Wealth Inequality and the Losses from Financial Frictions*

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Abstract

Does wealth inequality exacerbate or alleviate the degree of misallocation in an economy where financial markets are imperfect? To address this question, I exploit the idea that inequality should have a different effect across sectors. Using a difference-in-difference strategy, I show that sectors that are more in need of external finance are relatively smaller in countries with higher income inequality. To rationalize this fact, I build a model in which sectors differ in their fixed cost requirement, agents face collateral constraints, and production is subject to decreasing returns. I calibrate the model to match moments of the US economy. The calibrated model is consistent with the documented facts on inequality and cross-sector outcomes. At the calibrated parameters, wealth inequality exacerbates the effect of financial frictions on the economy. Quantitatively, an increase in wealth inequality of about 30 points in Gini generates losses of 30 percent of per capita income. JEL Codes: E44, D31, O10, O40.

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1 Introduction

A large body of work in economics studies the effects of financial frictions on economic development. An important channel by which these frictions are thought to affect the economy is the misallocation of resources among production units. In the presence of collateral constraints, valuable resources may not flow to the agents with the highest marginal product. It is well-known that in this context the distribution of wealth can affect macroeconomic aggregates. A natural question arises: how does wealth inequality interact with the friction in the financial market? In other words, does wealth inequality tend to exacerbate or help alleviate the effect of financial frictions? The goal of this paper is to shed light on this question.

Answering this question is not straightforward. From a theoretical perspective, wealth inequality is associated with multiple effects, possibly playing in opposite directions. For example, with imperfect capital markets and minimum scale requirements, wealth inequality may help some agents start production in sectors with high scale requirements. At the same time, with decreasing returns to scale in production, wealth inequality may induce an inefficient distribution of firm size. The overall impact of wealth inequality depends on which of these forces dominates. From an empirical perspective, estimating the effect of inequality on aggregate productivity is challenging. An important threat to identification in cross-country regressions is the presence of country-specific omitted variable bias.[1]

To deal with these issues, I adopt the following strategy. On the empirical side, I propose to use the cross-sectoral variation in firms' reliance on external finance. I provide evidence that inequality has a differential effect on the size of sectors that rely more heavily on external finance. This shows that inequality has an effect on the economy through its interaction with financial frictions, but does not identify the effect of inequality on aggregate productivity. To make progress, I build a two-sector model with financial frictions and decreasing returns in which one sector has larger capital requirements. I calibrate the model to match key moments of the US economy. I then show that the calibrated model is consistent with the facts on income inequality and cross-sectoral outcomes. Finally, I use the calibrated model to assess the aggregate impact of wealth inequality on the economy, that is, on the degree of misallocation of production resources.

I start by providing evidence on the effect of income inequality on the structure of production using a sample of 39 countries and 36 manufacturing industries. I employ the difference-in-difference methodology of Rajan and Zingales (1998) which, by focusing on cross-sectoral outcomes, allows to control for country and sector fixed effects. I find that manufacturing industries that rely more heavily on external finance are disproportionately smaller, in terms of value added shares, in countries with higher income inequality.[2] This is in contrast to the effect of financial development, which is associated with relatively higher value added shares of externally dependent sectors. Importantly, I

[1] The difficulty in identifying the aggregate effect of inequality can be seen in the empirical literature on income inequality and economic growth, in which different papers have reached opposite conclusions - see Banerjee and Duflo (2003).

[2] I focus on income inequality due to the lack of data on wealth inequality for a wide range of countries, especially financially developing ones.

find evidence of significant interaction effects between income inequality and financial development. Perhaps counter-intuitively, the disproportionately negative effect of income inequality on the size of externally dependent sectors is first stronger and then weaker, as financial development improves. While the diff-in-diff methodology helps in terms of identification, it does not shed light on the aggregate effects of inequality. Additionally, the facts are on income, not wealth inequality. I rely on theory to make progress.

I consider a static two-sector model that features key elements from the literature on financial frictions and economic development. First, I assume that production is subject to decreasing returns to scale. With constant returns, the distribution of firm size would have no impact on aggregate outcomes. Second, I assume that agents face collateral constraints, which ensures that the distribution of wealth has an impact on the distribution of firm size, and thus, via decreasing returns, on aggregate output. Third, there are sector-specific fixed costs of operating a firm. The difference in fixed costs creates a difference in financing needs across sectors, which provides a way to map the model to the data. Fourth, agents face an occupational/sectoral choice: they can choose whether to work for a wage or start a firm in either of the two sectors.[3]

An important feature of my methodology is that I employ a static model that takes the distribution of wealth as exogenously given. That is, I am agnostic about the underlying determinants of the distribution of wealth. Rather than proposing a theory of the distribution of wealth, I study the effects of arbitrary changes it. This approach is suited to capture the effect of any deep determinant of wealth inequality such as geographical conditions associated to large-scale agriculture (Engerman and Sokoloff (2000)), heterogeneity in agents' time discount factors (Krusell and Smith (1998), Krueger, Mitman, and Perri (2016)) or preferences for redistribution (Alesina and Giuliano (2009)). I focus on the effect that any such determinant can have on production efficiency through its effect on wealth inequality, keeping technology and the quality of financial institutions constant.[4]

I focus on the effect of wealth inequality on the distribution of firm size via three different channels. Consider a mean-preserving redistribution of one unit of wealth from a poor to a rich agent of equal productivity.[5] First, there is a decreasing returns channel. To the extent that the relatively poor agent is more severely constrained, such transfer entails a flow of resources away from a high marginal product firm into a low marginal product firm. Second, there is a capital demand

[3]These assumptions are common in the literature. Technological non-convexities, occupational/sectoral choice and decreasing returns are featured in e.g. Galor and Zeira (1993), Banerjee and Newman (1993), Banerjee and Duflo (2005), Buera and Shin (2013), Midrigan and Xu (2014) and Buera, Kaboski, and Shin (2011).

[4]Indeed, such deep determinants of wealth inequality may affect the development of financial institutions. For this reason, the empirical evidence on the effects of inequality (which I later use to evaluate the model) is obtained after controlling for financial development.

[5]I focus on changes in the dispersion of wealth among agents of equal productivity. That is, I abstract from changes in the distribution of wealth *across* ability types. To the extent that wealth and ability are positively correlated, an unconditional increase in wealth inequality would increase aggregate productivity. However, measuring how wealth and ability are correlated, or how increases in wealth inequality redistribute wealth across ability types, is difficult. For this reason, I abstract from differences in ability across agents in the baseline model. In an extension, I consider a version of the model with heterogeneity in both wealth and ability and perform mean preserving spreads to the distribution of wealth conditional on ability.

channel. If the poorer agent is capital constrained while the wealthier is not, the increase in wealth inequality tends to decrease aggregate capital demand. This happens because the poorer agent is borrowing at capacity while the wealthier agent has reached her optimal scale and has no use for the extra funds other than lending. The reduction in aggregate capital demand depresses the interest rate and exacerbates the effects of financial frictions. Finally, there is an extensive margin channel as wealth inequality can increase, or decrease, the number of agents that is able to meet the minimum capital requirement of the capital intensive sector. Depending on which of these forces dominates, wealth inequality can exacerbate or alleviate the degree of misallocation in the economy.

To sort out the quantitative importance of these effects, I calibrate the parameters of the model to match several moments of the US economy, including the degree of income and wealth inequality.[6] I then test the calibrated model by evaluating its ability to match the cross-sectoral effects of income inequality discussed above. More precisely, I impose mean-preserving variation in wealth inequality that is consistent with the observed variation in income inequality. The model's predictions are in line with data: higher income inequality is associated with lower relative value added in the more externally dependent sector. The model also predicts interaction effects between inequality and financial development consistent with those in the data. Specifically, for low levels of financial development, the negative effect of wealth inequality on relative value added becomes stronger as financial institutions improve. When financial development is sufficiently high, further improvements in financial development tend to weaken the effects of inequality.[7]

With the calibrated model at hand, I study the aggregate effects of wealth inequality. Keeping average wealth and the technology parameters fixed at their US levels, I perform mean preserving spreads to the distribution of wealth to span a range of income Gini coefficients as observed in the sample. The main result of the paper is that, at the calibrated parameters, wealth inequality tends to exacerbate the effects of financial frictions, placing the economy further away from its first best. This happens because inequality shifts resources towards agents with relatively low marginal product of capital (decreasing returns channel) and agents who have reached their optimal scale (capital demand channel). The reduction in aggregate capital demand tends to depress the interest rate.[8] Furthermore, wealth inequality reduces the number of agents that is able to meet the fixed

[6]Of particular importance is the degree of decreasing returns in production. This parameter, which controls the slope of the profit function, is chosen to map the degree of wealth inequality into the degree of income inequality observed in the US. That is, I ensure that the model's mapping between wealth and income inequality is exactly correct for the US. In subsequent quantitative exercises, I vary the degree of wealth inequality to match the range of income inequality observed in the countries in my sample. In this way, I rely on the model to infer the degree of wealth inequality from observed income inequality and thus bypass the lack of wealth data for developing countries.

[7]The intuition for the non-monotone interaction effect relies on the capital demand channel. When financial development is low, an increase in inequality is likely to redistribute resources among constrained agents who are borrowing at capacity. Given the linearity of the collateral constraint on wealth, this means that the effect on total capital demand is likely to be small. When financial frictions improve, an increase in inequality is likely to shift resources away from constrained entrepreneurs into the hands of unconstrained entrepreneurs and thus reduce aggregate capital demand. Put differently, the strength of the capital demand channel is increasing in the degree of financial development. At some point, when financial development is sufficiently high and most producers have reached their optimal scale, wealth inequality has once again no effect on aggregate capital demand.

[8]A pattern of increasing wealth inequality and falling interest rates was observed in the US and other developed nations in recent decades. My paper suggests a mechanism that can rationalize this pattern as causal. Auclert and Rognlie (2016) study a related mechanism via the effect of inequality on aggregate savings.

cost and enter the more externally dependent sector (extensive margin channel). Quantitatively, the losses from wealth inequality can be large. An increase in wealth inequality of about 30 points in Gini reduces income per capita by approximately 30%.[9] I show that about a quarter of these losses can be accounted by the extensive margin channel.

Related Literature. This paper is related to several strands of the literature. A large empirical literature studies the effect of income inequality on the macroeconomy. The standard approach has been to run a cross-country growth regression with inequality added as an independent variable.[10] A well-known concern with this methodology is the presence of omitted-variable bias. A second generation of papers emerged after the development of a new dataset by Deininger and Squire (1996), which provides high quality data for a more comprehensive set of countries, with consecutive measurements of income inequality for each country. The panel structure of their dataset allowed researchers to control for time-invariant, unobservable country characteristics, and thus help reduce omitted-variable bias - see Forbes (2000) and Li and Zou (1998). I provide an alternative way to help identify the effects of income inequality on macroeconomic outcomes by applying a methodology akin to Rajan and Zingales (1998). By focusing on the cross-industry effects of income inequality, I am able to include country and sector fixed effects to alleviate the concern of omitted-variable bias.

An important body of theoretical work studies the role of the distribution of wealth in shaping macroeconomic outcomes in the presence of financial frictions.[11] One strand of the literature focuses on financial frictions that affect households' consumption behavior and thus aggregate demand - see Krueger, Mitman, and Perri (2016), Guerrieri and Lorenzoni (2017) or Auclert and Rognlie (2016). Another strand of the literature studies financial frictions that affect the supply side of the economy. In these theories, the distribution of wealth interacts with the friction in financial markets and affects the allocation of resources for production. Seminal contributions in this area are Banerjee and Newman (1993), Galor and Zeira (1993), Greenwood and Jovanovic (1990), Piketty (1997), Lloyd-Ellis and Bernhardt (2000) and Jeong and Townsend (2008). The theoretical framework employed in this paper falls into this latter class. In addition, by documenting the differential effect of inequality on sectors that rely heavily on external finance, and the presence of interaction effects between financial development and inequality, this paper provides evidence for financial frictions on the supply side as a channel through which the distribution of wealth matters.

A large literature studies the underlying determinants of wealth inequality. A structural literature in macroeconomics investigates the role of heterogeneity in patience, earnings risk, intergenerational

[9] This number should be interpreted as an upper bound for two reasons. First, a range of 30 points in income Gini is the maximum observed in the sample. Second, I have abstracted from changes in inequality that redistribute wealth across ability types. To the extent that wealth and ability are positively correlated, such redistribution would tend to lower the losses from wealth inequality.

[10] For examples of this approach, see Perotti (1996), Alesina and Rodrik (1994), Alesina and Perotti (1996), and Persson and Tabellini (1994).

[11] An additional class of theories that predict an effect of the distribution of wealth on the macroeconomy is given by political economy models, where inequality leads to the implementation of redistributive policies that may harm economic growth - see e.g. Alesina and Rodrik (1994) and Persson and Tabellini (1994).

transfers, or medical expenditure shocks in the context of Bewley models - see De Nardi (2015) and Krueger, Mitman, and Perri (2016) for surveys of this vast literature. A literature in political economy studies how historical, cultural or ideological factors shape individuals' preferences for redistribution (see Alesina and Giuliano (2009) for a summary) and Alesina, Cozzi, and Mantovan (2012) show how such preferences can affect tax policy and inequality. A literature in comparative development and economic history has tried to uncover the deep-rooted determinants of inequality. For example, Engerman and Sokoloff (2000) argue that factor endowments, such as soils or climate, associated to large-scale agriculture led to a highly unequal distribution of wealth in the European colonies in Latin America. In turn, societies that began with extreme inequality developed political institutions that contributed to the persistence over time of the high degree of inequality.[12] Acemoglu and Robinson (2000) link the extension of voting rights in Western societies in the nineteenth century to an increase in redistribution and a reduction in inequality. In contrast, I do not take a stand on the underlying determinants of inequality. Instead, I measure the effect that any such determinant can have on production efficiency through its effect on wealth inequality.[13]

Given its static nature, my methodology can be linked to the literature on development accounting - see Caselli (2005). This literature quantifies the relative importance of the factors of production and aggregate efficiency in explaining cross-country differences in income. The key theoretical object in this exercise is an aggregate production function that maps the different factors of production, such as physical and human capital, into total income. The static theory of my paper provides one such aggregate production function which, because of financial frictions, takes the entire distribution of wealth as an input.[14] In this way, my methodology aims to quantify the role of wealth inequality as a proximate determinant of income, as in a development accounting exercise. My results should therefore be interpreted as a diagnostic test on the importance of the underlying factors that control wealth inequality.

This paper is also related to the quantitative literature that studies the effects of financial frictions on aggregate productivity (Jeong and Townsend (2007), Buera, Kaboski, and Shin (2011), Midrigan and Xu (2014), Moll (2014)). This literature typically considers a dynamic framework in which agents make optimal savings decisions subject to idiosyncratic shocks to their productivity. In this literature, the distribution of wealth and ability is endogenous and determined by the structure of the Euler equation together with parameters including the degree of financial development. Conditional on this distribution, the static framework employed by my methodology

[12] Easterly (2007) provides econometric evidence for this hypothesis.

[13] Admittedly, such deep factors may directly affect the degree of contemporary misallocation, beyond their effect through the distribution of wealth. The losses from inequality predicted by my model aim to isolate the effect of any such determinant through wealth inequality only. The empirical findings on the effects of inequality, which I use to evaluate the model, are obtained after controlling for the quality of the financial system. Identifying exogenous variation in wealth inequality, which is uncorrelated to institutional development, is beyond the scope of this paper.

[14] In contrast, standard development accounting exercises employ aggregate production functions that depend on the distribution of wealth only through its mean, that is, the total stock of physical capital. This reflects the underlying assumption of perfect factor markets, which implies no connection between the agents' endowments and the inputs employed by firms. See Banerjee and Duflo (2005) for a discussion of aggregate production functions.

follows closely the ones used in this literature. In addition, while not the primary focus of this paper, I quantify the effect of tightening financial frictions on aggregate productivity, while keeping the distribution of wealth constant. I interpret my results as capturing short run effects and providing an upper bound to the losses from financial frictions in the medium and long run.[15]

Finally, this paper is related to the literature on misallocation and aggregate total factor productivity (Restuccia and Rogerson (2008), Hsieh and Klenow (2009)). I add to this literature by showing that, in the presence of financial frictions, inequality in the distribution of wealth constitutes a source of misallocation that can substantially reduce aggregate productivity.

The rest of the paper is organized as follows. Section 2 contains the empirical evidence on inequality, financial development and relative industry size. Section 3 outlines the model and Section 4 contains the calibration. Section 5 assess the model's ability to match the cross-sector evidence documented in Section 2. Section 6 computes the losses from wealth inequality. Section 7 concludes.

2 Empirical Evidence

In this section, I provide evidence of the effect of income inequality on the relative size of manufacturing industries.[16] As a measure of industry size, I use the industry's share in total manufacturing value added.[17] The main finding is that sectors that rely more heavily on external finance account for disproportionately lower shares of total manufacturing value added in countries with higher income inequality. This is in contrast to the effect of financial development, which is associated with higher value added shares of externally dependent sectors. I also find significant interaction effects between income inequality and financial development. More precisely, the disproportionately negative effect of income inequality on value added shares of the high external dependence sectors becomes first stronger and then weaker as financial development improves.

Section 2.2 takes a first pass at the data by comparing average industry value added shares in high vs low external dependence industries, in both high and low income inequality countries. Section 2.3 provides cross-country regressions of relative value added in high dependence industries on income inequality, financial development and other country-level controls. Finally, Section 2.4 provides cross-country cross-industry regressions in the spirit of Rajan and Zingales (1998) - henceforth RZ. All three types of evidence exhibit consistent results. Subsection 8.3 in the Appendix contains robustness checks, including alternative measures of financial development and income inequality.

[15] I find that financial frictions can reduce output by up to 35%, keeping the initial distribution of wealth constant. While on impact agents cannot adjust their wealth holdings, over time they can react to a tightening of financial frictions by adapting their savings behavior and self-financing, possibly making up for some of the short run output loss.

[16] I focus on income rather than wealth inequality due to issues of data availability. Data on the distribution of wealth across countries is only available for a small set of developed economies - see the Luxembourg Wealth Study Database. In contrast, data for income inequality is available for a wide range of countries, both financially developing and developed.

[17] Section 8.3 in the Appendix considers output and export shares as alternative measures.

2.1 Data

I use value added data for a sample of 39 countries and 36 ISIC Rev.2 manufacturing industries. Data on value added across countries and industries is obtained from the Industrial Statistics Yearbook, compiled by the United Nations Statistical Division (1993) - henceforth UNSD. Data on income inequality at the country level is obtained from Deininger and Squire (1996). Their database provides data on Gini coefficients and represents a quality improvement over previous datasets in terms of: (i) comprehensive coverage of the population, (ii) comprehensive coverage of income sources, and (iii) the requirement that observations be based on household surveys. I focus on the 1980s for comparability with RZ.

Australia	Finland	Zimbabwe	Portugal
Banglades	France	Malaysia	Singapore
Belgium	Germany	Mexico	South Africa
Brazil	Greece	Morocco	Spain
Canada	India	Netherlands	Sri Lanka
Chile	Italy	New Zealand	Sweden
Colombia	Japan	Norway	Turkey
Costa Rica	Jordan	Pakistan	UK
Denmark	Kenya	Peru	Venezuela
Egypt	Korea	Philippines	

Table 1: Countries in UNSD Data

Data on financial development was obtained from the IMF's *International Financial Statistics* (IFS) and the International Finance Corporation's (IFC's) *Emerging Stock Market Factbook*. The leading measure of financial development used is the *capitalization ratio*, defined as the sum of domestic credit plus stock market capitalization over GDP. Stock market capitalization is obtained from the Emerging Stock Market Factbook. Domestic credit is taken from the IFS, as the sum of lines 32a through 32f, excluding 32e. Domestic credit to the private sector is given by line 32d. Section 8.3.2 in the Appendix considers three alternative measures of financial development: (i) the ratio of domestic credit to the private sector plus stock market capitalization to GDP, (ii) the ratio of stock market capitalization to GDP, and (iii) the accounting standards. Data on accounting standards is taken from the Center for International Financial Analysis and Research.

The availability of data on financial development and high quality income inequality limits the number of countries that can be included in the sample. The capitalization ratio can be computed for 41 countries in 1980. Deininger and Squire (1996) report the Gini coefficient in 1980 for about one third of these countries. I overcome this problem by using measurements of income inequality that are as close as possible to 1980. Table 12 in the Appendix shows the year used for each country in the sample.[18] Finally, I discard countries for which there is no data in the Industrial Statistics

[18]The adopted criterion implies using, for a few countries, the Gini coefficient for a post-1980 year. A similar issue is present in RZ, who measure stock market capitalization for the earliest year in the 1980's for which data is available. For three African countries (Zimbabwe, South Africa and Kenya), high quality data on income inequality is available

Yearbook that is separated by at least 5 years during the 80s.[19] The final sample consists of 39 countries, which are listed in Table 1.[20]

Data on external financial dependence for 36 3-digit ISIC manufacturing sectors during the 1980s is taken from RAJAN AND ZINGALES (1998). They use firm-level data on publicly traded US firms from Compustat (1994) and measure a firm's dependence on external finance as the fraction of capital expenditures that is not financed with internal cashflows from operations. Table 13 in Section 8.2 of the Appendix lists the 36 sectors, in order of increasing external financial dependence.

2.2 A First Pass: Split-Sample Analysis

As a first pass at gauging the effects of income inequality on cross-sector levels, I perform a simple split-sample analysis. I compare average value added shares of low and high external dependence industries in a sub-sample of 20 countries with high, and 19 countries with low income inequality. An industry's value added share is defined as the ratio of nominal value added to total manufacturing value added in the country in 1980. Table 2 contains the results. We see that low income inequality countries exhibit similar average industry shares in high vs low external dependence sectors. Countries with high income inequality, however, feature smaller shares in industries with high external dependence. In other words, income inequality is associated with disproportionately lower value added shares in sectors with high external dependence. The diff-in-diff estimate is -1.48%.

Panel B in Table 2 shows that financial development has the opposite effect. Financially developed countries - that is, those with high capitalization ratio - exhibit disproportionately higher shares in externally dependent sectors. The diff-in-diff estimate is 0.82%.

Panel A			
	High Inequality	Low Inequality	Difference
High FinDep	2.55 %	3.24%	-0.69 %
Low FinDep	4.05 %	3.26%	0.79 %
Difference	-1.50 %	-0.02 %	-1.48 %
Panel B			
	F. Developed	F.Developing	Difference
High FinDep	3.03 %	2.70%	0.33 %
Low FinDep	3.44 %	3.93%	-0.49 %
Difference	-0.41 %	-1.23 %	0.82 %

Notes: The table shows average industry shares in total manufacturing value added for 1980 for different groups of industries and countries. The 36 manufacturing industries are classified in a group of high external dependence and a group of low external dependence, according to the median level of external dependence. High inequality countries are those with Gini coefficient larger than the median. Financially developed countries are those with capitalization ratio larger than the median.

Table 2: Descriptive Statistics for Industry Shares

only for single year in the early 1990s. I include these observations in the sample, but I show that the results are robust to excluding these three countries.

[19]This is a way to increase the quality of the observations, which is also used by RZ.

[20]The final sample coincides with the one used in RZ, except for two countries, Austria and Israel, for which data on income inequality is not available.

2.3 Cross-Country Analysis

I now study the effect of income inequality and financial development on relative value added at the country level. I define log relative value added in country k as $lrva_k \equiv log(va_{Hk}) - log(va_{Lk})$, where va_{Hk} is nominal value added in sectors with external dependence higher than the median in country k in 1980, and va_{Lk} is similarly defined for industries with external financial dependence lower than the median. I estimate the following specification on the cross-section of countries:

$$lrva_k = c + \beta_1 \lambda_k + \beta_2 G_k + \gamma X_k + \epsilon \tag{1}$$

where λ_k is the capitalization ratio in 1980, G_k is the income Gini coefficient in 1980[21], and X_k is a vector of country-level controls including the stock of human capital (defined as years of schooling in the population over 25), per capita income, and indicators of the origin of the legal system (British, French, German, or Scandinavian).

Table 3 reports the results. Columns (1)-(3) show that inequality and financial development have opposite effects on relative levels: while financial development is associated with *higher* relative value added in externally dependent industries, the effect of inequality on relative levels is *negative*. This is consistent with the results of the split-sample analysis of the previous section.

Dep. var.	Log Relative VA in High Dependence Industries		
	(1)	(2)	(3)
Capitalization ratio	0.633**		0.593**
	(0.242)		(0.238)
Gini		-2.098**	-2.068**
		(0.943)	(0.874)
Controls	Y	Y	Y
Observations	39	37	37
R2	0.412	0.393	0.494

Notes: Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. The dependent variable is the logarithm of the ratio of total value added in high external financial dependence industries to total valued added in low external financial dependence industries in 1980. Both the coefficient estimate and the standard error for the Gini coefficient are multiplied by 100. Controls include the stock of human capital, per capita income and an indicator variable for origin of the legal system (English, French, German or Scandinavian).

Table 3: Cross-Country Regressions for Industry Levels

2.4 Cross-Country Cross-Industry Analysis

This section establishes the main empirical results of the paper. I use the difference-in-difference methodology pioneered by Rajan and Zingales (1998) to identify the differential effect of income inequality and financial development on industry value added shares. I estimate the following

[21] When the Gini coefficient was not available for 1980, the closest possible earlier year was used. See Section 8.1 in the Appendix for further details.

specification:

$$log(s_{jk}) = c + \alpha_j + \alpha_k + \beta_1 ed_j \lambda_k$$
$$+ \beta_2 ed_j G_k + \beta_3 ed_j \lambda_k G_k + \epsilon_{jk} \tag{2}$$

where s_{jk} is industry j's share of total value added in manufacturing in 1980 and ed_j is the level of external financial dependence in industry j. This empirical model includes two double interaction terms and a triple interaction one. Since our interest lies on the interactions between financial development and inequality, a specification including all possible interactions between external dependence at the sector level and income inequality and financial development at the country level is necessary. The advantage of this difference-in-difference approach comes from the inclusion of country and sector fixed effects. I am thus able to address the issue of bias from omitted country-specific and industry-specific variables. Apart from these fixed effects, only RHS regressors that vary with both industry and country are required.

To interpret the estimation of (2), it is useful to consider the difference in log value added shares between a sector with high (H) and a sector with low (L) external dependence, $log(s_{Hk}) - log(s_{Lk})$. This log share differential is equal to log relative value added, as defined in Section 2.3. Thus, differencing equation (2) we have that:

$$\frac{\partial lrva_k}{\partial G_k} = (\beta_2 + \beta_3 \lambda_k)\, \Delta ed, \tag{3}$$

which means that relative value added is decreasing in the level of income inequality as long as $\beta_2 + \beta_3 \lambda_k < 0$. Note that (3) makes clear the presence of interaction effects: if $\beta_3 < 0$, we have that financial development strengthens the negative effect of income inequality on relative value added. Likewise, the effect of financial development on relative value added is given by

$$\frac{\partial lrva_k}{\partial \lambda_k} = (\beta_1 + \beta_3 G_k)\, \Delta ed \tag{4}$$

Financial development generates an increase in relative value added as long as $\beta_1 + \beta_3 G_k > 0$. If additionally $\beta_3 < 0$, an increase in income inequality weakens the positive effect of financial development on relative value added.

Table 4 contains the results of the estimation of (2). I find that industries with high reliance on external finance account for a *lower* share of total manufacturing value added in countries where the distribution of income is more unequally distributed (see column (2)). Columns (3) and (4) show that these results do not go away when both financial development and inequality terms are included at the same time.[22] Furthermore, I find that industries that are more dependent on external finance account for a relatively higher share of total manufacturing value added in more financially developed countries.

[22]It should be noted that, in spite of the lack of significance of the double interaction term between inequality and external financial dependence in column (4), the effect of inequality on relative shares is still negative, as the triple interaction term is negative and significant. Also, it should be noted that, at the average level of inequality, the coefficients of column (4) imply a positive effect of financial development on industry shares.

Dep. var.	Log Industry Share in 1980 Manufacturing VA			
	(1)	(2)	(3)	(4)
Ext dep x total cap	1.062***		0.970***	2.581**
	(0.200)		(0.219)	(1.031)
Ext dep x gini		-2.801***	-2.080***	0.610
		(0.626)	(0.685)	(1.772)
Ext dep x total cap x gini				-3.662*
				(2.149)
Country and Sector FE	Y	Y	Y	Y
Observations	1257	1191	1191	1191
R2	0.544	0.539	0.550	0.552

Notes: Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. All regressions include country and industry fixed effects. The dependent variable is the log of an industry's share in total manufacturing value added in 1980. The variable "Ext dep" is a measure of the industry's level of external financial dependence, as constructed by Rajan and Zingales (1998). The variable "total cap" stands for the total capitalization ratio, which is defined as the ratio of domestic credit plus stock market capitalization to GDP. The variable "gini" stands for the income Gini coefficient, taken from Deininger and Squire (1996). The coefficients estimates and standard errors of any term that includes the Gini coefficient were multiplied by 100.

Table 4: Cross-Country Cross-Industry Regressions for Levels

To get a sense of the magnitude of the effects, consider the following calculations. The industry at the 75th percentile of dependence is Machinery (with external dependence of 0.45), while the industry at the 25th percentile is Beverages (with an index of 0.08). The country at the 75th percentile of income inequality is Peru (with a Gini of 49.33), while the country at the 25th percentile is India (with a Gini of 32.14). Setting the level of financial development at the sample mean, the coefficients in column (4) of Table 4 imply that the ratio of value added in Machinery to value added in Beverages should be 16.20% lower in Peru as compared to Pakistan. As for financial development, we have that the country at the 75th percentile of financial development is Canada (with a capitalization ratio of 0.9771), while the country at the 25th percentile is Philippines (with capitalization ratio of 0.4602). Setting income inequality at its sample mean, the coefficients in column (4) imply that the ratio of value added in Machinery to value added in Beverages should be 22.74% higher in Canada as compared to Philippines.

Interaction Effects. An important implication of Table 4 is the presence of interaction effects between income inequality and financial development. Perhaps counter-intuitively, the negative coefficient of the triple interaction term in column (4) implies that the disproportionately negative effect of income inequality on value added shares of high external dependence sectors becomes *stronger* when financial development improves. In other words, financial development strengthens the negative effect of income inequality on relative value added. To further investigate this interaction, I run equation (2) on both a sub-sample of financially developing and developed countries. Table 5 contains the results. A comparison of column (3) in Panel A vs B confirms that the negative effect of income inequality is indeed stronger for financially developed countries. However, a comparison of column

(4) in Panel A vs B shows that for financially developed countries the negative effect of income inequality weakens with financial development. To summarize, there is evidence of a *non-monotone* interaction effect: when financial development is low, an improvement in financial institutions tends to strengthen the negative effect of income inequality on cross-industry levels; for sufficiently high level of financial development, this effect is reversed.

Panel A - Financially Developing	Log Industry Share in Manufacturing VA			
	(1)	(2)	(3)	(4)
Ext dep x total cap	0.608		-0.217	4.490
	(0.485)		(0.727)	(3.008)
Ext dep x gini		-2.477***	-2.702**	2.988
		(0.766)	(1.223)	(3.692)
Ext dep x total cap x gini				-11.063*
				(6.042)
Observations	788	788	788	788
R2	0.535	0.539	0.540	0.543
Panel B - Financially Developed	**Log Industry Share in Manufacturing VA**			
	(1)	(2)	(3)	(4)
Ext dep x total cap	1.085***		1.440***	0.015
	(0.319)		(0.333)	(1.851)
Ext dep x gini		-2.294**	-3.870***	-8.174
		(1.127)	(1.160)	(5.701)
Ext dep x total cap x gini				3.582
				(4.523)
Observations	403	403	403	403
R2	0.634	0.642	0.658	0.659

Notes: Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. All regressions include country and industry fixed effects. A country is classified as financially developing when its ratio of total capitalization is lower than the 60th percentile.

Table 5: Cross-Country Cross-Industry Regressions, Financially Developing vs Developed

3 The Model

The goal of this section is to provide a theory to account for the facts on income inequality and financial development documented in the previous section. I build the simplest theory that can address, qualitatively and quantitatively, the facts. To do so, I include the following core ingredients in the theory. First, agents are heterogeneous in their wealth holdings, a feature that is essential to study the effects of wealth inequality.[23] Second, there are two sectors in the economy. While several of the channels by which inequality affects economic development in the model would also be present in a one-sector economy, multiple sectors are needed to contrast the theory with findings of the previous section. Third, agents face collateral constraints. This element is necessary to account for the effects of financial development, and its interactions with income inequality, documented above. In the model, collateral constraints imply that the distribution of wealth has an effect on the distribution of firm size. Fourth, there are decreasing returns to scale in production. This assumption guarantees that the distribution of firm size has an effect on the overall degree of production efficiency. Together with collateral constraints, this element ensures that the distribution of wealth affects the production side of the economy. Fifth, there are sector-specific fixed costs. The presence of fixed costs creates an extensive margin channel for inequality, as changes in the distribution of wealth affect the mass of agents who can afford the fixed cost. Additionally, the difference in fixed costs across sectors provides a natural way to map the theory to the data. The sector with higher fixed cost turns out to be the more externally dependent one. Sixth, there is occupational and sectoral choice. Without this assumption, the distribution of wealth within the different sectors and occupations would become a primitive of the model, and, due to cross-country data limitations, this would complicate the calibration and model testing exercises.[24]

Finally, I consider a static model where the distribution of wealth is exogenously given. I do not take a stand on the underlying determinant of wealth inequality - whether it is preferences for redistribution (Alesina and Giuliano (2009)), geographic conditions (Engerman and Sokoloff (2002), Easterly (2007)) or heterogeneity in time discount factors (Krusell and Smith (1998), Krueger, Mitman, and Perri (2016)). In this sense, the approach of this paper is related to the static approach in development accounting (Caselli (2005)), which assumes an aggregate production function that maps factor endowments to income. The model presented below provides one such production function where the entire distribution of capital holdings, and not just its mean, matters.

[23] In the baseline model, I abstract from heterogeneity in ability. Instead, I focus on redistributions of wealth among agents of similar productivity. I do not study changes in the distribution of wealth across agents of different ability. Section 8.8 in the Appendix provides an extension of the model with heterogeneity in both wealth and ability.

[24] The assumption of occupational and sectoral choice implies that the country-wide distribution of wealth can be recovered from the country-wide distribution of income, which is observable for a wide range of countries - see Sections 4 and 5 for details. Since data on income distribution at the sector/occupation level is typically not available for a wide range of countries, this assumption makes the calibration of the model possible, without the need of making further assumptions on the between-sector and within-sector distributions.

3.1 Environment

I consider an economy with two intermediate sectors ($i = 1, 2$) and one final good sector. The final good is both a consumption good and an input into the production of the intermediates. In turn, the intermediates are used for the production of the final good. The final good is assumed to be the numeraire.

The economy is populated by a unit mass of producer-consumer agents who are endowed with physical capital, or wealth, and labor. I assume that all agents are endowed with the same amount of labor (normalized to unity) and that wealth is the only dimension of heterogeneity among agents. I relax this assumption in Section 8.8 of the Appendix where I extend the model to incorporate heterogeneity in ability. I denote by $G(\omega)$ the distribution of initial wealth. Agents derive utility from consumption of the final good.

At the beginning of the period, agents choose their occupation: they can work for a wage w, or operate a business in intermediate good sector 1 or 2.[25] For simplicity, it is assumed that they cannot engage in production of the final good. To start a firm in intermediate sector i, agents must pay a sector-specific fixed cost of f_i units of capital. The intermediate sectors are assumed to differ in their fixed cost requirement, with $f_2 > f_1$. As will be clear below, this will imply that sector 2 is the more externally dependent sector. After paying the fixed cost, the agents produce according to the following technology:

$$A_i(k^{\alpha}l^{1-\alpha})^{\nu} \tag{5}$$

where k denotes capital (or units of the final good), l denotes labor, ν is the share of payment going to the variable factors - that is, the span-of-control parameter (Lucas (1978)) -, α is the share of this payment going to capital, and A_i is sector-level productivity. It is assumed that $\alpha, \nu \in (0, 1)$, which means that intermediate producers are subject to diminishing returns to scale. Note that while the factor elasticities in (5) are identical across sectors, sector 2 is in effect more capital intensive due to its higher fixed cost.

Production of the final good is done by a set of competitive firms, who have access to a constant returns to scale technology,

$$\left[\gamma Y_1^{\frac{\varepsilon-1}{\varepsilon}} + (1-\gamma)\, Y_2^{\frac{\varepsilon-1}{\varepsilon}}\right]^{\frac{\varepsilon}{\varepsilon-1}}$$

where $\gamma \in (0, 1)$, $\varepsilon \in [0, \infty)$ and Y_i denotes quantity of intermediate input i. Note that production of the final good does not require a fixed cost. Final good firms start with no wealth and earn zero profits.

After agents have chosen their occupation, a market for capital rental meets where capital is lent at rate r. As is common in the literature (Buera, Kaboski, and Shin (2011),Midrigan and Xu (2014),Evans and Jovanovic (1989)), it is assumed that capital loans are due at the end of the period. The crucial assumption is that trade in the capital market is subject to a friction, by which the amount of borrowing is limited by the entrepreneur's net worth. I assume that agents can borrow up to a fraction of their wealth. More precisely, an agent with wealth ω is able to borrow a total

[25] Agents can at most have one occupation. That is, an agent cannot both run a firm and be a worker.

of $(\lambda - 1)\omega$, where $\lambda \geq 1$ is a parameter that captures the degree of financial development in the economy. This specification of the borrowing constraint is widely used in literature (Banerjee and Newman (2003), Buera and Shin (2013)), and is chosen for tractability reasons. A higher value of λ is associated with better financial markets, with $\lambda = 1$ corresponding to the absence of credit and $\lambda = \infty$ corresponding to perfect capital markets.[26]

3.2 Equilibrium

In this section, I study the behavior of entrepreneurs and final good firms. I then define and characterize the equilibrium.

Problem of Entrepreneurs. Entrepreneurs' occupational and production decisions are as follows. First, they must decide whether to work for a wage, or engage in production of intermediate goods. If they become entrepreneurs, they need to choose a sector in which to operate, how much output to produce and which combination of inputs to employ. Assuming, without loss of generality, that all capital is borrowed, the production problem of agent ω in sector i is:

$$\pi_i(\omega) = \max_{k,l} p_i A_i (k^{\alpha} l^{1-\alpha})^{\nu} - wl - (r+\delta)(k + f_i) \quad \text{s.t. } k + f_i \leq \lambda\omega \tag{6}$$

where p_i denotes the price of intermediate good i and w denotes the wage rate. Note that I have assumed that the fixed cost and working capital both depreciate at the same rate. The *unconstrained* solution to this problem is given by

$$k_i^u = \left(p_i A_i \nu \left(\frac{1-\alpha}{w}\right)^{\nu(1-\alpha)} \left(\frac{\alpha}{r+\delta}\right)^{1-\nu(1-\alpha)} \right)^{\frac{1}{1-\nu}} \tag{7}$$

$$l_i^u = \left(p_i A_i \nu \left(\frac{1-\alpha}{w}\right)^{1-\alpha\nu} \left(\frac{\alpha}{r+\delta}\right)^{\alpha\nu} \right)^{\frac{1}{1-\nu}} \tag{8}$$

with associated unconstrained profits

$$\pi_i^u = (1-\nu) \left(p_i A_i \nu^{\nu} \left(\frac{\alpha}{r+\delta}\right)^{\alpha\nu} \left(\frac{1-\alpha}{w}\right)^{(1-\alpha)\nu} \right)^{\frac{1}{1-\nu}} - (r+\delta) f_i \tag{9}$$

The solution to the *constrained* problem is given by

$$k_i(\omega) = \min\left\{\max\left\{\lambda\omega - f_i, 0\right\}, k_i^u\right\} \tag{10}$$

$$l_i(\omega) = \left(\frac{p_i A_i \nu(1-\alpha)}{w}\right)^{\frac{1}{1-\nu(1-\alpha)}} k_i(\omega)^{\frac{\alpha\nu}{1-(1-\alpha)\nu}} \tag{11}$$

[26] For simplicity, I assume that final good firms are not subject to the financial friction.

Agents with wealth below f_i/λ cannot enter into sector i. This introduces a non-convexity that will play an important role in the analysis. Finally, profits after entry into sector i are

$$\pi_i(\omega) = \left(\frac{1}{(1-\alpha)\nu} - 1\right)\left(\frac{p_i A_i (1-\alpha)\nu}{w^{(1-\alpha)\nu}}\right)^{\frac{1}{1-(1-\alpha)\nu}} k_i(\omega)^{\frac{\alpha\nu}{1-(1-\alpha)\nu}} - (r+\delta)(k_i(\omega)+f) \tag{12}$$

Each entrepreneur sorts into the occupation/sector that is most profitable to her, with resulting profits before entry of $\pi(\omega) = max\{w, \pi_1(\omega), \pi_2(\omega)\}$. Output is given by

$$y_i(\omega) = A(\frac{1}{w} p_i A(1-\alpha)\nu)^{\frac{(1-\alpha)\nu}{1-(1-\alpha)\nu}} k_i(\omega)^{\frac{\alpha\nu}{1-(1-\alpha)\nu}}$$

Final good producer problem. Final good producers, who are not subject to financial frictions, solve the following problem:

$$\max_{Y_1, Y_2} \left[\gamma Y_1^{\frac{\varepsilon-1}{\varepsilon}} + (1-\gamma) Y_2^{\frac{\varepsilon-1}{\varepsilon}}\right]^{\frac{\varepsilon}{\varepsilon-1}} - p_1 Y_1 - p_2 Y_2$$

First order conditions imply:

$$\frac{\gamma}{1-\gamma}\left(\frac{Y_1}{Y_2}\right)^{-\frac{1}{\varepsilon}} = \frac{p_1}{p_2} \tag{13}$$

I normalize the price of the final good to unity which, together with free entry into the final good sector, implies:

$$\left[\gamma^\varepsilon p_1^{1-\varepsilon} + (1-\gamma)^\varepsilon p_2^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} = 1$$

Sorting of agents into occupations and sectors. From now on, I assume $f \equiv f_2 > f_1 = 0$. I focus on the empirically relevant equilibria with positive production of both intermediates. This requires $p_2 A_2 > p_1 A_1 \geq 0$. The higher return per unit in sector 2 is necessary to compensate for the higher fixed cost of this sector. Furthermore, since labor is essential into the production of intermediate goods, any equilibrium needs to feature $w < \pi_1^u$, which ensures that not all agents prefer working for a wage over entrepreneurship in sector 1. Thus, the equilibrium is characterized by two wealth thresholds, $\hat{\omega}_0$ and $\hat{\omega}$, such that all agents poorer than $\hat{\omega}_0$ become workers, agents with wealth in $(\hat{\omega}_0, \hat{\omega})$ become entrepreneurs in sector 1, and agents with wealth above $\hat{\omega}$ enter sector 2.[27] These two thresholds are determined by the following indifference conditions:

$$w = \pi_1(\hat{\omega}_0) \tag{14}$$

$$\pi_1(\hat{\omega}) = \pi_2(\hat{\omega}) \tag{15}$$

[27] The prediction that wealthier individuals sort into entrepreneurship has empirical support. Evans and Jovanovic (1989), Evans and Leighton (1989), Holtz-Eakin, Joulfaian, and Rosen (1994) show that, in the US, wealth affects positively the probability that individuals become entrepreneurs. Blanchflower and Oswald (1998) provide similar evidence for the United Kingdom. Hurst and Lusardi (2004) show that this relationship is non-linear, with wealth having a positive effect on the propensity to own a business only at the top of the wealth distribution.

For given prices, Figure 1 shows the returns to each occupation as a function of wealth.[28] The presence of a higher fixed cost in sector 2 implies that wealthy individuals have a comparative advantage in this sector. Intuitively, the decision of entering sector 2 instead of sector 1 is equivalent to the payment of a fixed cost in exchange for a higher (effective) price per unit. Such decision is profitable for a sufficiently large volume of production, which, under borrowing constraints, happens for wealthy enough entrepreneurs. It is important to note that agents with sufficiently low wealth ($\omega < f/\lambda$) are not able to enter sector 2, so that their occupational choice is restricted to working for a wage vs entrepreneurship in sector 1.

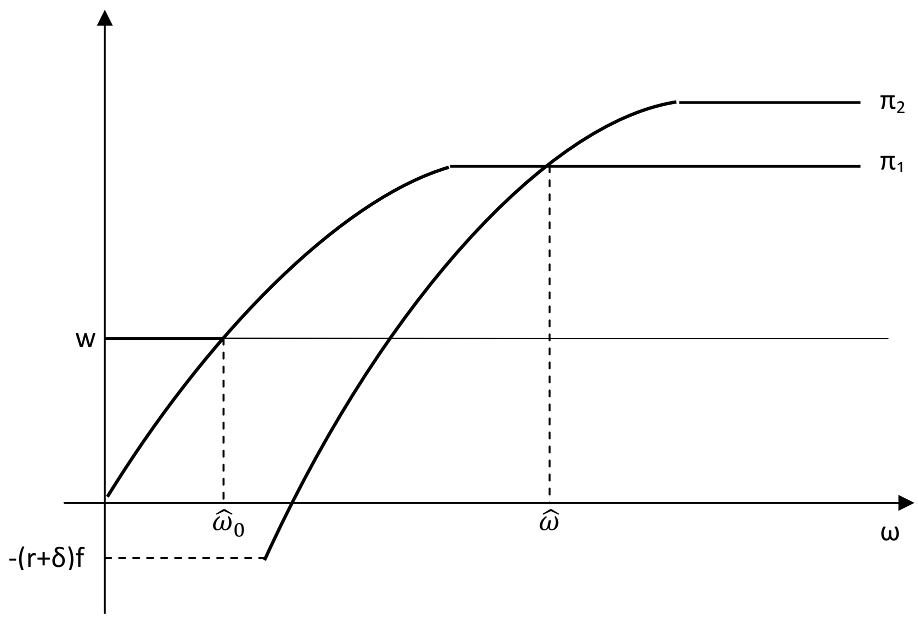


Figure 1: Occupation and Sector Sorting

Equilibrium Definition. Given a distribution of wealth $G(\omega)$, an equilibrium with positive production of both intermediates consists of prices (p_1, p_2, r, w) and wealth thresholds $(\hat{\omega}_0, \hat{\omega})$ such that:

1. Marginal agents are indifferent:

$$w = \pi_1 (\hat{\omega}_0)$$

$$\pi_1 (\hat{\omega}) = \pi_2 (\hat{\omega})$$

2. Capital market clears:

$$\int_{\hat{\omega}_0}^{\hat{\omega}} k_1 (\omega) \, dG (\omega) + \int_{\hat{\omega}}^{\infty} (k_2 (\omega) + f) dG (\omega) = \mathbb{E} [\omega] \quad (16)$$

[28]Note that for wealth values below f/λ profits in sector 2 are not defined.

3. Labor market clears:

$$\int_{\hat{\omega}_0}^{\hat{\omega}} l_1(\omega)\, dG(\omega) + \int_{\hat{\omega}}^{\infty} l_2(\omega)\, dG(\omega) = G(\hat{\omega}_0) \tag{17}$$

4. Final good producers' optimality:

$$\int_{\hat{\omega}_0}^{\hat{\omega}} A_1 k_1(\omega)^{\alpha\nu} l_1(\omega)^{(1-\alpha)\nu}\, dG(\omega) = \left(\frac{\gamma}{1-\gamma}\frac{p_2}{p_1}\right)^{\varepsilon} \int_{\hat{\omega}}^{\infty} A_2 k_2(\omega)^{\alpha\nu} l_2(\omega)^{(1-\alpha)\nu}\, dG(\omega) \tag{18}$$

5. Zero profits in final good:

$$\left[\gamma^{\varepsilon} p_1^{1-\varepsilon} + (1-\gamma)^{\varepsilon} p_2^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} = 1 \tag{19}$$

The equilibrium prices and wealth thresholds completely characterize production in the economy, for a given distribution of wealth. Implicit in this definition is the extensive margin constraint that $\hat{\omega} \geq f/\lambda$.[29] This constraint requires that the mass of agents allocated to sector 2 in equilibrium does not exceed the mass of agents that are wealthier than the effective fixed cost, f/λ.[30]

3.3 Effects of Wealth Inequality

The main purpose of this paper is to study the effects of increased wealth inequality on macroeconomic aggregates. In the model, the presence of financial frictions implies that the distribution of wealth affects the allocation of productive resources, and thus has an impact on aggregate production. But what is the nature of this link? Does a more unequal distribution of wealth lead to higher or lower production efficiency?

To think about this question, it is useful to consider three channels through which higher wealth inequality affects the economy. Consider a simple example in which a unit of capital is redistributed from a poor and constrained agent to a wealthier, not necessarily constrained agent. First, there is a decreasing returns channel. Since the wealthy agent is operating at a bigger scale, her marginal product of capital is lower than that of the poor-constrained agent. Thus, a poor-to-rich redistribution of capital will decrease output.[31] To see this more formally, consider average output in sector 1:

$$\frac{1}{G(\hat{\omega}_0) - G(\hat{\omega})} \int_{\hat{\omega}_0}^{\hat{\omega}} y_1(\omega) dG(\omega) = \frac{1}{G(\hat{\omega}_0) - G(\hat{\omega})} \int_{\hat{\omega}_0}^{\hat{\omega}} A(\frac{1}{w} p_1 A(1-\alpha)\nu)^{\frac{(1-\alpha)\nu}{1-(1-\alpha)\nu}} k_1(\omega)^{\frac{\alpha\nu}{1-(1-\alpha)\nu}} dG(\omega)$$

Since $k_1(\omega)$ is a concave function of wealth, and $\alpha, \nu \in (0,1)$, output $y_1(\omega)$ is also a concave function of wealth. Thus, for given prices and wealth thresholds, any mean preserving spread to the distribution of wealth of agents in sector 1 will reduce average output in this sector.[32] Note that this is a partial

[29] This constraint is implicit in condition (1) of the equilibrium definition, as $\pi_2(\hat{\omega})$ is not defined for $\hat{\omega} < f/\lambda$.

[30] In an equilibrium with positive production of both intermediate goods, this constraint turns out to not bind (i.e. $\hat{\omega} > f/\lambda$). This follows directly from the fact that $\pi_1(f/\lambda) > 0 > -(r+\delta)f = \pi_2(f/\lambda)$. Intuitively, it is never socially optimal to assign the agent with wealth exactly equal to f/λ to sector 2, since he would produce no output and incur in a cost of f units of capital.

[31] For simplicity, I focus on the case where both entrepreneurs produce in the same sector.

[32] That is, a mean preserving spread to $\frac{G(\omega)}{G(\hat{\omega}_0)-G(\hat{\omega})}$.

equilibrium effect, as prices and wealth thresholds are kept constant.

Second, there is a capital demand channel. If the two agents are constrained entrepreneurs, the linearity of the borrowing constraint implies that a redistribution of wealth has no effect on capital demand. If the wealthier agent has reached the optimal scale and the poorer has not, then a poor-to-rich redistribution of wealth between the two entrepreneurs decreases capital demand. This is because the richer agent has no use for the extra unit of capital other than lending, but the poor agent is at her maximum borrowing capacity. Figure 2 depicts the capital demand channel. To see this effect more formally, consider total capital demand for the case in which all agents in sector 1 are constrained (which happens when $k_1^u/\lambda \geq \hat{\omega}$), $\int_{\hat{\omega}_0}^{\infty} h(\omega)\, dG(\omega)$, where $h(\omega) = min\{\lambda\omega, k_2^u + f\}$ is capital demand of agent ω irrespective of her sector. As $h(\omega)$ is concave, any mean preserving spread to the distribution of wealth among entrepreneurs reduces total capital demand.[33] However, we can also have a situation where the wealthier agent is constrained while the poorer one is not. Figure 3 depicts this situation. In this case, a poor-to-rich redistribution of wealth between the two agents increases capital demand. Formally, the capital demand function is not globally concave and a mean preserving spread can result in higher aggregate capital demand. Finally, if the relatively poor agent is a worker while the wealthier one is a constrained entrepreneur, aggregate capital demand also increases.

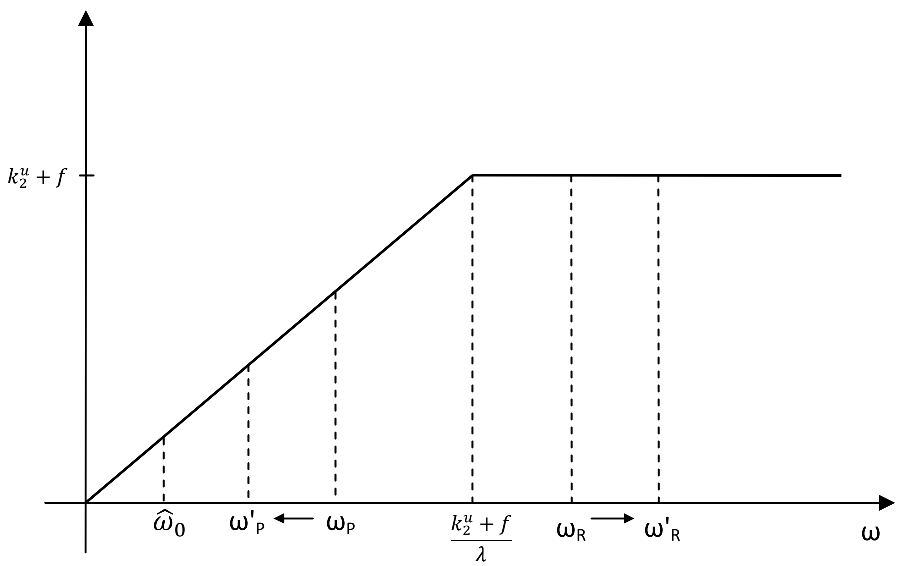


Figure 2: Wealth Inequality and the Capital Demand Channel

[33]A reduction in capital demand, and the associated reduction in labor demand, harm the economy by depressing the interest rate and the wage. The depressed interest rate and wage lead to an excessive amount of entrepreneurship, as well as to an inefficiently high scale of production units. See Section 4 for more details.

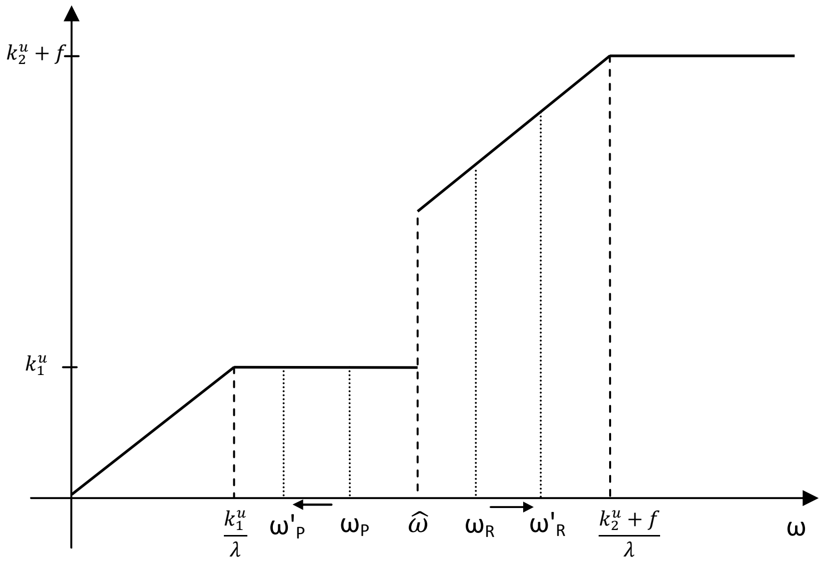


Figure 3: Wealth Inequality and the Capital Demand Channel, II

Third, there is an extensive margin effect by which inequality can increase or decrease the mass of agents below the effective fixed cost, f/λ. In our two agents example, suppose that the wealthier agent is unable to enter sector 2 (i.e. $\omega < f/\lambda$) and that the number of production units in sector 2 is sub-optimally low. In this case, a poor-to-rich redistribution of wealth can result in higher entry into sector 2 and thus higher overall efficiency in production. The case in which the poor-to-rich redistribution places more agents below the threshold f/λ is also possible and would exacerbate the effect of financial frictions.

The overall effect of wealth inequality on production efficiency depends upon which of these effects dominates. In turn, this depends on the specific values of the parameters of the model. If the effective fixed cost is high and/or decreasing returns are not too strong (high f/λ and high ν), then it is likely that the extensive margin effect dominates and inequality is beneficial for the economy. When the fixed cost is relatively low and/or decreasing returns are strong, inequality is likely harm the economy. To assess the strength of each of these effects and the overall impact of inequality, Section 4 proceeds to calibrate the parameters of the model.

4 Calibration

In this section, I calibrate the technology parameters of the model to match several key moments of the US economy. I use the US to identify the technology parameters because this country was used to construct the sector-level measure of external financial dependence used in Section 2.[34] To calibrate the technological parameters, I need to also calibrate the parameters of the distribution of wealth and the quality of financial institutions in the US. When studying the effects of inequality and financial development in the next two sections, I do not use the financial and wealth distribution parameters estimated in this section, but rather calibrate these parameters to the sample of countries used to establish the facts in Section 2. In short, I identify the technological parameters from the US and the non-technological parameters from the countries in the sample.

Parametrization of Wealth Distribution. I assume that wealth is Pareto distributed:

$$G(\omega) = 1 - (\frac{\omega_{min}}{\omega})^{\theta} \text{ for } \omega \geq \omega_{min}$$

where $\theta > 1$ is the shape parameter and ω_{min} is the scale parameter. This assumption is made for two reasons. First, this distribution turns out to be a good approximation for the upper tail of the wealth distribution (see Pareto (1897), Klass et al. (2006)). In Section 8.5 of the Appendix I provide evidence for this statement using Survey of Consumer Finances data for the US. Second, the Pareto distribution is conveniently parametrized to study changes in inequality. The scale parameter controls the average level of wealth, which is equal to: $\mathbb{E}[\omega] = \theta/(\theta - 1)\omega_{min}$. The shape parameter controls the degree of wealth inequality in the economy. Specifically, a lower value of θ generates a uniform decrease in the Lorenz curve - that is, it generates a new distribution of wealth that is Lorenz dominated. This increase in wealth inequality is fully captured by the wealth Gini coefficient, which is given by:

$$Gini = \frac{1}{2\theta - 1}$$

Calibration Strategy. The model has 8 technological parameters $(\alpha, \nu, A_1, A_2, f, \gamma, \varepsilon, \delta)$, 1 parameter characterizing the quality of financial institutions (λ), and 2 parameters characterizing the distribution of wealth ($\omega_{\min}$,θ). I take the annual depreciation rate to be $\delta = 0.06$, a standard value in the literature. I assume throughout the paper that there are no productivity differences across sectors, $A_1 = A_2 = A$, and I normalize this parameter to unity without loss of generality.[35] I calibrate the remaining parameters to match salient moments of the US economy in the 1980s.

I start by calibrating the wealth distribution parameters ($\omega_{\min}$,θ) to match the mean and the Gini coefficient of the US wealth distribution. I then estimate the elasticity of substitution between the two intermediate sectors, ε, from a time series regression of relative values on relative quantities

[34]Note also that I have not included the US in the sample of countries used to establish the cross-sector facts of Section 2.

[35]This assumption, which allows me to fully focus on differences in capital intensity across sectors, has been made by other papers in the literature - see e.g. Buera, Kaboski, and Shin (2011) who assume the distribution of talent to be symmetric across sectors.

for the US. I then calibrate the remaining 5 technological parameters $(\gamma, \alpha, \nu, f, A)$ and the quality of financial markets parameter (λ) to match the following 6 moments of the US economy in 1980: (i) the share of payments to capital in manufacturing GDP, (ii) the share of high externally dependent sectors in total manufacturing value added, (iii) relative capital per workers across sectors, (iv) the income Gini coefficient, (v) the ratio of external finance to GDP. While these 5 parameters are simultaneously chosen to match the 5 moments, it can be helpful to associate one parameter to each moment.[36]

As is typical in calibrations of the neo-classical growth model, we can think of α as controlling the share of payments to capital in manufacturing GDP,

$$r\mathbb{E}\left[\omega\right]/Y \tag{20}$$

It should be noted that, since the model has borrowing constraints and fixed costs, the share of payments to capital will not be exactly given by α, as in the frictionless model without fixed costs. In particular, the capital share can be lower than the value of α.

Consider now moment (ii). Since the intermediate goods are produced with only capital and labor, and do not require any further intermediate goods, we can interpret p_2Y_2 as value added in the high external dependence sector. We can think of $1-\gamma$ as controlling the share of the externally dependent sector in manufacturing GDP, p_2Y_2/Y. This is exactly true for the case in which technology in the final good sector is Cobb-Douglas - that is, $\varepsilon = 1$.

The third moment, relative capital per worker across sectors, identifies the fixed cost in the high external dependence sector, f. If the fixed cost was zero, the model would predict that capital intensities should be equalized across sectors. A positive fixed cost makes sector 2 more capital intensive, in the sense that $(k_2 + f)/l_2 > (k_1/l_1)$. In partial equilibrium, a higher fixed cost trivially increases the relative capital labor ratio. In general equilibrium, however, prices and thresholds change so that a higher fixed cost may have a non-monotone effect on relative capital intensity across sectors.[37] At the calibrated parameters, this relationship is increasing.

[36]Moments (i) and (iii) are both related to the degree of capital intensity in production. Moment (i) affects both sectors equally, while moment (iii) is included to get at the difference in capital intensity across sectors.

[37]For given prices, a higher fixed cost tends to increase capital demand, as unconstrained producers in sector 2 will demand the same amount of working capital and a higher amount of capital for the fixed cost. Note that the constrained agents in sector 2 demand the same amount of capital, as $k_2 + f = \lambda\omega$. However, these agents will use less working capital, k_2, when the fixed cost is higher, so that labor demand falls. These effects tend to increase the interest rate and decrease the wage. The higher fixed cost has a negative direct effect on sector 2 profits, so that some agents flow to sector 1. This tends to increase p_2 and decrease p_1. A constrained agent in sector i produces at the following capital to labor ratio - including fixed costs:

$$(\lambda\omega)^{\frac{1-\nu}{1-(1-\alpha)\nu}}\left(\frac{w}{p_2A(1-\alpha)\nu}\right))^{\frac{1}{1-(1-\alpha)\nu}}$$

Since p_2 increases and p_1 decreases, the capital labor ratio of constrained agents tends to decrease by more in sector 2. However, wealth thresholds also change: $\hat{\omega}$ increases, so that sector 2 firms are larger on average - this tends to increase the capital labor ratio in sector 2. At the same time, $\hat{\omega}_0$ also increases. Thus, the average size of firms in sector 1 can move in either direction. As for unconstrained agents, the increase in the relative price of capital tends to decrease k/l by same proportion in both sectors - in fact, unconstrained k/l ratios are equalized across sectors. But sector 2 agents have a higher fixed costs, which tends to increase their unconstrained total capital labor ratio.

The span of control parameter, ν, is chosen to generate a realistic level of inequality in the distribution of income. In other words, the model generates a mapping between the exogenous wealth distribution and the endogenous income distribution, and this mapping is crucially affected by ν. To see this, note that agent ω's income is given by

$$i(\omega) = r\omega + max\left\{w, \pi_1(\omega), \pi_2(\omega)\right\} \tag{21}$$

For given prices, a higher ν leads to a steeper profit function $\pi_i(\omega)$ in both sectors. To see this, note that the profit function becomes a less concave function of wealth when ν is higher - see equation (12).[38] Furthermore, an increase in ν leads to a higher interest rate, which also tends to increase income inequality. Finally, an increase in ν leads to a lower wage and a higher mass of workers, so that income inequality is further increased.

The parameter governing the quality of financial institutions, λ, is chosen so that the model generates an external finance to GDP ratio similar to that of the US in 1980. A higher λ naturally leads to more borrowing, as poor-constrained agents expand their demand for capital.

Distribution of Wealth in the US. The assumption that wealth is Pareto distributed implies that only two moments of the US distribution of wealth are required for its calibration: average wealth and the wealth Gini coefficient. The latter moment allows me to identify the shape parameter, θ, and the former moment then pins down the scale parameter, ω_{min}. I use data from the 1983 Survey of Consumer Finances (SCF) to characterize the distribution of wealth in the US. Because household wealth is highly skewed, the upper tail of the distribution is often underrepresented in survey data. The advantage of the SCF data is that it provides a high-income supplement, which is taken from the Internal Revenue Service's Statistics of Income data.[39] Table 6 shows values for average wealth and the wealth Gini coefficient for the entire population of US households. These values imply $\theta^{US} = 1.1412$ and $\omega_{min}^{US} = \$14,813.88$.

	Average Wealth	Wealth Gini
All US households	\$119,724	77.98

Notes: Data from the US Survey of Consumer Finances for 1983. Both the normal and the high income sample are included. Wealth (net worth) is given by variable B3324, which is defined as gross assets excluding pensions plus total net present value of pensions minus total debt (B3305 + B3316 - B3320).

Table 6: Moments of Wealth Distribution, US 1983

[38] Consider revenue net of labor costs, that is, the first term of the profit function for a constrained entrepreneur:

$$\left(\frac{1}{(1-\alpha)\nu} - 1\right)\left(\frac{p_i A_i (1-\alpha)\nu}{w^{(1-\alpha)\nu}}\right)^{\frac{1}{1-(1-\alpha)\nu}} (\lambda\omega)^{\frac{\alpha\nu}{1-(1-\alpha)\nu}}$$

It is easy to see that the rate of growth of this term with respect to wealth depends on the exponent $\frac{\alpha\nu}{1-(1-\alpha)\nu}$, which is increasing in ν.

[39] See Wolff (1999) for a comparison among 3 household surveys which report wealth: the SCF, the Bureau of the Census' Survey of Income and Program Participation, and the Institute for Social Research's Panel Survey of Income Dynamics.

Measurement of Other US Moments. I measure moments (i)-(vi) in the data using the following sources. The aggregate capital share is set at 0.33, a standard value in the literature. For moment (ii), I use value added data for the US in 1980 from UNSD. I classify the 36 3-digit ISIC sectors into two groups, according to external financial dependence.[40] I find that high external dependence sectors account for 64.7% of total manufacturing value added.[41] Relative scales across sectors (both in terms of labor, l_2/l_1, and in terms of capital, $(k_2+f)/k_1$) are estimated from the 1987 US Economic Census, which provides detailed industry data at the 4-digit SIC sector level. I measure the labor input as the number of employees per establishment and the capital input as the (beginning of year) gross value of assets per establishment. I classify the approximately 460 sectors into two groups, according to their level of external financial dependence. To do so, I replicate the measure of external financial dependence in Rajan and Zingales (1998) at the 4-digit SIC level using firm-level data from COMPUSTAT for the 1980-1990 period. Table 7 summarizes the capital and labor demands in the high and low external dependence sectors.

	Employees per Establishment	Value of Assets per Establishment
Low External Dependence	48	1.72M
High External Dependence	50	2.70M

Notes: The number of employees per establishment and the beginning of year gross value of assets per establishment are taken from the 1987 Economic Census at the 4-digit SIC level of disaggregation. The 460 sectors are classified into two equally sized groups of high external dependence and low external dependence sectors, where the sectoral measure of external dependence is computed as in Rajan and Zingales (1998). To average the different variables across sectors (within each of the two groups), sectors are weighted according to the number of establishments they have. The letter M stands for million of US dollars.

Table 7: Labor and Capital Across Sectors

We see that the labor input is larger in the high external dependence group of sectors, but the difference is fairly small. In contrast, the capital input - as measured by the total value of assets - is 1.56 times larger in the high external dependence group of industries. This implies that externally dependent sectors have a higher capital-labor ratio and that the ratio of capital intensity across sectors is approximately 1.5. This feature of the data is key to the identification of the fixed cost.

The Gini coefficient for the distribution of income in the US is taken from Deininger and Squire (1996), which in turn use data from the Census Bureau. I take the average of the income Gini coefficients during the 1980s. Averaging over time helps to reduce any potential measurement error present in the data. I find a value for the average income Gini coefficient of 36.9.

I define the ratio of external finance as the sum of domestic credit and stock market capitalization over GDP. This is the leading measure of financial development used in Section 2.

[40] For a list of the 36 manufacturing sectors, ordered by external financial dependence, see Table 13 in Section 8.2 of the Appendix.

[41] As a robustness check, I also estimate this moment with NIPA data (which uses the NAICS system), and find a value of 59.14%.

Elasticity of substitution between intermediates. A remaining parameter in the calibration is the elasticity of substitution between intermediates, ε. Recall that the calibration of α, ν, γ, f and A outlined above was conditional on a value of ε. Following Acemoglu and Guerrieri (2008), I estimate the elasticity of substitution using equation (13) and exploiting the time variation in relative value added and relative quantities. In particular, equation (13) implies the following relation between relative value added and relative quantities across sectors:

$$\log\left(\frac{p_2 Y_2}{p_1 Y_1}\right) = \log\left(\frac{1-\gamma}{\gamma}\right) + \frac{\varepsilon - 1}{\varepsilon}\log\left(\frac{Y_2}{Y_1}\right) \tag{22}$$

The UNSD data does not provide a measure of Y_2/Y_1 that is comparable across countries for a given point in time - as PPP sector prices are not available. However, the UNSD data does provide quantity indices, i.e. value added in constant prices, that capture movements in Y_2/Y_1 over time for a given country. By taking logs, any term related to constant prices is placed in the time-constant term of the regression.

I use data for the US for the period between 1967 and 1991, taken from the UNSD. I aggregate the 36 ISIC sectors into two groups of industries according to their level of external dependence. I then sum value added across all industries within each group to obtain total value added in high and low external dependence industries. I use the index of industrial production provided by the UNSD data to approximate for quantities. To average across sectors within a group, I weight each industry by its share in the group's total value added. Table 8 contains the results. The estimated coefficient for relative quantity implies a value of $\varepsilon = 3.1142$.

Dep. var.	Relative Value Added
Constant	1.1096***
	(0.1628)
Relative quantity	0.6789***
	(0.1626)
Observations	25
R2	0.4775
Implied ε	3.1142

Notes: Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels.

Table 8: Estimation of ε

Results for the Calibration of Technology Parameters. Table 9 summarizes the results of the calibration of the technology parameters. In the next two sections, I will assume that the technology parameters are common to all countries in the sample. I will also assume that all countries have the same level of average wealth, which I set at the US value in 1980.

Effects of Financial Frictions. How does the calibrated economy compare to the first best? In a frictionless economy, the equilibrium is characterized by the mass of producers in each sector/occupation, as all firms within each sector are identical. Section 8.4 in the Appendix contains a

Target Moment	Data	Parameter
Share of Ext.Dep. Sectors in Manufacturing VA	0.647	γ= 0.4262
Share of Capital in Manufacturing GDP	0.33	α = 0.5855
Relative Capital Intensity in Ext.Dep. Sectors	1.50	f = $55,280
Income Gini	35.2	ν =0.7153
External Finance to GDP ratio	1.9624	λ = 3.0790

Notes: "Ext. Dep." stands for externally dependent sectors. In the data, the 36 manufacturing sectors are classified into two groups according to their level of external financial dependence, as measured by Rajan and Zingales (1998).

Table 9: Calibration of Technology Parameters

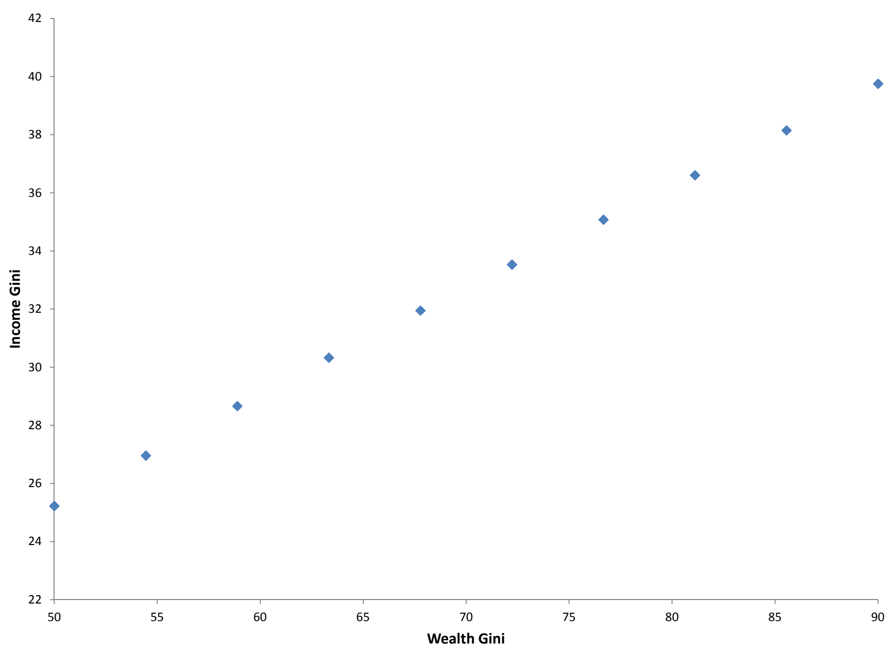
definition of the equilibrium in the first best economy. Table 10 shows selected equilibrium outcomes for the calibrated US economy and the first best. Both economies share the same technology and distribution of wealth parameters. By depressing capital and therefore labor demand, financial frictions tend to depress both the interest and the wage. The economy shifts its production pattern towards the less capital intensive sector. The depressed wage and interest rate lead to higher profits and this results in an excessive amount of entrepreneurship in the economy with frictions. The presence of a fixed cost, together with financial frictions, results in too many firms in sector 1 and too few in sector 2. Firms in sector 1 are on average too small relative to the first best size, while firms in sector 2 are on average too large. This distortion in firm size follows from the combination of the different price effects. The depressed interest rate and wage induce firms in both sectors to choose a higher scale. In sector 2, the higher price reinforces the increase in scale. In sector 1, the effect of the lower price tends to dominate the interest rate and wage effect, and average scale is lower.

	Calibrated	First Best
Interest Rate	0.0401	0.0876
Wage	$19,813	$19,517
Price 1	0.4640	0.4822
Price 2	0.5421	0.5326
Mass Workers	0.5382	0.5649
Mass Sector 1	0.2564	0.1781
Mass Sector 2	0.2054	0.2570
GDP	$35,970	$37,188
Average Capital Sector 1	$124,502	$194,514
Average Capital Sector 2	$372,215	$275,834
Rel. Output Sector 2	1.5763	1.8522

Notes: The table shows equilibrium outcomes for both the model with frictions calibrated to the US and the first best economy. For both economies, the technology parameters are set according to Table 9 and the wealth distribution is calibrated to the US as described in the previous section.

Table 10: Calibrated Economy vs First Best

Wealth Inequality - Income Inequality Mapping. In the next sections, I study the effects of mean-preserving variation in wealth inequality on the economy. Since wealth inequality is not observable in the UNSD sample of countries, I compare the model and the data on the income inequality dimension. Thus, the wealth inequality - income inequality mapping is important. Figure 4 depicts this mapping. The technology parameters are set at their calibrated values - see Table 9. Financial development is set at the level of the median country.[42] I perform mean preserving spreads to the initial distribution of wealth, keeping total wealth constant at the level of the US in the 1980s. Figure 4 shows that the model generates an upward sloping relationship between wealth and income inequality. In partial equilibrium, such positive relation is straightforward. In general equilibrium, however, an upward sloping relation is not granted. As explained below, wealth inequality tends to decrease both the interest rate and the wage, to decrease the price of good 1, and to increase the price of good 2. These price changes tend to make profits a steeper function of wealth, thus increasing income inequality. At the same time, the lower interest rate gives less importance to interest income, $r\omega$, a term that tends to transmit wealth inequality to income inequality. It turns out that at the calibrated parameters, the latter effect is not dominant.



Notes: The figure plots the income Gini coefficient generated by the model for various levels of exogenous wealth inequality. Total wealth is kept constant. The model is evaluated at the calibrated parameters, and the level of financial development of the median country.

Figure 4: Wealth Inequality - Income Inequality Mapping

[42]This is a level of λ that generates an external finance to GDP ratio as in the median country in the sample. See Section 5 for details on how the calibration of $(\lambda, \theta, \omega_{min})$ is done for the median country.

5 Model Testing

In this section, I evaluate the performance of the calibrated model by assessing its ability to match the cross-sector facts documented in Section 2. Keeping the technology parameters fixed, I impose variation in the degree of wealth inequality (or financial development) and assess whether the calibrated model generates a relation between income inequality (or the external finance to GDP ratio) and cross-sector levels that is qualitatively and quantitatively similar to the one documented in Section 2. I find that the model can account for the cross-sector facts of Section 2.

Performing this exercise requires identifying a realistic range of values for the degree of inequality in the distribution of wealth. Due to the lack of wealth data across countries, the empirical results in Section 2 involved inequality in the distribution of income, not wealth. I overcome this problem by finding a range of values for wealth inequality that generates, through the model, income Gini coefficients as observed in the sample. In other words, I use the model to map observed income inequality into unobserved wealth inequality.

Throughout this section, I keep average wealth and the technology parameters fixed at their US values - as calibrated in Table 9 the previous section. The remaining parameters - those controlling the distribution of wealth, (ω_{min}, θ) and the quality of financial institutions (λ) - are varied to study the effects of inequality and financial development. To study these two phenomena separately, it is useful to calibrate $(\omega_{min}, \theta, \lambda)$ to generate an external finance to GDP ratio and an income Gini coefficient as observed for the median country in the UNSD sample. The median country has a capitalization ratio of 0.6957 and an income Gini coefficient of 38. This calibration yields $\theta = 1.10$, $\omega_{min} = \$10,884$ and $\lambda = 1.164$ for the median country.

The rest of this section is organized in three subsections, each corresponding to one of the facts documented in Section 2. Subsection 5.1 compares the model's predictions with the data on financial development and cross-industry levels. Subsection 5.2 compares the model's predictions with the data on income inequality and cross-industry levels. Finally, subsection 5.3 deals with the interaction effects between financial development and income inequality.

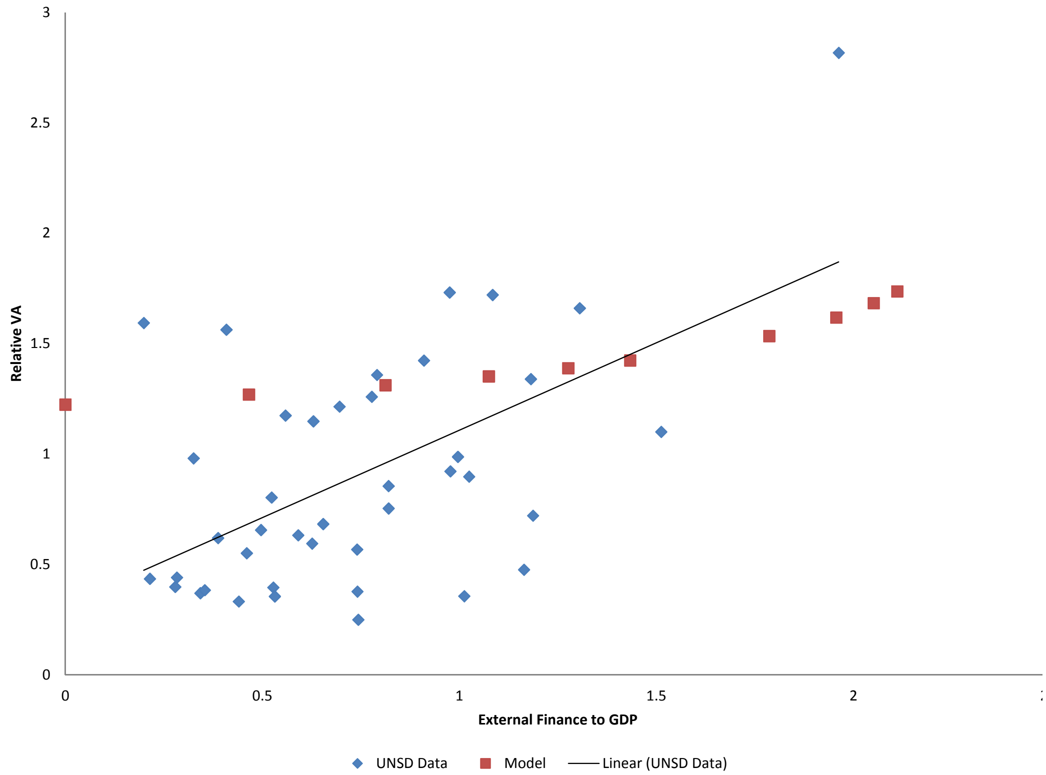
5.1 Financial Development and Relative Industry Size

Section 2 showed that sectors that rely more heavily on external finance exhibit disproportionately higher value added shares in countries with higher total capitalization ratios. In this section, I assess the ability of the calibrated model to match this fact. I set the shape parameter of the wealth distribution at the value of the median country in the UNSD sample. I then vary the value of λ to span a range of external finance to GDP ratios as observed in the data.

Figure 5 compares the model's predictions on relative value added across sectors, $p_2Y_2/(p_1Y_1)$, to the 1980 UNSD data. As in the data, the model generates an upward sloping relationship between the external finance to GDP ratio and relative value added across sectors. The model, however, generates a flatter relationship. The regression coefficient of relative value added across sectors on the external finance to GDP ratio is 0.723 for the data and 0.238 for the model.[43] This suggests

[43]Both coefficients are significant at the 1% level.

that the model explains as causal about 30% of the cross-country relationship between relative value added and finance.



Notes: The Figure plots the ratio of value added in sector 2 to value added in sector 1, $\frac{p_2 Y_2}{p_1 Y_1}$, against the ratio of external finance to GDP, for both the model's simulations and the UNSD data for 1980.

Figure 5: Financial Development and Relative Value Added

5.2 Inequality and Relative Industry Size

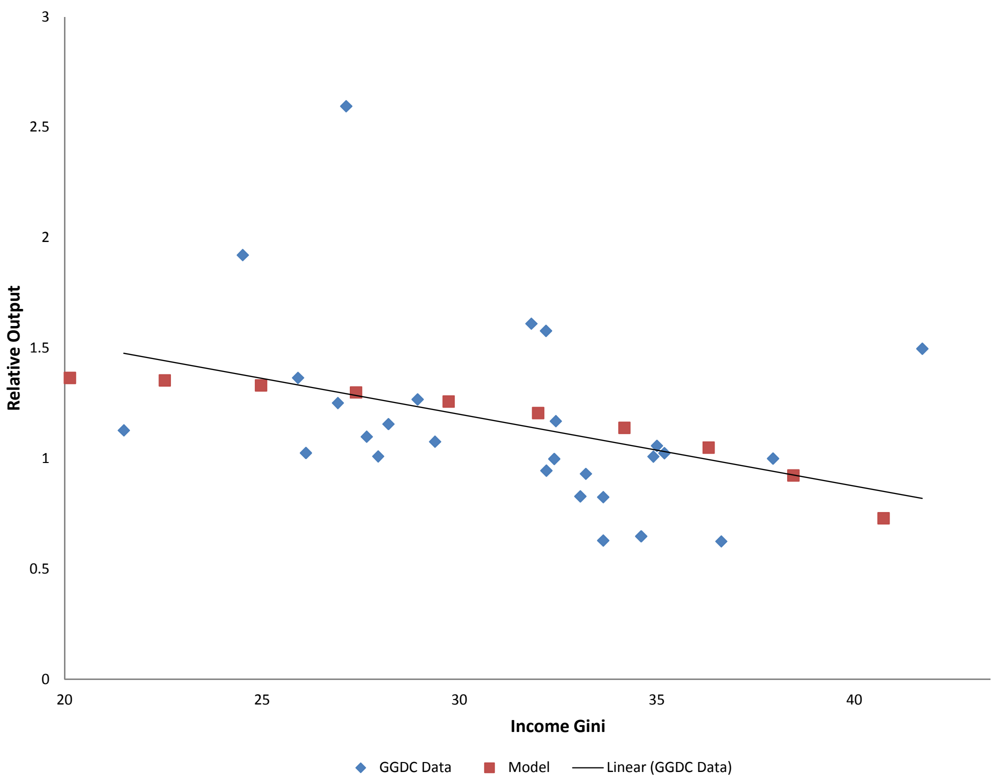
Sections 2 and 8.3.3 showed that sectors that rely more heavily on external finance exhibit disproportionately lower value added shares and output levels in countries with higher income inequality. I now assess the ability of the calibrated model to match this fact. I set the quality of financial institutions at the level of the median country in the UNSD sample. I then perform mean preserving spreads (henceforth MPS) to the distribution of wealth to span a range of income Ginis as observed in the UNSD sample.[44] In the sample, income Gini coefficients vary from approximately 25 to 62, with a median value of 38. The calibrated model is able to generate an income Gini coefficient of up

[44] A MPS consists of a reduction in θ and ω_{min} in such a way that average wealth, $E[G(\omega)]$, is kept constant. More specifically, a MPS consists of $(d\theta, d\omega_{min})$ such that $d\theta < 0$ and

$$d\omega_{min} = \frac{\omega_{min}}{\theta(\theta - 1)} d\theta < 0$$

to 40.[45] Nevertheless, the range of income Ginis generated by the model is large enough to make a quantitative comparison with the data.

Figure 6 shows relative output in sector 2, Y_2/Y_1, against the income Gini coefficient both for the model and the GGDC data.[46] Note that the model was calibrated to match several moments of the US economy in the 1980s, while the GGDC data corresponds to OECD countries in 1997. For the simulated data, each point (square) corresponds to a different value of the shape parameter, θ. At the calibrated parameters, the model predicts that higher wealth inequality leads to both higher income inequality and lower relative output in the more externally dependent sector. This is consistent with the evidence from the GGDC data - see diamonds in Figure 6. The calibrated model fares well with this feature of the data.



Notes: The figure plots the ratio of output in the high externally dependent sector to output in the low externally dependent sector, Y_2/Y_1, against the income Gini coefficient.

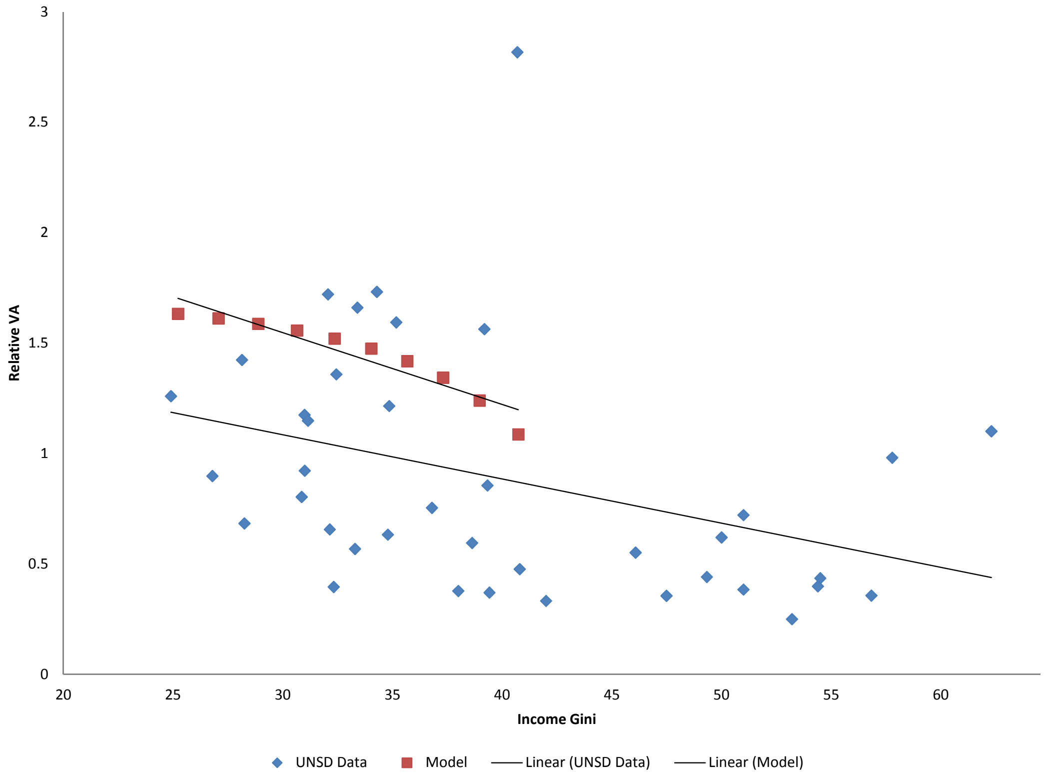
Figure 6: Inequality and Relative Output: Model vs Data

I now evaluate the model's predictions on relative value added. Figure 7 below shows the ratio of value added in the high external dependence sector to value added in the low external dependence

[45] Other models of occupational choice with collateral constraints also have a hard time in generating a high degree of income inequality. For example, Jeong and Townsend (2008) show that a calibrated version of the occupational choice model of Lloyd-Ellis and Bernhardt (2000) is consistently unable to generate the degree of income inequality observed in the Thai data.

[46] GGDC stands for Groningen Growth and Development Centre. See Section 8.3.3 in the Appendix for details on the GGDC data.

sector against income inequality, both for the sample and the UNSD data. At the calibrated elasticity of substitution between sectors, the model's negative relation between inequality and relative output carries over to the relation between inequality and relative value added. Importantly, Figure 7 shows that this pattern is supported by the data.



Notes: The Figure plots the ratio of value added in the high external dependence sector to value added in the low external dependence sector, $\frac{p_2 Y_2}{p_1 Y_1}$, against the income Gini coefficient, for both the model's simulations and the UNSD data for 1980.

Figure 7: Inequality and Relative Value Added

To quantitatively evaluate the model, I compare regression coefficients from the real and the simulated data. Table 11 contains the results. Comparing coefficients in columns (1) and (3), we establish that the model accounts for about 65% of the relation between inequality and relative value added found in the data. Comparing columns (2) and (4), we see that the model accounts for about 37% of the relation between inequality and relative output found in the data.

	Data		Model	
	(1)	(2)	(3)	(4)
	Rel VA	Rel Output	Rel VA	Rel Output
Income Gini	-1.702***	-3.11*	-1.135***	-1.458***
	(0.821)	(1.65)	(0.083)	(0.110)
Observations	37	26	10	10
Adjusted R2	0.490	0.182	0.998	0.998

Notes: Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. Rel VA stands for relative value added across sectors, $p_2Y_2/(p_1Y_1)$. Rel Output stands for relative output across sectors, Y_2/Y_1. Column (1) uses data for 1980 from UNSD (value added) and IFS and IFC (capitalization ratio). Column (2) uses GGDC data for 30 OECD countries in 1997. Data regressions control for capitalization ratio, the stock of human capital and origin of the legal system (English, French, German or Scandinavian). Column (1) also controls for real per capita GDP. Simulated data regressions control for the external finance ratio.

Table 11: Inequality and Levels: Model vs Data

5.3 Interaction between Finance and Inequality

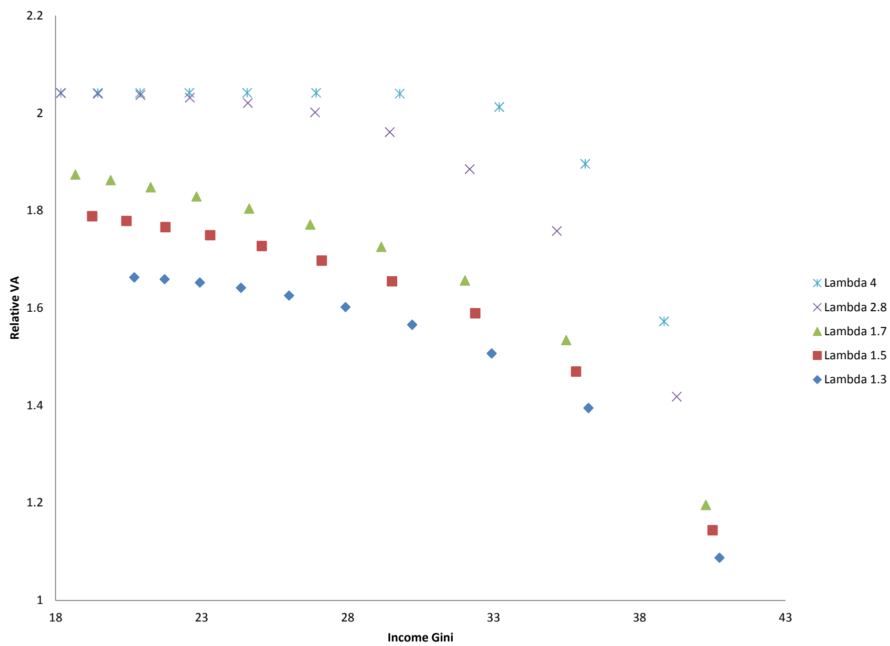
Sections 2.4 and 8.3.3 document the presence of interaction effects between financial development and income inequality. Specifically, Table 4 showed that income inequality reduces industry value added shares disproportionately more in sectors with high external dependence. Additionally, and perhaps counter-intuitively, Table 4 showed that this effect i stronger for more financially developed countries.[47] Table 19 in Section 8.3.3 in the Appendix shows a similar pattern for relative output: inequality has a disproportionately negative effect on relative output of the high dependence sector, and this effect increases with financial development. Table 5 showed that eventually, for a sufficiently high level of financial development, this effect is reversed and financial development weakens the effect of income inequality. I now assess whether the calibrated model can come to terms with this pattern.

Figure 8 below shows the effect of higher wealth inequality on relative value added in sector 2, $p_2Y_2/(p_1Y_1)$, for different levels of financial development. We see that the negative effect of wealth inequality on relative value added becomes stronger when λ increases from 1.3 to 1.7. Eventually, for high enough λ, the negative effect of inequality on relative value added becomes weaker as λ increases. Thus, the model matches the type of non-monotone interaction effect found in the data. Figure 22 in the Appendix shows a similar pattern for the effect of inequality on relative output of sector 2.

The intuition for this effect relies on the capital demand channel. Figure 9 below shows a partial equilibrium example of a redistribution that leads to the type of interaction effects found in the data. The Figure shows capital demand as a function of wealth for the case in which all sector 1 entrepreneurs are constrained, for two values of λ and given prices and thresholds. Consider a poor-to-rich redistribution of wealth between agents A and B. In the financially underdeveloped economy, both agents are borrowing at capacity and the redistribution has no effect on total capital demand. When financial institutions are improved, however, the wealthy agent reaches the optimal scale and the transfer of resources depresses total capital demand, worsening allocative efficiency. That is, the

[47]To see this note that the coefficient for the triple interaction term between financial development, income inequality and external financial dependence is negative.

capital demand channel is stronger in the high-λ economy. At some point, for sufficiently high λ, both agents become unconstrained and the redistribution of wealth has no impact on capital demand. To summarize, the capital demand channel can account for the non-monotone interaction effect found in the data.



Notes: The Figure shows the effect of income inequality (generated via higher wealth inequality) on relative value added of sector 2, for different levels of financial development.

Figure 8: Interaction Effects, Relative Value Added

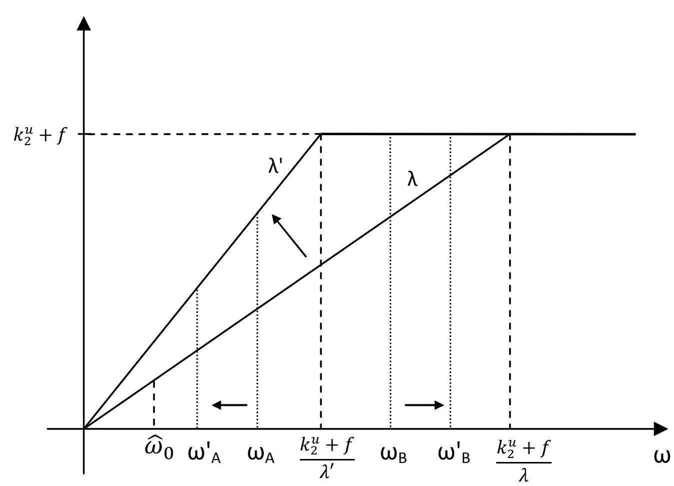


Figure 9: Interaction Effects and Capital Demand

6 Wealth Inequality and the Losses from Financial Frictions

This section studies the impact of wealth inequality on the macroeconomy. I find that, at the calibrated parameters, wealth inequality exacerbates the effects of financial frictions, placing the economy further away from its first best. I show that wealth inequality reduces production efficiency through the decreasing returns, the capital demand and the extensive margin channels. Quantitatively, the losses from wealth inequality can be large. An increase in wealth inequality of 42 points in Gini (consistent with an increase of 15 points in income Gini) reduces per capita output by 46%. I show that about a quarter of these losses can be attributed to the extensive margin channel. Finally, I show that financial frictions can reduce output per capita by up to 35%, keeping the distribution of wealth fixed.

Section 6.1 studies the effects of increased wealth inequality and contains the main result of the paper. Section 6.2 quantifies the importance of the extensive margin channel. Section 6.3 assesses the sensitivity of the losses to parameter values. Section 6.4 computes the losses from financial frictions. Section 8.8 in the Appendix quantifies the effects of increased wealth inequality in a calibrated version of the model with heterogeneity in wealth and ability.

6.1 Increased Wealth Inequality

In this section, I study the effects of increased wealth inequality. To do so, I set average wealth and the technology parameters at their US calibrated values - see Table 9. I set the quality of financial institutions at the level of the median country in the UNSD sample, $\lambda = 1.164$. I then perform mean preserving spreads to the distribution of wealth to span a range of income Ginis as observed in the data.

Figures 10 and 11 show the effect of wealth inequality on several equilibrium outcomes. At the calibrated parameters, the MPS to the distribution of wealth reduces capital demand. In turn, this reduces labor demand, as the labor choice of constrained agents is tied to their capital demand. In this way, both the interest rate and the wage are depressed - see upper part of Figure 10.[48] Recall from Section 4 that the interest rate and the wage were already depressed as a result of financial frictions. As the economy tilts its production pattern towards sector 1, the relative price of sector 2 tends to increase - see lower part of Figure 10. The MPS tends to shift agents away from sector 2 and into sector 1 and the working occupation - see first two rows of Figure 11.[49] At the same time, the aggregate amount of capital held by sector 2 entrepreneurs is higher after the MPS, while aggregate capital in sector 1 is lower - see last row of Figure 11. Thus, the MPS results in fewer and on average larger firms in sector 2, and more and on average smaller firms in sector 1. Financial frictions have a similar effect on the distribution of firm size - see Section 4. This means that wealth inequality

[48] An increase in wealth inequality together with a reduction in the real interest rate is consistent with the experience of the US and other developed nations in recent decades. Auclert and Rognlie (2016) also provide a mechanism consistent with this pattern, although they focus on the effect of inequality on the interest rate via aggregate savings.

[49] The MPS places a higher proportion of agents below $\hat{\omega}_0$, so that in partial equilibrium labor supply increases. This reinforces the fall in the wage rate, which in turn makes some agents enter entrepreneurship. In the new equilibrium the proportion of workers is higher.

exacerbates the negative effects of financial frictions on the distribution of firm size. Finally, the MPS to the distribution of wealth tends to decrease the mass of agents that is able to enter sector 2 - see top right graph in Figure 11. This means that wealth inequality reduces production efficiency also through the extensive margin channel.

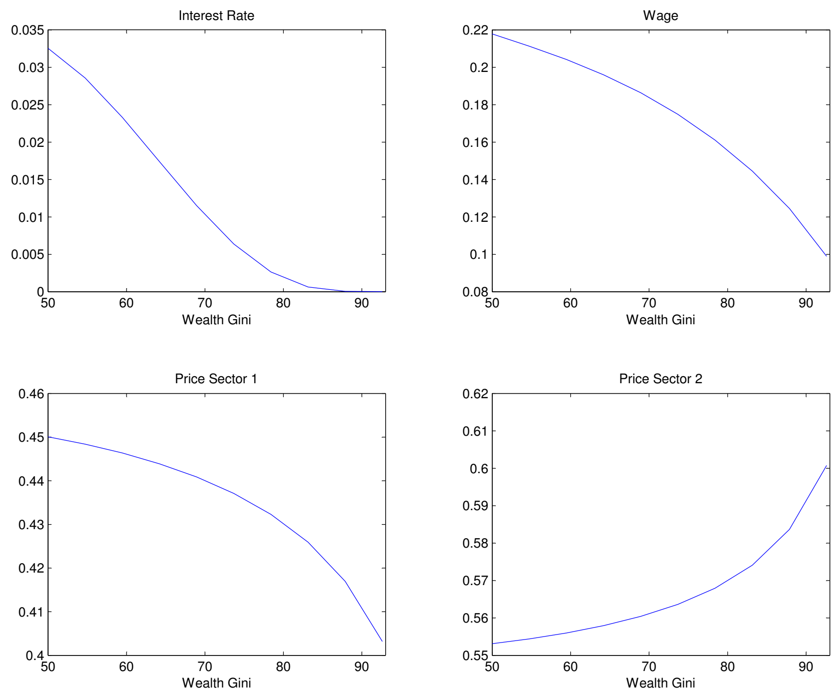


Figure 10: Wealth Inequality and Equilibrium Prices

I now quantify the overall impact of wealth inequality on real per capita output. Figure 12 shows output per capita relative to the US calibrated benchmark for different values of exogenous wealth inequality. We see that wealth inequality reduces per capita output. Quantitatively, an increase in wealth inequality of 42 points in Gini (consistent with an increase of 15.5 points in the income Gini) reduces output per capita by 46.3%.[50] This number should be interpreted as an upper bound on the losses from wealth inequality for two reasons. First, an increase of 42 points in the wealth Gini is admittedly a massive redistribution of wealth.[51] Second, the experiments considered in this section redistribute wealth among agents of equal productivity, as the model abstracts from differences in ability. To the extent that agents differ in ability, and that ability and wealth are positively correlated, an increase in the dispersion of the marginal distribution of wealth will transfer resources to more

[50] An increase of 15.5 points in income Gini is equivalent to 1.5 times a standard deviation of income inequality in the sample.

[51] While data on wealth inequality for a wide range of countries is not available, the Luxembourg Wealth Study Database provides measurements on wealth Ginis for a handful of countries. In 2002, Sweden had a wealth Gini of 89 while Italy had one of 60. Thus, a cross-country difference of about 30 points in wealth Ginis has been documented. An increase in the wealth Gini of this magnitude is associated with losses in output of about 30%.

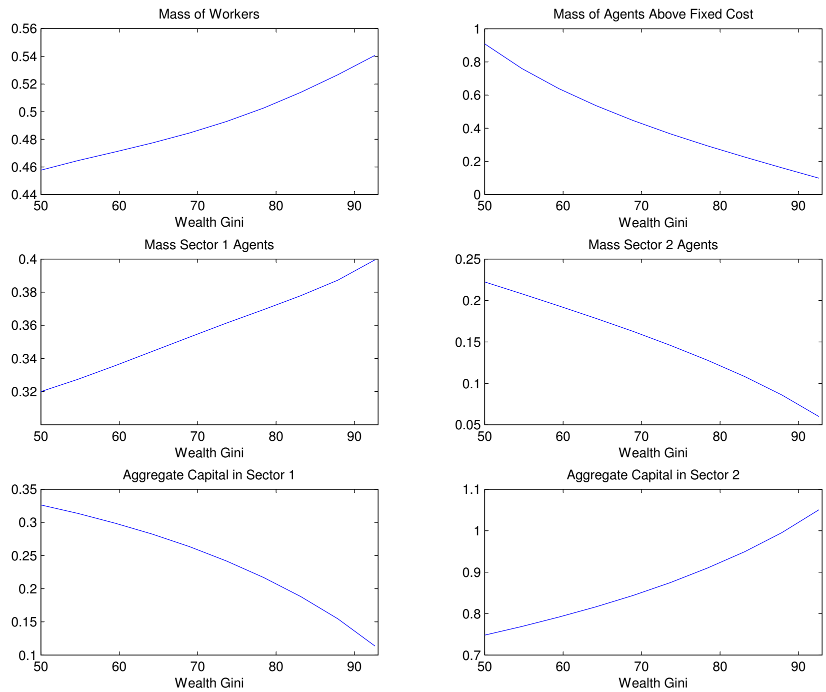


Figure 11: Wealth Inequality and Equilibrium Outcomes

productive agents, thus reducing the losses reported above.[52]

Figure 13 compares the calibrated model simulations with cross-country data on income inequality and real GDP for 1980. For the model, I consider GDP relative to the US calibrated benchmark, while for the data I take GDP relative to the US. The regression coefficient of output per capita on the income Gini coefficient is -1.037 for the model and -1.982 for the data.[53] Comparison of these coefficients suggests that variation in wealth inequality can account for 52.3% of the relation between income inequality and real per capita GDP observed in the data.

[52]In Section 8.8 of the Appendix, I extend the analysis of this section to a setting with heterogeneity in both wealth and ability. I allow wealth and ability to be correlated and discipline this correlation with data on wealth and entrepreneurship from the Survey of Consumer Finances. I then perform mean preserving spreads to the distribution of wealth conditional on ability. That is, I keep average wealth by ability type fixed. I do not consider experiments that redistribute wealth across ability types.

[53]Both coefficients are significant at the 1% level.

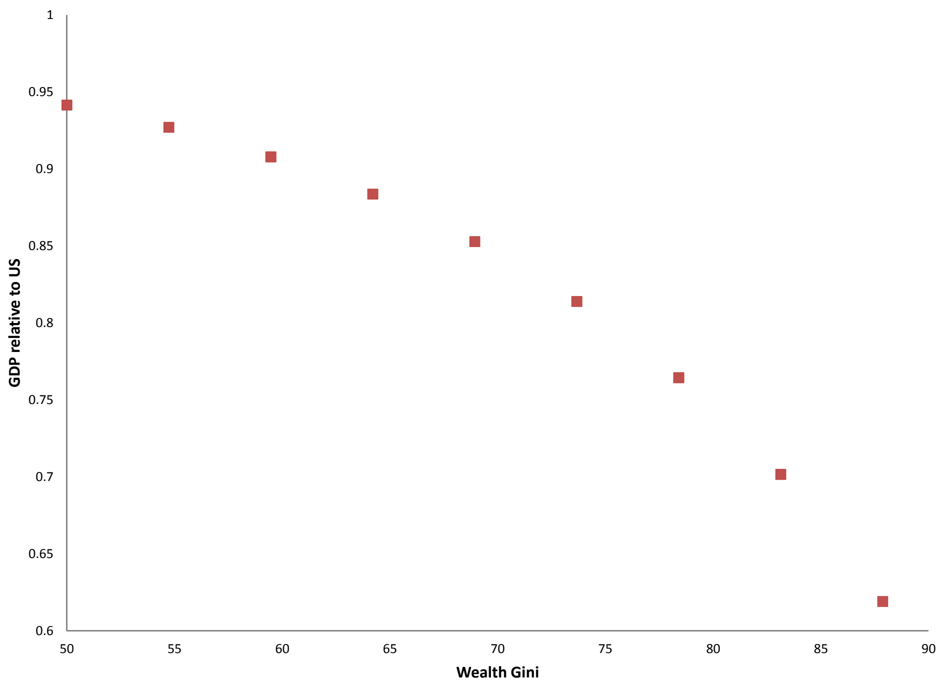
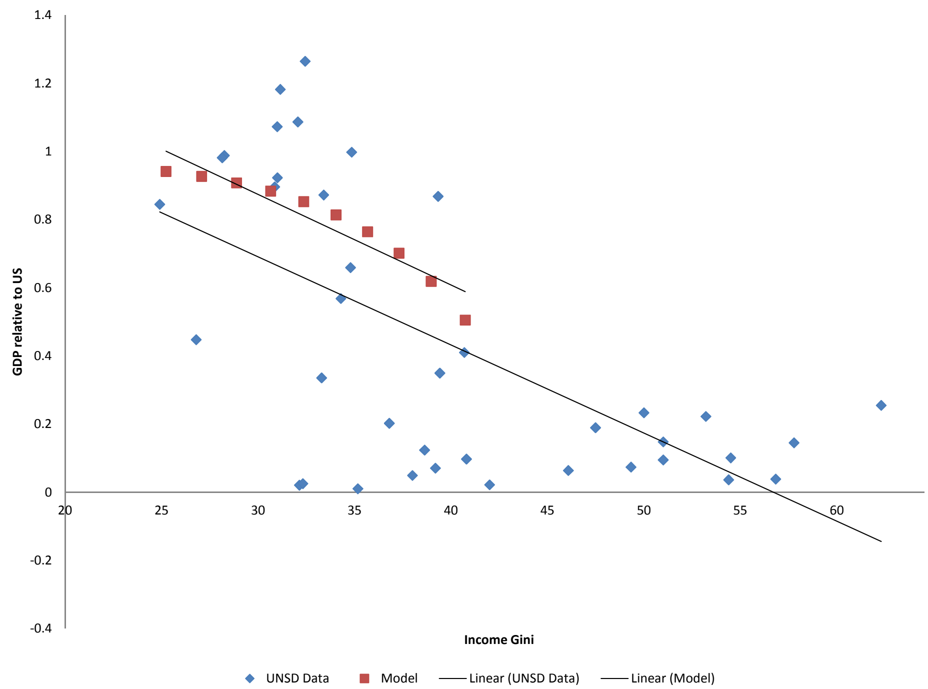


Figure 12: The Losses from Wealth Inequality



Notes: For the data, the Figure plots GDP relative to the US for 1980 against income inequality. For the model, the figure plots GDP relative to first best against income inequality.

Figure 13: Inequality: Model vs Data

To summarize, I find that higher inequality in the distribution of wealth tends to exacerbate the effects of financial frictions. This happens because inequality places resources in the hands of the wealthier, relatively unconstrained agents who have a lower marginal product of capital. Moreover, as wealthy agents tend to be operating at the optimal scale, and therefore have no use for extra funds other than lending, while wealth-poor agents tend to be borrowing at maximum capacity, inequality decreases capital demand. Furthermore, wealth inequality reduces the mass of agents that is able to meet the fixed cost and enter the more externally dependent sector. Thus, wealth inequality harms production efficiency through the decreasing returns, the capital demand and the extensive margin channels.

6.2 The Role of the Extensive Margin

Figure 11 showed that wealth inequality leads to a decrease in the mass of agents above the effective fixed cost, f/λ. Recall that only agents with wealth higher than this threshold can enter sector 2 and that the equilibrium exhibits a sub-optimally low mass of agents in this sector (see Section 4). This suggests that part of the losses found in the previous section come from the *extensive margin channel* - that is, the fact that wealth inequality reduces the mass of agents that is able to enter sector 2.[54]

[54] At the same time, we know from Section 3 that the extensive margin constraint never binds (i.e. $\hat{\omega} > f/\lambda$) - see also Figure 11.

To quantify the importance of this channel, I perform the following exercise. I consider the problem of a planner that can freely assign capital and labor to agents, and agents to sectors, subject to an exogenous constraint on the mass of agents that can be assigned to sector 2. Specifically, letting μ_0 and μ denote the mass of workers and sector 1 entrepreneurs respectively, the planner's problem is given by:

$$\max_{k_1,k_2,l_1,l_2,\mu,\mu_0} A\left[\gamma(\mu k_1^{\alpha\nu} l_1^{(1-\alpha)\nu})^{\frac{\varepsilon-1}{\varepsilon}} + (1-\gamma)\left((1-\mu-\mu_0)\, k_2^{\alpha\nu} l_2^{(1-\alpha)\nu}\right)^{\frac{\varepsilon-1}{\varepsilon}}\right]^{\frac{\varepsilon}{\varepsilon-1}} + (1-\delta)\,\mathbb{E}[\omega]$$

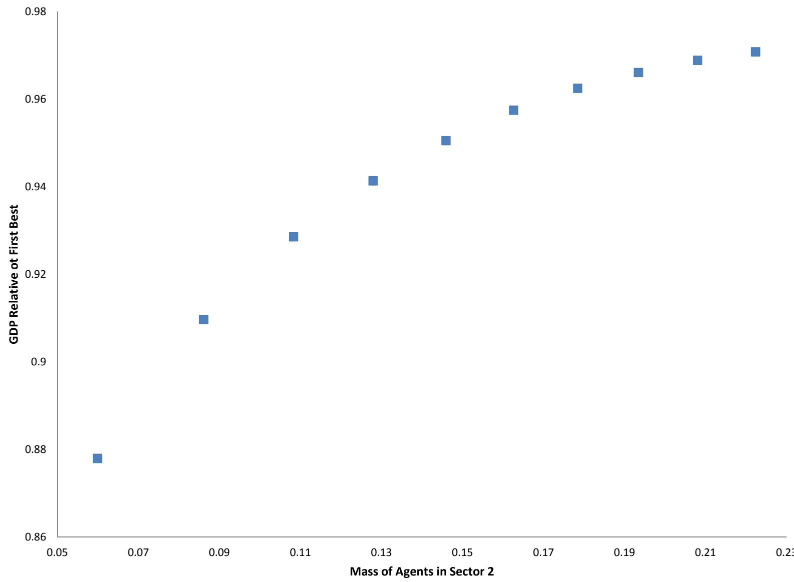
subject to

$$\mu k_1 + (1-\mu-\mu_0)(k_2+f) = \mathbb{E}[\omega]$$

$$\mu l_1 + (1-\mu-\mu_0)\, l_2 = \mu_0$$

$$1-\mu-\mu_0 \le c$$

I keep the technology parameters and average wealth at their calibrated values. I study the losses in output per capita arising from variation in the maximum amount of agents that can be assigned to sector 2 (i.e. c). In particular, I decrease c from about 22% to 6%, which is the range for the mass of agents allocated to sector 2 that results from variation in wealth inequality, as obtained in the previous section - see Figure 11. Figure 14 contains the results. We see that a decrease in the maximum amount of agents that can be assigned to sector 2 from 22% to 6% leads to a reduction in output per capita of about 10%. This amounts to a quarter of the losses from wealth inequality found in the previous section.



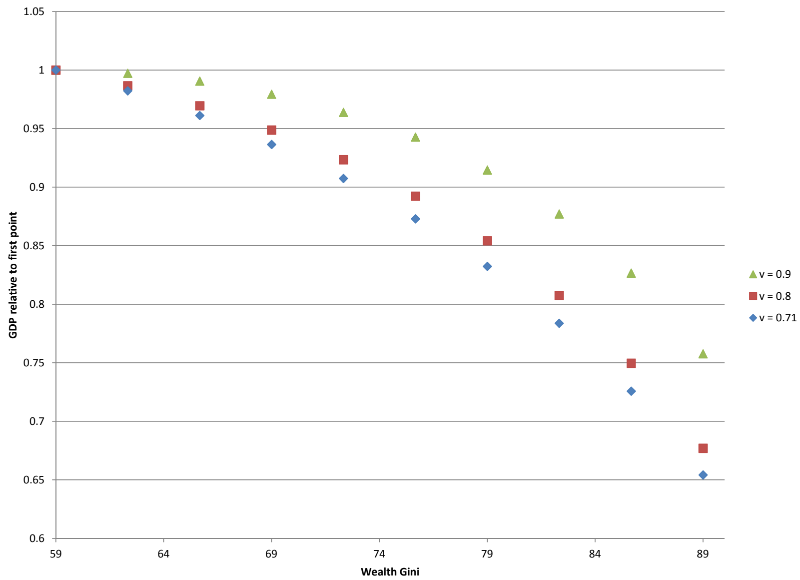
Notes: The Figure plots GDP relative to first best GDP against the maximum mass of agents that the planner can assign to sector 2.

Figure 14: Extensive Margin Losses

6.3 Sensitivity Analysis

Parameter values. How do the results of this section depend on the specific values of the parameters used? Here I focus on a crucial parameter: the span of control. Section 8.6 in the Appendix performs sensitivity analysis with respect to the fixed cost and finds that a higher fixed cost is associated with smaller losses from inequality - consistent with the discussion of the extensive margin channel in Section 3.3. The span of control parameter governs the degree of decreasing returns to scale present in the technology of intermediate goods. Figure 15 shows the effects of wealth inequality on income per capita for different values of this parameter. As expected, higher values of ν lead to smaller losses from wealth inequality, as the decreasing returns channel is weakened. However, the losses from wealth inequality are still large, even for $\nu = 0.9$: an increase in the wealth Gini from 59 to 89 points leads to a reduction in income per capital of about 25%.[55]

[55]Once I move away from the calibrated parameters, I do not use the model to map wealth to income inequality. Instead, I consider a realistic range of wealth Ginis. I take 59 and 89 since these values are observed in 2002 for Italy and Sweden, respectively, according to the Luxembourg Wealth Study data.



Notes: The Figure plots GDP relative to the first point against the wealth Gini coefficient, for different values of the span of control.

Figure 15: Span of Control and the Losses from Wealth Inequality

Heterogeneity in Ability. Section 8.8 in the Appendix presents an extension of the model with heterogeneity in both wealth and ability. Agents are characterized by their sector-specific ability draw and wealth (i.e. 3 dimensions of heterogeneity). I parametrize the joint distribution of wealth and ability as follows. Ability in each sector is assumed to be independently Pareto distributed. Then, conditional on the ability vector, wealth is log-normally distributed with a mean that is allowed to depend on ability. That is, wealth and ability are allowed to be correlated. I calibrate this model to salient moments of the US economy. I follow the approach in Section 4 for the parameters that are common to both models. I choose the dispersion in ability to match the concentration in the distribution of employment size in the US, as is common in the literature - see Buera, Kaboski, and Shin (2011). I choose the parameter governing the correlation between wealth and ability to match the correlation between wealth and entrepreneurship observed in the US, as documented in the Survey of Consumer Finance. I then perform mean preserving spreads to the conditional distribution of wealth given ability. Conceptually, this exercise is analog to the one in Section 6.1 above, as it redistributes wealth among agents of equal productivity as in the baseline model of Section 3. I find that an increase in wealth inequality of about 30 points in Gini is associated with losses in output of about 16 percent.[56]

[56]This number is about half the value found in the baseline model in Section 6.1, where an increase in the wealth Gini of 30 points leads to a decrease in output of about 30%. This discrepancy is related to the fact that, in the model with wealth and ability, the calibrated fixed cost turns out to be substantially larger than in the baseline. A larger fixed cost tends to reduce the losses from inequality, as shown in Section 8.6 in the Appendix and argued in Section 3.3 above.

6.4 The Losses from Financial Frictions

I now study the effects of financial frictions on the economy. I set average wealth and the technology parameters at their US calibrated values, as specified in Table 9. I set the shape parameter of the wealth distribution at the value of the median country in the UNSD sample. I then vary the value of λ to span a range of external finance to GDP ratios as observed in the data. Because the distribution of wealth is kept fixed, I interpret the results as an upper bound to the effects of financial frictions.

Figures 16 and 17 show the effects of financial frictions on various equilibrium outcomes. As borrowing constraints are tightened, capital demand contracts and the interest rate decreases. The contraction in capital demand shifts labor demand downwards, resulting in a decrease of the wage. The decrease in λ decreases profits disproportionately more in sector 2, so that the wealth threshold $\hat{\omega}$ tends to increase, and more agents enter sector 1. The effect of financial frictions on the wealth threshold that separates workers from sector 1 entrepreneurs, $\hat{\omega}_0$, is non-monotone. Initially, profits in sector 1 increase - as the reduction in the interest and wage rates is very pronounced. This tends to push $\hat{\omega}_0$ downwards and decrease the mass of workers. As financial frictions become tighter, the decrease in the wage and interest rates becomes less pronounced.[57] This means that, at some point, profits of the marginal agent in sector 1 decrease, so that $\hat{\omega}_0$ and the mass of workers both increase. Irrespective of this non-monotonicity, the flow of agents from sector 2 to sector 1 is large enough so that the mass of sector 1 entrepreneurs monotonically increases as financial frictions become tighter.

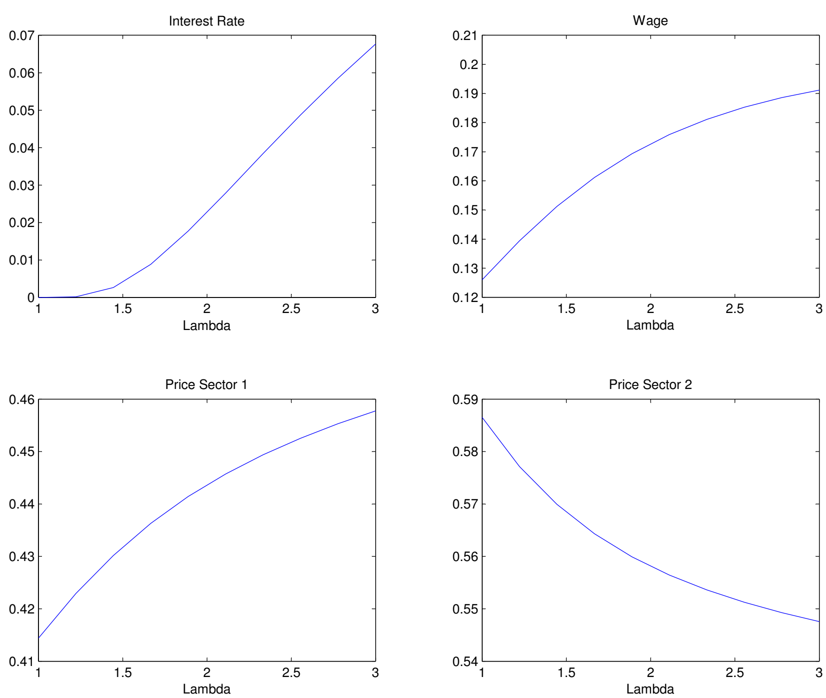


Figure 16: Effects of Financial Development, I

[57]Note the convex shape of the relationship between the interest rate and λ.

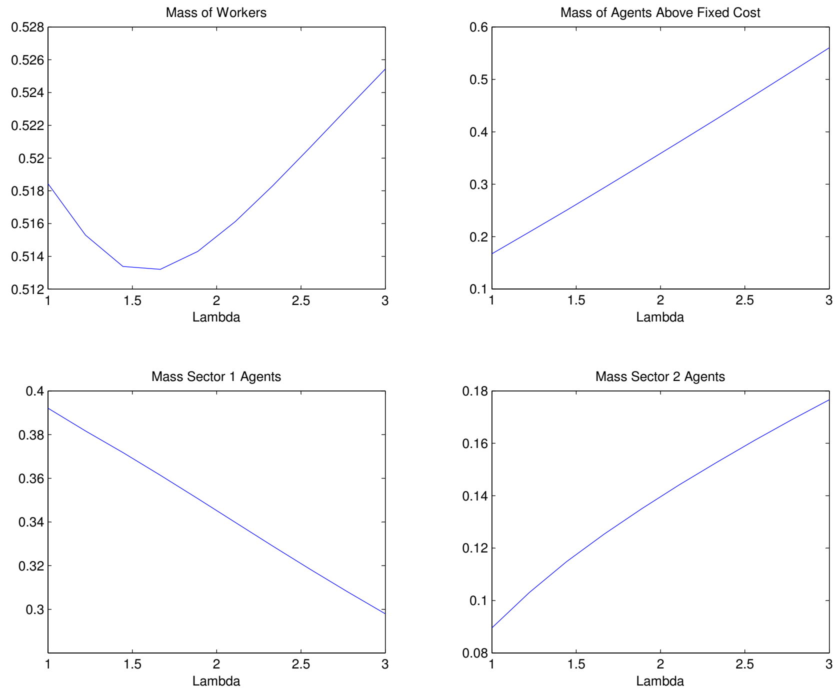


Figure 17: Effects of Financial Development, II

Figure 18 quantifies the overall impact of financial frictions on output per worker. It depicts output per capita relative to the US calibrated benchmark for different values of λ. We see that, in the calibrated model, financial frictions can reduce output to about 65% of the US level. In terms of observables, Figure 19 shows the cross-country relation between the ratio of external finance to GDP and output per capita relative to the US, both for the data and the model simulations, after controlling for income inequality. That is, for the data, I remove the variation stemming from income inequality.[58] The regression coefficient of output per capita on the ratio of external finance to GDP is 0.163 for the model and 0.23 for the data (controlling for the income Gini).[59] Comparison of these coefficients suggests that variation in the quality of financial institutions can account for about 70% of the cross country relation between finance and GDP observed in the data.

[58] That is, I plot the residuals of a regression of output per capita relative to the US on the income Gini. For the model, I report output relative to the first best, demeaned.

[59] Both coefficients are significant at the 10% level.

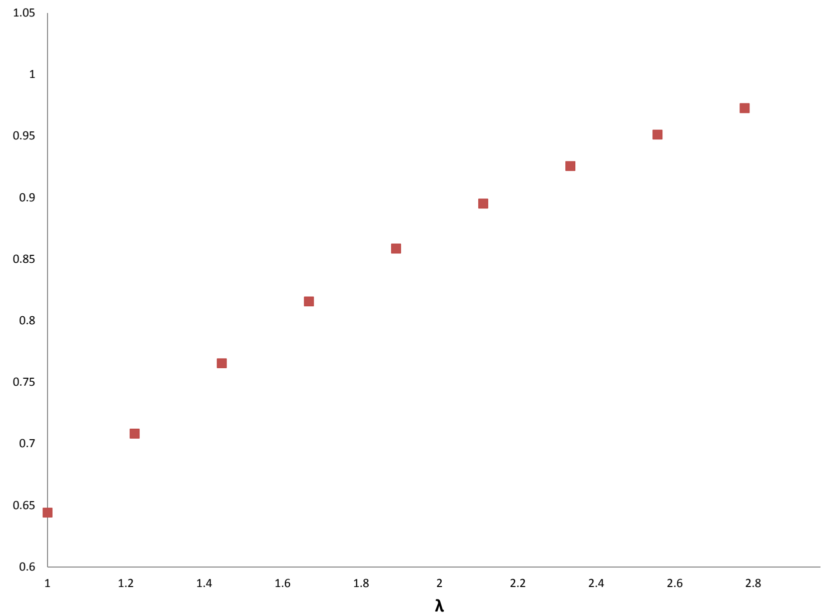
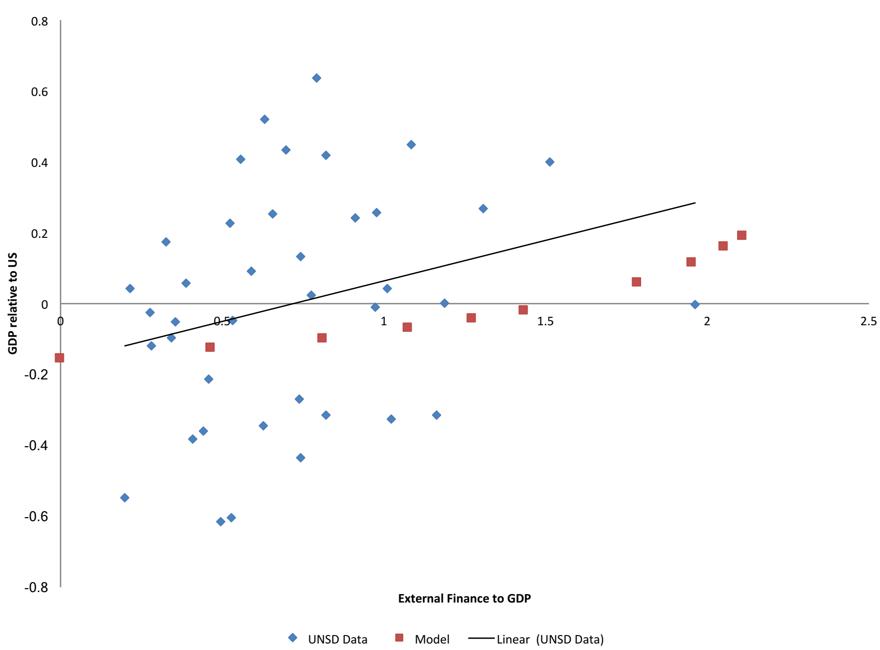


Figure 18: The Losses from Financial Frictions



Notes: For the data, the Figure plots GDP relative to the US in 1980 (net of the effect of the income Gini) against the external finance to GDP ratio. More precisely, the y-axis depicts the residuals from a regression of relative GDP on the income Gini. For the model, the figure plots GDP relative to first best (demeaned) against the external finance to GDP ratio.

Figure 19: Finance and Development: Model vs Data

Discussion. The above experiments impose variation in financial development while keeping the distribution of wealth constant. The results can therefore be interpreted as capturing the short run losses from financial frictions. While on impact the agents cannot adjust their wealth holdings, over time one can expect that they adapt their savings behavior and by self-financing possibly undo some of the lost output. In this sense, the numbers reported above constitute an upper bound to the losses from financial frictions. In contrast, most contributions in the literature have focused on steady states - see Jeong and Townsend (2007), Buera, Kaboski, and Shin (2011), Midrigan and Xu (2014).[60] By comparing steady states with different levels of financial development, the economy is given an infinite amount of time to adjust. In this section, I have considered the polar opposite case. For these reasons, to assess the model's ability to match the data, I focus on the empirical relationship between output and financial development keeping inequality constant - see Figure 19.

7 Concluding Remarks

In this paper, I explore the effects of wealth inequality on macroeconomic aggregates in an environment where financial markets are imperfect. More specifically, I ask whether wealth inequality tends to exacerbate or helps alleviate the degree of misallocation of production resources. To answer this question, I provide empirical evidence on the cross-sectoral effects of income inequality. I exploit the idea the inequality should have a differential effect on sectors that are more intensive in external finance. Focusing on cross-sectoral outcomes allows me to include country-specific fixed effects and improve on identification. I show that sectors that rely more heavily on external finance tend to be relatively smaller in countries with high income inequality.

To account for this fact, I build a two-sector static model in which sectors differ in their fixed cost requirement, agents face collateral constraints, and production is subject to decreasing returns. Without restricting the parameter space, the effect of wealth inequality on the efficiency of production can go in either direction. To discipline the analysis, I calibrate the parameters so that the model matches several moments of the US economy. I show that the calibrated model can come to terms with the cross-sectoral facts documented in the empirical section. The main result of the paper is that, at the calibrated parameters, wealth inequality exacerbates the effects of financial frictions, placing the economy further away from its first best. This happens because wealth inequality drives resources towards agents with low marginal product of capital, reduces capital demand and reduces the number of agents that can enter the capital intensive sector. Quantitatively, variation in wealth inequality can reduce income per capita by up to 46%.

[60] Notable exceptions are Buera and Shin (2013) and Moll (2014) who study transitions.

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8 Appendix

8.1 Year of Inequality Data

Country	Gini Year	Country	Gini Year	Country	Gini Year
Australia	1979	Greece	1981	Pakistan	1979
Banglades	1978	India	1977	Peru	1981
Belgium	1979	Italy	1980	Philippines	1985
Brazil	1980	Japan	1980	Portugal	1980
Canada	1979	Jordan	1980	Singapore	1980
Chile	1980	Kenya	1992	South Africa	1993
Colombia	1978	Korea	1980	Spain	1980
Costa Rica	1981	Malaysia	1979	Sri Lanka	1980
Denmark	1981	Mexico	1977	Sweden	1980
Egypt	1975	Morocco	1984	Turkey	1973
Finland	1980	Netherlands	1979	UK	1980
France	1979	New Zealand	1980	Venezuela	1979
Germany	1978	Norway	1979	Zimbabwe	1990

Table 12: Year of initial inequality

8.2 Sectors by External Financial Dependence

The following table displays the 36 3-digit ISIC manufacturing sectors, in order of increasing external financial dependence, as measured in Rajan and Zingales (1998).

ISIC	Industrial Sector	External Dependence	ISIC	Industrial Sector	External Dependence
314	Tobacco	-0.45	332	Furniture	0.24
361	Pottery	-0.15	381	Metal products	0.24
323	Leather	-0.14	3511	Basic chemicals except fertilizers	0.25
3211	Spinning	-0.09	331	Wood products	0.28
324	Footwear	-0.08	384	Transport equipment	0.31
372	Non-ferrous metal	0.01	354	Petroleum and coal products	0.33
322	Apparel	0.03	3843	Motor vehicle	0.39
353	Petroleum refineries	0.04	321	Textile	0.40
369	Nonmetal products	0.06	382	Machinery	0.45
313	Beverages	0.08	3841	Ship	0.46
371	Iron and Steel	0.09	390	Other industries	0.47
311	Food products	0.14	362	Glass	0.53
3411	Pulp, paper	0.15	383	Electric machinery	0.77
3513	Synthetic resins	0.16	385	Professional goods	0.96
341	Paper and products	0.18	3832	Radio	1.04
342	Printing and publishing	0.20	3825	Office and computing	1.06
352	Other chemicals	0.22	356	Plastic products	1.14
355	Rubber products	0.23	3522	Drugs	1.49

Table 13: Manufacturing Sectors by External Financial Dependence

8.3 Robustness

In this section, I will show that the empirical results in Section 2 are robust to (i) the measure of income inequality used, and (ii) the measure of financial development used. I also show that the facts documented in Section 2 hold for industry output and export shares.

8.3.1 Alternative Measures of Income Inequality

The main analysis focused on the Gini coefficient as a measure of income inequality. However, Deininger and Squire (1996) provide us with other statistics of the income distribution. In this section, I focus on three other statistics of the income distribution: the quintile ratio, the share of income held by the richest 20% , and the share of income held by the poorest 20%. The quintile ratio is defined as the ratio of the first quintile (i.e. the share of the top 20%) to the last quintile (the share of the bottom 20%). I start by showing, at the cross-country level, that the effect of income inequality on relative value added is robust to using these other measures of income inequality. Table 14 contains the results. The results are consistent with the ones in Table 3. The quintile ratio and the share of the richest 20% are negatively associated with relative value added in the high dependence industries. The share of income held by the poorest 20% (a measure equality in the distribution of income) is positively associated with relative shares.

Dep. var.	Relative VA in High Dependence Industries		
	(1)	(2)	(3)
Capitalization ratio	0.715***	0.727***	0.697***
	(0.223)	(0.223)	(0.219)
Quintile ratio	-0.021*		
	(0.012)		
Share of richest 20%		-1.611*	
		(0.934)	
Share of poorest 20%			7.726**
			(3.671)
Controls	Y	Y	Y
Observations	36	36	36
R2	0.4042	0.4012	0.4287

Notes: Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. The dependent variable is the ratio of total value added in high external financial dependence industries to total valued added in low external financial dependence industries in 1980. Controls include the stock of human capital, per capita income and an indicator variable for origin of the legal system (English, French, German or Scandinavian).

Table 14: Other Aspects of the Income Distribution, Cross-Country

I now re-do the cross-country cross-industry analysis for the three alternative measures of income inequality. The results are displayed in Table 15, which is the analog of Table 4 in the main text. We see that the quintile ratio and the share of the richest 20% have a disproportionately negative effect on industries that rely heavily on external finance. The share of the poorest 20% displays an opposite pattern. These results are consistent with income inequality inducing smaller value added shares in credit intensive sectors.

Dep. var.	Industry's Share in Manufacturing VA x		
	Quintile Ratio	Richest Quintile	Poorest Quintile
$ed \cdot \lambda$	0.023***	0.054***	-0.006
	(0.008)	(0.018)	(0.008)
$ed \cdot X$	0.038	0.040	-0.198
	(0.039)	(0.028)	(0.147)
$ed \cdot \lambda \cdot X$	-0.069*	-0.081**	0.400**
	(0.039)	(0.032)	(0.189)
Observations	1124	1124	1124
R2	0.475	0.4763	0.4764

Notes: Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. All regressions include country and industry fixed effects. The dependent variable is the industry's share in total manufacturing value added in 1980. Data is taken from the UNSD. Richest (Poorest) Quintile stands for the share in income held by the richest (poorest) 20% of the population, as reported by Deininger and Squire (1996).

Table 15: Other Aspects of the Income Distribution, Cross-Country Cross-Industry

8.3.2 Alternative Measures of Financial Development

In the main analysis we measured financial development as the ratio of domestic credit plus stock market capitalization to GDP (i.e. the capitalization ratio). Here I will consider three alternative measures: (i) the ratio of domestic credit to the private sector plus stock market capitalization to GDP (which I will call the *private capitalization ratio*), (ii) the ratio of stock market capitalization to GDP, and (iii) the accounting standards. Note that the first measure is different from the measure used in the main text in that it excludes domestic credit to the public sector. The third measure, which is also used in RZ, captures the standards of financial disclosure in a country. The higher these standards are, the easier it will be for firms to raise external finance. I use an index created by the Center for International Financial Analysis and Research, which rates each country on a 0 to 90 scale. Data on accounting standards is for 1990. Table 16 displays the results. Columns (1) and (3) show that the effect of income inequality on cross-industry value added shares is qualitatively similar to the one found in the main text, when using the total capitalization ratio.

8.3.3 Output as Alternative Measure of Industry Levels

While value added shares are naturally comparable across countries, the UNSD data cannot be used to compare sectoral output across countries, due to price level differences. For this reason, I use the Groningen Growth and Development Centre (GGDC) Productivity Level Database (Inklaar and Timmer (2008)) which offers value added data for 30 OECD countries and 26 NACE industries. Crucially, the GGDC data provides industry-specific Purchasing Power Parities (PPPs), which capture differences in output price levels across countries at a detailed industry level. Since the PPPs are given for the benchmark year of 1997, value added data will be comparable across countries only for this year. An important difference with the UNSD dataset is given by the fact that the GGDC data is not restricted to the manufacturing sector.

Dep. var.	Industry's Share in Manufacturing VA 1980		
	Private Cap.	Stock Mkt. Cap.	Accounting Standards
Ext dep x λ	0.035**	0.031	-0.0002
	(0.015)	(0.020)	(0.0003)
Ext dep x gini	0.002	-0.034***	-0.096*
	(0.020)	(0.012)	(0.058)
Ext dep x λ x gini	-0.050*	-0.031	0.001
	(0.029)	(0.035)	(0.0009)
Observations	1196	1196	1009
R2	0.4719	0.4693	0.5264

Notes: Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. All regressions include country and industry fixed effects. The dependent variable is the industry's share in total manufacturing value added in 1980. Private Cap. stands for the private capitalization ratio, defined as the ratio of domestic credit to the private sector plus stock market capitalization to GDP. Stock Mkt. Cap. stands for the ratio of stock market capitalization to GDP. Accounting standards is an index developed by the Center for International Financial Analysis and Research ranking the amount of disclosure of companies' annual reports in each country.

Table 16: Other Measures of Financial Development

Descriptive Statistics I start by comparing real value added in industries with high and low reliance on external finance, for countries with high and low levels of income inequality. I classify the 26 NACE sectors into high and low external dependence. For each country and each sector, I compute real value added in million US dollars - using the country-sector specific PPPs. I then sum real value added for all sectors in the high and in the low external dependence groups. Finally, I split the countries into high and low income inequality (Panel A), and into high and low financial development (Panel B). Table 17 contains the results. We see that income inequality is associated with a *decrease* in the difference in real value added between high and low external dependence industries.[61] The diff-in-diff estimate is negative. Panel B suggests that financial development is associated with higher real value added. Moreover, the positive effect of financial development is relatively uniform across sectors - the diff-in-diff estimator is positive, though not very large in magnitude.

[61]Put differently, income inequality is associated with an increase in real value added, and this increase is smaller for high external dependence sectors.

Value Added (millions USD)			
Panel A			
	High Inequality	Low Inequality	Difference
High FinDep	441,977	134,972	307,005
Low FinDep	443,922	102,611	341,311
Difference	-1,945	32,361	-34,306
Panel B			
	F. Developed	F.Developing	Difference
High FinDep	461,700	112,214	349,486
Low FinDep	444,752	101,652	343,100
Difference	16,948	10,562	6,386

Notes: The table shows average value added in high external dependence industries and low external dependence industries for 30 OECD countries, classified by income inequality and financial development. All data is taken from GGDC for 1997. The 26 NACE sectors are classified in a group of high external dependence and a group of low external dependence, according to the median level of external dependence. Then value added is summed across sectors within each group. High inequality countries are those with Gini coefficient larger than the median. Financially developed countries are those with capitalization ratio larger than the median.

Table 17: Descriptive Statistics for Industry Output

Cross-Country Analysis I now explore the effect of income inequality - and financial development - on relative *real* value added at the country level. For each country and sector, I compute real value added by deflating nominal value added with the country-sector specific PPPs. This is a measure of the sector's output that is comparable across countries. I then classify the 26 NACE sectors into two groups, according to their level of external financial dependence. I define relative real value added as the ratio of real value added in high to low external dependence sectors. Table 18 reports the results. Columns (1)-(3) indicate that income inequality is negatively associated with relative output in the high external dependence sectors. In contrast, financial development is positively associated with relative output. This is consistent with the results of the split-sample analysis of the previous section.

Dep. var.	Relative Real VA in High Dependence Industries		
	(1)	(2)	(3)
Capitalization ratio	0.204*		0.220**
	(0.112)		(0.102)
Gini		-3.24*	-3.11*
		(1.71)	(0.016)
Controls			
Observations	27	27	26
R2	0.083	0.090	0.182

Notes: Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. Data is taken from GGDC for 1997. The sample includes 27 OECD countries and 26 NACE sectors per country. The dependent variable is the ratio of total real value added in high external financial dependence industries to total real valued added in low external financial dependence industries in 1997. The capitalization ratio is defined as domestic credit + stock market capitalization over GDP.

Table 18: Cross-Country Regressions for Relative Output

Cross-Country Cross-Industry Analysis I now run the cross-country cross-industry specification in (2) with real value added instead of the industry's share as dependent variable. Table 19 contains the results. The coefficients in column (4) imply that both inequality and financial development reduce output disproportionately more in the high external dependence sectors. The negative sign of the coefficient for the triple interaction term implies that financial development strengthens the negative effect of income inequality on cross-industry output - an effect similar to the one found for value added shares.

Dep. var.	Real Value Added 1997			
	(1)	(2)	(3)	(4)
Ext dep x total cap	-25.79**		-23.84**	233.58*
	(11.94)		(10.05)	(137.54)
Ext dep x gini		-1.81	-1.38	3.92*
		(1.25)	(0.983)	(2.30)
Ext dep x total cap x gini				-7.91*
				(4.44)
Observations	780	754	754	754
R2	0.558	0.558	0.560	0.564

Notes: Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. All regressions include country and industry fixed effects. The dependent variable is real value added for 26 NACE sectors and 27 OECD countries in 1997. The variable "Ext dep" is a measure of the industry's level of external financial development, as constructed by Rajan and Zingales (1998). The variable "total cap" stands for the total capitalization ratio, which is defined as the ratio of domestic credit plus stock market capitalization to GDP.

Table 19: Cross-Country Cross-Industry Regressions, Industry Output

8.3.4 Export Shares as Alternative Measure of Industry Levels

In this section, I show that the main empirical result of the paper, namely that income inequality is associated with disproportionately lower levels in industries that rely more heavily in outside finance, also holds for export shares. I take data on the ratio of exports to GDP for a wide range of countries and industries from Manova (2008). Data for external dependence at the sector level is taken from Braun (2003). Data on financial development at the country level is taken from Beck, Demirgüç-Kunt, and Levine (2000). Finally, data from income inequality is taken from Deininger and Squire (1996). Table 20 contains the results. Columns (2)-(4) show a negative and significant coefficient for the double interaction term that includes the income Gini coefficient. This suggests that more unequal countries feature disproportionately lower export shares in sectors that rely more heavily on external finance.

Dep. var.	Industry's Average Export Share 1980-1997			
	(1)	(2)	(3)	(4)
Ext dep x total cap	0.795***		0.646***	0.848
	(0.187)		(0.1908)	(1.038)
Ext dep x gini		-6.191***	-4.619***	-4.239*
		(1.207)	(1.143)	(2.255)
Ext dep x total cap x gini				-0.482
				(2.346)
Observations	1134	1161	1134	1134
R2	0.7153	0.7112	0.7186	0.7186

Notes: Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. All regressions include country and industry fixed effects. The dependent variable is the industry's export share averaged over the period 1980-1997, taken from MANOVA (2008). The variable "Ext dep" is a measure of the industry's level of external financial development, as constructed by BRAUN (2003). The variable "total cap" stands for the total capitalization ratio, which is defined as the ratio of domestic credit plus stock market capitalization to GDP. The coefficients estimates and standard errors of any term that includes the Gini coefficient were multiplied by 100.

Table 20: Cross-Country Cross-Industry Regressions for Exports

8.4 First Best Equilibrium

In this subsection, I outline the equilibrium conditions for the perfect credit benchmark (that is, the economy with $\lambda = \infty$). In this case, all agents achieve the optimal scale of production, and personal wealth is irrelevant for production decisions. Thus, every agent is indifferent between the different sectors and occupations. An equilibrium now consists of prices (p_1, p_2, r, w), a mass of agents allocated to sector 1, μ, and a mass of workers, μ_0, such that:

1. Indifference:

$$(1-\nu)\left(p_1 A_1 \nu^{\nu}\left(\frac{\alpha}{r+\delta}\right)^{\alpha\nu}\left(\frac{1-\alpha}{w}\right)^{(1-\alpha)\nu}\right)^{\frac{1}{1-\nu}} = (1-\nu)\left(p_2 A_2 \nu^{\nu}\left(\frac{\alpha}{r+\delta}\right)^{\alpha\nu}\left(\frac{1-\alpha}{w}\right)^{(1-\alpha)\nu}\right)^{\frac{1}{1-\nu}} - (r+\delta) f \tag{23}$$

$$= w$$

2. Capital market clearing:

$$\mu\left(p_1 A_1 \nu\left(\frac{1-\alpha}{w}\right)^{\nu(1-\alpha)}\left(\frac{\alpha}{r+\delta}\right)^{1-\nu(1-\alpha)}\right)^{\frac{1}{1-\nu}} + (1-\mu-\mu_0)\left(\left(p_2 A_2 \nu\left(\frac{1-\alpha}{w}\right)^{\nu(1-\alpha)}\left(\frac{\alpha}{r+\delta}\right)^{1-\nu(1-\alpha)}\right)^{\frac{1}{1-\nu}} \tag{24}$$

$$= \mathbb{E}\left[\omega\right]$$

3. Labor market clearing:

$$\mu\left(p_1 A_1 \nu\left(\frac{1-\alpha}{w}\right)^{1-\alpha\nu}\left(\frac{\alpha}{r+\delta}\right)^{\alpha\nu}\right)^{\frac{1}{1-\nu}} + (1-\mu-\mu_0)\left(p_2 A_2 \nu\left(\frac{1-\alpha}{w}\right)^{1-\alpha\nu}\left(\frac{\alpha}{r+\delta}\right)^{\alpha\nu}\right)^{\frac{1}{1-\nu}} = \mu_0 \tag{25}$$

4. Final good optimality:

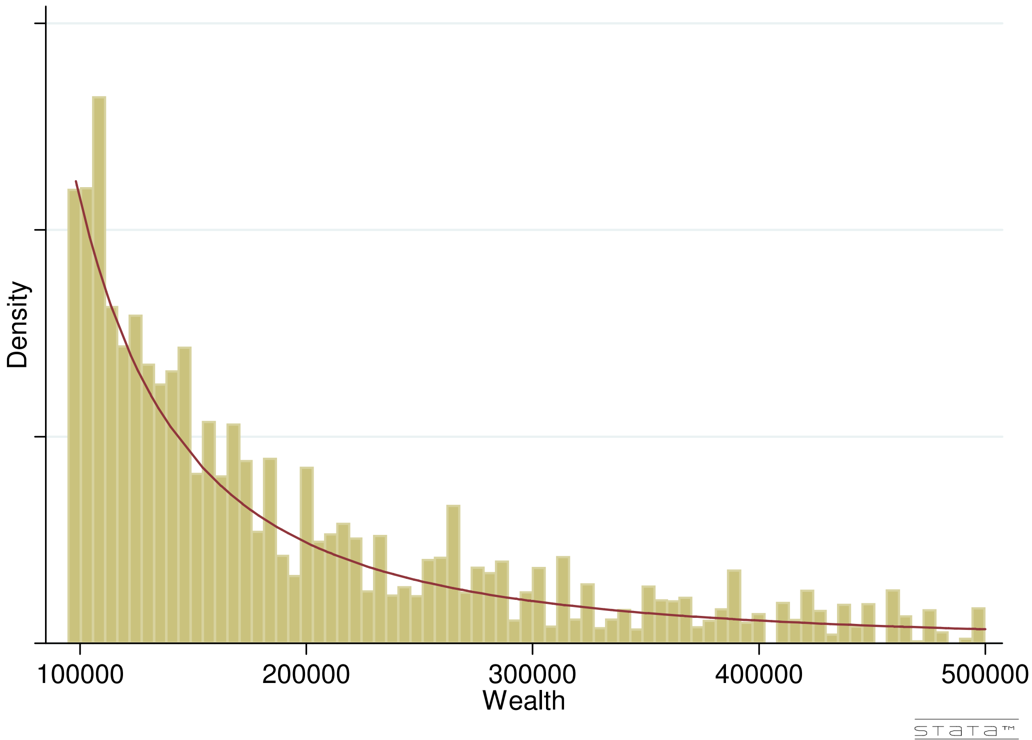
$$\mu\left(p_1 A_1\right)^{\frac{1}{1-\nu}} = \left(\frac{\gamma}{1-\gamma}\frac{p_2}{p_1}\right)^{\varepsilon}(1-\mu-\mu_0)\left(p_2 A_2\right)^{\frac{1}{1-\nu}} \tag{26}$$

5. Free entry into final good sector:

$$\left[\gamma^{\varepsilon} p_1^{1-\varepsilon} + (1-\gamma)^{\varepsilon} p_2^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} = 1 \tag{27}$$

8.5 US Distribution of Wealth and the Pareto Assumption

In this section, I show that the Pareto distribution is a good approximation of the upper tail of the wealth distribution. Figure 20 shows an histogram of the distribution of wealth among US households for 1983. Data is taken from the Survey of Consumer Finances. The figure shows households with wealth greater than \$95,000 - which represents 25% of the population. The figure also shows a Pareto density with shape parameter as the one assumed in the main text. We see that the Pareto density is close to the population histogram.



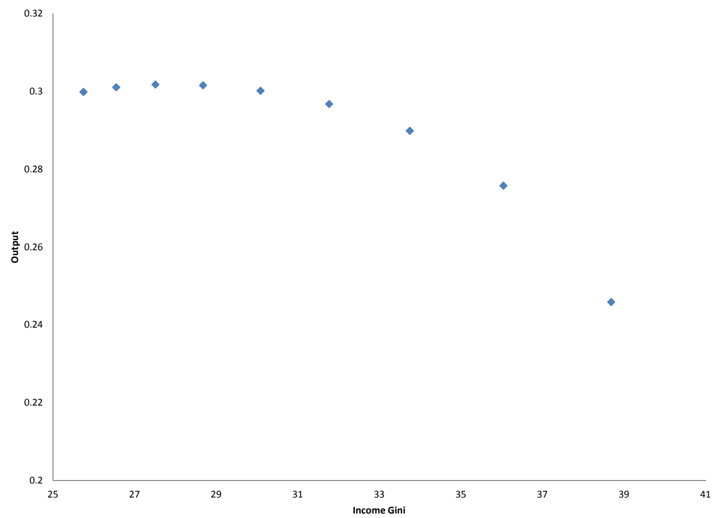
Notes: Data from the US Survey of Consumer Finances for 1983. The histogram shows data for households with wealth between \$95,000 and \$500,000. Both the normal and the high income sample are included. Wealth (net worth) is given by variable B3324, which is defined as.gross assets excluding pensions plus total net present value of pensions minus total debt (B3305 + B3316 - B3320). The solid line corresponds to the density of a Pareto distribution, with scale parameter \$95,000 and shape parameter equal to 1.1412.

Figure 20: Upper Tail of Wealth Distribution

I also perform a maximum likelihood fit of the Pareto distribution for wealth levels above \$95,000, and find an estimated shape parameter of 1.13. The value found in the calibration done in the main text was 1.14.

8.6 Sensitivity Analysis

Figure 21 considers the case in which the fixed cost is higher (f=\$200,000 instead of \$55,280). The rest of the parameters are kept at the values used in Section 6.1. I find that in this case the losses from wealth inequality are substantially smaller than in the baseline case with smaller fixed cost. First, for initially low values of inequality, a mean preserving spread can lead to higher output. Second, considering the full range of inequality values, output falls by about 18 percent, i.e. a substantially smaller loss than in the baseline model of the main text. These results are consistent with the discussion of the extensive margin channel in Section 3.3.

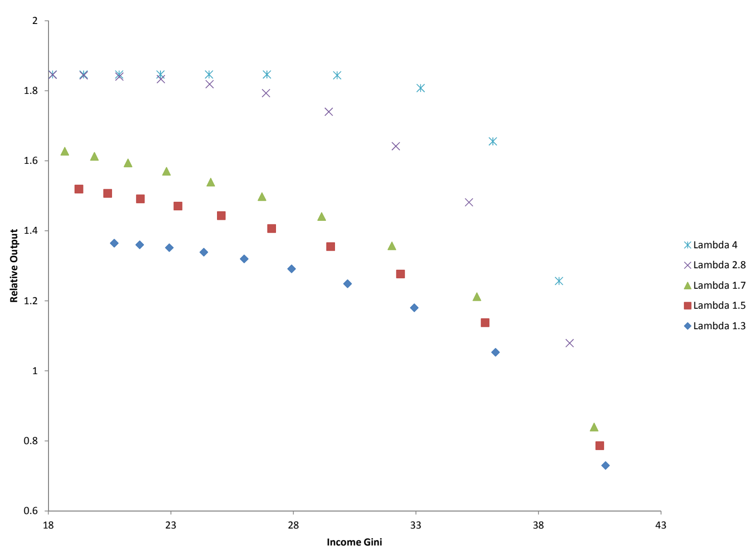


Notes: The Figure plots GDP relative to first best GDP against the maximum mass of agents that the planner can assign to sector 2.

Figure 21: Effects of Wealth Inequality for Higher Fixed Cost

8.7 Interaction Effects for Output

Figure 22 shows the effect of wealth inequality on relative output in sector 2, for different levels of financial development. The pattern is similar to the one reported in the main text for relative value added of sector 2.



Notes: The Figure shows the effect of income inequality (generated via higher wealth inequality) on relative output of sector 2, for different levels of financial development.

Figure 22: Interaction Effects in the Model

8.8 A Model with Ability

In this section, I extend the model of Section 3 to incorporate differences in ability. We now assume that agents are heterogeneous in both wealth and sector-specific ability a_i for $i = 1, 2$. Let $H(a_1, a_2, \omega)$ denote the joint distribution of wealth and ability. Agent (a_1, a_2, ω) has access to the following technology in sector i:

$$f(k, l; a_i) = a_i \left(k^{\alpha} l^{1-\alpha}\right)^{\nu}.$$

Optimal profits and input demands are given by expressions (6)-(12) in the main text, where A_i should be replaced by a_i. Conditional on the ability vector (a_1, a_2), agents still sort into the different occupations/sectors according to wealth. That is, agents choose the occupation/sector that maximizes their income $\max\{\pi_1(a_1, \omega), \pi_2(a_2, \omega), w\}$. Letting $o(a, \omega)$ denote the occupational policy function, the equilibrium is given by (p_1, p_2, w, r) such that:

1. Occupations are chosen optimally:

$$o(a, \omega) = \begin{cases} 0 & \text{if} \quad \max\{\pi_1(a_1, \omega), \pi_2(a_2, \omega), w\} = w \\ 1 & \text{if} \quad \max\{\pi_1(a_1, \omega), \pi_2(a_2, \omega), w\} = \pi_1(a_1, \omega) \\ 2 & \text{if} \quad \max\{\pi_1(a_1, \omega), \pi_2(a_2, \omega), w\} = \pi_2(a_2, \omega) \end{cases}$$

2. Capital market clears:

$$\int_{\{(a,\omega):o(a,\omega)=1\}} k_1(a_1, \omega)\, dH(a, \omega)$$
$$+ \int_{\{(a,\omega):o(a,\omega)=2\}} (k_2(a_2, \omega) + f)\, dH(a, \omega) = \mathbb{E}[\omega]$$

3. Labor market clears:

$$\int_{\{(a,\omega):o(a,\omega)=1\}} l_1(a_1, \omega)\, dH(a, \omega)$$
$$+ \int_{\{(a,\omega):o(a,\omega)=2\}} l_2(a, \omega)\, dH(a, \omega) = \int_{\{(a,\omega):o(a,\omega)=0\}} dH(a, \omega)$$

4. Final good producers' optimality:

$$\frac{\gamma}{1-\gamma}\left(\frac{Y_1}{Y_2}\right)^{-1/\varepsilon} = \frac{p_1}{p_2} \equiv \frac{1}{p}$$

   where

$$Y_1 \equiv \int_{\{(a,\omega):o(a,\omega)=1\}} f(k_1(a_1, \omega), l_1(a_1, \omega); a_1)\, dH(a, \omega)$$
$$Y_2 \equiv \int_{\{(a,\omega):o(a,\omega)=2\}} f(k_2(a_2, \omega), l_2(a_2, \omega); a_2)\, dH(a, \omega)$$

5. Zero profits in final good:

$$\left[\gamma^{\varepsilon} p_1^{1-\varepsilon} + (1-\gamma)^{\varepsilon} p_2^{1-\varepsilon}\right] = 1.$$

Parametrization of Joint Distribution. I parametrize the joint distribution of ability and wealth, $H(a_1, a_2, \omega)$, as follows. Assume that a_1, a_2 are iid Pareto distributed:

$$P(a_i \geq \tilde{a}) = \left(\frac{a_m}{\tilde{a}}\right)^{\eta},$$

where a_m,η are the scale and shape parameters, respectively. Then, conditional on the ability vector $(a_{1,}a_2)$, wealth is log-normally distributed:

$$log(\omega)\,|log(a_1), log(a_2) \sim \mathbb{N}\left(\mu + \frac{1}{2}\rho \ln(a_1) + \frac{1}{2}\rho \ln(a_2), \sigma^2\right).$$

Thus, $H(a, \omega)$ is parametrized by 5 parameters $(a_m, \eta, \rho, \mu, \sigma)$, where a_m, η control the mean and dispersion of ability, μ, σ control the mean and dispersion in wealth and ρ controls the correlation between wealth and ability. To see this, note that the conditional mean for wealth is given by:

$$\mathbb{E}[\omega\,|\mathbf{a}] = e^{\mu+\sigma^2/2} a_1^{\rho/2} a_2^{\rho/2},$$

so that ρ governs the elasticity of average conditional wealth with respect to ability. It can be shown that average wealth is given by

$$\mathbb{E}[\omega] = e^{\mu+\sigma^2/2}\left(\frac{\eta}{\eta - \rho/2}\right)^2 a_m^{\rho},$$

which is finite under $\rho/2 < \eta$.

This parametrization allows us to perform mean-preserving spreads to the distribution of wealth without affecting the total amount of wealth available for each ability type. More precisely, an increase in σ accompanied by a decrease in μ that keeps $\mu + \sigma^2/2$ constant tends to increase the dispersion in wealth (both within ability types and overall) without affecting $\mathbb{E}[\omega\,|\mathbf{a}]$.

Calibration. The calibration strategy of the model with ability follows the baseline calibration in the main text for parameters that are common to both models and adds the following moments for the novel parameters. The parameter that controls the correlation between wealth and ability, ρ, is chosen to match the correlation between wealth and entrepreneurship observed in the US data. Following Buera, Kaboski, and Shin (2011), the parameter governing the dispersion in ability, η, is chosen to match the degree of concentration in the distribution of firm size (measured as employment) in the US. The scale parameter of the ability distribution, a_m, is chosen to match the real interest rate. The rest of the parameters are calibrated as in the main text.[62]

I obtain data on entrepreneurial status from the Survey of Consumer Finances. I consider several definitions of entrepreneur following Cagetti, De Nardi, and others (2006). The first definition includes business owners or self-employed. The second definition includes all individuals who own privately held businesses buy may not manage them. The third includes business owners who actively

[62] Note that the parameters governing the mean and dispersion of the distribution of wealth conditional on ability, μ and σ, are analogous in the current model to θ and ω_{min} in the main text.

	Percent in Population	Share of Total Wealth	Correlation Wealth-Entrep.
1. Business Owners or Self Employed	17.68	58.04	0.18
2. Business Owners	14.44	54.78	0.20
3. Business Owner and Manager	12.06	45.98	0.18
4. Self Employed	10.43	26.65	0.09
5. Own, Manage and Self Employed	6.77	21.63	0.10

Notes: Data based on Survey of Consumer Finance, 1983. Wealth (net worth), coded as B3324, is defined as gross assets excluding pensions, plus total net present value of pensions, minus total debt (B3305 + B3316 - B3320).

Table 21: Entrepreneurship and Wealth

Target Moment	US Data	Model	Parameter
Average Wealth	$ 119,724	$119,010	μ= 3.56
Wealth Gini	77.98	77.41	σ^2= 1.49
Interest Rate	0.06	0.05	a_m =0.23
Share of Capital	0.3	0.33	α = 0.42
Income Gini	41.77	41.63	ν =0.72
Employment Share by Top 10 %	0.69	0.7	η= 4.5
Correlation Wealth- Entrep.	0.18	0.11	ρ= 3.98
Share Ext Dep Sector	0.647	0.63	γ= 0.42
Relative Capital Intensity	1.77	1.42	f=$1,000,000

Notes: Share Ext Dep Sector stands for the share of externally dependent sectors in manufacturing value added. In the data, 36 manufacturing sectors are classified in two groups according their level of external financial dependence as defined in RZ. The employment share of the top 10% establishments corresponds to the share of total employment accounted by the largest 10% establishments. Data on establishment employment is taken from the US Economic Census of 1987. The correlation between wealth and entrepreneurship is computed from data of the Survey of Consumer Finance of 1983. Entrepreneurs are individuals that are business owners or self employed.

Table 22: Calibration: Model with Ability

manage their business. The fourth definition includes self-employed individuals only. The fifth one includes business owners who are managers and also self-employed. Table 21 contains descriptive statistics. For the calibration, I focus on the first definition of entrepreneurship.

Table 22 contains the results of the calibration. The model is able to match well most moments, except the correlation between wealth and ability and the relative capital intensity, which are both underestimated. In terms of non-targeted moments, Figure 23 shows the fraction of entrepreneurs for 10 wealth deciles, both for the data (according to the different definitions considered) and the calibrated model. The model generates a pattern of increasing prevalence of entrepreneurship as we move up in the distribution of wealth, although not as strong as in the data.

Effect of Wealth Inequality. With the calibrated model at hand, I now study the effect of mean preserving spreads in the conditional distribution of wealth. I keep the parameters governing technology (α, ν), the marginal distribution of ability (a_m, η), and the wealth-ability correlation ρ fixed at their US level given by Table 21. I set the level of financial development λ to match the

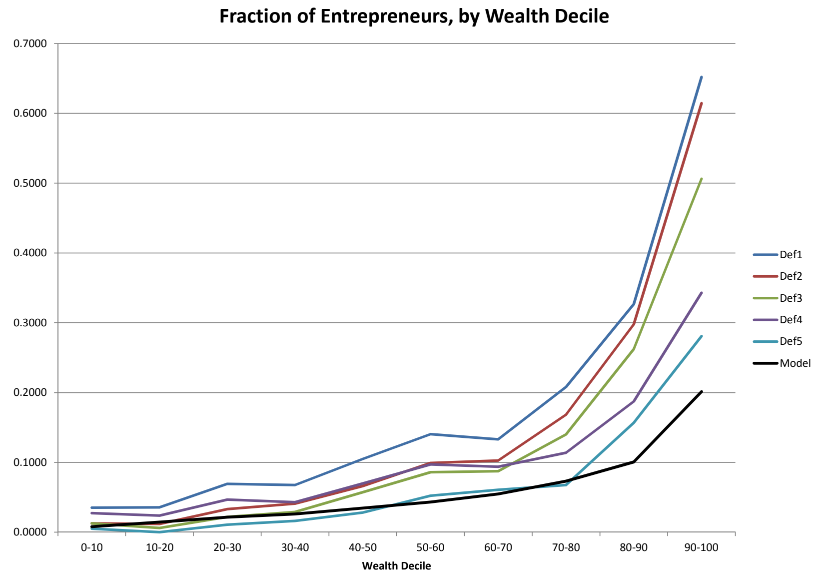


Figure 23: Fraction of Entrepreneurs by Wealth Decile: Model and Data

external finance to GDP ratio of the median country in the sample (0.69) which yields $\lambda = 1.22$. I then perform mean preserving spreads to the conditional distribution of wealth given ability. Formally, $\Delta\sigma^2 > 0$ and $\Delta\mu = -\Delta\sigma^2/2$. This ensures that, within every ability type (a_1, a_2), there is larger dispersion in wealth while average wealth is kept constant. In other words, the allocation of wealth across ability types, given by $\mathbb{E}[\omega\,|\mathbf{a}]$, is kept constant. I choose a range of values of σ^2 to span a wealth Gini coefficient between 60 and 89, the range observed in the data. Figure 24 contains the results. We see that an increase in wealth inequality of about 30 points in Gini leads to losses in output of about 16 percent. This number is about half as large as the one reported in the baseline model in the main text.[63] Note that in the model with ability considered in this section the calibrated fixed cost turns out to be much larger than the one in the baseline model without ability. As discussed in Section 3.3, a large fixed cost can make inequality more beneficial by allowing agents to enter the more externally dependent sector.

[63]In the baseline model without ability in the main text, we found that an increase in 30 points in the wealth Gini led to a reduction in output of about 30 percent.

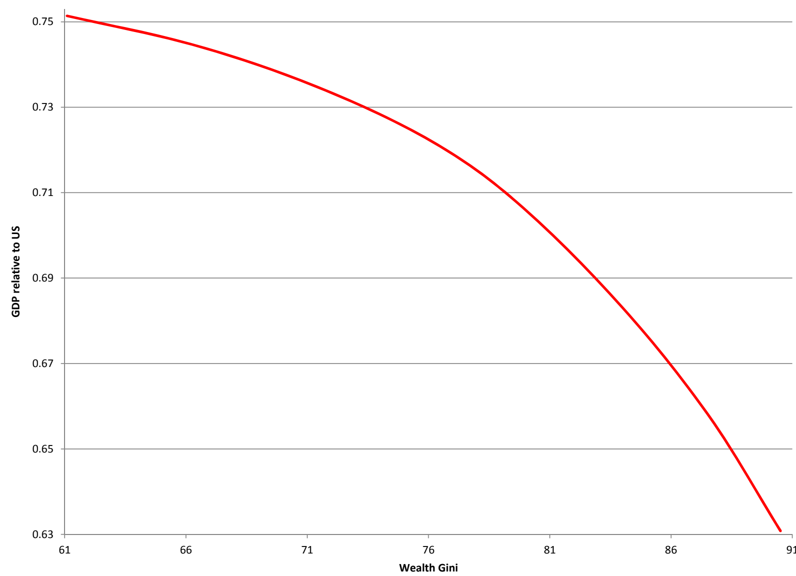


Figure 24: The Losses from Wealth Inequality: Model with Ability