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. The model features key elements from the literature on financial frictions and economic development. I calibrate the model to match standard 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 that is consistent with an increase in income inequality of 15 points in Gini generates losses of 46 percent of per capita income.

1 Introduction

A large body of work in economics studies the effects of financial frictions on the economy. The main 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 becomes relevant for the determination of 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 central goal of this paper is to shed light on this question.

Answering this question raises a number of theoretical and empirical challenges. On the theory side, wealth inequality is likely to be associated with multiple effects, many of them 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, thus allowing the economy to overcome financial frictions. At the same time, when production is subject to decreasing returns, wealth inequality may induce an inefficient distribution of firm size, with some firms being too large and others too small. The overall impact of wealth inequality on the economy will depend on which of these forces dominates. On the empirical side, there are two main problems. First, data on wealth inequality is typically not available for financially developing countries. For this reason, many studies have instead focused on income inequality. Second, it is hard to identify the effects of income inequality on the *aggregate* economy. This difficulty is perhaps best exemplified by the literature on income inequality and economic growth, in which different papers have reached opposite conclusions. A fundamental concern in studying the relationship between inequality and aggregate outcomes at the cross-country level is country-specific omitted variable bias.

To overcome these problems, I propose to use the cross-sectoral variation in firms' reliance on external finance. I exploit the idea that inequality should have a differential effect on sectors that rely more heavily on external finance. On the empirical side, this allows me to better identify the effects of income inequality, albeit at the cross-country cross-industry level. I provide direct evidence of an impact of inequality on the cross-sector structure of production, but I do not identify the aggregate effect of inequality. To make progress, a theory is needed. I build a two-sector model with financial frictions and decreasing returns, in which one sector has larger capital requirements. As expected, the effect of wealth inequality on the degree of misallocation depends on parameters. For this reason, I proceed to calibrate the parameters of the model. I first calibrate the technology parameters to match key moments of the US economy. Assuming that technology is common across countries, I then vary the degree of wealth inequality to span a range of income Gini coefficients as observed in the data.[1] I test the model by assessing whether it can match the documented 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.

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[1]That is, I use the calibrated model to address the lack of data on wealth inequality. I use the model's mapping between wealth and income inequality, together with the observed range of income Gini coefficients, to identify a range for wealth inequality.

I start by establishing three new facts. First, using the difference-in-difference methodology pioneered by RAJAN AND ZINGALES (1998), I show that industries that rely more heavily on external finance account for disproportionately *higher* shares of total manufacturing value added in countries with better financial institutions.[2] Second, and more important for the purpose of this paper, I show that industries that rely more heavily on external finance account for disproportionately *lower* shares of total manufacturing value added in countries with higher income inequality.[3] Thus, industries that rely more heavily on outside finance tend to be larger in financially developed countries and smaller in high income inequality countries. Third, I find significant evidence of *interaction* effects between income inequality and financial development. Perhaps counter-intuitively, the disproportionately negative effect of income inequality on value added shares and output of the high external dependence sectors becomes *stronger* when financial development improves. However, when financial development is high enough, this interaction effect is reversed so that financial development weakens the negative impact of inequality on cross-sectoral levels.

To account for the documented facts on income inequality, financial development and cross-industry outcomes, I build a two-sector model in which sectors differ in their fixed-cost requirement, agents are subject to collateral constraints, and production features decreasing returns. Agents have different levels of wealth, and choose whether to work for a wage or start a firm in one of the two sectors. The ingredients of the model are standard in the literature on financial frictions and economic development.[4] The difference in fixed costs creates a difference in financing needs across sectors, which will provide a way to map the model to the data. In equilibrium, agents sort into the different sectors/occupations according to their wealth, with poor enough agents becoming workers, intermediate agents sorting into the sector with low financial needs, and wealthy enough agents sorting into the sector with high financial needs.

In the model, wealth inequality affects the economy through three different channels and its final effect on the degree of production efficiency depends on parameters. To understand these effects, as an illustration, consider a mean-preserving poor-to-rich redistribution of one unit of wealth. 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 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*: wealth inequality can increase

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[2]This fact is related to the main finding in RAJAN AND ZINGALES (1998). They document that sectors that rely more heavily on external finance grow disproportionately faster in more financially developed countries. My fact is on levels, not growth rates.

[3]I focus on income inequality due to the lack of wealth inequality data for a wide range of countries.

[4]For example, GALOR AND ZEIRA (1993), BANERJEE AND DUFLO (2005) and BUERA, KABOSKI, AND SHIN (2011) feature technological non-convexities. MIDRIGAN AND XU (FORTHCOMING), BUERA AND SHIN (2010), and BUERA, KABOSKI, AND SHIN (2011) feature decreasing returns and occupational choice.

(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 either 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. The technological parameters are calibrated to match several moments of the US economy in the 1980s. The fixed cost requirement of the high external dependence sector is chosen to match the relative capital intensity across sectors, as documented in the data. I choose the degree of decreasing returns in production - which controls the slope of the profit function - so that the model maps the degree of wealth inequality into the degree of income inequality observed in the US. That is, I make sure that the model does a good job in mapping wealth to income inequality for the US, a country for which both income and wealth data is available.

I test the calibrated model by evaluating whether it can match the facts on financial development, income inequality and cross-sector levels. First, I vary the quality of financial institutions to span a range of external finance to GDP ratios as observed in the data. Consistent with the data, the model predicts that the ratio of external finance to GDP is positively associated with relative value added shares of the sector with high external financial dependence. Second, 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 the documented cross-sectoral relation: higher income inequality is associated with *lower* relative value added shares (and lower relative output) in the more externally dependent sector. Third, the calibrated model predicts interaction effects between income inequality and financial development that are compatible with the ones documented in the data. Specifically, for a range of low levels of financial development, the model predicts that the negative effect of wealth inequality on relative output becomes *stronger* as financial institutions improve. The intuition for this 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. This means that the effect on total capital demand is likely to be small. When financial frictions are less tight, 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 no effect on aggregate capital demand. Therefore, the capital demand channel can account for the non-monotone interaction effect found in the data.

I then use the calibrated model to study the *aggregate* effects of increased wealth inequality. Keeping average wealth and the technology parameters fixed at their US levels, I perform mean pre-serving 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 emerges: 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). Furthermore, wealth inequality reduces the number of agents that is able

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to meet the fixed cost and enter the more externally dependent sector (extensive margin channel). In this way, wealth inequality harms production efficiency through the three possible channels. Quantitatively, the losses from wealth inequality can be large. An increase in wealth inequality that leads to an increase in income inequality of 15 points in Gini reduces income per capita by 46%. I show that about a quarter of these losses can be accounted by the extensive margin channel.

Finally, I use the calibrated model to study the losses from financial frictions, keeping the distribution of wealth constant. I find that financial frictions can reduce output per capita by up to 35%.[5]

Related Literature. This paper is related to several literatures in economics. A large empirical literature studies the effects of income inequality on macroeconomic performance. The standard approach to measure this relationship has been to run a variant of Robert J. Barro's cross-country regression, with inequality added as an independent variable.[6] As is well-known, this methodology is subject to the econometric problem 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, thus helping reduce omitted-variable bias (see FORBES (2000) and LI AND ZOU (1998)). I contribute to this literature by providing an alternative way to identify the effects of income inequality on macroeconomic outcomes. By focusing on the cross-industry effects of income inequality, I am able to include country (and sector) fixed effects and address the issue of country-specific omitted-variable bias.

There is also a vast theoretical literature that studies the effects of inequality on macroeconomic outcomes. Two broad classes of theories predict an effect of the distribution of wealth on economic performance: political economy theories, and models of imperfect capital markets. In the former class of theories, inequality leads - via the political process - to the implementation of redistributive policies which may harm economic growth - see ALESINA AND RODRIK (1994) and PERSSON AND TABELLINI (1994) for prominent examples. In the latter class of theories, the distribution of wealth interacts with the friction in financial markets, and affects the way in which production resources are allocated. Seminal contributions in this area are BANERJEE AND NEWMAN (1993), GALOR AND ZEIRA (1993), PIKETTY (1997) and GREENWOOD AND JOVANOVIC (1990), among others. By documenting the differential effect of income inequality on sectors that rely more heavily on external finance, and the interaction effects between financial development and inequality, my paper provides evidence for financial frictions as a channel through which the distribution of wealth matters.

This paper is also related to the quantitative literature that studies the effects of financial frictions

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[5]In comparing this number with the losses found in the literature, an important caveat should be made. The literature typically studies the effect of financial frictions *across steady states* (see BUERA, KABOSKI, AND SHIN (2011), MIDRIGAN AND XU (2010)). That is, the economy is given an infinite amount of time to adjust to the change in financial institutions. In this paper I study the opposite case: I vary the degree of financial frictions while keeping the wealth distribution constant. In other words, I compute the losses from financial frictions *on impact*.

[6]For examples of this regression, see ALESINA AND PEROTTI (1996) and PERSSON AND TABELLINI (1994), among others

on aggregate productivity (JEONG AND TOWNSEND (2007), BUERA AND SHIN (2010), BUERA, KABOSKI, AND SHIN (2011), MIDRIGAN AND XU (2010), MOLL (2010)). This literature typically considers a dynamic framework in which agents are heterogeneous in wealth and ability, and there are idiosyncratic shocks. In this paper, I consider a stripped-down version of the typical model of this literature. In particular, I propose a static model with a single source of heterogeneity (wealth) and no shocks. I abstract from dynamics and shocks because I take the distribution of wealth as an exogenous primitive of the economy. In other words, the goal of this paper is not to provide a theory of the determinants of the distribution of wealth, but rather to study the effects of exogenous changes in it. Finally, I abstract from heterogeneity in ability to focus on a single type of misallocation, namely distortions in the allocation of capital across firms.[7]

The theoretical framework used in this paper is closely related to the one in BUERA, KABOSKI, AND SHIN (2011). They consider a two-sector economy in which differences in fixed cost requirements drive differences in external financing needs across sectors. They study the effects of varying the quality of financial institutions, and show that financial frictions reduce productivity disproportionately more in the sector with high financial needs. In this paper, I use a somewhat similar framework to study a different question: the effects of increased wealth inequality, for a given level of financial development. In this sense, the two papers should be viewed as complementary.

This paper is also related to the quantitative literature on wealth inequality (CAGETTI AND DENARDI (2006), QUADRINI (2000), CASTAÑEDA, DIAZ-GIMENEZ, AND RIOS-RULL (2003)). CAGETTI AND DENARDI (2006) study the role of financial frictions in explaining the high degree of concentration in wealth observed in the US. They ask whether borrowing constraints exacerbate or mitigate the degree of wealth inequality. In contrast, my paper takes the distribution of wealth as a primitive and studies the effects of exogenous changes in inequality on the degree of misallocation resulting from financial frictions.

Finally, this paper is related to the literature on credit market imperfections and international trade. KLETZER AND BARDHAN (1987) and MATSUYAMA (2005) provide theories where financial development is a source of comparative advantage in sectors that are more intensive in external finance. BECK (2003) and MANOVA (2008) show that indeed financial development increases exports disproportionately more in these sectors. While I do not focus on international trade, my model also features financial development as a source of comparative advantage in finance-intensive sectors. I provide evidence that financial development leads to disproportionately higher output and value added shares in sectors with high external financial dependence. More importantly, I emphasize the role of the distribution of wealth as a source of comparative advantage.[8] In this sense, my paper is related to WYNNE (2005) who shows that wealthier nations should produce more in sectors that are more affected by credit market imperfections. In this paper, I focus on a different aspect of the wealth distribution, namely the degree of inequality for a given level of average wealth.

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[7]Incorporating heterogeneity in ability would add a second type of misallocation to the model: the misallocation of talent across sectors/occupations and firms.

[8]In the Appendix, I show that my facts on income inequality and cross-industry levels also hold for exports. I show that countries with higher income inequality exhibit disproportionately lower export shares in industries that rely more heavily in outside finance.

The rest of the paper is organized as follows. Section 2 contains the empirical evidence on inequality, financial development and cross-industry outcomes. Section 3 outlines the model and Section 4 contains the calibration of the technology parameters. Section 5 tests the model by assessing whether it can match the cross-sector facts documented in Section 2. Section 6 studies the aggregate effects of wealth inequality. Finally, Section 7 concludes.

2   Empirical Evidence

The goal of this section is to provide evidence of the effect of income inequality and financial development on cross-industry levels.[9] As a measure of industry levels, I use the industry's share in total manufacturing value added. Section 8.2 in the Appendix considers output and export shares as alternative measures. I document three facts. First, sectors that rely more heavily on external finance exhibit disproportionately *higher* value added shares in countries with better financial institutions. Second, sectors that rely more heavily on external finance account for disproportionately *lower* shares of total manufacturing value added in countries with higher income inequality. Third, 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.

To take a first glance at the data, Section 2.2 compares average industry value added shares in high vs low external dependence industries, both for high and low income inequality countries. Then, Section 2.3 provides cross-country regressions of relative value added in high dependence industries on income inequality, financial development and several controls at the country level. Finally, since the cross-country methodology is subject to country-specific omitted-variable bias, 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 8.2 in the Appendix contains robustness checks, including alternative measures of financial development and income inequality.

2.1   Data

I use value added data for a sample of 39 countries and 36 ISIC Rev.2 manufacturing industries in 1980. 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.

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[9]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.

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 8.2.2 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.[10] 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.[11] The final sample consists of 39 countries, which are listed in Table 1.

Data on external dependence for 36 3-digit ISIC 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.

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[10]This is the same country sample size used in RZ. I adopt similar standards for the inclusion of countries in the dataset. Notably, I discard countries for which there is no data in the Industrial Statistics Yearbook that is separated by at least 5 years during the 80s. This is a way to increase the quality of the observations .

[11]The adopted criterion implies using, for a few countries, the Gini coefficient for a post-1980 year. A similar problem occurs 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 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.

2.2 Descriptive Statistics

As a first pass at gauging the effects of income inequality on cross-sector sector levels, I perform a simple split-sample analysis. I compare average industry value added shares of low and high dependent 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 shows that in low income inequality countries average industry shares in high vs in low external dependence sectors are similar. Countries with high income inequality, however, exhibit smaller shares in industries with high external dependence. In other words, income inequality tends to disproportionately decrease industry shares in sectors with high external dependence. The diff-in-diff estimate is -1.52%.

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 vs. low dependence sectors. The diff-in-diff estimate is 0.82%.

The split-sample averages in Table 2 suggest that financial development and income inequality have opposite effects on industry shares.

Panel A			
	High Inequality	Low Inequality	Difference
High FinDep	2.55 %	3.24%	2.02 %
Low FinDep	4.05 %	3.26%	0.71 %
Difference (Δs_k)	-1.50 %	-0.02 %	-1.52 %
Panel B			
	F. Developed	F.Developing	Difference
High FinDep	3.03 %	2.70%	0.33 %
Low FinDep	3.44 %	3.93%	-0.49 %
Difference (Δs_k)	-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

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 relative value added in country k as $rva_k \equiv va_{Hk}/va_{Lk}$, where va_{Hk} is nominal value added in sectors with external dependence higher than the median in total manufacturing value added 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 model on the cross-section of countries:

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

where λ_k is the capitalization ratio in 1980, G_k is the income Gini coefficient in 1980[12], and X_k is a vector of country-level controls including human capital stock (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 different 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.	Relative VA in High Dependence Industries		
	(1)	(2)	(3)
Capitalization ratio	0.744***		0.7233***
	(0.2241)		(0.2235)
Gini		-1.739*	-1.702**
		(0.9348)	(0.8212)
Controls	Y	Y	Y
Observations	39	37	37
R2	0.4208	0.3188	0.4908

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. 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 shares. I estimate the following specification:

$$s_{jk} = c + \alpha_j + \alpha_k + \beta_1 ed_j * \lambda_k$$

$$+\beta_2 ed_j * G_k + \beta_3 ed_j * \lambda_k * G_k + \epsilon_{jk} \tag{2}$$

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

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[12]When the Gini coefficient was not available for 1980, the closest possible earlier year was used.

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 value added shares between a sector with high (H) and a sector with low (H) external dependence. Letting $\Delta s_k \equiv s_{Hk} - s_{Lk}$ denote this *share differential*, we have that

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

which means that the share differential 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 the share differential. Likewise, the effect of financial development on the share differential is given by

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

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

Table 4 contains the results. 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.[13] 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.

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[13]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.	Industry's Share in 1980 Manufacturing VA			
	(1)	(2)	(3)	(4)
Ext dep x total cap	0.0147***		0.0140***	0.0385**
	(0.0039)		(0.0045)	(0.0154)
Ext dep x gini		-0.0336***	-0.0238**	0.0176
		(0.0097)	(0.0106)	(0.00252)
Ext dep x total cap x gini				-0.0558*
				(0.0293)
Country and Sector FE	Y	Y	Y	Y
Observations	1262	1196	1196	1196
R2	0.4645	0.4614	0.4690	0.4702

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 ratio of the industry's value added to the total manufacturing value added in 1980. 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. 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 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 Machinery's value added share should be 0.28 percentage points lower than that of Beverages, in Peru as compared to Pakistan. Note that the average share in the sample is 2.77 percent - as there is a total of 36 sectors. 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 inequality at its mean, the coefficients in column (4) imply that Machinery's value added share should be 0.62 percentage points higher than that of Beverages, 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 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. 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 (2) 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 sum up, 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	Industry's Share in Manufacturing VA			
	(1)	(2)	(3)	(4)
Ext dep x total cap	0.0083		0.0005	0.0516
	(0.0063)		(0.0093)	(0.0349)
Ext dep x gini		-0.0271***	-0.0264	0.0361
		(0.0100)	(0.0160)	(0.0446)
Ext dep x total cap x gini				-0.1229*
				(0.0737)
Observations	827	827	827	827
R2	0.4455	0.4471	0.4471	0.4486
Panel B - Financially Developed	Industry's Share in Manufacturing VA			
	(1)	(2)	(3)	(4)
Ext dep x total cap	0.0205**		0.0265**	-0.0291
	(0.0107)		(0.0111)	(0.0500)
Ext dep x gini		-0.0379*	-0.0627***	-0.2284
		(0.0209)	(0.0200)	(0.1504)
Ext dep x total cap x gini				0.1374
				(0.1124)
Observations	435	369	369	369
R2	0.5677	0.5654	0.5794	0.5812

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, for Financially Developing and Developed

3 The Model

3.1 Basic 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 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.[14]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 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 decreasing returns to scale 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 the 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 (FORTHCOMING),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 a widely used specification of the borrowing constraint: agents can only borrow up to a fraction of their wealth. More precisely, an agent with wealth ω is able to borrow a total of $(\lambda - 1)\omega$, where $\lambda \geq 1$ is a parameter that captures the degree of financial development in the economy. This specification is widely used in literature (BANERJEE AND NEWMAN (2003), BUERA AND SHIN (2010)), 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.

Finally, I assume that final good firms are not subject to the financial friction. This assumption is made for simplicity.

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

3.2 Equilibrium

In this section, I characterize 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 that all capital is borrowed, the production problem of agent ω in sector i is:

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

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

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

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

with associated unconstrained profits

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

The solution to the *constrained* problem is given by

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

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

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

$$\pi_i(\omega) = \left(\frac{1}{(1-\alpha)\nu} - 1 \right) \left(\frac{p_i A_i (1-\alpha)\nu}{w^{(1-\alpha)\nu}} \right)^{\frac{1}{1-(1-\alpha)\nu}} k_i(\omega)^{\frac{\alpha\nu}{1-(1-\alpha)\nu}} - (r+\delta)(k_i(\omega) + f) \quad (6)$$

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

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

FOCs imply

$$\frac{\gamma}{1-\gamma} \left(\frac{Y_1}{Y_2} \right)^{-\frac{1}{\varepsilon}} = \frac{p_1}{p_2} \tag{7}$$

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 $f \equiv f_2 > f_1 = 0$. Also, I will focus in 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 required 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.[15] These two thresholds are determined by the following indifference conditions,

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

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

For given prices, Figure 1 shows the returns to each occupation as a function of wealth.[16] 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.

Definition. Given a distribution of wealth $G(\omega)$, an equilibrium with positive production of

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[15]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.

[16]Note that for wealth values below f/λ profits in sector 2 are not defined.
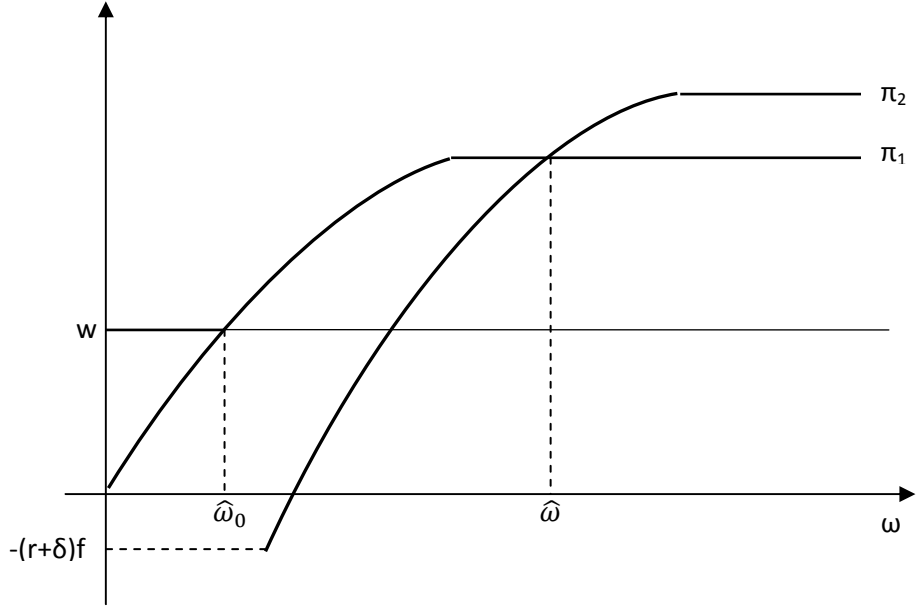
Figure 1: Occupation and Sector Sorting

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:

$$\int_{\hat{\omega}_0}^{\hat{\omega}} k_1 (\omega) \, dG (\omega) + \int_{\hat{\omega}}^{\infty} (k_2 (\omega) + f) dG (\omega) = E [G (\omega)] \tag{8}$$

3. Labor market clears:

$$\int_{\hat{\omega}_0}^{\hat{\omega}} l_1 (\omega) \, dG (\omega) + \int_{\hat{\omega}}^{\infty} l_2 (\omega) \, dG (\omega) = G(\hat{\omega}_0) \tag{9}$$

4. Final good producers' optimality:

$$\int_{\hat{\omega}_0}^{\hat{\omega}} A_1 k_1 (\omega)^{\alpha \nu} l_1 (\omega)^{(1-\alpha)\nu} \, dG (\omega) = \left(\frac{\gamma}{1 - \gamma} \frac{p_2}{p_1} \right)^{\varepsilon} \int_{\hat{\omega}}^{\infty} A_2 k_2 (\omega)^{\alpha \nu} l_2 (\omega)^{(1-\alpha)\nu} \, dG (\omega) \tag{10}$$

5. Zero profits in final good:

$$\left[\gamma^\varepsilon p_1^{1-\varepsilon} + (1-\gamma)^\varepsilon p_2^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} = 1 \tag{11}$$

The equilibrium prices and wealth thresholds completely characterize production in the economy, given the distribution of wealth.

Implicit in this definition is the *extensive margin* constraint that $\hat{\omega} \geq f/\lambda$.[17] 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. It turns out that in an equilibrium with positive production of both intermediate goods this constraint never binds (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.

Agent ω's end-of-period wealth is given by

$$(1+r)\omega + max\{w, \pi_1(\omega), \pi_2(\omega)\}$$

On the other hand, agent ω's income is given by

$$i(\omega) = r\omega + max\{w, \pi_1(\omega), \pi_2(\omega)\} \tag{12}$$

This equation will play an important role in the coming analysis.

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 agent (not necessarily constrained). 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.[18] 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

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

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

wealth. Thus, for given prices and wealth thresholds, any mean preserving spread in the distribution of wealth of agents in sector 1^{19} will reduce average output in this sector. Note that this is a partial 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 will have 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 will decrease 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^{20}, $\int_{\hat{\omega}_0}^{\infty} h(\omega) \, dG(\omega)$, where $h(\omega) = max\{\lambda\omega, k_2^u + f\}$ is capital demand of agent ω, irrespective of her sector. Since $h(\omega)$ is a concave function of wealth, any mean preserving spread to the distribution of wealth among entrepreneurs will reduce total capital demand. However, we can also have a situation where the wealthier agent is constrained while the poorer is not. Figure 3 depicts this situation. In this case, a poor-to-rich redistribution of wealth between the two agents will increase 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.
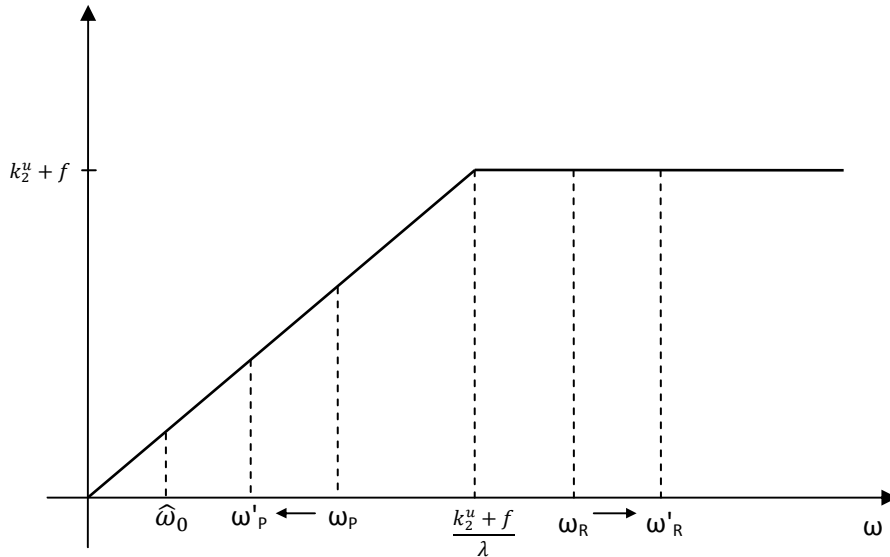

Figure 2: Wealth Inequality and the Capital Demand Channel

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

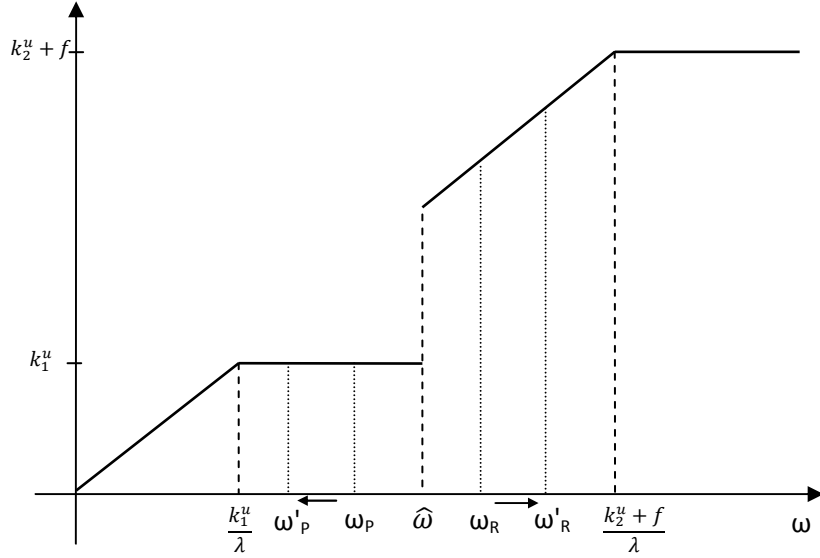[20]This happens whenever $k_1^u/\lambda \geq \hat{\omega}$.

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 the first best features a higher number of production units in sector 2. 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. This, in turn, 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 will most 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

The goal of this section is to calibrate the technology parameters of the model. I choose these parameters to match several key moments of the US economy in the 1980s. 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.[21] To calibrate these parameters, I will also need to calibrate the distribution of wealth and the quality of financial institutions for the US. Note however that, when studying the effects of inequality and financial development, the next two sections will not use the financial and wealth distribution parameters estimated in this section, but rather calibrate these parameters from 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.

I start by assuming that the distribution of wealth is Pareto, that is:

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

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 8.4 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: $E[G(\omega)] = \theta/(\theta-1)\omega_{min}$. 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:

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

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 (ω_{min}, θ). I calibrate these parameters so that the model matches several relevant moments of the US economy in 1980. 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[22],

$$A_1 = A_2 = A$$

This assumption allows me to fully focus on differences in capital intensity across sectors. Moreover, to identify differences in productivity across sectors I would need data on sectoral prices, p_1 and p_2, which the UNSD data does not provide.

The calibration procedure is as follows. I start by calibrating the wealth distribution parameters (ω_{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

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

[22]Other papers have done similar assumptions. For example, BUERA, KABOSKI, AND SHIN (2011) assume the distribution of talent to be symmetric across sectors.

of relative values on relative quantities 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 and (vi) the interest rate. While these 6 parameters are simultaneously chosen to match the 6 moments, it can be helpful to associate one parameter to each moment.

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,

$$\frac{(r+\delta) E\left[G\left(\omega\right)\right]}{Y} \tag{13}$$

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 $p_2 Y_2$ as value added in the high externally dependent sector. We can think of $1-\gamma$ as controlling the share of the externally dependent sector in manufacturing GDP, $p_2 Y_2/Y$. 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, will identify 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.[23] At the calibrated parameters, this relationship is increasing.

The span of control parameter - ν - is chosen so that the model generates a realistic level of inequality in the distribution of income. In other words, the model generates a mapping between

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[23]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:

$$(\lambda\omega)^{\frac{1-\nu}{1-(1-\alpha)\nu}} \left(\frac{w}{p_2 A(1-\alpha)\nu}\right)^{\frac{1}{1-(1-\alpha)\nu}}$$

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 (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

$$i(\omega) = r\omega + max\left\{w, \pi_1\left(\omega\right), \pi_2\left(\omega\right)\right\} \tag{14}$$

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 (6).[24]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 of capital.

Finally, the productivity parameter, A, is chosen to match the annual real interest rate in the US. Since we are feeding the model with a value for the total capital stock, $E[G(\omega)]$, the productivity parameter controls the marginal product of capital and thus affects the equilibrium interest rate.

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.[25] 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 $\omega_{min}^{US} = \$14,813.88$.

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[24]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.

[25]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.

	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

Measurement of Other US Moments I measure moments (i)-(v) 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 ISIC sectors into two groups, according to external financial dependence. I find that high external dependence sectors account for 64.7% of total manufacturing value added.[26] 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	3.18M

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 1.84 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 1.79. 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

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

Gini coefficients during the 1980s. Averaging over time helps reducing any potential measurement error present in the data. I find a value for the average income Gini coefficient of 36.9.

Finally, 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.

Elasticity of substitution between intermediates. A key 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 (7) and exploiting the time variation in relative value added and relative quantities. In particular, equation (7) implies the following relation between relative value added and relative quantities across sectors:

$$\log\left(\frac{p_2 Y_2}{p_1 Y_1}\right) = \log\left(\frac{1-\gamma}{\gamma}\right) + \frac{\varepsilon-1}{\varepsilon}\log\left(\frac{Y_2}{Y_1}\right) \tag{15}$$

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 provided. However, the UNSD data does provide quantity indices (or, alternatively, 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 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.

Target Moment	US Data	Parameter
Share of Ext.Dep. Sectors in Manufacturing VA	0.647	γ = 0.4262
Share of Capital in Manufacturing GDP	0.33	$\alpha = 0.5855$
Relative Capital Intensity in Ext.Dep. Sectors	1.79	f = $55,280
Income Gini	36.9	ν =0.7153
External Finance to GDP ratio	1.0183	$\lambda = 3.0790$
Interest Rate	0.0679	A = 1.0631

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

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 8.3 in the Appendix contains a precise 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 thus 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. Furthermore, there are 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.

	Calibrated US	First Best
Interest Rate	0.0679	0.0876
Wage	$19,451	$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 US vs First Best

The 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 will compare the model and the data on the income inequality dimension. Thus, the wealth inequality - income inequality mapping is of crucial importance. 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.[27] 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.
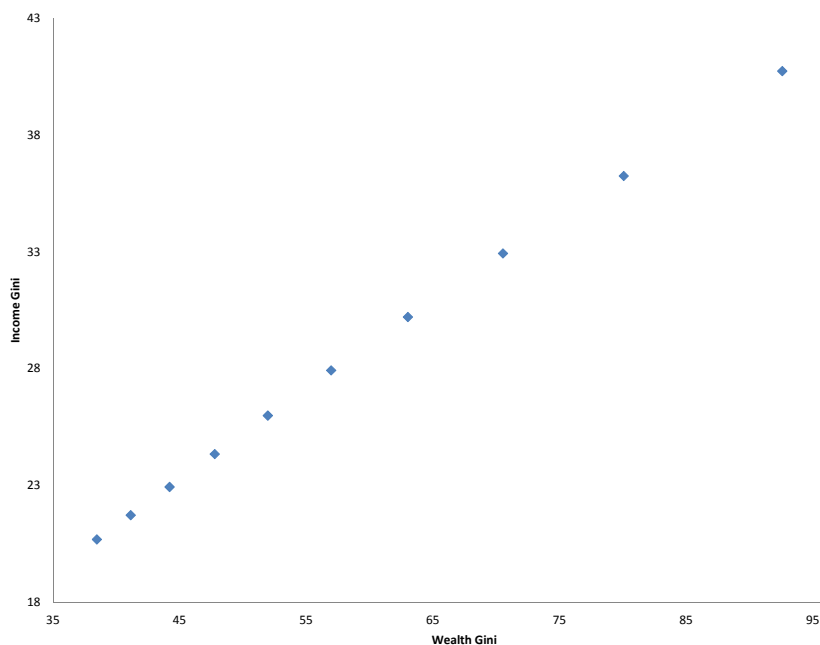
Notes: The figure plots the income Gini coefficient generated by the model for various levels of exogenous wealth inequality. Total wealth is kept constant. The model is evaluated at the calibrated parameters, and the level of financial development of the median country.

Figure 4: Wealth Inequality - Income Inequality Mapping

[27]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

The goal of this section is to bring the model to the data. To assess its performance, I evaluate whether the calibrated model can 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.

An important issue arises in performing this exercise: the need to identify a realistic range of values for the degree of inequality in the distribution of wealth. Recall that 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 the previous section. The remaining parameters - those controlling the distribution of wealth, (ω_{min}, θ) and the quality of financial institutions (λ) - will be varied to study the effects of inequality and financial development. To study each of these 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 $\theta = 1.10$ 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, both for the model and the data.

5.1 Financial Development and Relative Levels

Section 2 established 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 whether the calibrated model can match this fact. To do so, 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.

Figure 5 compares the model's predictions on relative value added across sectors, $p_2 Y_2 / (p_1 Y_1)$, 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.[28] This suggests that the model explains as causal about 30% of the cross-country relationship between relative value added and finance.
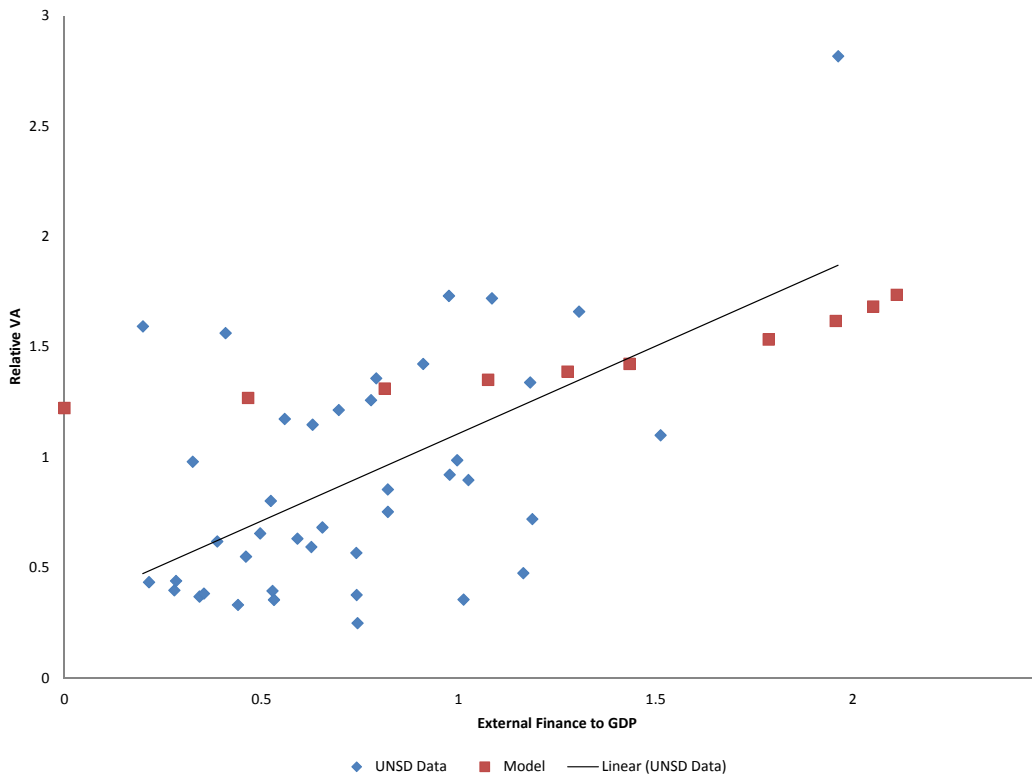
Notes: The Figure plots the ratio of value added in sector 2 to value added in sector 1, $\frac{p_2 Y_2}{p_1 Y_1}$, against the ratio of external finance to GDP, for both the model's simulations and the UNSD data for 1980.

Figure 5: Financial Development and Relative Value Added

5.2 Inequality and Relative Levels

Sections 2 and 8.2.3 establish 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 whether the calibrated model can match these facts. 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. 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.[29] In the sample, income Gini coefficients vary from approximately 25 to 62,

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

[29]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

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

with a median value of 38. The calibrated model is able to generate an income Gini coefficient of up to 40. 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[30]. 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 below. The calibrated model fares very well with this feature of the data.
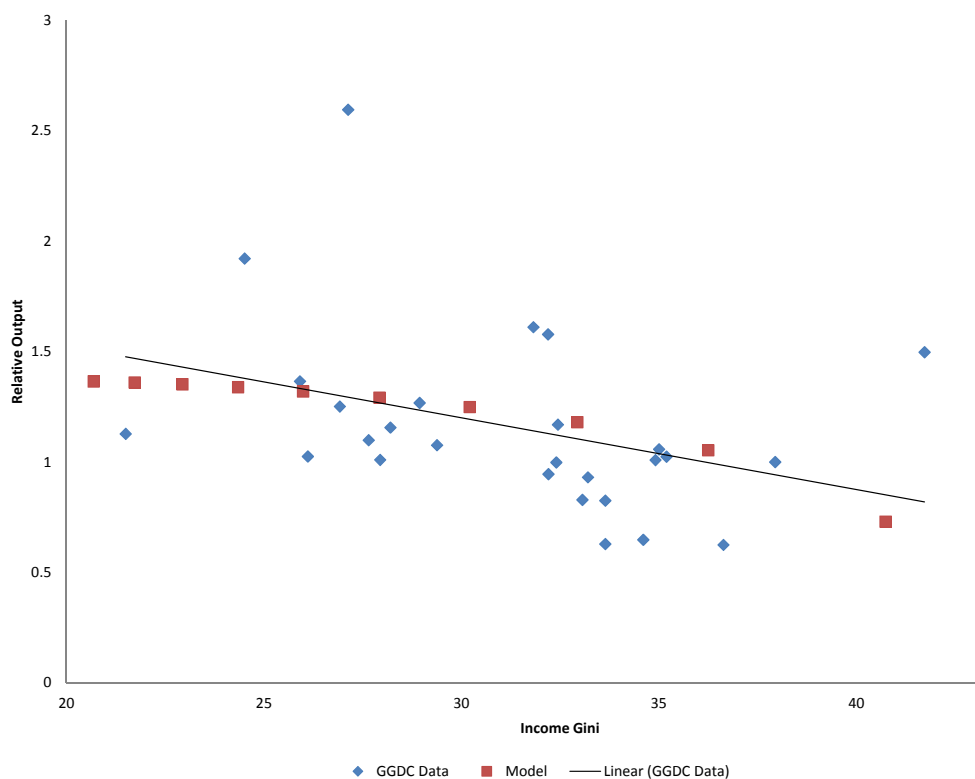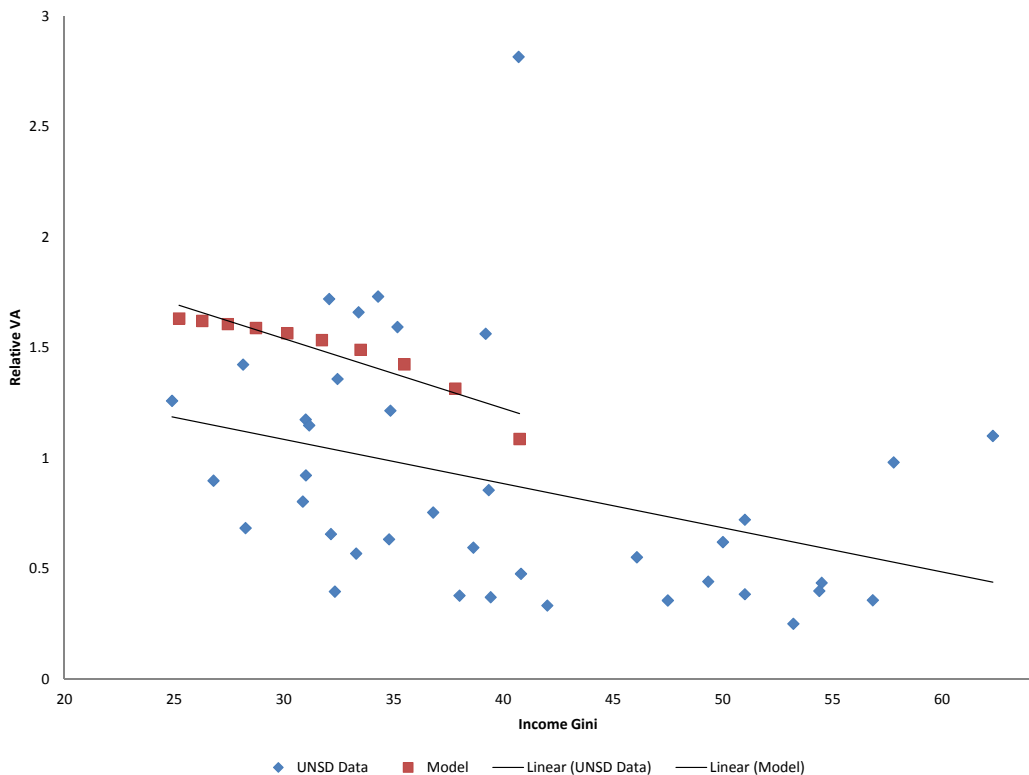

Notes: The figure plots the ratio of output in the high externally dependent sector to output in the low externally dependent sector, Y_2/Y_1, against the income Gini coefficient.

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 sector against income inequality, both for the sample and the UNSD data. At the calibrated elasticity

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[30]See Section 8.2.3 in the Appendix for details of the GGDC data.

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 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 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 1996. 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 Effects

Sections 2.4 and 8.2.3 document the presence of interaction effects between financial development and income inequality. Specifically, Table 4 shows 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 is *stronger* for more financially developed countries.[31] Table 18 in Section 8.2.3 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. In this section, I assess whether the calibrated model can generate 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 20 in the Appendix shows a similar patter for the effect of inequality on relative output of sector 2. The intuition for this effect comes from 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 capital demand channel is stronger in the high-λ economy. At some point, for sufficiently high λ,

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

both agents become unconstrained and the redistribution of wealth has no impact on capital demand. To sum up, the capital demand channel can account for the non-monotone interaction effect found in the data.
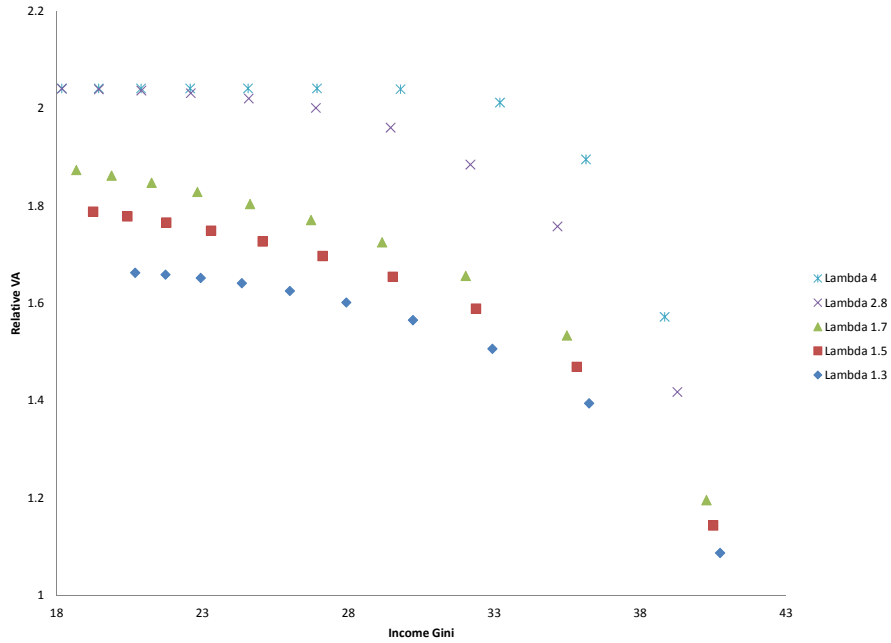
Notes: The Figure shows the effect of income inequality (generated via higher wealth inequality) on relative value added of sector 2, for different levels of financial development.

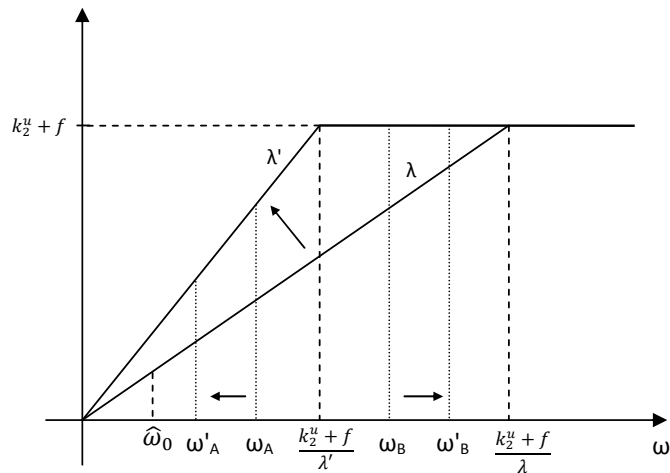Figure 8: Interaction Effects, Relative Value Added

Figure 9: Interaction Effects and Capital Demand

6 Wealth Inequality and the Losses from Financial Frictions

Having established the goodness of fit of the calibrated model, this section studies the overall impact of wealth inequality on the economy. 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 that is consistent with an increase in income inequality of 15 points in 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, by way of comparison, I compute the losses from financial frictions, keeping the distribution of wealth fixed. I find that financial frictions can reduce output per capita by up to 35%.

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 changes in parameters. Finally, Section 6.4 computes the losses from financial frictions.

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. I then perform mean preserving spreads to the distribution of wealth to span a range of income Ginis 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). 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).[32] 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 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

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[32]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.

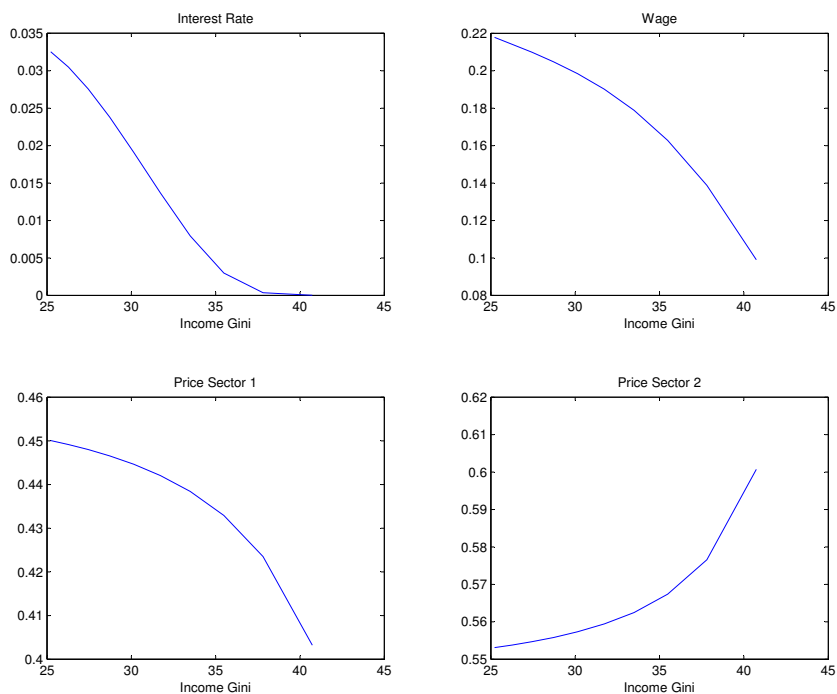also through the extensive margin channel.

Figure 10: Wealth Inequality and Equilibrium Prices

I now quantify the overall impact of wealth inequality on real per capita output. Figure 12 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. In the sample, the difference between the country at the 75th percentile of income inequality and the country at the 25th percentile is given by 18 points in Gini. The calibrated model predicts that an increase in wealth inequality that generates an increase in the income Gini of 15.5 points reduces output by 46.29%. The losses from wealth inequality can be large.
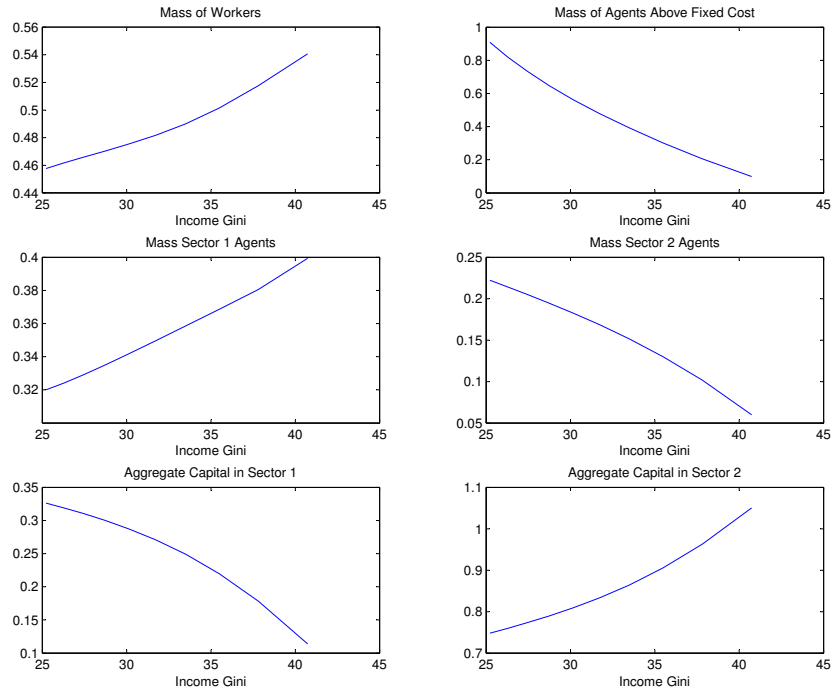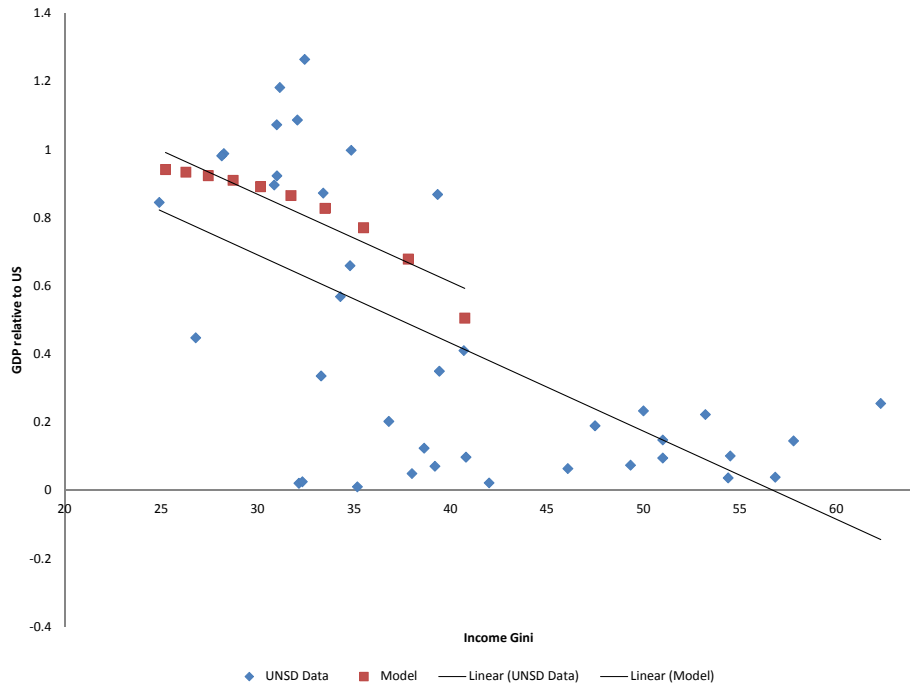
Figure 11: Wealth Inequality and Equilibrium Outcomes

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 12: The Losses from Wealth Inequality

The regression coefficient of output per capita on the income Gini coefficient is -0.991 for the model and -1.982 for the data.[33] Comparison of these coefficients suggests that variation in wealth inequality can account for about 50% of the relation between income inequality and real per capita GDP observed in the 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 tends to decrease 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 Losses from the Extensive Margin Channel

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 suboptimally 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.[34] 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:

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

subject to

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

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

$$1 - \mu - \mu_0 \leq c$$

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

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

[34]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 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 13 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.
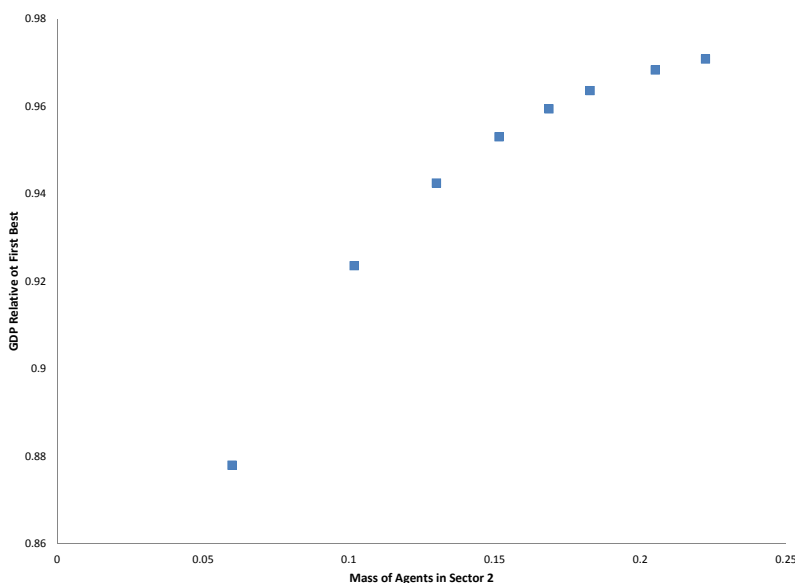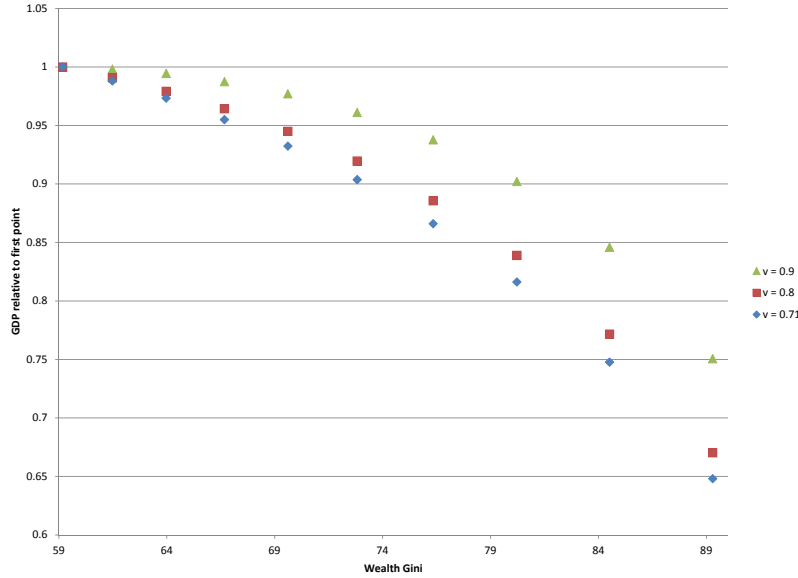

Notes: The Figure plots GDP relative to first best GDP against the maximum mass of agents that the planner can assign to sector 2.

Figure 13: Extensive Margin Losses

6.3   Sensitivity Analysis

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 8.5 in the Appendix performs sensitivity analysis with respect to the fixed cost. The span of control parameter governs the degree of decreasing returns to scale present in the technology of intermediate goods. Figure 14 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, since 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%.[35]

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[35]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 14: Span of Control and the Losses from Wealth Inequality

6.4 The Losses from Financial Frictions

I now use the calibrated model to 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.

Figures 15 and 16 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.[36] 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.

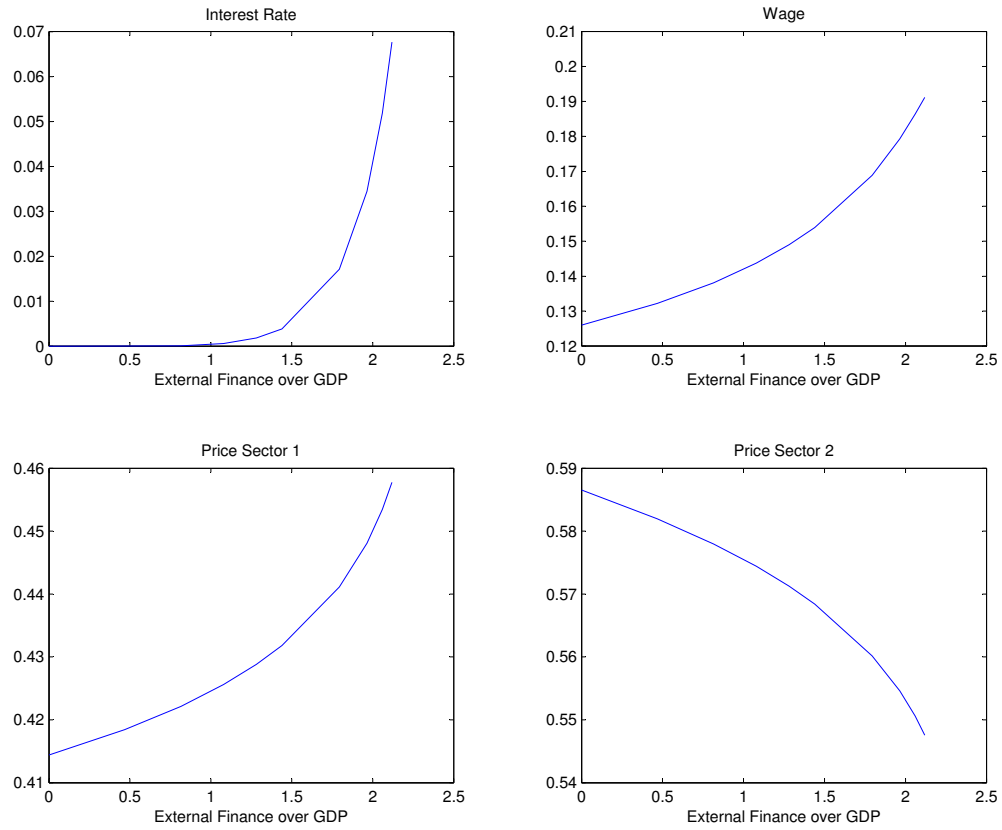[36]Note the convex shape of the relationship between the interest rate and λ.

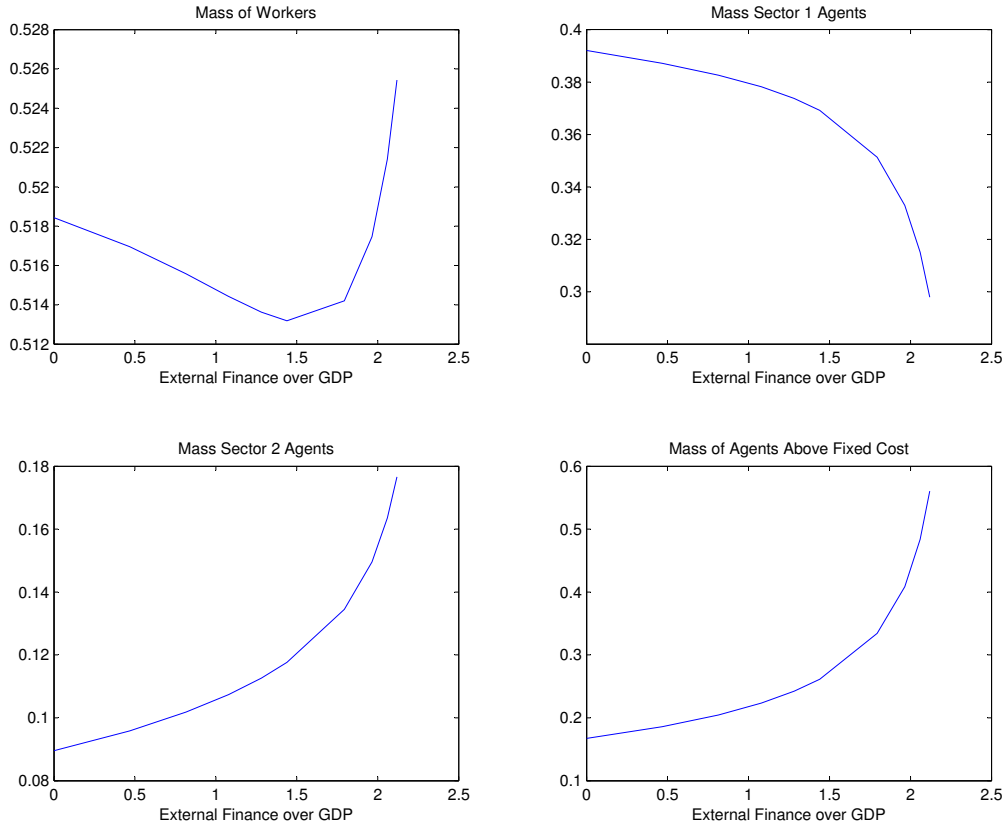Figure 15: Effects of Financial Development

Figure 16: Effects of Financial Development

I now quantify the overall impact of financial frictions on output per worker. Figure 17 shows the cross-country relation between finance and GDP per capita relative to the US, both for the data and the model simulations. In the calibrated model, financial frictions can reduce output to about 65% of the US level. The regression coefficient of output per capita on the ratio of external finance to GDP is 0.163 for the model and 0.201 for the data.[37] Comparison of these coefficients suggests that variation in the quality of financial institutions can account for about 80% of the cross country relation between finance and GDP observed in the data.

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[37]Both coefficients are significant at the 1% level.
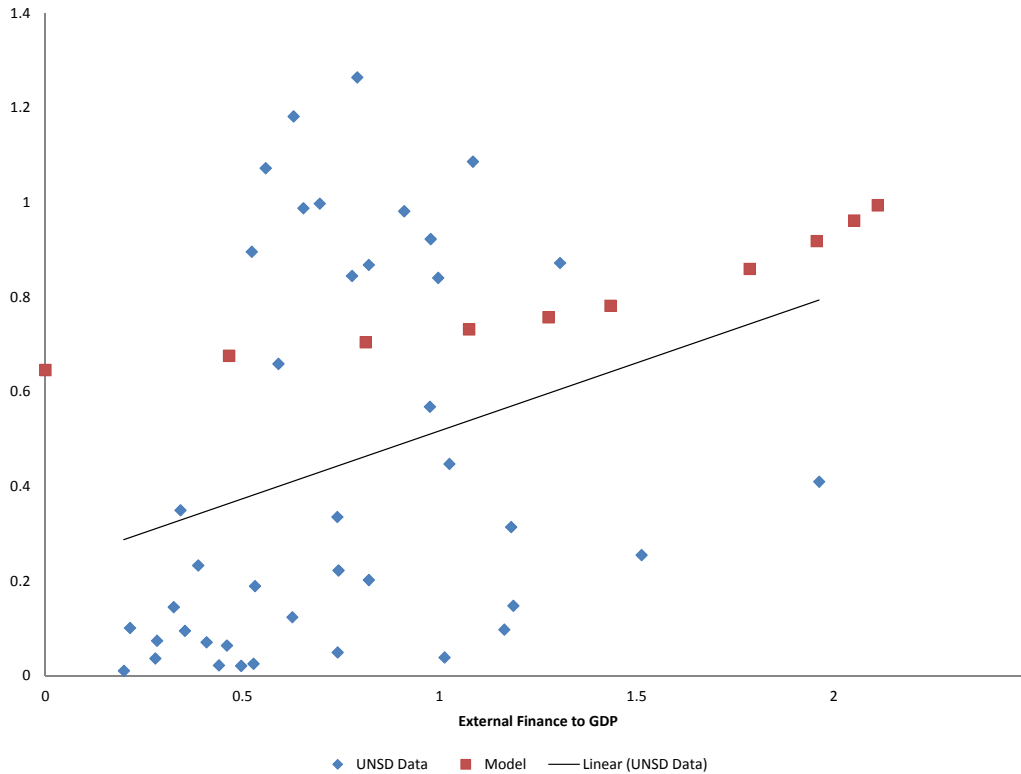
Notes: For the data, the Figure plots GDP relative to the US in 1980 against the external finance to GDP ratio. For the model, the figure plots GDP relative to first best against the external finance to GDP ratio.

Figure 17: Finance and Development

In comparing the losses from financial frictions reported in this section with the ones found in the literature, an important caveat should be made. The literature typically studies the effect of financial frictions *across steady states* (see BUERA, KABOSKI, AND SHIN (2011), MIDRIGAN AND XU (2010)). That is, the economy is given an infinite amount of time to adjust to the change in financial institutions. In this section, I have studied the opposite case where the economy is given no time to adjust. In other words, I have computed the losses from financial frictions *on impact*.

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 establish a number of new facts 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 finance. By focusing on cross-sectoral outcomes, which allows me to include country-specific fixed effects, I am able to reach a higher standard of 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 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. To assess the model's performance, I show that the calibrated model is able to match 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%.

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

Table 12: Year of initial inequality

8.2 Robustness

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

8.2.1 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 13 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.

46

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 13: 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 14, 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 14: Other Aspects of the Income Distribution, Cross-Country Cross-Industry

8.2.2 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 15 displays the results. Columns (1) and (3) show that the effects of income inequality on cross-industry value added shares is qualitatively similar to those found in the main text, when using the total capitalization ratio.

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 15: Other measures of financial development

8.2.3 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.

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 16 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.[38] 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.

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 16: 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 17 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

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

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 17: 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 18 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 18: Cross-Country Cross-Industry Regressions, Industry Output

8.2.4 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 THORSTEN BECK AND LEVINE (2000). Finally, data from income inequality is taken from DEININGER AND SQUIRE (1996). Table 19 contains the results.

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 19: Cross-Country Cross-Industry Regressions for Exports

8.3 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 two sectors. A static 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:

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

(16)

$$= w$$

2. Capital market clearing

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

(17)

3. Labor market clearing

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

(18)

4. Final good optimality

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

(19)

5. Free entry into final good sector

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

(20)

8.4   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 18 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.
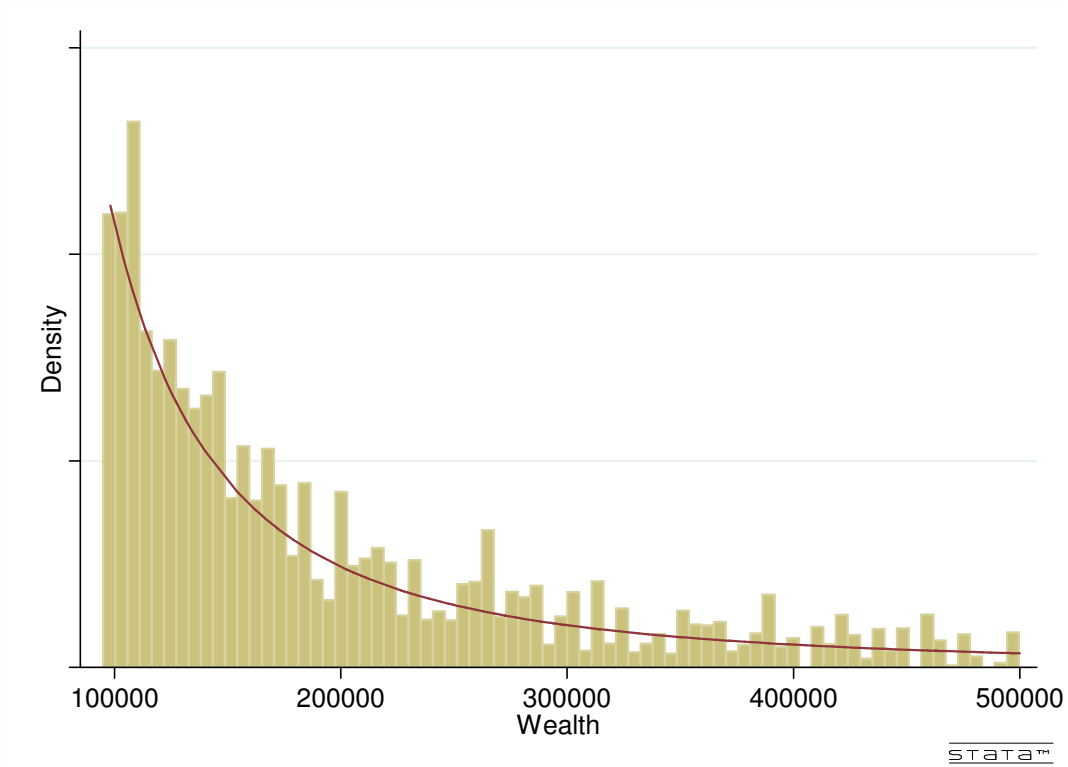
Notes: Data from the US Survey of Consumer Finances for 1983. The histogram shows data for households with wealth between $95,000 and $500,000. Both the normal and the high income sample are included. Wealth (net worth) is given by variable B3324, which is defined as.gross assets excluding pensions plus 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 18: 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.

8.5 Sensitivity Analysis

Figure 19 considers the case in which the fixed cost is higher (f=200,000 instead of 55,280). I find that for this case wealth inequality can have a positive effect on income per capita.
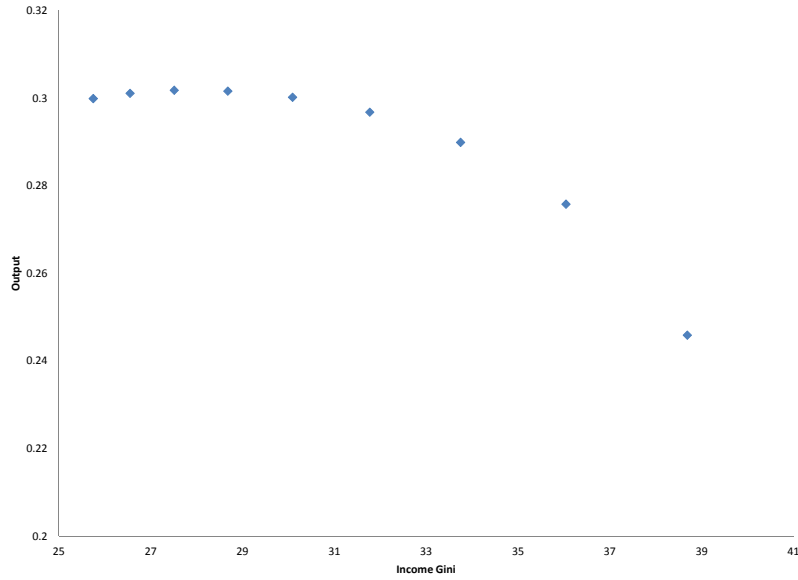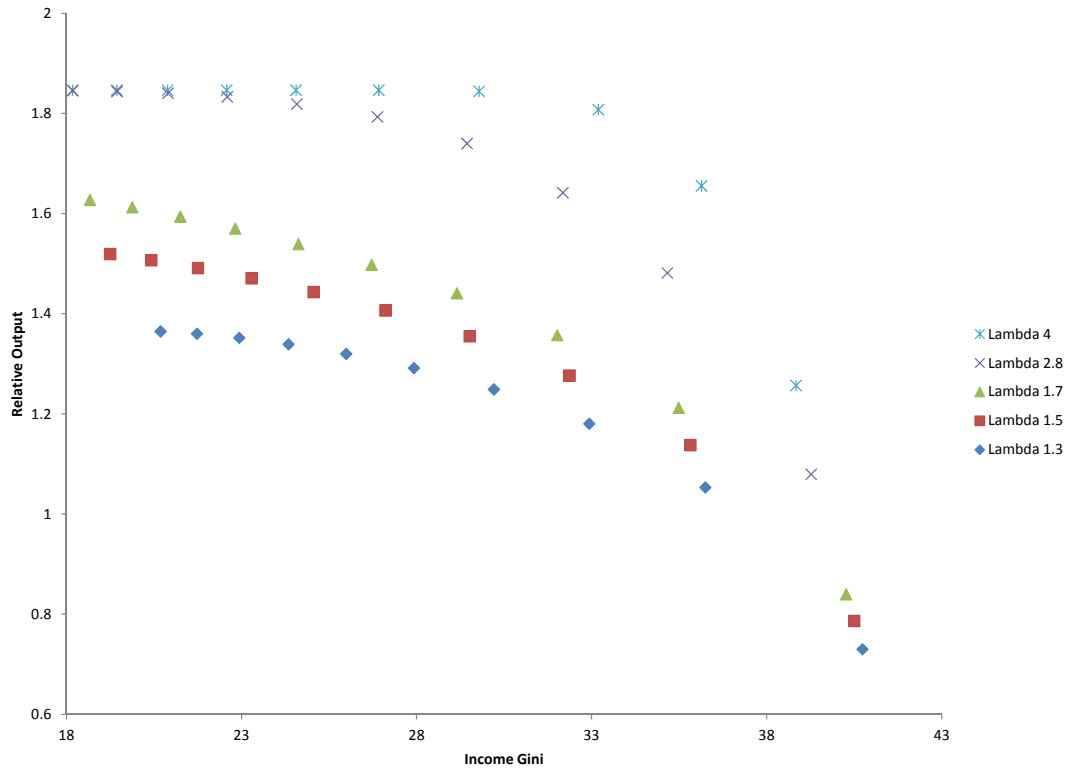
Figure 19: Effects of Wealth Inequality for Higher Fixed Cost

8.6   Interaction Effects for Output

Figure 20 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 output 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 20: Interaction Effects in the Model