Macroeconomic implications of insolvency regimes*

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Abstract

This paper investigates how creditor and debtor rights in the case of firm insolvency impact on the equilibrium outcomes in a firm dynamics model. I build a heterogeneous firm model with financial frictions where defaulting firms can enter insolvency and continue production or be liquidated and exit. Financial frictions impact firm production decisions and make capital relatively more costly than labour for borrowing constrained firms. As a result, financially constrained firms are less capital intensive and have a lower capital-to-labour ratio than unconstrained firms. Two insolvency regimes are compared, a creditor-friendly regime such as the UK and a debtor-friendly regime such as the US. Debtor-friendly regimes are shown to be more costly in the steady-state, leading to larger spreads on firm debt. The model dynamics find a response to productivity shocks that are largely consistent with the UK and the US following the financial crisis. I show that the model provides a precise account for the differential effects of productivity shocks across economies that differ in the credit/debtor rights. In particular, in an application to the financial crisis, I show that labour productivity falls more sharply in the creditor-friendly regime while employment does not. This paper suggests a possible explanation for the different employment and labour productivity response in the UK and US since the financial crisis.

Keywords: Firm Dynamics, Financial Frictions, Insolvency, Debt Restructuring, Labour Productivity.
JEL Classification: D25, E24, E44

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1 Introduction

In the aftermath of the 2007/2008 financial crisis output in both the UK and the US fell considerably. Real GDP fell by 5.88 percent in the UK between 2007Q4-2009Q2 while real GDP fell by 4.24 percent in the US over the same period. Despite UK output falling further than in the US, the UK labour market remained surprisingly resilient, as employment fell by 1.65 percent between 2007Q4-2009Q2 compared to the US where employment decreased by 5.34 percent. The key driver of the fall in UK output was labour productivity, which fell 3.3 percent. In the US, labour productivity actually increased by 2.3 percent.[1]

This paper suggests a link between labour productivity and a country's insolvency regime. It is well documented, for example by Djankov, Hart, McLiesh and Schleifer (2008), that the UK insolvency regime is more creditor-friendly than in other countries, including the US. The UK insolvency regime features two main procedures, administration and liquidation. The stated aim of administration is to maintain the firm as a going concern and is similar in principle to the US Chapter 11 procedure. The key difference is in the control firm ownership maintains once insolvency begins. In the US, Chapter 11 allows firm management to remain in place and a court arbitrates between debtor and creditor. In the UK, administration replaces management with a professional 'insolvency practitioner' or 'administrator'. The administrator has full control of the business during administration. Liquidation on the other hand is a simple winding-up process, similar to the US Chapter 7 procedure where the firm ceases trading and the assets of the firm are sold off to satisfy creditors as much as possible. The incentives of firm management to default on its debt will depend on the insolvency regime in place and may impact on the firm's production decisions through the interest rate on firm debt.

I model the UK insolvency regime using a firm dynamics model in the spirit of Hopenhayn (1992) with the addition of financial frictions. Firms have access to both equity and debt. Equity is subject to exogenous issuance costs as in Gomes (2001) while debt is modeled using the costly-state verification framework of Townsend (1979). I allow for the firm to endogenously choose between two insolvency procedures. The first, restructuring, like administration in the UK and Chapter 11 in the US, allows the firm to continue subject to agreement between the parties. The second, liquidation, as in the UK and the US through Chapter 7, involves firm exit. If the firm chooses to restructure its debt, the firm and lender must bargain over the proceeds from restructuring. I distinguish between a creditor-friendly regime such as the UK and a debtor-friendly regime such as the US through the firm's bargaining power during restructuring. Defaulting is costly and leads to a loss of efficiency. In particular, the cost of holding capital increases for high-risk firms. In the model, I find that more borrowing constrained firms have a lower capital-to-labour ratio and thus have lower labour productivity.

I calibrate this model to UK aggregate data and find that the creditor-friendly bankruptcy regime features better steady-state properties, with higher output and higher labour productivity. This

[1] UK data is from the UK Office of National Statistics (ONS), US GDP data is from the US Bureau of Economic Analysis (BEA), US productivity and unemployment data from the US Bureau of Labor Statistics (BLS). Labour productivity for the UK is measured as output per hour worked for the whole economy. Labour productivity for the US is output per hour worked for the non-farm business sector.

result is driven by banks charging lower interest rates on debt in the creditor-friendly regime which in turn implies lower barriers to entry for firms and higher employment in the steady state. In order to explore they dynamics of the model, I analyse an unanticipated aggregate productivity shock. The model finds a response to shocks that are largely consistent with the UK and the US following the financial crisis. Specifically, employment falls most in the debtor-friendly regime while labour productivity falls more in the creditor-friendly regime. A debtor-friendly insolvency regime, while more costly in the steady-state allows firms to remain less borrowing constrained following a large aggregate shock and as a consequence these firms hold more capital relative to their counterparts in a creditor-friendly regime.

In order to further establish the link between firm behaviour and labour productivity since the financial crisis, Figure 1 and Figure 2 show the change in the number of firms, employment by these firms and the ratio of employment to number of firms for the UK and US respectively. The key takeaway from these graphs is that following the financial crisis, the number of firms in the UK fell more, in percentage terms than employment. This results in a higher employment per firm, which is a crude measure of the average firm size. In the US this result is reversed, employment fell more than the number of firms and the average firm size fell. I consider two possible explanations for this behaviour. First, that the firms that exited the economy in the US tended to be larger compared to the UK. This would cause the average size of the firms remaining to fall. A second explanation is that continuing firms in the US reduced their employment to a much greater extent than in the UK, that is firms adjusted the intensive margin of employment more in the US than in the UK. In Figures 3 and 4 I examine whether these differences derive from selection effects, exit of larger firms in the US relative to the UK, or from adjustment of employment at the intensive margin. I find that the size of exiting firms increased marginally in both the UK and the US between 2008 and 2014. This suggests that the differences in employment are driven by incumbent firms adjusting their workforce. This paper presents a possible mechanism through which this can occur, driven by differences between the bankruptcy regimes in the UK and US.

Related Literature

This paper is related to the large literature that explores the interaction between financial frictions and firm dynamics. The firm dynamics build on Hopenhayn (1992), where firms are heterogeneous, face idiosyncratic productivity shocks and pay fixed costs to both enter and to continue production. Entry in this paper follows that of Clementi and Palazzo (2016); the mass of potential entrants is fixed and the free entry condition pins down the productivity of the marginal entrant. With the potential number of entrants fixed, the wage is sensitive to fluctuations in employment and allows for interesting transition dynamics in a model with no aggregate uncertainty. The addition of financial frictions to heterogeneous firm models has been explored by Cooley and Quadrini (2001), Covas and Den Haan (2012), and Clementi and Palazzo (2016).

The debt finance in this paper is based on the costly-state verification framework of Townsend (1979) which features in the work of Bernanke and Gertler (1989), Carlstrom and Fuerst (1997), Bernanke Gertler and Gilchrist (1999) and others. Equity finance is modeled as in Gomes (2001), Cooley and Quadrini (2001) and Covas and Den Haan (2012). Corbae and D'Erasmo (2017) also

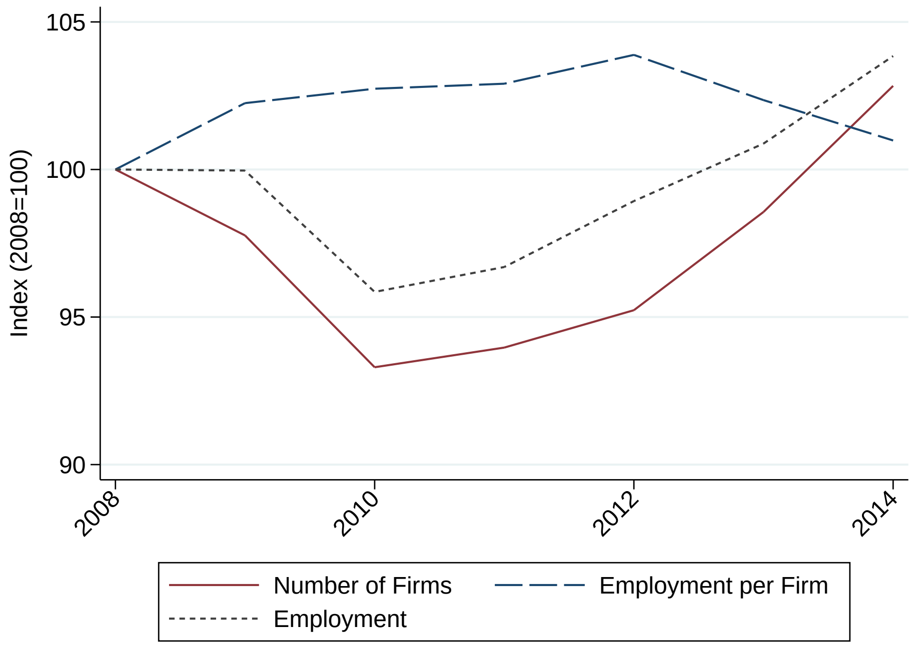

Figure 1: UK employment per firm since the financial crisis: Index of the total number of firms, total employment associated with those firms and the average employment per firm, 2008=100. Source: Eurostat

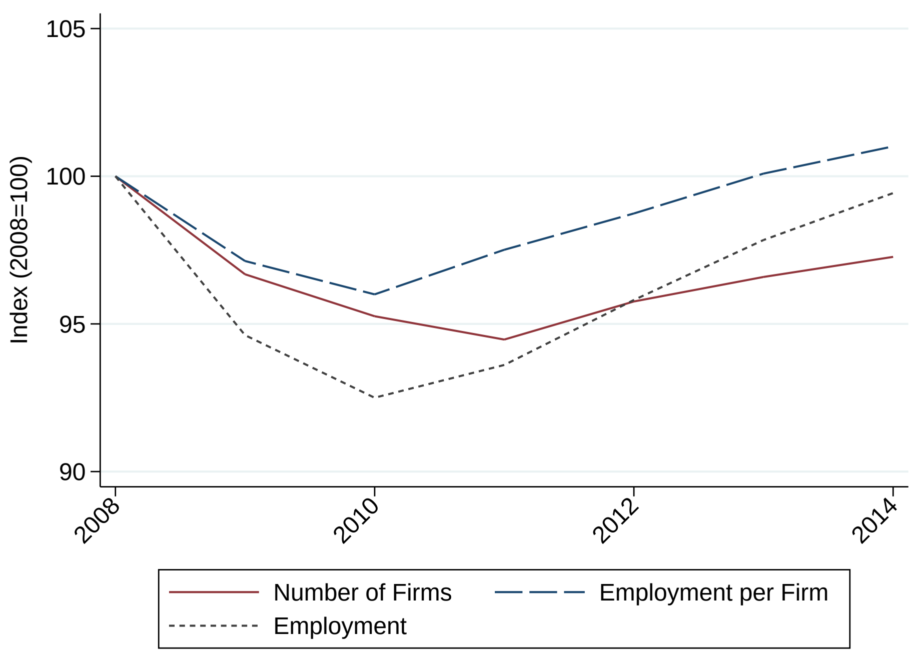

Figure 2: US employment per firm since the financial crisis: Index of the total number of firms, total employment associated with those firms and the average employment per firm, 2008=100. Source: Business Dynamic Statistics.

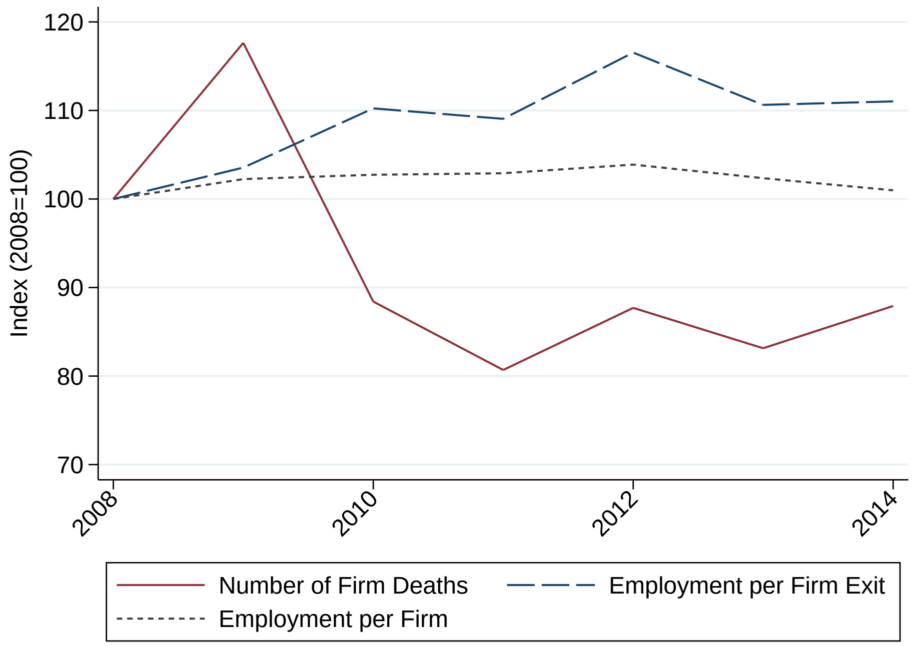

Figure 3: Size of UK firm exits since the financial crisis: Index of the total number of firm deaths, total employment associated with exiting firms and the average employment per firm, 2008=100. Source: Eurostat

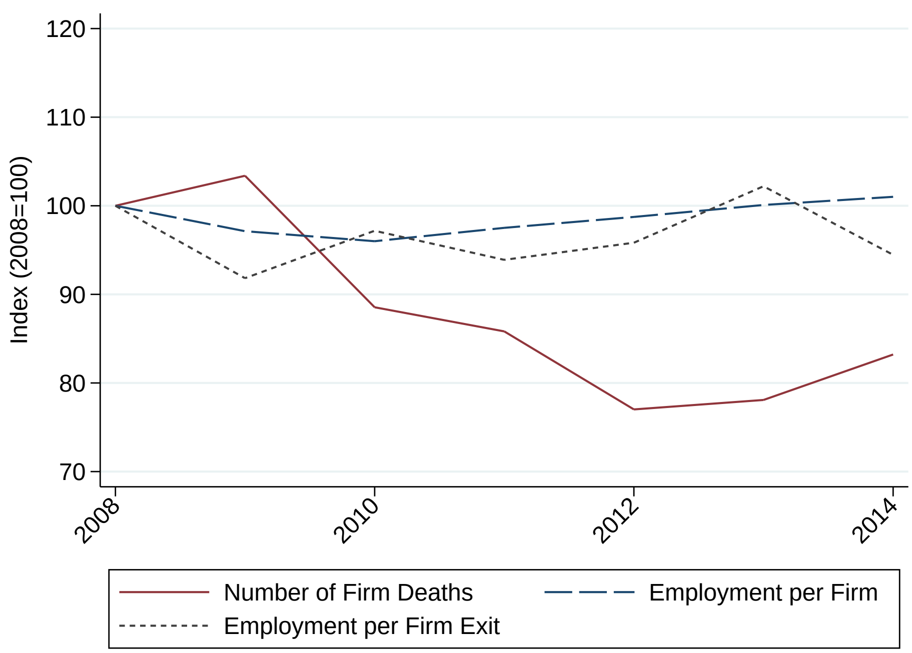

Figure 4: Size of US firm exits since the financial crisis: Index of the total number of firm deaths, total employment associated with exiting firms and the average employment per firm, 2008=100. Source: Business Dynamic Statistics.

study the choice between restructuring and liquidation in the context of a heterogeneous firms model, focusing on the US system of Chapter 11 and Chapter 7. The main difference between this paper and theirs is the treatment of the labour market. They assume a fixed supply of inelastically supplied labour and model firm entry as in Hopenhayn (1992) where the free-entry condition pins down the equilibrium wage. This rules out the possibility of aggregate employment dynamics as without aggregate shocks, the wage remains constant and entry adjusts to clear the market. In my paper, households supply labour elastically and the mass of potential entrants is held fixed. This allows for fluctuations in both the wage and employment in response to unanticipated aggregate shocks.

Others have investigated the implications of creditor rights in insolvency on firm behaviour. Acharya, Amihud and Litov (2011) study a model featuring two insolvency regimes, an 'equity-friendly system' as in the US and a 'debt-friendly-system' as in the UK and find that the insolvency regime impacts the leverage ratio. In related work, Acharya, Amihud and Litov (2011) study empirically the difference in insolvency regimes across countries and find having strong creditor rights in a country leads firms to reduce risk and become more reluctant to borrow.

This paper is also related to the literature on labour productivity, especially on the literature that focuses on the UK 'productivity puzzle'. Blundell, Crawford and Jin (2014) set out the empirical evidence underlying the 'productivity puzzle' and explore some of the possible causes behind it. This paper is not meant to provide a theory of the UK's low productivity, but rather to highlight the UK's insolvency regime as a possible contributing factor and to investigate the extent to which this is the case.

2 Model

Consider a discrete time general equilibrium model with a representative household and heterogeneous firms facing financial frictions. Firms are owned by households and produce a homogeneous good using capital (k) and (n). Firms fund their costs of production through internal funds and two sources of external funding: equity (e) and debt (b). Issuing equity is subject to an external issuance cost while debt finance occurs through a one-period contract with competitive risk-neutral financial intermediaries. Debt is risky and firms can default on their debt. A firm that defaults on its debt faces an endogenous choice between two forms of insolvency; debt restructuring and liquidation. A firm that enters liquidation ceases trading and is forced to exit, firms receive nothing and financial intermediaries receive the revenue of the firm less a liquidation cost. A firm that restructures its debt remains in the market and is able to produce in the following period. The payoffs following a restructuring is the result of bargaining between the firm and the bank. There is a representative household that maximises lifetime utility. Household income is derived from labour income, asset holdings, and dividends from firms.

2.1 Firms

Firms enter the period with net worth x. The inputs of capital (k) and labour (n) are decided one period in advance. At the beginning of the period the firm's revenue for the period is realised. Following the realisation of their revenue, firms decide whether or not to default on their debt and

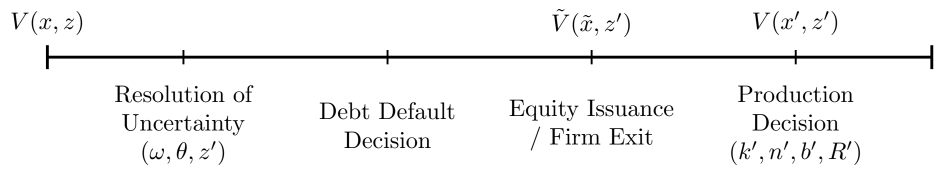

Figure 5: Timing of the model

if a firm defaults, it chooses whether to enter insolvency or liquidation. Next, firms issue equity (e) or dividends and choose whether to produce in the following period. Finally, firms that choose to produce next period choose next period's capital (k'), labour (n') and the terms of debt financing (b', R') for the next period. With R' the interest rate charged by the bank. Figure 5 summarises the timing of a firm's problem. The timing of the firm's problem closely follows Cooley and Quadrini (2001).

In order to produce, firms must also pay a fixed cost of production $c_f > 0$. Firms that have positive net worth following the default decision are able to exit following the issuance of a final dividend. Each firm produces a homogeneous output according to a decreasing returns to scale production function. The firm's production technology is given by

$$y = z\omega \left(k^{1-\alpha} n^{\alpha}\right)^{v} \qquad \alpha \in (0,1)\,,\ v \in (0,1)$$

Firm-specific productivity consists of a persistent component z and a transitory component ω. There is no aggregate uncertainty in the model. The persistent productivity component $z \in (0, \infty)$ follows an AR(1) process

$$\ln z' = \rho_z \ln z + \varepsilon_z'$$

where $\varepsilon_z' \sim N(\mu_{\varepsilon,z}, \sigma_{\varepsilon,z})$. The transitory productivity component is realised at the beginning of the period, after k, n and b have been chosen. It is assumed to be iid across firms and across time, orthogonal to ε_z, and with values $\omega \in \Omega \subset \mathbb{R}_+$ drawn from a distribution with cdf $G(\cdot)$.

The persistent component of productivity z' is observed at the end of the current period, before the firm decides if it will default on b and before the financing and production decisions of the next period are chosen.

At the beginning of each period, a firm is characterised by its net worth x and the realisation of its persistent productivity level z. Firms are risk-neutral and maximise the present discounted value of future dividends; firms discount dividends using the discount factor $(1+r)^{-1}$ where $1+r$ is the risk-free interest rate which remains constant over time. The present discounted value of future dividends for a firm with persistent productivity z and net worth x is denoted by $V(x,z)$. I denote the implicit opportunity cost of a firm with persistent productivity z' exiting as $\bar{x}(z')$ which is defined through the following equation

$$V\left(\bar{x}\left(z'\right), z'\right) = 0$$

As firms with zero net worth are able to exit the economy without incurring the fixed cost of production it follows that $V(0, z') \geq 0$ and the cost of exit will be weakly negative $\bar{x}(z') \leq 0$ for all values of z'.

In addition to using internal funding, firms are able to issue equity e and obtain debt financing b. Issuing equity is subject to an exogenously given cost function which is increasing in the amount of equity issued. The issuance cost function is given as

$$\psi(e) = \begin{cases} \frac{1}{2}\psi_0 e^2 & e \geq 0 \\ 0 & e < 0 \end{cases}$$

The assumption of quadratic equity issuance is also made in Covas and Den Haan (2012). An implication of the equity issuance cost is that a firm issuing a negative quantity of equity is equivalent to a dividend issuance and I economise on notation by allowing e to capture both equity issuance ($e > 0$) and dividend issuance ($e < 0$). The firm must purchase both capital and labour before production occurs. The firm's budget constraint is

$$b' + e + \tilde{x} = k' + \frac{1}{1+r}\left(wn' + c_f\right)$$

The term $\tilde{x}$ is the firm's end-of-period net worth after the realisation of revenues but before the firm issues equity, w is the aggregate wage and $1 + r$ is the risk-free interest rate which is assumed to be constant across time. The last term in the firm's budget constraint reflects the requirement that firms have sufficient funds available to pay both workers and the fixed cost of production next period.

2.2 Financial Intermediaries

Firms borrow from competitive, risk-neutral financial intermediaries. The opportunity cost for financial intermediaries of lending to firms is equal to the risk-free interest rate $(1 + r)$. Financial intermediaries maximise their expected profits from lending. In equilibrium, free entry of financial intermediaries implies that they break even in expectation. A firm that repays its debt has the following end-of-period net worth

$$\tilde{x}_R(\omega, k, n, Rb; z) = z\omega\left(k^{1-\alpha}n^{\alpha}\right)^v + (1-\delta)k - Rb$$

The variable δ is the capital depreciation rate which is a common parameter across firms. If a firm defaults on its debt it must choose to enter either liquidation or insolvency. A firm that enters liquidation is forced to exit and forfeit any current revenue and expected future earnings. The bank receives the firm's resources after production less a dead-weight loss equal to a fraction $(1 - \underline{\theta}) \in (0, 1)$ of the firm's resources after production. The total cost of liquidation is

$$(1-\underline{\theta})\left(z\omega\left(k^{1-\alpha}n^{\alpha}\right)^v + (1-\delta)k\right) - \bar{x}(z')$$

Liquidation in this model is similar to the default costs in the costly state verification of Townsend (1979). Part of the firm's end of period net worth comes from selling its undepreciated capital at the end of the period; the liquidation cost includes a fire-sale cost on this transaction. A liquidated firm makes the following payment to financial intermediaries

$$T_L(\omega, k, n; z) = \underline{\theta}\left(z\omega\left(k^{1-\alpha}n^{\alpha}\right)^{v} + (1-\delta)k\right)$$

A firm that restructures its debt does not exit and the firm bargains with the bank over the resources after production less a dead-weight loss that results from restructuring. This dead weight loss is

$$(1-\theta)zE[\omega]\left(k^{1-\alpha}n^{\alpha}\right)^{v} + (1-\underline{\theta})(1-\delta)k$$

where $\theta \in \Theta \subset [0,1]$ is a firm specific recovery rate drawn from cdf $H(\theta)$ known before the firm decides on whether to default on its debt. The recovery rate θ is realised at the same time as ω andz', before the firm's default decision but after the debt contracts have been finalised.

Two features of the restructuring cost are worth emphasising. First, the restructuring cost depends on the expected value of the revenue shock rather than the realisation of ω which adds a fixed cost element to the restructuring cost. As the liquidation cost is decreasing in the realisation of ω this ensures that, everything else equal, a lower realisation of ω makes it more likely that a firm chooses liquidation over restructuring. Second, the cost of restructuring features the same fire-sale cost on undepreciated capital as in the liquidation case, this is a simplifying assumption.

A firm that begins the restructuring process can be forced into liquidation by either the firm or the bank and therefore both parties take their payoffs from firm liquidation as their outside option and any remaining surplus is then bargained between the firm and the bank. A defaulting firm will restructure only if there is a positive surplus obtained over firm liquidation. The surplus from restructuring over liquidation is

$$S_B\left(\theta, \omega, z', k, n; z\right) = \left((1-\underline{\theta})\omega - (1-\theta)E[\omega]\right)z\left(k^{1-\alpha}n^{\alpha}\right)^{v} - \bar{x}\left(z'\right)$$

The firm's bargaining weight is denoted by $\phi \in [0,1]$ and is a key parameter in our modeling of insolvency regimes. High values of ϕ close to one imply that the bargaining power lies mostly with the firm and the insolvency regime is a more debtor-friendly regime such as the US while low values of ϕ close to zero would mean the bargaining power lies with the bank and the insolvency regime is a creditor-friendly regime such as the UK. A firm that restructures will begin the next period with the following cash-in-hand

$$\tilde{x}_B\left(\theta, \omega, z', k, n; z\right) = \phi S_B\left(\theta, \omega, z', k, n; z\right) + \bar{x}\left(z'\right)$$

A restructured firm makes the following payment to financial intermediaries

$$T_B\left(\theta, \omega, z', k, n; z\right) = (1-\phi)S_B\left(\theta, \omega, z', k, n; z\right) + \underline{\theta}\left(z\omega\left(k^{1-\alpha}n^{\alpha}\right)^{v} + (1-\delta)k\right)$$

In addition to endogenous liquidations, with probability $\chi \in (0,1)$ the firm is forced to exogenously exit and should it be unable to repay its debt, the firm is forced into liquidation. Firms that face exogenous exit are not able to restructure, this guarantees that these firms exit.

2.3 Households

There is a risk-neutral representative household that discounts the future at rate $\beta \in (0,1)$ and maximises the following utility function

$$\sum_{t=0}^{\infty} \beta^t \left[C_t + a \ln\left(1 - N_t\right)\right], \quad a > 0$$

where C_t is aggregate consumption and N_t is the aggregate labour supplied by the household. Households own both firms and financial intermediaries and buy risk-free bonds B_t from financial intermediaries which are used to lend to firms. They maximise the discounted present value of utility subject to the following budget constraint

$$C_t + B_{t+1} + \int s_{jt+1} p_{jt} dj = w_t N_t + \left(1 + r_t\right) B_t + \Pi_t^B + \int s_{jt}\left(d_{jt} + p_{jt}\right) dj$$

where p_{jt}, d_{jt} and s_{jt} denote the price, dividends and fraction of shares in firm j owned by the household and Π_t^B denotes the profits of financial intermediaries.

As households are risk-neutral, the risk-free interest rate will be constant across time and firms and households discount the future at the same rate. The first order conditions for the household labour supply is given by

$$\frac{a}{1 - N_t} = w_t$$

3 Equilibrium

3.1 Debt Resolution

At the beginning of every period, a firm that borrowed in the previous period must make a decision between repayment, and default. If the firm defaults it must decide between filing for restructuring or liquidating the firm. The default decision the firm makes at the beginning of the next period will impact the interest rate the firm is charged on debt in the current period.

Figure 6 is an illustration of the firm's debt resolution decision in (θ, ω)-space for a hypothetical (z', k, n, Rb, z). We can separate the space into three subsets. The first subset $\mathcal{S}_R\left(z', k, n, Rb; z\right)$ is the region where the firm will repay its debt. The second subset $\mathcal{S}_B\left(z', k, n, Rb; z\right)$ is the region where the firm will default on its debt and restructure its debt. The final subset $\mathcal{S}_L\left(z', k, n, Rb; z\right)$ is the region where the firm will default on its debt and will liquidate the firm. Formally these regions are defined as follows

$$\begin{aligned}\mathcal{S}_R\left(z', k, n, Rb; z\right) = \big\{(\theta, \omega) \in \Theta \times \Omega : \, & x_R\left(\theta, \omega, z', k, n, Rb; z\right) \geq x_B\left(\theta, \omega, z', k, n; z\right), \\ & x_R\left(\omega, z', k, n, Rb; z\right) \geq \bar{x}\left(z'\right)\big\}\end{aligned}$$

$$\begin{aligned}\mathcal{S}_B\left(z', k, n, Rb; z\right) = \big\{(\theta, \omega) \in \Theta \times \Omega : \, & x_R\left(\theta, \omega, z', k, n, Rb; z\right) < x_B\left(\theta, \omega, z', k, n; z\right), \\ & x_B\left(\theta, \omega, z', k, n; z\right) \geq \bar{x}\left(z'\right)\big\}\end{aligned}$$

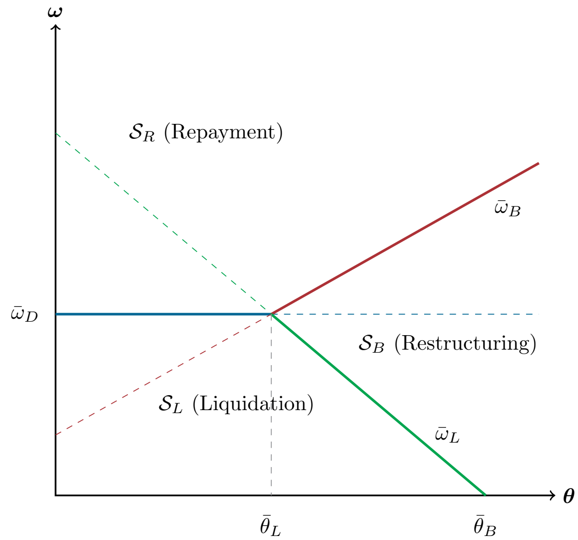

Figure 6: Firm's debt resolution decision

$$\mathcal{S}_L\left(z',k,n,Rb;z\right)=\left\{(\theta,\omega)\in\Theta\times\Omega: x_R\left(\theta,\omega,z',k,n,Rb;z\right)<x_B\left(\theta,\omega,z',k,n;z\right),\right.$$
$$\left. x_B\left(\theta,\omega,z',k,n;z\right)<\bar{x}\left(z'\right)\right\}$$

The boundaries of these sets can be characterised by cutoffs of θ and $\bar{\omega}$. First consider the case where a firm is indifferent between repayment and liquidation, then the following must hold

$$\bar{\omega}_D\left(z',k,n,Rb;z\right)=\max\left\{\frac{Rb+\bar{x}\left(z'\right)-(1-\delta)\,k}{f\left(k,n\right)},0\right\}$$

For ω less than this cutoff, the firm will always default on its outstanding debt. Next, for $\omega < \bar{\omega}_D\left(z',k,n,Rb;z\right)$ the firm will be indifferent between restructuring and liquidation if the following equation holds

$$\theta=\left[1-\left(1-\underline{\theta}\right)\omega\right]-\frac{-\bar{x}\left(z'\right)}{f\left(k,n\right)}$$

This equation is decreasing in ω. Using this allows us to define cutoffs $\bar{\theta}_B\left(z',k,n;z\right)\geq\bar{\theta}_L\left(z',k,n,Rb;z\right)$ such that a defaulting firm will always prefer restructuring if $\theta>\bar{\theta}_B\left(z',k,n;z\right)$ and a defaulting firm will always be liquidated whenever $\theta<\bar{\theta}_L\left(z',k,n,Rb;z\right)$

$$\bar{\theta}_L\left(z',k,n,Rb;z\right)=\max\left\{\left[1-\left(1-\underline{\theta}\right)\bar{\omega}_D\left(z',k,n,Rb;z\right)\right]-\frac{-\bar{x}\left(z'\right)}{f\left(k,n\right)},0\right\}$$

$$\bar{\theta}_B\left(z',k,n;z\right)=\max\left\{1-\frac{-\bar{x}\left(z'\right)}{f\left(k,n\right)},0\right\}$$

For values of $\theta\in\left[\bar{\theta}_L\left(z',k,n,Rb;z\right),\bar{\theta}_B\left(z',k,n;z\right)\right]$ whether a defaulting firm will restructure or liquidate depends on the realisation of ω. Specifically, there will be a cutoff $\bar{\omega}_L\left(z',k,n;z\right)$ such that if $\omega\geq\bar{\omega}_L\left(z',k,n;z\right)$ a defaulting firm will restructure while if $\omega<\bar{\omega}_L\left(z',k,n;z\right)$ a defaulting firm will be liquidated. The cutoff is defined by the following equation

$$\bar{\omega}_L\left(z',k,n;z\right)=\max\left\{\frac{\bar{x}\left(z'\right)+\left(1-\theta\right)f\left(k,n\right)}{\left(1-\underline{\theta}\right)f\left(k,n\right)},0\right\}$$

In cases where the firm has some bargaining power during restructuring ($\phi > 0$) the firm may choose to restructure when $\omega > \bar{\omega}_D\left(z',k,n,Rb;z\right)$. For this to occur, the recovery rate from restructuring must be sufficiently high, that is $\theta > \bar{\theta}_L\left(z',k,n,Rb;z\right)$. The firm will prefer restructuring over repayment of its debt whenever $\omega < \bar{\omega}_B\left(\theta,z',k,n;z\right)$ where the cutoff is defined by the following equation

$$\bar{\omega}_B\left(\theta,z',k,n,Rb;z\right)=\max\left\{\bar{\omega}_D\left(z',k,n,Rb;z\right)+\phi\left(\frac{\left(\theta-\bar{\theta}_L\left(z',k,n,Rb;z\right)\right)f\left(k,n\right)+\bar{x}\left(z'\right)}{\left[1-\phi\left(1-\underline{\theta}\right)\right]f\left(k,n\right)}\right),0\right\}$$

I refer to this case as strategic default as the firm has sufficient funds to be able to repay its loan but chooses to restructure its debt as they receive a higher net-worth by doing so. This is the only cutoff which depends on ϕ, specifically, $\bar{\omega}_B\left(\theta,z',k,n,Rb;z\right)$ is increasing in ϕ and thus for a given $\left(z',k,n,Rb,z\right)$ firms have a greater incentive to restructure in a creditor-friendly (high ϕ) regime than in debtor-friendly (low ϕ) regime.

Finally, a firm that is hit by an exogenous exit shock (χ) can choose to repay its debt, or default on its debt. In both cases, the firm will be forced to exit. A firm hit by this shock will repay its debt whenever $\omega \geq \bar{\omega}_E\left(k,n,Rb;z\right)$ and will default (and enter liquidation) whenever $\omega < \bar{\omega}_E\left(k,n,Rb;z\right)$ where the cutoff is defined as

$$\bar{\omega}_E\left(k,n,Rb;z\right)=\max\left\{\frac{Rb-\left(1-\delta\right)k}{f\left(k,n\right)},0\right\}$$

3.2 Bank's Problem

The expected profit of a bank for a given debt contract $\left(k,n,Rb,b;z\right)$ is written as

$$\begin{aligned}
\Pi_B\left(k,n,Rb,b;z\right)=&\left(1-\chi\right)E_{z'|z}\left[Rb\int_{\mathcal{S}_R\left(z',k,n,Rb;z\right)}d\left[G\left(\omega\right)\times H\left(\theta\right)\right]\right]\\
&+\left(1-\chi\right)E_{z'|z}\left[\int_{\mathcal{S}_B\left(z',k,n,Rb;z\right)}T_B\left(\theta,\omega,z',k,n;z\right)d\left[G\left(\omega\right)\times H\left(\theta\right)\right]\right]\\
&+\left(1-\chi\right)E_{z'|z}\left[\int_{\mathcal{S}_L\left(z',k,n,Rb;z\right)}T_L\left(\omega,k,n;z\right)d\left[G\left(\omega\right)\times H\left(\theta\right)\right]\right]\\
&+\chi E_{z'|z}\left[Rb\int_{\omega\geq\bar{\omega}_D\left(k,n,Rb;z\right)}dG\omega\right]\\
&+\chi E_{z'|z}\left(\int_{\omega<\bar{\omega}_D\left(k,n,Rb;z\right)}T_L\left(\omega,k,n;z\right)dG\omega\right)\\
&-\left(1+r\right)b
\end{aligned}$$

For a given contract $(k, n, Rb, b; z)$ the profit of the bank is strictly decreasing in the firm's bargaining power ϕ. There are two reasons for this. First as discussed in the previous section, a firm with high bargaining power is more likely to default on its debt and enter the restructuring process and the bank's profit from restructured debt is strictly less than if the debt was repaid. Second, as the bank has less bargaining power, it will receive a lower payment when the debt is restructured.

3.3 Firm's problem

Following the realisation of its revenue and its default decision, a firm that is not liquidated has cash-in-hand $\tilde{x}$ and knows the persistent component of its productivity for the next period z'. The firm can now choose to produce in the next period or it can issue a final dividend and exit. The equity issuance problem is written as follows

$$\tilde{V}\left(\tilde{x}, z'\right) = \max_{e} \left\{ -\left(e + \psi\left(e\right)\right) + \frac{1}{1+r} V\left(\tilde{x} + e, z'\right), \tilde{x} - \psi\left(-\tilde{x}\right) \right\}$$

The value function $\tilde{V}(\cdot, \cdot)$ is not everywhere differentiable. Specifically, there will be a point of non-differentiability at the point where the firm is indifferent between default and repayment as well as at points of indifference between exit (without default) and production. Nevertheless, by applying Theorem 1 from Clausen and Strub (2016) it follows that at the optimal solution to the equity issuance problem the following first order condition is satisfied[2]

$$\frac{1}{1+r} \frac{\partial V\left(\tilde{x} + e, z'\right)}{\partial e} = 1 + \frac{\partial \psi\left(e\right)}{\partial e}$$

A firm with $\partial V / \partial e > 1 + r$ will issue equity until they are no longer borrowing constrained. A firm with $\partial V / \partial e = 1 + r$ is no longer borrowing constrained and will be indifferent between issuing dividends and accumulating additional assets. To ensure that firms do not accumulate too many bonds and the asset market clears, I assume that in this situation shareholders demand that firms issue dividends rather than accumulate assets. This ensures that there is a maximum net-worth for a firm conditional on z.[3]

The firm's problem can be written recursively as

[2] To apply Theorem 1 from Clausen and Strub (2016) and obtain the first order condition presented in this section, it is necessary to construct a 'differentiable lower support function', this is made possible by the differentiability of the function $\psi(e)$. If this function was not differentiable, as in Gomes (2001) then this would not be possible and we would not be able to use Clausen and Strub's theorem here.

[3] A common assumption made here is that firms discount the future at a rate smaller than $1/1 + r$. I avoid making this assumption here so that there exist unconstrained firms in equilibrium. I will exploit the existence of these firms in my calibration strategy.

$$
\begin{aligned}
V(x,z) = \max_{\{k,n,b,R\}} \Bigg\{ & (1-\chi) E_{z'|z} \left[\int_{\mathcal{S}_R(z',k,n,Rb;z)} \tilde{V}\left(\tilde{x}_R(\omega,k,n,Rb;z), z'\right) d\left[G(\omega)\times H(\theta)\right] \right] \\
& + (1-\chi) E_{z'|z} \left[\int_{\mathcal{S}_B(z',k,n,Rb;z)} \tilde{V}\left(\tilde{x}_B\left(\theta,\omega,z',k,n;z\right), z'\right) d\left[G(\omega)\times H(\theta)\right] \right] \\
& + \chi E_{z'|z} \left[\int_{\omega \geq \bar{\omega}_D(k,n,Rb;z)} \tilde{x}_R(\omega,k,n,Rb;z)\, dG(\omega) \right] \Bigg\}
\end{aligned}
$$

subject to

$$
\tilde{V}(\tilde{x},z) = \max\left\{ \max_e \left\{ -\left(e+\psi(e)\right) + \frac{1}{1+r} V(\tilde{x}+e,z) \right\}, \tilde{x} - \psi(-\tilde{x}) \right\}
$$

$$
b + x = k + \frac{1}{1+r}\left(wn + c_f\right)
$$

$$
\Pi_B(k,n,Rb,b;z) = 0
$$

3.4 Firm Entry

Every period there is a constant mass $M > 0$ of prospective firms. Each firm draws an initial productivity level z_0 from a distribution $G_E(\cdot)$. Firms observe their initial productivity level and then decide whether to enter the market or not. In order to enter, a firm must pay a fixed entry cost $c_e > 0$. Entrants fund the cost of entry through an initial equity issuance and enter the economy with zero net-worth $x = 0$. The value of a prospective entrant which receives an initial productivity level z_0 is

$$
V_E(0,z) = \max_e \left\{ -\left(e+\psi(e)\right) + \frac{1}{1+r} V(e,z) \right\}
$$

Firms will only enter if their initial productivity level is sufficiently high and there is a cutoff value $\bar{z}$ such that firms enter when $z_0 > \bar{z}$ with the cutoff defined by the following free-entry condition

$$
V_E(0,\bar{z}) = c_e
$$

Firms that enter the market decide on their production inputs and financing for the following period. Entrants do not produce until the period following their entry.

3.5 Recursive Competitive Equilibrium

A recursive competitive equilibrium consists of (i) value functions V, $\tilde{V}$, and V_E, (ii) policy functions $n(x,z,\Gamma)$, $k(x,z,\Gamma)$, $b(x,z,\Gamma)$, $R(x,z,\Gamma)$, $e(\tilde{x},z',\Gamma)$ and $\bar{z}(\Gamma)$ (iii) a wage function $w(\Gamma)$ and distribution of firms Γ such that

1. The value functions $V(x,z)$, $\tilde{V}(\tilde{x},z')$ and policy functions $n(x,z,\Gamma)$, $k(x,z,\Gamma)$, $b(x,z,\Gamma)$, $R(x,z,\Gamma)$, $e(\tilde{x},z',\Gamma)$ solve the incumbent firm's problem

2. The value function $V_E(0, z)$ and the policy functions solve the prospective firm's problem free entry condition hold for entrants and firms enter the market only if $z \geq \bar{z}$ where$V_E(0, \bar{z}) = c_e$

3. Given the wage function $w(\Gamma)$ and the interest, the labour, equity and bond markets clear

4. The distribution of firms is consistent with firm decision rules and evolves according to the following law of motion

$$\begin{aligned}
\Gamma_{t+1}\left(x', z'\right) = &(1-\chi) \int_{\mathcal{S}_R} \left(1 - \tilde{\chi}\left(\omega, x; z\right)\right) \mathbb{1}_{\{x', z' | x, z\}} \Gamma_t\left(x, z\right) d\left[G\left(\omega\right) \times H\left(\theta\right)\right] \\
&+ (1-\chi) \int_{\mathcal{S}_B} \left(1 - \tilde{\chi}\left(\theta, \omega, z', x; z\right)\right) \mathbb{1}_{\{x', z' | x, z\}} \Gamma_t\left(x, z\right) d\left[G\left(\omega\right) \times H\left(\theta\right)\right] \\
&+ M \int_{z > \bar{z}} \mathbb{1}_{\{x', z' | x = 0, z\}} dG\left(z\right)
\end{aligned}$$

where $\mathbb{1}_{\{x', z' | x, z\}}$ is the indicator function given the firm's policy function. $\tilde{\chi}_R(\omega, x; z)$ and $\tilde{\chi}_R(\omega, x; z)$ are the exit rules for firms following repayment and restructuring of debt respectively. These equations are given by

$$\begin{aligned}
\tilde{\chi}_R\left(\omega, x; z\right) = &\mathbb{1}\left\{\tilde{V}\left(\tilde{x}_R\left(\omega, k\left(x, z\right), n\left(x, z\right), R\left(x, z\right) b\left(x, z\right); z\right), z\right) < \right. \\
&\left. \tilde{x}_R\left(\omega, k\left(x, z\right), n\left(x, z\right), R\left(x, z\right) b\left(x, z\right); z\right)\right\}
\end{aligned}$$

$$\begin{aligned}
\tilde{\chi}_B\left(\theta, \omega, z', x; z\right) = &\mathbb{1}\left\{\tilde{V}\left(\tilde{x}_B\left(\theta, \omega, z', k\left(x, z\right), n\left(x, z\right); z\right), z\right) < \right. \\
&\left. \tilde{V}\left(\tilde{x}_B\left(\theta, \omega, z', k\left(x, z\right), n\left(x, z\right); z\right), z\right) < \tilde{x}_B\left(\theta, \omega, z', k\left(x, z\right), n\left(x, z\right); z\right)\right\}
\end{aligned}$$

4 Calibration

I solve the model numerically using a baseline calibration of the model to UK data since the financial crisis. One period in the model is a year. The distribution of entrants is assumed to be the stationary distribution implied by the AR(1) process for z. I approximate the process for z using the method described in Tauchen (1986). The distribution for θ is assumed to be a standard uniform distribution. The distribution of the revenue shocks ω are log-normal with $\mu_\omega = -\frac{1}{2}\sigma_\omega^2$ so that $E[\omega] = 1$.

The model parameters are split into two categories, those calibrated using the model through indirect inference and those that are calibrated outside of the model or taken from standard values found in the literature. The first set of parameters are set out in Table 1 and are not inferred using the model. Standard parameters (the discount rate, capital depreciation and production function parameters) are chosen to be consistent with existing estimates from the literature. The benchmark model also sets the firm's bargaining power during restructuring equal to 0.01, with the UK being a creditor-friendly restructuring regime.

The mass of potential entrants M is set so that steady state employment equals 0.72 which is approximately the employment rate of the UK. The utility function parameter a is chosen so that the household's labour supply equation is consistent with the wage w which is normalised to 1.

Parameter		Value	Source
Interest rate	r	0.04	annual interest rate
Depreciation rate	δ	0.1	standard parameter
Discount factor	β	1/1.04	inverse of $1+r$
Labour production elasticity	α	0.65	standard parameter
Firm Bargaining Power	ϕ	0.01	benchmark assumption
Decreasing returns parameter	v	0.85	standard parameter
Exogenous exit probability	χ	0.0238	exit rate of UK firms over 20 years old
Mass of potential entrants	M	0.478	set so that $N = 0.72$
Labour utility parameter	a	0.28	set so that $w = 1$
Persistence of z productivity	ρ_z	0.669	estimated from UK firm data (see text)
Standard deviation of z	σ_z	0.21	estimated from UK firm data (see text)

Table 1: Calibrated parameters

Parameter		Value	Target
Fixed cost of production	c_f	0.148	Entry rate of UK firms
Cost of entry	c_e	0.714	One year survival rate of UK firms
s.d. of revenue shocks	σ_ω	0.786	Liquidation rate of UK firms
Recovery rate of liquidation	$\underline{\theta}$	0.800	Ratio of administrations to liquidations
Equity issuance cost parameter	ψ	2.036	Debt-to-equity ratio

Table 2: Model-estimated parameters

The exogenous exit probability χ is a requirement for finding a stationary distribution in the model, without it firms that accumulate sufficient assets that the borrowing constraint does not bind never exit. In a similar vein, this parameter is calibrated to the exit rate of established UK firms. Companies House UK provides summary statistics of the UK companies register. Part of this analysis includes the percentage of companies on the companies register that are in liquidation or the course of dissolution by the age since incorporation of the firm. I take the average liquidation/dissolution of firms aged 20 years and older to be the value of χ. Firms aged 20 years and older represent around 10 percent of the active register in the UK.

In the model firms that grow large enough that the borrowing constraint are able to borrow and save at the risk free rate. At this point, firm investment in a given time period depends on the realisation of z and the capital-to-labour ratio is not distorted by default risk. Using this feature of the model, the parameters for the persistent firm technology z is estimated independently from the other parameters on Compustat data for UK firms. As publicly listed firms, these firms are assumed to be large enough that they behave in the same manner as the unconstrained firms in our model. To estimate the parameters we follow a method similar to that described in Cooper and Haltiwanger (2006), in particular, I estimate the following equation

$$\ln \pi_{it} = \rho_\varepsilon \ln \pi_{it-1} + \tilde{\eta}_{it}$$

where π_{it} is the firm's operating profit and the parameters are estimated using a panel fixed effects model with a complete set of time dummies.

The second set of parameters are jointly calibrated using moments from the model. Table 2

Targeted Moments	Model	Data
Firm entry rate	0.118	0.123
One year survival rate	0.902	0.905
Proportion of defaulting firms	0.013	0.0115
Ratio of restructures to liquidations	0.114	0.160
Debt-to-equity ratio	12.06	9.54
Untargeted Moments	**Model**	**Data**
Debt recovery-rate in default	0.718	0.74
Average spread on borrowing	0.0101	0.0204

Table 3: Calibrated Moments

sets out the benchmark values and provides a summary of the moments targeted. The fixed cost of production (c_f) is calibrated to the average startup rate of UK firms between 2008 and 2015, using data from Compustat. The cost of entry (c_e) is calibrated to the one year survival rate of UK firms, also taken from Eurostat data. The standard deviation of the revenue shock (σ_ω) is calibrated to the proportion of administrations to liquidations in the UK between 2008 and 2017 where the model equivalent of a firm entering administration is debt restructuring. The liquidation recovery rate ($\underline{\theta}$) is calibrated to the proportion of administrations to total insolvencies between 2008 and 2017. The source of both of these moments is the UK Insolvency Service.

Table 3 sets out the moment from the data as well as the moments implied by the benchmark calibration as well as comparing the fit of two untargeted moments. The first of these is the recovery rate on debt. For data on this, I use the mean undiscounted recovery rate of all sampled UK firms from Davydenko and Franks (2008) of 0.71. Their definition of the recovery rate is one minus the ratio of the bank's total final loss to the total debt exposure at default. The model equivalent is the fraction of Rb that is recovered by the bank conditional on a firm defaulting on its debt. The second untargeted moment is the average spread on firm debt. For this I use Bank of England data to generate a series for the average interest rate charged to firms.

5 Results

5.1 Steady State

In this section I explore the steady state properties of the benchmark model and compare it to the steady state of a model that features a more debtor-friendly insolvency regime. The debtor-friendly regime uses the same parameters as the benchmark model, with the exception of the firm's bargaining power during debt restructure (ϕ) which is increased from 0.01 in the benchmark model to 0.99. As the mass of entrants is fixed at the same quantity for the two models, the wage adjusts to ensure the labour market clears.

Table 4 compares the aggregate values of the steady states for the two regimes. The economy with the debtor-friendly insolvency regime (high-ϕ) has lower output, lower aggregate capital and a lower equilibrium wage. This is because the increase in firm bargaining power leads to firms getting charged higher interest rates. This is shown in table 5 which compares the moments of the two models. The debtor-friendly regime features a slightly higher spread on firm borrowing despite a

Moments	Benchmark Model ($\phi = 0.01$)	Debtor-friendly ($\phi = 0.99$)
Wage (w)	1.0	0.987
Employment (N)	0.72	0.707
Aggregate Capital (K)	2.72	2.66
Output (Y)	4.08	3.96
Y/N	5.66	5.60
K/N	3.78	3.77
Ratio of K/N to optimal K/N	0.946	0.954

Table 4: Steady State Aggregates of Insolvency Regimes

Moments	Benchmark Model ($\phi = 0.01$)	Debtor-friendly ($\phi = 0.99$)
Firm entry rate	0.118	0.112
One year survival rate	0.902	0.931
Proportion of defaulting firms	0.013	0.0061
Ratio of restructures to liquidations	0.114	0.312
Debt-to-equity ratio	12.06	11.68
Debt recovery-rate in default	0.710	0.712
Average spread on borrowing	0.0101	0.0108

Table 5: Moments of Insolvency Regimes

lower default probability. This is due to the impact of the firm's bargaining power on the average recovery rate of loans in default.

The fall in the equilibrium wage means that for this calibration, the debtor-friendly regime features a slightly lower capital-to-labour ratio and thus lower labour productivity as measured by the output to employment ratio as found in table 4. To remove the effect of the wage on the capital-to-labour ratio and isolate the impact of the financial frictions table 4 reports the ratio of the average to the optimal capital-to-labour ratio. Both regimes feature lower than optimal capital investment. This is due to the financial frictions distorting the relative price of capital and labour. This is made clear in the following equation for the capital-to-labour ratio which I obtained from the first-order conditions of the firm's problem

$$\frac{n}{k} = \left(\frac{\alpha}{1-\alpha}\right)\left(\frac{r + \delta + (1-\delta)\,\Lambda_\delta\left(k, n, Rb; z\right)}{w}\right)$$

where $\Lambda_\delta\left(k, n, Rb; z\right)$ is a distortion to the capital-to-labour ratio given by the following equation

$$\begin{aligned}\Lambda_k\left(k, n, Rb; z\right) = {} & (1-\chi)\left(1-\underline{\theta}\right) E_{z'|z}\left[\int_{\bar{\theta}_L(z',k,n,Rb;z)}^{1} G\left(\bar{\omega}_B\left(\theta, z', k, n, Rb; z\right)\right) dH\theta\right] \\ & + (1-\chi)\left(1-\underline{\theta}\right) E_{z'|z}\left[H\left(\bar{\theta}_L\left(z', k, n, Rb; z\right)\right) G\left(\bar{\omega}_D\left(z', k, n, Rb; z\right)\right)\right] \\ & + \chi\left(1-\underline{\theta}\right) G\left(\bar{\omega}_E\left(k, n, Rb; z\right)\right)\end{aligned}$$

The distortion increases with the firm's probability of default. This is due to the fire-sale cost of selling depreciated capital if the firm defaults which makes holding capital less efficient for firms with a higher default probability. The debtor-friendly regime features a lower default probability

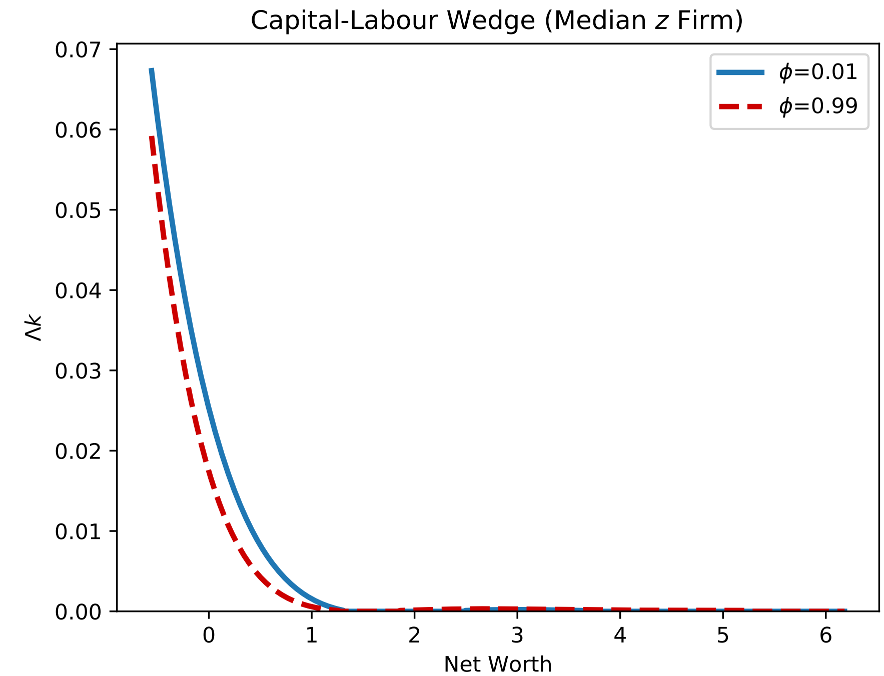

Figure 7: Distribution of Persistent Firm Productivity (z) of Entrants

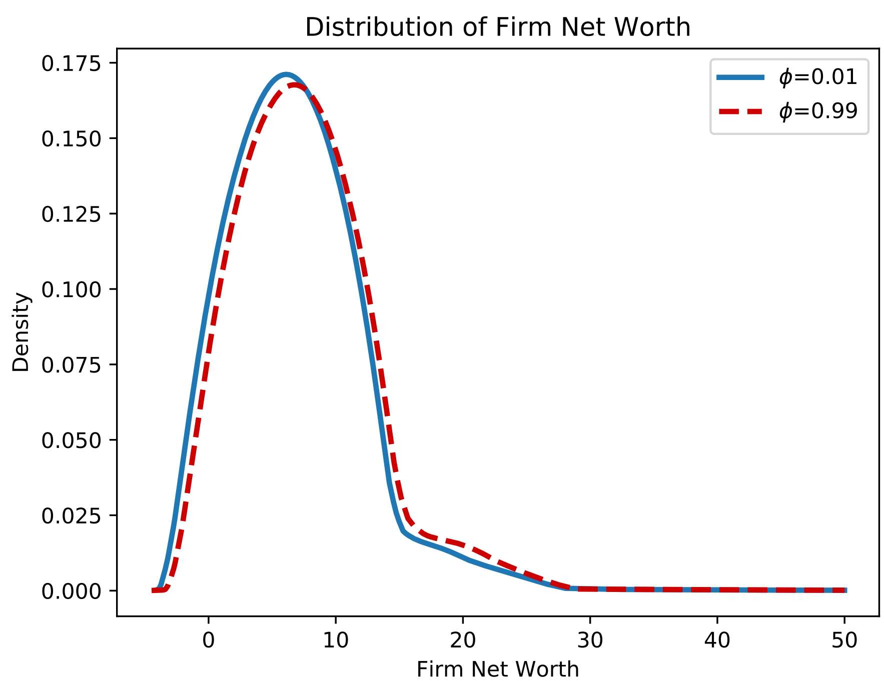

Figure 8: Distribution of Firm Net Worth (x) in the Steady State

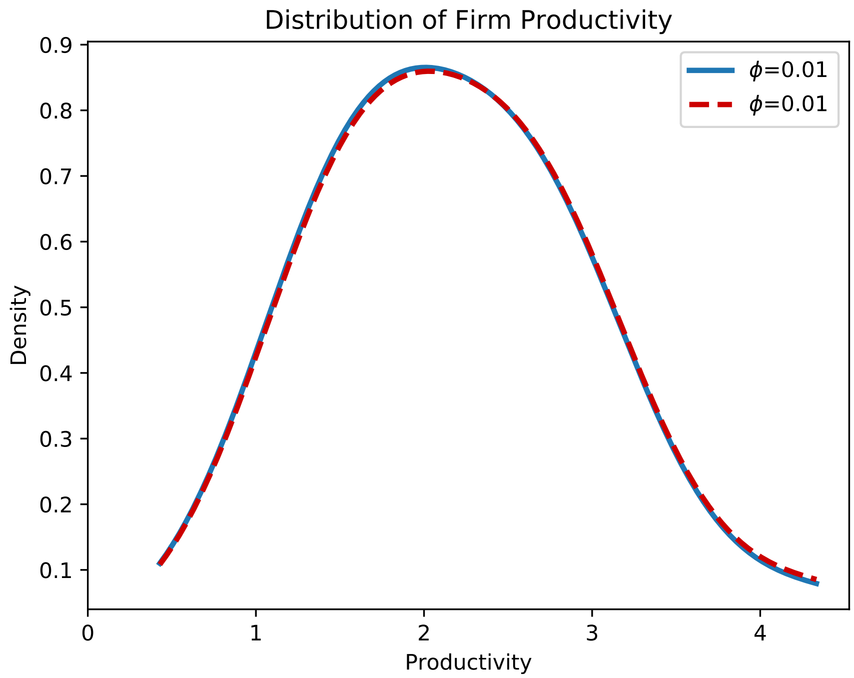

Figure 9: Distribution of Persistent Firm Productivity (z) in the Steady State

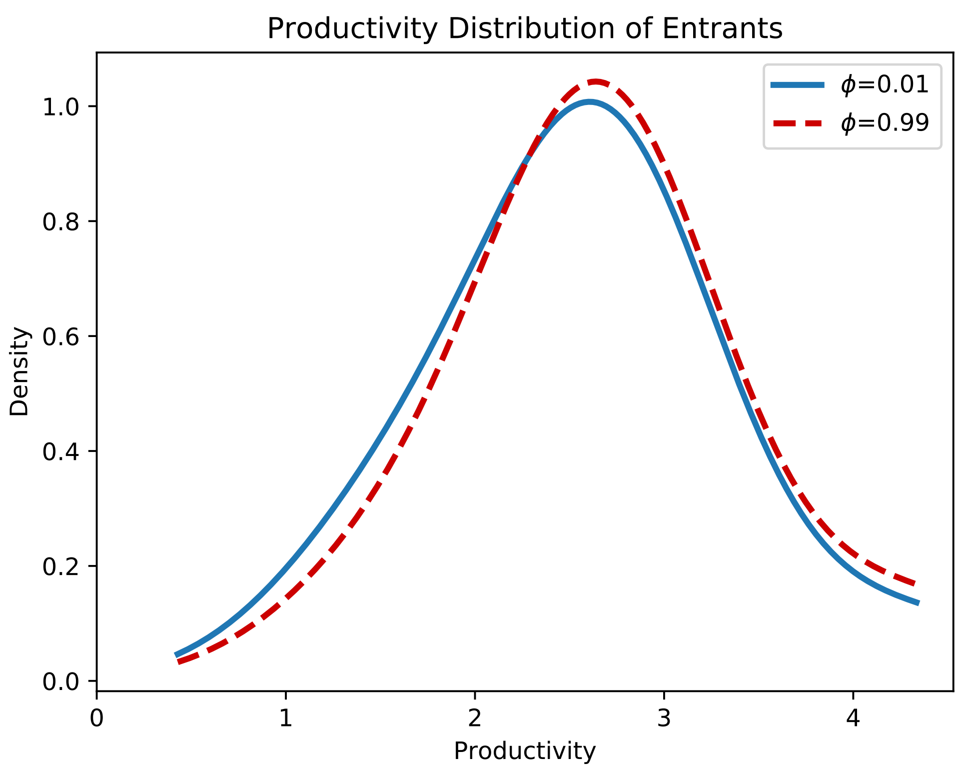

Figure 10: Distribution of Persistent Firm Productivity (z) of Entrants

which lowers the value of Λ_k. Figure 7 compares the value of the wedge Λ_k for values of net worth x, fixing the productivity z of firms to the median productivity in the benchmark regime.

The unconditional distributions of firm net worth and persistent productivity z are shown in Figure 8 and Figure 9 respectively. The debtor-friendly insolvency regime results in more selection into the economy and thus the distribution of firm net worth x and productivity z shift to the right. The increase in firm bargaining power leads to the bank charging higher interest spreads. This in turn makes production more costly in the debtor-friendly regime and thus less productive firms exit sooner and there is more selection in firm entry. Figure 10 shows the productivity distribution of entrants in the steady state. As the mass of potential firms M is held constant between the two regimes, the greater selection in the debtor-friendly regime results in fewer entrants, a smaller mass of firms in the stationary distribution and a higher survival rate of newly entering firms. The fall in the equilibrium wage again dampens the variation of the distributions across regimes.

5.2 Dynamics

In this section I present the dynamic response of the model to an unexpected aggregate shock to the distribution of firms. In order to generate an aggregate shock in a model without aggregate uncertainty, I ensure that a larger than normal number of firms receive a bad draw of their idiosyncratic shock z. Specifically, I draw a value of z for each firm as normal but with some probability a firm receives a worse realisation of z than the one they were drawn. By modeling the shock in this way, the realisation of z is still consistent with the expecations of an individual firm but in aggregate the distribution of these shocks would occur with probability zero. The aggregate shock described here can also be thought of as a shock do the distribution of firms as following the impact of the shock, the economy will no longer be at the stationary firm distribution.

I calibrate the shock to ensure a 1 percent fall in employment in the benchmark model on impact. Firms with low z will exit the economy, reducing the mass of incumbent firms below the steady state value. As the mass of entrants is constrained by the value of M, the wage will adjust to ensure the labour market clears. I assume that firms fully anticipate the path of wages, which after the initial probability zero shock follow a deterministic path. As the wage changes, the firm's policy functions also change. From a technical point of view, this requires the firm's problem to be solved in order to find the wage that clears the market.

Figure 11 sets out the response of the two regimes to the negative shock to z. Employment falls less in the creditor-friendly ($\phi = 0.01$) than the debtor-friendly ($\phi = 0.99$) regime, employment falling 1 percent on impact when $\phi = 0.01$ compared to 1.29 percent when $\phi = 0.99$. Labour productivity, measured as the ratio of output to employment, falls in both models, but falls most in the creditor-friendly regime. In this experiment, the debtor-friendly regime leads to a 29 percent larger peak drop in employment and a 20 percent smaller fall in labour productivity following the negative productivity shock.

Labour productivity falls as firms are more borrowing constrained when their bargaining power is low and this in turn leads to firms lowering their capital holdings, with the capital-to-labour ratio falling more in the creditor-friendly regime. The response of output to the shock is similar in both regimes, suggesting that the employment and productivity responses roughly offset. The firm's

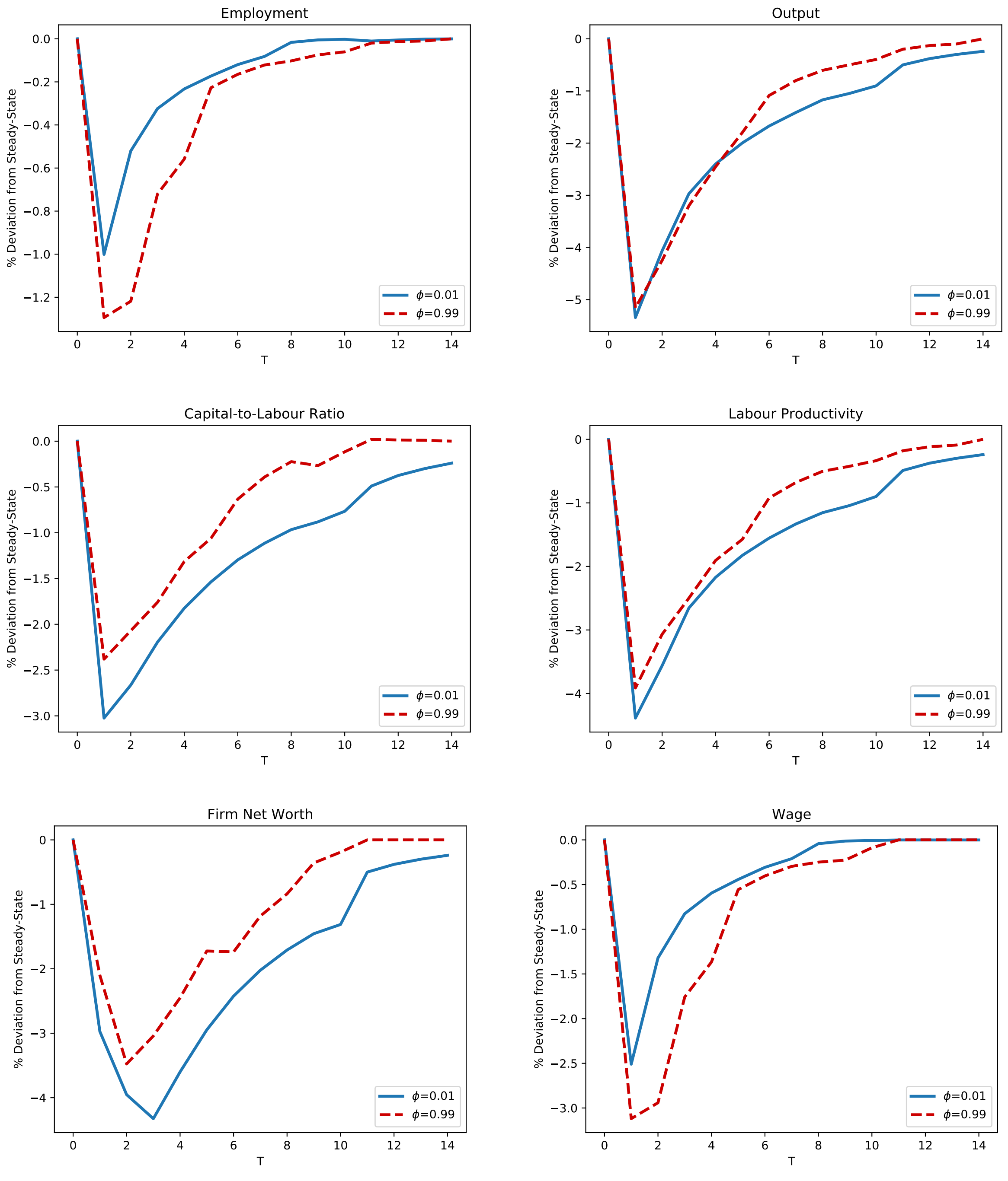

Figure 11: Dynamic Response to a negative shock to Firm productivity z

bargaining power during restructuring may be costly in the steady-state, but provides a degree of insurance when the firm, or the economy, is hit by a negative shock. Firms that default as a result of the shock are more likely to restructure their debt when their bargaining power is high and firms that restructure their debt will begin the next period with higher net worth and thus are less borrowing constrained than if their bargaining power was low.

Another result to note is that the wage falls further in the debtor-friendly insolvency regime. As firms hit by the negative productivity shock more firms exit and employment falls. As employment falls, the household labour supply condition results in a falling wage. In the creditor-friendly bankruptcy regime, borrowing constrained firms substitute from capital to labour and the resulting fall in employment is less, hence the equilibrium wage falls less. The debtor-friendly regime does not fully capture the US experience, labour productivity still falls in the model while it rose slightly following the crisis. Fully capturing the response of the US economy was not the purpose of this exercise and I chose to calibrate the model to UK data only. However, the current formulation of the model would struggle to reverse the direction of the labour productivity response. This is because the capital-to-labour ratio will fall as the firm's default risk increases and a negative shock will increase the firm's probability of default. Nevertheless, the model presented here highlights how the difference in insolvency regimes between the UK and the US can partly explain the fall in labour productivity the UK witnessed since the financial crisis.

6 Conclusion

This paper presents a heterogeneous firm model of the UK's creditor-friendly insolvency regime and investigates a hypothetical change in the insolvency regime to a US-style debtor-friendly regime. The insolvency regime is modeled as a costly-state verification model where firms have the option to restructure their debt. Default costs create a wedge on the capital-to-labour wedge, effectively raising the price of holding capital for high-risk firms. As a consequence of this, firms that are more borrowing constrained have a lower capital-to-labour ratio and thus lower labour productivity. In the steady-state, less firm bargaining power results in lower firm borrowing rates and higher output. The dynamic response of the benchmark model to a negative shock matches the response of the UK to the financial crisis. In particular, following a negative shock to firm productivity firms in the creditor-friendly regime substitute from capital to labour. This dampens the fall in employment while causing labour productivity to fall. Firms in a debtor-friendly insolvency regime, while more costly in the steady-state allows firms to remain less borrowing constrained following a large aggregate shock and thus these firms hold relatively more capital relative to their counterparts in a creditor-friendly regime. In addition to the static benefits of the UK regime the results highlight the trade off in the dynamic response to shocks. The counterfactual debtor-friendly insolvency regime led to a 29 percent larger peak drop in employment following the negative productivity shock but a 20 percent smaller fall in labour productivity.

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