performance. Stressing firms' resource base, RBV complements the industry-based view, which focuses on the industry factors (Porter, 1980). Based on RBV, a firm's resources drive its HRM behaviours (Barney and Mackey, 2016; Collins, 2020). In this research, we explore financing capabilities (e.g., low leverage or high borrowing capacity) as a firm resource that is linked to workforce size.

The third pillar of the strategy tripod is the institution-based view (IBV). Institutions are defined as ''the rules of the game'' (North, 1990) that directly drive organisations' strategic choices and activities by exerting legitimacy pressures upon them (Akhtar et al., 2008; Cooke, 2014; Peng et al., 2008; Wei and Lau, 2008). IBV stresses the interplay between institutions and organisations which shapes strategic choices. In particular, the conditions of an institutional framework, which firms operate in, additional to industry conditions and firm resources, shape firms' strategies (Peng et al., 2008). In this research, we consider the co-existing soft- and hard-budget constraints as the important institutional factor in China which is often treated as an important indicator for the business environment in emerging economies (e.g., Lin and Tan, 1999; Megginson et al., 2014).

According to the strategy tripod perspective, we need to see industry conditions, firm resources, and institutions as independent variables, and focus on the dynamic interaction between them as drivers of firm strategic decisions (Peng et al., 2008).

2.2 Contextualisation of the strategy tripod framework in HRM in China

The three forces encapsulated in the strategy tripod framework represent important factors which collectively explain firms' strategic activities such as workforce size adjustments in the Chinese economy, which is an ideal lab for the purpose of this research. China has actively pursued export-led growth strategy and become the world's top exporter and importer in the last decades (Gao et al., 2010). Consequently, Chinese firms have been highly exposed to external shocks especially exchange rate fluctuations (Feenstra and Hong, 2010; Dai and Xu, 2017). Exports have become increasingly important in stimulating employment in China, as import penetration is also found to affect China's labour market (Feenstra and Hong, 2010). Thus, external shocks such as exchange rate fluctuation can affect Chinese firms by impacting export and import prices, and firm competitiveness, which in turn affect firm workforce sizing. Previous research has identified the impact of exchange rate fluctuations and documented firm responses such as pricing to markets (Bowe and Saltvedt, 2004), intra-firm trading (Song, 2015), and use of hedging (Hutson and Stevenson, 2010). Recent research confirms that Chinese firms' heterogeneous employment responses to exchange rate shocks depend on their exporting orientation (Dai and Xu, 2017). However, no attention has been paid to the role of the institutional factor - differential budget constraints - on firms' operating behaviour under exogenous shocks. Neither the role of firm financial capabilities is examined. This research addresses these issues.

2.2.1 The industrial environment factor – exchange rate fluctuation

As the industry-based view (Porter, 1980) posits, the dynamism and volatility of shocks in the industry can create a high degree of uncertainty towards which firms react through adjusting their HR architecture. The exchange rate fluctuation is a key industrial factor, which influences the costs of materials and services and revenues of the players within a given industry if inputs and sales involve international payments and foreign currency transactions

(Campa and Goldberg, 2001; Moser et al., 2010). Accordingly, this industry-specific factor is operationalised as a disaggregated industry-level variable using 3-digit industry-level data. The firms would exhibit various reactions, including the HRM strategy of workforce re-sizing, in response to their specific industry exchange-rate shocks.

The shocks of exchange rate as an impactful factor at the industry level can render influence on a firm's HR design (Zagelmeyer and Gollan, 2012). The fluctuating exchange rates cause ups and downs in the sale revenues and costs of materials. They influence firms directly through three channels (Campa and Goldberg, 2001). Consider the case of currency appreciation; the rationale can also be applied to currency depreciation but in an opposite direction. First, appreciation of home currency makes domestic products more expensive relative to products abroad (*export exposure*). Hence, the price competitiveness of domestic firms decreases and export sales decline. Firms may decide to, partially or entirely, absorb the negative shock, instead of passing the price increase to customers, through cutting costs, including reducing their workforce. A second channel is through *import competition*. Foreign sellers can gain greater market share in the domestic market after appreciation of the domestic currency, due to a lower level of relative production costs and prices. Even non-exporting firms may be affected by exchange rate changes through foreign competition in the domestic market. At firm level the import competition can be dealt with through workforce contraction among others. The third channel can counteract the first two effects. While currency appreciation reduces the competitiveness of domestic goods, it renders intermediate inputs cheaper (*cost exposure* through imported intermediate inputs). Industries, which rely heavily on imported material inputs may actually gain competitiveness through exchange rate appreciations of the domestic currency, and hence boost businesses' workforce size. Therefore, in theory, the effects of foreign exchange movements on workforce size may be

mixed and it is an empirical matter to determine which channel is dominant (Campa and Goldberg, 2001; Dai and Xu, 2017).

Consequently, studies need to jointly consider and examine the industry effect and other important forces that influence firm behaviours, namely the institutional factors and firm capabilities, following the strategy tripod perspective (Peng et al., 2008).

2.2.2 The institutional factor – hard vs. soft budget constraint

The institutional environment, the second pillar of the strategic tripod, also forms a critical factor which defines how businesses operate (Akhtar et al., 2008; Peng et al., 2008; Wei and Lau, 2008), including their HRM activities (Gooderham et al., 2019). Since the inception of the "open door policy" in the 1980s and the enterprise privatisation that followed, a dual-track economic system has emerged in China. A transition economy, China follows a gradual, piece-meal, and incremental approach where state-owned enterprises (SOEs) and private firms co-exist (Lin and Tan, 1999; Cunningham, 2010). An important feature of the institutional framework of Chinese economy is the presence of soft budget constraint (SBC) associated with the SOEs; for a review, please see Kornai et al. (2003). SBC is manifested as policy favours for many SOEs by the state to address their poor performance due to the viability problems of the SOEs and policy burdens inherited from the socialist system (e.g., access to low-interest loans, tax reductions, tariff protection, legal monopolies). Under the SBC (dual-track) system in China, SOEs and private firms receive very different institutional treatment in terms of financing by the government and largely state-owned financial institutions. Chinese firms' employment behaviours are significantly affected by the institution of SBC, particularly considering the limited role of unions and underdeveloped legal system to protect workers' rights in China's labour market (Elfstrom and Kuruvilla,

2014). One of the key functions of SOEs is to support the traditional system of employment security which is ultimately underwritten by the state.

There are three groups of SBC instruments in favour of SOEs (Lin and Tan, 1999). The first group involves forms of soft credit, which is the most common means of SBC. The second group includes fiscal measures in the form of subsidies or tax considerations such as reduction or postponement of obligations. Thirdly, there are various indirect methods of support. For example, the government may rescue an enterprise suffering from sales difficulties by imposing trade restrictions on imports or providing export subsidies thus limiting foreign competition. Importantly, SBC measures are not limited to once-off interventions (Kornai et al., 2003). Under SBC, SOEs demonstrate diminished sensitivity to price signals and external shocks because they feel less need to attend to relative prices on the output and input markets because the difference between revenue and expenditure becomes no longer critical (Kornai et al., 2003). Consequently, the firms with SBC show less propensity to respond to external shocks such as exchange rate fluctuation by making significant adjustments, including workforce sizing (Rizov, 2005).

Private firms, in contrast, face *hard budget constraint*; they are required to provide more collateral than SOEs in order to obtain credit which in turn affects their behaviours in the input markets (Brandt and Li, 2003) such as the labour market. Unlike their state-owned counterparts which enjoy financial buffer backed by the institutional system of SBC, private firms ought to carefully monitor the environment and to take actions to respond to opportunities and circumvent threats (Hu et al., 2016). Facing the economic impact of fluctuating exchange rates, private firms generally will be more market-oriented, agile, and responsive, including making changes in the HR area. Hence, they are significantly more flexible and aggressive in adjusting their labour force under external shocks. In short, the

financial regime of SBC defines the difficulty/ease of how Chinese firms can access credit and put a lead to pressures from dealing with the hurdles of exchange rate fluctuations.

Based on the preceding discussion, we propose that:

H1: Under an exchange rate shock, firms with hard budget constraint (i.e., private firms) will adjust their labour force more aggressively than firms with soft budget constraint (i.e., SOEs).

2.2.3 The firm capabilities – low vs. high leverage

Firms' strategic responses such as workforce sizing, in the light of industrial shocks and institutional constraints, are also affected by their resource base (Peng et al., 2008). One of the key resources in the context of this research is the firms' financial capability to tackle the economic pressures from exchange rate changes and budget constraints. Prior research has found that under SBC firms' responses to business cycle shocks would differ compared to firms with hard budget constraint (Rizov, 2005; 2008). Furthermore, under hard budget constraints, firms with high leverage are characterised by diminished borrowing capacity and face high bankruptcy costs. Therefore, they are more likely to actively optimise resource allocation, including workforce sizing, (Sharpe, 1994; Rajan and Zingales, 1995).

The hardship posed by the institutional system to the firms facing hard budget constraints represents a difficult challenge which is further multiplied by external shocks. Firms' capabilities in accessing external financing, sometimes from informal channels (Ayyagari et al., 2010), stand out as a critical factor to deal with external shocks. Firms with low leverage possess a lower level of risk and hence more capacity for borrowing and obtaining financial relief; in contrast, high leverage increases the possibility of financial distress and bankruptcy, and thus limits firm ability to finance its investment through borrowing (Chang and Rhee, 2011). When the debt level is high (high leverage), the firm faces a high level of business risks especially when the external environment is highly

volatile and when it faces a financial and institutional system that is not private borrower friendly. Thus, firms with high leverage have stronger motivation to increase cash flows by cutting costs related to employees and are more likely to offer their employees less security (Bae et al., 2011). It is also more likely firms with high leverage to introduce more severe workforce size adjustments in order to accommodate the impact of the external shocks (Rizov, 2005).

In short, based on the arguments from the preceding detailed discussion, we propose:

H2: Under an exchange rate shock and hard budget constraint (i.e., private firms), highly levered firms will adjust their workforce more aggressively than less-levered firms.

3 Empirical methodology and data

3.1 The Chinese firm data

We use the dataset of the Annual Report of Industrial Enterprise Statistics compiled by the Chinese National Bureau of Statistics which covers the entire population of all SOEs and other types of firms with annual turnover of or above five million RMB (approximately $700,000 at a recent foreign exchange rate) in all manufacturing industries in China. The firms contained in this dataset account for about 90% of total industry output. The National Bureau of Statistics collects the data using a consistent calculation standard with strict double-checking procedures to ensure that the data for SOEs and other "above scale" firms is reliable. The dataset includes information on gross output, sales, value added, exports, employment, net fixed assets, firm ownership structure, geographic location, and rich financial statement details. The raw data available for our analysis covers the period 2000 to 2006 with an average of around 190,000 firms per year. This period offers a good mix of state- and privately-owned firms and is also characterised with important changes in the exchange-rate regime in China associated with country's WTO accession which are

important prerequisites for testing our theory. Our analysis is based on all domestic firms, excluding foreign firms, with all variables of interest available. The panel has an unbalanced structure, with an average of 2.9 observations per firm. For simplicity, we regard all non-state-owned domestic firms as private firms in our analysis.

3.2 Variables and empirical specification

The dependent variable - the workforce size changes - is measured by the difference of natural logarithm of number of employees in current year and natural logarithm of number of employees in the previous year.

To proxy the industry conditions, we rely on widely used, in trade literature and the International Monetary Fund (IMF), industry-specific real effective exchange rates (REER). We generate three REER measures, to capture exchange rate variations, coming through each of the three different channels, identified by Campa and Goldberg (2001) and discussed in Section 2.2.1. We calculate the export weighted REER (ER^X) at 3-digit industry level to capture the first channel - export exposure. The second channel – impact on domestic sales of import-competing firms – is captured by the import-weighted REER (ER^M) at 3-digit industry level. The term implies that the competitive pressure caused by exchange rate appreciation on domestic sales of firms is higher the higher the degree of competition from foreign suppliers is. Finally, the third channel - imported input cost-side effect - of exchange rate shocks, ER^I is measured by the weighted average of the import exchange rate EX^M at 2-digit final-output industry level, the weights being the share of imported input in total input for each input industry of any final-output industry calculated from the input-output table in 2002.

Industry-specific REER is an appropriate industry factor, as each industry not only has different trade partners in different countries, but also has different trade weight with each trading country. REER is generated as a weighted average of exposure to different

exchange rates within a given industry as explained in Zhang and Liu (2012). This calculation approach required us to identify the range of foreign countries to be included as trading partners, their relative export and import weights and relevant price indices for each year. To calculate different REERs for each industry, all the exchange rates are expressed as foreign currency against Renminbi (RMB) which means a higher exchange rate index implies an appreciation of RMB. Our REERs vary across industries and across time as illustrated in Graph 1 (for the textile industry as an example). As evident from the graph, having appreciations and depreciations with varying magnitudes within the period of analysis provides us with an appropriate context to study the impact of exchange rate movements on firm behaviour.

[Graph 1 about here]

In proxying the institutional factors, we follow Megginson et al. (2014) and use the state ownership information, the SOEs dummy, to capture SBCs. To proxy firm financial capability for private firms with hard budget constraints, and thus, the financing constraint, we use two common measures of financial leverage: the debt ratio and the net leverage ratio (e.g., Sharpe, 1994; Rizov, 2005). The debt ratio is total debt over total assets. We also use net leverage ratio, which is computed as total debt over total assets, with net short-term assets subtracted from both numerator and denominator. Net short-term assets are the short-term assets minus short-term debt. Netting out short-term liquid assets is meant to produce a comprehensive measure of overall tightness of the firm balance sheet. We also generate a binary measure - high leverage dummy - by the median of the leverage measure which we use in the main specification and to create subsamples.

Our econometric analysis follows Kaiser and Siegenthaler (2016) and employs a fixed effects estimation framework which presents an appropriate way to deal with firm heterogeneity. As in Moser et al. (2010) and Kaiser and Siegenthaler (2016), independent

variables are lagged one period to mitigate issues of simultaneity in the effects. We estimate the following labour demand specification (equation 1) with dependent variable the workforce change ΔY:

$$\Delta Y_{it} = \alpha_0 + \alpha_1 \Delta ER^X_{j(t-1)} + \alpha_2 \Delta ER^M_{j(t-1)} + \alpha_3 \Delta ER^I_{k(t-1)} + \boldsymbol{X}_{\boldsymbol{i(t-1)}}\boldsymbol{\beta} + \boldsymbol{Z}_{\boldsymbol{j(t-1)}}\boldsymbol{\gamma} + u_i + w_t + \varepsilon_{it}, \qquad (1)$$

where *i* and *t* denote firms and years, *j* and *k* denote 3-digit and 2-digit industries respectively. ΔY_{it} is the workforce change, which is calculated as a difference between Y_{it} and Y_{it-1} with Y being the natural logarithm of the number of employees. Exchange rate measures ER^X, ER^M, ER^I are all in first differences (Δ) to capture the changes of exchange rates. Vector $\boldsymbol{X}$ contains a set of firm characteristics drawn from the existing empirical literature such as export share XS, import penetration IP(1-XS), firm sales, wage, age, mark-up, and location. Detailed definitions of variables is provided in the Appendix. The firm ownership dummy *SOE*, a time-invariant variable, distinguishes between state-owned firms and the rest of domestic firms; *SOE* equals 1 if the firm is state owned and 0 otherwise. We exclude firms, which switched ownership during the period. Further, we control for regional differences (coastal vs. inland regions) which are important in China due to the distinct nature of the economies of the two types of region. Location dummy *Coast* distinguishes between coastal and inland province location, which equals 1 if the firm is in a coastal province and 0 otherwise. We include location dummy and its interactions with exchange rates in the regressions. Vector $\boldsymbol{Z}$ presents a set of industry characteristics: capital-labour ratio, domestic sales, mark-ups, wages (at 3-digit level), and foreign output (at 2-digit level). Industry-year level variables capture others endogenous shocks common to all firms in an industry over time that are different from exogenous exchange rate fluctuations. Details on each variable are provided in the Appendix.

In equation (1) significant α coefficients indicate the effects of exchange rate changes on ΔY. The fixed effect u_i captures the unobservable time-invariant firm heterogeneity; ε_{it} is an idiosyncratic error term. Time dummies are also included to control for any fixed effects common across firms.

Additional to the full sample of domestic firms available, we also conduct our empirical analysis with matched SOE-private firm samples to see whether firms' responses to exchange rate changes can be reliably attributed to their ownership status. We use a matching method to find a subsample of private firms which is similar to the SOEs in several important dimensions. Specifically, nearest neighbour matching is employed to ensure we have controlled for unobserved heterogeneity between private firms and SOEs. This econometric strategy is particularly well suited for isolating all other possible effects associated with workforce changes. We end up with a subsample of private firms representing 16% of the total private firm sample and matching the SOE sample available. Detailed statistics are shown in Table 1 (Column 3).

[Table 1 about here]

Table 1 reports means, standard deviations and number of observations for the main variables considered, according to firm ownership type. The summary statistics confirm many of the stylised facts found by other studies. SOEs are bigger, in terms of employment, and older, pay lower wages, have lower mark-ups, and export less, compared to domestic private firms. In Column 3, the summary statistics for matched private firms are reported which confirm that we correctly pick up the private firms with similar characteristics to the SOEs. Table 2 reports the number of observations for SOEs and domestic private firms in the data during the period 2000-2006. The number of SOEs decreased during the period, whereas number of private firms grew. About one third of the SOEs switched their ownership during this period and they are excluded from our study.

[Table 2 about here]

Chinese economy is well-known for its regional divide between coastal and inland regions. Literature in regional disparity attributes the divide to three main reasons: globalization, decentralization, and marketization (Hao and Wei, 2010). Therefore, it is useful to consider the differences between the two regions when examining the workforce adjustment in Chinese firms under exchange rate shocks. Table 3 shows the statistics for the firms in coastal and inland regions under different ownership types. Firms in the coastal region pay higher wages, sell more, export more and face higher import competition, but are smaller in size (number of employees) and have lower mark-up when compared with firms in the inland region. When comparing SOEs and private firms across regions, we find that the leverage measures are higher for SOEs in the inland region, whereas private firms have higher leverage in the coastal region. One could wonder whether the financial environments would be different between coastal and inland regions. Manova and Yu (2016) generate financial development measures across Chinese provinces which show no significant difference between the two types of provinces. The mean difference test of our leverage measures for private firms also shows no significant difference between regions, suggesting the coastal region does not have a better financial environment in China. The test for SOEs between regions, however, shows a significant difference, which suggests that SOEs in the coastal region characterised by significantly lower leverage receive less financial support than those located in the inland region. This may be regarded as consistent with the government's preferential financial support to promote development in the inland region. To take into account the regional division, we include coastal dummy and its interaction with exchange rate measures in our estimations which may otherwise suffer from omitted variable bias.

[Table 3 about here]

4 Estimation results

Estimation results of fixed effects (FE) and instrumental variables-generalized method of moments (IV-GMM) (as a robustness check) models for workforce adjustment are reported in Tables 4-6. For brevity, Tables 5-6 only report main coefficients of interest, exchange rates, while all control variables are included in the regressions. First difference of log of number of employees is used as dependent variable which represents the rate of workforce adjustment. The standard errors are clustered at the 3-digit industry level as in Kaiser and Siegenthaler (2016) to account for the fact that the exchange rates vary at this level. Overall, the estimated effects of the firm specific control variables are significant and plausible. In the rest of the results section we focus on the exchange rate shock impacts on workforce adjustment which is our main interest in this paper.

Table 4, Column 1 provides evidence from fixed-effects estimation that workforce changes are significantly negatively affected by export exchange rates irrespective of firm ownership. In other words, an appreciation of export REER significantly decreases the workforce in domestic firms. As the distinction between coastal and inland provinces is important, we add *Coast* dummy in the specification which depicts differences in exposure to foreign markets, economic development, and infrastructures. We interact the *Coast* dummy with the exchange rate measures to identify the differential effects across regions; the reference group is inland provinces. We find significant positive coefficient for the interaction of *Coast* dummy and export exchange rates. In the coastal provinces the export exchange rate effects are mitigated, possibly due to better economic environment and infrastructure there resulting in more competitive firms in coastal provinces which are therefore less affected by exchange rate shocks. Adding coastal information provides a richer picture and helps separate the exchange rate effects from different sources.

[Table 4 about here]

Table 4, Columns 2-4 report results when we interact the SOE dummy with all three exchange rate measures for the full sample of domestic firms. Column 2 provides evidence in support of H1. The coefficients of export exchange rates remain statistically significant. SOEs are significantly different in terms of the effects of export exchange rates: a positive and significant effect is found for export exchange rates when interacting with the SOE dummy. The workforce of SOEs, with soft budget constraint, is significantly less negatively adjusted due to export exchange rate changes, compared with private firms, with hard budget constraint. The results in Column 3, for the matched private firms and SOEs sample, still show the significant difference in the effects of export exchange rate changes between SOEs and matched private firms. In the last column, as a robustness check, an instrumental variables estimator using two-step GMM shows qualitatively similar effects. More explanations on robustness checks are presented in the next section.

In Table 5 we split the sample into SOEs and private firms. Running subsamples is identical to running a pooled sample with interaction term for each variable in the regression with the subsample identifier which is a less restrictive case. In China, SOEs operate in very different environment from private firms and act like a separate segment in the economy. Therefore, it is interesting to analyse the subsample results under a less restrictive scenario rather than allowing for the interactions of exchange rates only. Columns 1-3 report the results for SOEs, private firms and matched private firms from fixed-effects estimations respectively. The specification in Columns 1 for the SOEs shows results different from the ones for private firms - a finding in support of H1. Although the coefficients of imported-input exchange rate and of the interaction between coast dummy and imported-input exchange rate for SOEs are significant, they are not robust and become insignificant at 5% in Column 4 when we use IV-GMM estimator, to deal with endogeneity problem. In Column 4,

all exchange rate measures and their interaction terms are insignificant for SOEs regardless location and exchange-rate channel meaning that SOEs, with soft budget constraint, do not significantly respond to exchange-rate shocks in terms of workforce size which is consistent with H1.

[Table 5 about here]

Columns 2 and 3 show a similar picture as in Table 4: export exchange rates have significant negative effect on employment in private firms with hard budget constraint. Imported-input cost exposure has significant and positive effect on employment in private firms in inland provinces. The results are consistent with our prior expectations and further support H1. An appreciation of imported input REER, however, significantly raises employment which demonstrates the effect of cheaper inputs on employment due to appreciation of RMB. This implies that firms using more imported production inputs experience a positive exchange rate shock on employment. The role of imported inputs appears significant, considering that one of the key features of China's exports is that the share of processing-and-assembly exports, using imported inputs, amounts to more than 50 percent of the total exports during the period analysed. We also find that for private firms located in coastal region the exchange rate effects are mitigated as in Table 4. It is also noteworthy that the results for the matched sample of private firms in Column 3 (fixed effects estimation) and Column 5 (IV-GMM estimation) are generally consistent with the results from the full sample and our expectations. Compared with SOEs, the workforce size of private firms, with hard budget constraint, is more sensitive to exchange rate shocks from different channels and their behaviour is different across different regions.

To test H2 for private firms under hard budget constraint and with different firm capabilities, we focus on private firms only. We add a high leverage dummy and its interactions with the exchange rates in the specification to investigate further the role of firm

(financial) capabilities and their interplay with exchange rate shocks. The reference group is low-debt private firms. The split between high-debt and low-debt sub-samples is by the median of debt ratio for private firms. In Table 6, Columns 1-2 when using fixed effects and IV-GMM estimators respectively, we find that highly levered private firms experience significantly negative impact on their workforce from export exchange rates and positive impact from import (competition) exchange rates compared with low-leverage private firms. These effects mean that high-leverage firms' workforce size is more vulnerable to exchange rate shocks compared to low-leverage firms – a finding in support of H2.

A further explanation is needed for the positive import exchange rate impact. The appreciation of the domestic-currency exchange rate negatively affects competitiveness of exporting firms in international markets as well as increases competition in the domestic market from imports. The results, however, suggest that some exporting firms relocate output to domestic markets in response to the negative export exchange rate shock. This implies that in terms of workforce adjustment high-leverage firms would reduce labour due to export reduction and try to mitigate further workforce reduction by redirecting production towards domestic markets whenever possible.

[Table 6 about here]

Thus, it is interesting to observe a significant positive effect of import exchange-rate shocks on high-leverage private firms, because such firms (with less financial capabilities) suffer more significant negative export exchange-rate impact. These firms are pressured to respond by switching their export production to domestic markets to mitigate the negative impact when the overall exchange rate impact comes mainly from export exchange rates. While low-leverage firms, with good financial capabilities have little need to respond by competing in domestic markets as they are less vulnerable to exchange rate shocks. In an exercise with the sub-sample of high-import-penetration industries only, we find that the

positive import exchange-rate effects disappear as high-leverage private firms cannot compete against the strong import competitors in those industries and therefore are not able to switch production from export to domestic markets. These findings provide further support of our arguments above and of H2.

In Columns 3-4, we use an alternative leverage measure - net leverage ratio - and generate a high leverage dummy to further check the robustness of the results. The additional results exhibit similar patterns, in support of H2.

In Columns 5-6 we split the private firm sample into sub-samples of firms by high-debt dummy to explore further the role of firm financing capabilities in a less restricted scenario. For low-leverage private firms we find an insignificant impact of export and import exchange rates on workforce adjustment (but a significant positive imported-input exchange rate effect, suggesting an imported cost advantage they enjoy), whereas the negative export exchange rate effects are significantly stronger for high-leverage private firms – a finding consistent with H2. The results from sub-samples also suggest that the explanation above for the positive import exchange-rate impacts is right in the sense that the export exchange-rate shocks are the major channel of the exchange-rate impacts and we do not observe any significant impacts from import exchange-rate shocks in the subsamples. The high-leverage firms' switching from export production to domestic markets under negative export exchange-rate pressure does not significantly help them to fight the strong negative impact.

5 Robustness checks

As shown in Tables 4-6, we run several robustness checks to confirm our findings. Fixed effects model is most widely used in panel data estimation to control for the unobservable time-invariant firm heterogeneity. However, it could not deal with endogeneity problem. Therefore, we also use IV-GMM estimator - an instrument variable estimation approach - to

deal with endogeneity problem. Due to the static nature of our estimation and the number of interaction terms and controls used, we do not use system-GMM estimations as in Nucci and Pozzolo (2010) and Kaiser and Siegenthaler (2016). Instead, we use instrumental variable (IV) estimations with two-step GMM to deal with endogeneity problem and verify that the results are robust. The endogenous variables and instrument variables used are explained in the table notes for each IV-GMM estimation. Our IV-GMM fixed-effects panel data estimations comfortably pass all IV related tests. The IV-GMM results qualitatively resemble those from the fixed effects models, and consistently support H1 and H2.

We also use sample of private firms matched to SOEs to verify differences in behaviour under different budget constraints and to check the robustness of our results as discussed in Section 3.2. The results with matched private firms are similar to those from the full private-firm sample.

In another robustness check, we use an alternative measure for financial leverage: net leverage ratio. In Table 6, Column 3 we report results with the net leverage ratio which are very similar to those reported in previous columns, thus, supporting H2.

Finally, we use also alternative estimators such as OLS and random effects models, and the results from them are similar to those from the fixed effects models. The test for choosing between random effects and fixed effects models suggested that fixed effects model should be used. These results are available on request.

6 Discussion and conclusion

In general, economies are linked to each other regionally and globally. This gives rise to external shocks such as exchange rate fluctuations, which can influence business costs, sales and revenues (Feenstra and Hong, 2010; Dai and Xu, 2017) which, in turn, can impact firm HR practices (Datta et al., 2010; Wood et al., 2018). The exchange rate of two currencies can

go either down or up. In face of this, firms can size up or down their workforce. In this paper, we explore the effects in the dual-track Chinese economy, which not only sees a close link with the global markets (Feenstra and Hong, 2010; Dai and Xu, 2017) but also possesses unique institutions that warrant our research attention (Akhtar et al., 2008; Wei and Lau, 2008).

To explain the workforce adjustment strategies, we use the strategy tripod perspective, a useful framework that integrates the industry-, institution-, and resource-based views to explain how firms' strategy is shaped (Peng et al., 2008), within the context of China's transition economy. We theorise that exchange rate shocks as an industrial force, the SOE-favouring financial regime as a powerful institutional force, and the financial leverage structure of firms as an organisational capability factor together drive Chinese firms' strategy in adjusting their workforce size. Our analysis demonstrates that the influence of exchange rate shocks is a complex one which can either drive up or down the business workforce size. Therefore, we need to look to all pillars of the strategic tripod. In our framework, the financial regime in China's institutional system plays a key role in terms of the softness/hardness of budget constraints the firms face. As a result, firms with unfavourable treatment of the financial institutions (with hard budget constraint) will be more actively adjusting their business strategies, in our case the workforce sizing. Firm financing capabilities also matter in our research setting – firms with high (or low) leverage are less (more) able to access financial resources externally and will be more (less) inclined to adjusting workforce size to tackle external shocks such as exchange rate fluctuations.

Our study uses a sizeable longitudinal dataset of the Annual Report of Industrial Enterprise Statistics which covers the entire population of Chinese domestic firms. Our empirical analyses show support to our theoretically motivated and contextualised hypotheses following the logic of the strategy-tripod framework. We find that under exchange rate

fluctuations, firms operating under the financial institutions of hard budget constraint adjust their workforce size to a greater degree than firms facing soft budget constraint. Additionally, under this situation of exchange rate shocks and the financial institutions of hard budget constraint, firms with high debt ratio (high leverage) adjust their workforce size to a greater degree than those firms with low debt ratio.

6.1 Implications

Our findings have important implications for knowledge advancement and further research. There is limited knowledge on how external shocks impact workforce size changes in the HRM literature. Many studies narrowly emphasise downsizing as an outcome of environmental impact (Datta et al., 2010) despite the fact that the impact can be negative or positive, and thus drive down or up the size of a firm's workforce. In reality, the shocks of exchange rate fluctuations have complex impact on firms, and how firms react to them through practicing workforce sizing remains largely unknown (Schenkel and Teigland, 2017; Zagelmeyer and Gollan, 2012). Our research adds to the workforce size literature and explicitly addresses the above-mentioned knowledge gap by examining how firms use workforce size change as a strategic response to react to the constant exchange rate fluctuations, which affect the cost of materials/services and revenue of sales if transactions in more than one currency are involved (Moser et al., 2010). Exchange rates can move both downwards and upwards, bringing different and complex effects on businesses. We disentangle the effects of this external force on workforce sizing within the Chinese context and offer more nuanced knowledge on how firms use this HRM strategy to address external shocks.

The second contribution of our study lies in its application of the strategy-tripod framework to systematically examine how firms' workforce sizing is driven by the joint

influence of the three forces of industrial conditions, institutions, and firm capabilities (Peng et al., 2009). This interplay has been largely overlooked in the HRM research in spite of some recent calls for more research on institutional contexts in HRM studies (e.g., Gooderham et al., 2019). Our analysis, therefore, offers a strategy tripod based investigation into the formation of firm workforce sizing through theorising and testing the notion that workforce size changes are made under the joint influence of the three forces - industry conditions, institutions, and firm capabilities. We build up the theoretical model in the context of China's transition economy where exporting is a significant feature of economic activity. Our analysis adds to the HRM literature with results from a strategy tripod perspective into firms' strategic choice of workforce size adjustments as an outcome of the influence of the three important forces.

Our findings offer potentially interesting and varied policy implications for the case of China and beyond. While it is clear that exchange rate changes impact on firms' workforce size, the state may find it beneficial to develop policy and schemes to help businesses in hardship to survive the shocks and stop losing valuable human resources. A recent example is from the COVID-19 context when due to fears of large scale unemployment caused by national lockdowns amid the pandemic, many European countries introduced 'soft-budget schemes' (e.g., the UK's furlough scheme) to bail out their businesses so that employees remain paid and in employment. Although this example is not about exchange rate impact, the mechanism is similar – the institutional force of government intervention can help smooth the business cycle and stabilise the labour market. Another channel for such protection is through the businesses themselves. Developing more and resilient financial capabilities could help firms absorb the impact of external shocks and benefit from a stable and productive workforce.

6.2 Limitations and future research directions

Our study has a few limitations, which peer researchers may want to address in further studies. For example, we only investigate the effects of external shocks on an important HRM strategy - the workforce sizing. There are other important HRM strategies, which businesses use to deal with external shocks and institutional forces. Therefore, we call for more studies into the firm responses within the area of HRM strategy.

Another area to expand the scope of enquiry is the institutional framework. Institutions are a broad concept (North, 1990; Peng et al., 2008). We only consider the unique financial institutions in China in terms of the budget constraint effects on businesses. Other institutional factors also warrant more research efforts, for example, the changing regulations on labour relations, migration, unionisation, labour protection, and minimum wage.

Last but not the least, although our study controls for location in coastal vs. non-coastal regions and its interactions with exchange rate measures in the estimations, the research could be expanded to examine the variance in more depth. Division between coastal and non-coastal (inland) regions is one of the key features of Chinese economy. Our research finds significant differences in firms' labour adjustment under exchange rate shocks across the two types of region, and we encourage fellow researchers to examine further the regional effect.

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Appendix: Definitions and measurement of the variables

Firm-level variables:

Employment (Workforce Y): the natural logarithm of the number of employees

Workforce Size Change (∆Y): the difference between log (number of employees) at year t and log (number of employees) at year t-1

Export share: the firm's overseas turnover over total sales.

Import penetration: the firm level import penetration, calculated as 3-digit industry level import share IP multiplied by one minus export share (1-XS).

Real Sales: log real sales is the sum of total turnover deflated by PPI indices (Source: Chinese Year book).

Real Wage: log real wage, the ratio of the firms' total wage bill (which includes wages, salaries, and social security and pension costs) to its number of employees, deflated by RPI indices. (Source: Chinese Yearbook)

Age: the natural logarithm of the subtraction of current year and the incorporation year for each firm in each year

Markup: Value added minus total wage bill over total sales

State-owned firm dummy: the dummy variable equals to 1 if the firm's 95% or more capital are from the state and 0 otherwise.

Coast dummy: the dummy variable equals to 1 if the firm is located in one of the eleven provinces along the coast (Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi, Hainan), and 0 otherwise.

Leverage: two measures: one is total debt over total assets, the other is called "net leverage" ratio. This latter is computed as total debt over total assets, with net short-term assets subtracted from both numerator and denominator. Net short-term assets is the short-term assets minus short-term debt. Netting out short-term liquid assets is meant to produce a comprehensive measure of overall "tightness" of the firm's balance sheet.

Industry-level variables:

Export REER: the natural logarithm of 3-digit manufacturing industry level real effective exchange rate, export weights are for top 25 export destination countries. We generate a version of detrended 3-digit industry level REER using linear and quadratic time trend. Industrial trade data is from Chinese trade data compiled by China Customs Statistics. Nominal exchange rates are from the IMF, International Financial Statistics. The exchange rates are deflated using inflation index from the IMF, World Economic Outlook Database.

Import REER: the natural logarithm of 3-digit manufacturing industry level real effective exchange rate, import weights are for top 25 import sourcing countries. We generate a version of detrended 3-digit industry level REER using linear and quadratic time trend.

Imported input REER: weighted average of import REER, weights are the percentage of import over total usage of each 2-digit level input industry for each final-output (2-digit level) industry, calculated from Chinese input-output table 2002 ***(***Data Source: Chinese Statistic Bureau).

Capital-labour ratio: the median of firm-level ratio of capital to number of employees for each 3-digit industry. Capital is the sum of fixed asset, intermediate input and long-term investment

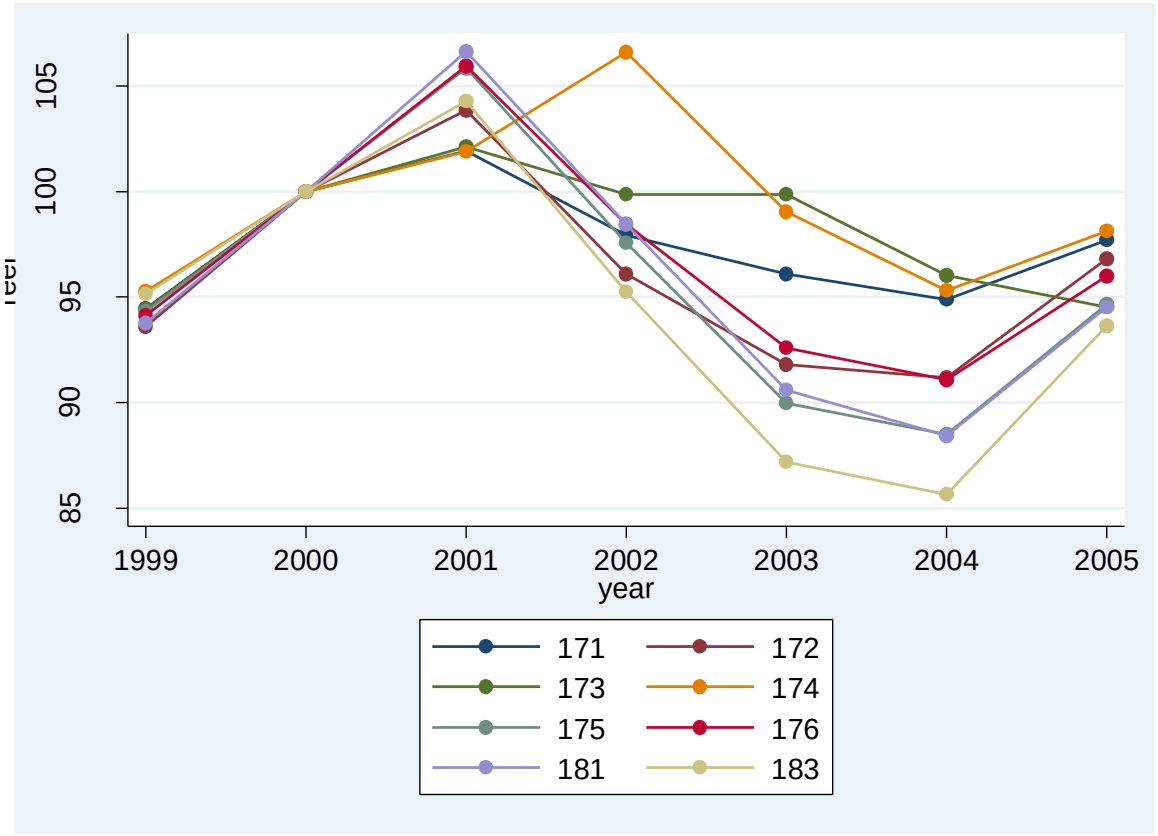
Domestic sales: sum of total domestic sales for each 3-digit industry

Industry-level wages: the median of firm wages including pension and other social welfare for each 3-digit industry

Industry-level markup: the median of firm markup for each 3-digit industry

Foreign output: sum of other countries production for each 2-digit industry. Data source: United Nations Industrial Development Organization (UNIDO) Industrial Demand-Supply Balance Database, 1990-2013.

Graph 1: Export REER (ER^X) for the textile industry



Note: The textile industry is identified at 2-digit level and the 3-digit code component industries are used to illustrate the heterogeneity of the exchange rate shocks.

Table 1 Summary statistics for key variables, domestic firms

	SOEs	Private firms	Matched Private firms
# observations	68,976	948,680	149,610
Percentage by # observations	6.78%	93.22%	14.7%
Real sales	77356.2	49949.9	64245.8
	(587078)	(352338)	(508982)
No. of emp.	419.31	200.50	310.20
	(1964.9)	(590.4)	(890.8)
Age	27.27	9.10	17.6
	(17.3)	(10.45)	(14.7)
Real Wage	11.44	13.08	12.40
	(13.72)	(12.37)	(12.24)
Markup	0.102*	0.183*	0.184*
	(18.6)	(5.25)	(8.02)
Export Share (XS)	0.031	0.120	0.061
	(0.14)	(0.29)	(0.20)
Debt ratio	0.819	0.600	0.635
	(0.74)	(4.98)	(0.47)
Net Leverage	0.602*	0.343*	0.424*
	(3.08)	(17.69)	(12.05)

Note: In each cell, mean and standard deviation (in the parentheses) are reported from top to bottom respectively. * Medians instead of means are reported due to skewness.

Table 2 Panel structure

	SOEs	Private firms
Year	*# observations*	*# observations*
2000	17,418	83,692
2001	13,106	92,713
2002	11,045	103,693
2003	8,479	118,161
2004	8,467	175,660
2005	5,579	175,219
2006	4,882	199,542
Total	68,976	948,680

Table 3 Summary statistics for coastal and inland regions

	SOEs		Private firms	
	Coastal region	Inland region	Coastal region	Inland region
Export Share (XS)	0.046	0.019	0.15	0.045
	(0.17)	(0.11)	(0.32)	(0.18)
*(1-XS)*IP*	0.232	0.221	0.188	0.179
	(0.44)	(0.49)	(0.35)	(0.36)
Real Wage	12.69	10.47	13.78	11.3
	(15.23)	(12.32)	(12.3)	(12.4)
No. of emp.	383	447.7	186	237
	(2332)	(1619)	(503)	(767)
Real Sales	79140	75960	51080	47079
	(772508)	(611941)	(372220)	(295848)
Markup	0.094*	0.110*	0.169*	0.228*
	(13.9)	(21.6)	(5.72)	(3.85)
Debt Ratio	0.786	0.845	0.601	0.597
	(0.80)	(0.68)	(0.31)	(9.36)
Net Leverage	0.539	0.652	0.347	0.334
	(3.83)	(2.33)	(19.9)	(10.1)
# observations	30287	38689	680771	267909

Note: In each cell, mean and standard deviation (in parentheses) are reported. * Medians instead of means are reported due to skewness.

Table 4 Regression results from full sample

Testing H1: hard vs. soft budget constraint

Dependent variable	(1)	(2)	(3)	(4)
D.Employment	Domestic firms	Domestic firms	SOEs and Match_private	Domestic firms (IV-GMM)
$D.ER^X$	-0.168***	-0.206***	-0.147**	-0.184***
	(0.0489)	(0.0486)	(0.0659)	(0.0514)
$D.ER^M$	-0.00906	-0.0246	-0.0351	-0.0632
	(0.0429)	(0.0436)	(0.0558)	(0.0477)
$D.ER^I$	0.862	0.916	0.690	0.801
	(0.565)	(0.581)	(0.625)	(0.745)
SOEdummy *$D.ER^X$		0.350***	0.273***	0.252***
		(0.0734)	(0.0813)	(0.0803)
SOEdummy *$D.ER^M$		0.0821	0.0562	0.121*
		(0.0604)	(0.0668)	(0.0623)
SOEdummy *$D. ER^I$		-0.597	-0.841	-1.008
		(0.764)	(0.753)	(0.862)
Coast* $D.ER^X$	0.188***	0.204***	0.161**	0.196***
	(0.0516)	(0.0509)	(0.0686)	(0.0573)
Coast* $D.ER^M$	-0.0412	-0.0339	-0.00212	0.000846
	(0.0389)	(0.0397)	(0.0537)	(0.0468)
Coast*$D. ER^I$	-0.586	-0.570	-0.820	-1.184
	(0.554)	(0.557)	(0.756)	(0.749)
Coast dummy	0.236***	0.236***	-0.164***	-0.855*
	(0.0330)	(0.0330)	(0.00994)	(0.480)
XS	-0.0201***	-0.0200***	-0.00749	-0.0185*
	(0.00643)	(0.00643)	(0.0145)	(0.00957)
(1-XS)*IP	0.00720***	0.00730***	0.00245	0.00109
	(0.00264)	(0.00263)	(0.00324)	(0.00386)
L.Wage	0.353***	0.353***	0.388***	0.112***
	(0.00638)	(0.00637)	(0.00984)	(0.0340)
L.Age	-0.244***	-0.243***	-0.250***	-0.228***
	(0.0196)	(0.0196)	(0.0367)	(0.0306)
L.Sales	-0.136***	-0.136***	-0.0823***	-0.0632***
	(0.00400)	(0.00400)	(0.00422)	(0.00754)
L.Markup	-0.000459*	-0.000460*	-0.000203	0.00483
	(0.000267)	(0.000267)	(0.000246)	(0.00329)
Markup	0.262***	0.268***	0.198	0.291**
(industry level)	(0.0863)	(0.0860)	(0.127)	(0.119)
Domestic wage	-0.00388***	-0.00375***	-0.00239*	-0.00206
(industry level)	(0.00122)	(0.00121)	(0.00140)	(0.00153)
Observations	632,874	632,874	149,114	293,511
R-squared	0.075	0.076	0.082	
Hansen J test p-value				0.160
Underidentification test p-value				0.00
Number of id	237,725	237,725	46,476	89,460

Notes: Standard errors clustered at 3-digit industry level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

a. The dependent variable is first difference of log number of employees. All independent variables are lagged one period. Time, province dummies are included in regressions. Exchange rates are first difference of lagged REERs. Only the significant industry-level coefficients are reported for brevity.

b. Fixed effects estimations are reported Columns 1-3. Results from IV-GMM estimation are reported in Columns 4. Endogenous variables are lagged wage and sales, instruments used are two-period lagged wage, export share, import penetration and mark-up; one-period lagged interaction between coast

dummy and export REER; and lagged first difference of sales. Instrument variable estimation using two-stage GMM with fixed-effects is implemented for the regression.

Table 5 Regression results by ownership sub-samples
Testing H1: hard vs. soft budget constraint

Dependent variable	(1)	(2)	(3)	(4)	(5)
	SOEs	Private	Match_private	SOEs	Match_private
D.Employment	(FE)	(FE)	(FE)	(IV-GMM)	(IV-GMM)
$D.ER^X$	0.156	-0.213***	-0.163***	-0.0478	-0.171**
	(0.0999)	(0.0472)	(0.0620)	(0.129)	(0.0720)
$D.ER^M$	0.0324	-0.0229	-0.0388	0.0846	-0.00278
	(0.0802)	(0.0436)	(0.0583)	(0.0794)	(0.0671)
$D.ER^I$	-3.053***	1.307**	1.803***	-2.301*	2.354***
	(0.873)	(0.564)	(0.625)	(1.250)	(0.911)
Coast*$D.ER^X$	-0.109	0.233***	0.256***	0.199	0.324***
	(0.120)	(0.0539)	(0.0761)	(0.184)	(0.105)
Coast* $D.ER^M$	-0.145	-0.0280	0.0367	-0.197	0.0234
	(0.107)	(0.0424)	(0.0627)	(0.134)	(0.0791)
Coast*$D. ER^I$	3.786***	-0.985*	-2.306***	0.937	-3.240***
	(1.347)	(0.554)	(0.803)	(1.927)	(1.154)
Observations	42,276	590,598	106,838	22,711	64,144
R-squared	0.121	0.074	0.071		
Hansen J test p-value				0.941	0.390
Underidentification test p-value				0.00	0.00
Number of id	14,852	222,873	31,624	6,687	17,945

Notes: Standard errors clustered at 3-digit industry level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample was split by ownership dummy (SOEs, private and matched private firms). All independent variables in Table 4 are included. For brevity, we only report main coefficients of interest, the exchange rate measures.

a. Results from fixed effects estimations are reported in Columns 1-3.
b. Results from IV-GMM estimations are reported in Columns 4-5. Endogenous variables are lagged wage and sales, instruments used are two-period lagged wage, export share and mark-up; and lagged first difference of sales. Instrument variable estimations using two-stage GMM with fixed-effects are implemented for the regressions.

Table 6 Regression results from private firm sample with debt/leverage dummy interactions and by sub-samples

Testing H2: high vs. low leverage

Dependent variable	(1) Private (full sample)	(2) Private (full sample) (IV-GMM)	(3) Private (full sample)	(4) Private (full sample) (IV-GMM)	(5) Private (High debt subsample)	(6) Private (Low debt Subsample)
D.employment	Debt dummy	Debt dummy	Leverage Dummy§	Leverage Dummy§		
$D.ER^X$	-0.165***	0.0340	-0.145***	0.0376	-0.282***	-0.108
	(0.0525)	(0.0704)	(0.0513)	(0.0699)	(0.0774)	(0.0729)
$D.ER^M$	-0.0657	-0.117**	-0.0732*	-0.113**	0.0177	-0.0538
	(0.0442)	(0.0582)	(0.0435)	(0.0560)	(0.0553)	(0.0520)
$D.ER^I$	1.386**	0.902	1.327**	0.775	1.359	1.690**
	(0.611)	(0.745)	(0.600)	(0.726)	(0.835)	(0.736)
High debt dummy	0.00155	-0.00833**	0.00283	-0.00585*		
	(0.00296)	(0.00370)	(0.00260)	(0.00339)		
High debt dummy	-0.0938**	-0.260***	-0.137***	-0.276***		
$*D.ER^X$	(0.0452)	(0.0633)	(0.0405)	(0.0596)		
High debt dummy	0.0888**	0.118**	0.103**	0.111**		
$*D.ER^M$	(0.0437)	(0.0519)	(0.0398)	(0.0498)		
High debt dummy	-0.190	-0.0244	-0.0365	0.257		
$*D.\ ER^I$	(0.524)	(0.680)	(0.484)	(0.650)		
$Coast*D.ER^X$	0.236***	0.170***	0.238***	0.172***	0.312***	0.164**
	(0.0542)	(0.0634)	(0.0540)	(0.0634)	(0.0786)	(0.0693)
Coast* $D.ER^M$	-0.0323	0.00153	-0.0325	0.00166	-0.0332	-0.00926
	(0.0427)	(0.0517)	(0.0426)	(0.0518)	(0.0558)	(0.0511)
$Coast*D.\ ER^I$	-0.958*	-1.046	-0.967*	-1.070	-1.004	-1.280*
	(0.559)	(0.684)	(0.556)	(0.683)	(0.840)	(0.686)
Observations	590,598	271,196	590,598	271,196	304,863	285,735
R-squared	0.074		0.074		0.086	0.069
Hansen J test p-value		0.456		0.442		
Underidentification test p-value		0.00		0.00		
Number of id	222,873	82,796	222,873	82,796	137,402	135,079

Notes: Standard errors clustered at 3-digit industry level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
See notes for Table 4 for controlled variables with additional debt (leverage in Columns 3-4) dummies and its interactions with exchange rates. High debt dummy takes the value 1 if a firm has on or above the median of the debt ratio (or net leverage ratio in Columns 3-4) for private firms, and 0 otherwise. The sample was split by debt dummy in Columns 5 and 6. For brevity, we only report main coefficients.

a. Results from fixed effects estimations are reported in Columns 1, 3 and 5-6.
b. Results from IV-GMM estimations are reported in Columns 2 and 4. Endogenous variables are lagged wage and sales, instruments used are two-period lagged wage, export share, and sales. Instrument variable estimations using two-stage GMM with fixed-effects are implemented for the regressions.
c. § Results using high net leverage ratio dummy and its interactions with exchange rates, as alternatives to high debt dummy and its interactions, are reported in Columns 3-4 to check the robustness of the results. High net leverage dummy takes the value 1 if a firm has on or above the median of the net leverage ratio for private firms, and 0 otherwise.