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Resource misallocation and aggregate productivity

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Chapter One

Introduction

1.1 Background

Explaining the large income disparity across countries and regions has been one of the most important preoccupations of economics research. Standard economic theories have sought to explain income differences in terms of factor accumulation and total factor productivity (TFP). Decades-long research in development accounting has shown that TFP contributes at least as much as factor inputs in explaining income per capita. Most reviews of the literature contend that TFP accounts for 50% - 70% of per capita income differences across countries (Hsieh and Klenow, 2010; Caselli, 2005). An important challenge in this literature is identifying the origins of these considerable differences in aggregate productivity.

The conventional wisdom in the recent literature is that institutions are the fundamental determinants of long run differences in growth and development (Hall and Jones, 1999; Acemoglu and Johnson, 2005). By affecting the incentives of agents to engage in productive activities, inefficient institutions hamper the process of factor accumulation and productivity growth (Acemoglu and Zilibotti, 2001). A large theoretical and empirical literature also addresses how policies that undermine the adoption and diffusion of new

technologies lower aggregate productivity in developing countries (Parente and Prescot, 1994).

Aggregate productivity, however, masks substantial productivity heterogeniety. There is now extensive evidence that firms within very narrow industrial classifications exhibit large and persistent productivity heterogeneity (Syverson, 2011). Studies also show that reallocation among firms makes very high contribution to aggregate productivity growth (Foster *et al.*, 2001). Therefore, the low productivity observed in developing countries could be the result of inability to allocate production factors from less efficient to more efficient firms and sectors. Allocative inefficiency, or 'resource misallocation' as we refer to it in this thesis, could thus be an important reason for the large TFP gap observed across countries (Hsieh and Klenow, 2009; Bartelsman *et al.*, 2013).

Figure (1.1) highlights this point by identifying misallocation along with technology as a driver of aggregate productivity. While technological differences are often explained by institutional barriers for the adoption and diffusion of new innovations (Parente and Prescott, 1994), less is known as to why resource misallocation could vary across countries. What explains the coexistence of mediocre firms or sectors alongside highly productive ones in the same economy? In properly functioning markets, the high return in more productive sectors would lure producers away from less efficient sectors, increasing aggregate productivity in the process. Moreover, less productive firms in a well-functioning market would be driven out of the market by more efficient competitors, thus leading to reallocation to more productive firms.

Figure (1.1) identifies two potential explanations for the presence of misallocation. First, factor and product markets could suffer from imperfections that hinder the efficient allocation of resources across producers. For example, incomplete and asymmetric information problems in financial markets could induce inefficiencies by hampering the allocation of capital across producers (Greenwald *et al.*, 1984). Such market failures are widespread especially, but not exclusively, in developing countries. In countries like Ethiopia, for example, the uncompetitive and underdeveloped financial market has greater problems of screening efficient producers, which limits financial access to productive firms. This could lower aggregate productivity compared to other countries that have more developed financial sectors.

Secondly, poorly designed policies and institutions can hinder the efficient allocation of resources across heterogeneous producers. Distorting policies that induce resource misallocation, also called 'government failure,' are particularly rampant in developing countries (See Banerjee and Duflo, 2005; Erosa and Cabrillana, 2008). For example, restrictive and cumbersome labor regulation could reduce the flexibility with which firms can employ new workers during expansion and shed redundant workforce during slowdown. Another example of a distorting policy is government ownership of firms, which is widespread in many transition economies. Since public firms are likely to benefit from preferential market access from government agencies, they have greater chance of survival even when they are inefficient, whereas more productive private firms fail for the same reasons. Thus misallocation can be a consequence of institutions that protect inefficient firms.

Figure 1.1: The sources and implications of resource misallocation
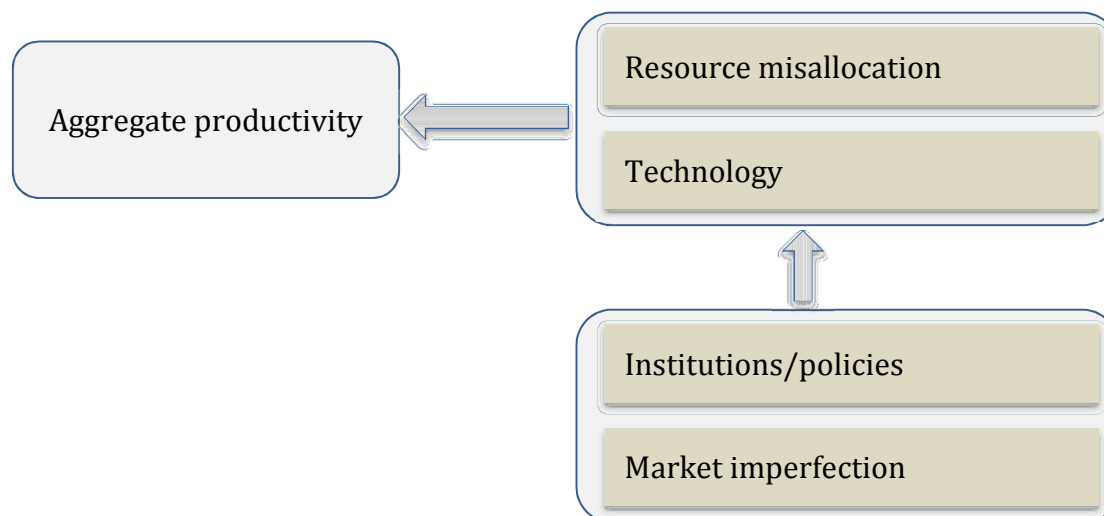
1.2   Motivation and Related Literature

The all-inclusive nature of aggregate productivity (or the Solow residual) has earned it the byname of being 'a measure of our ignorance'. Recent efforts seek to illuminate the constituents of aggregate productivity by looking beyond the standard explanation of technology. An emerging strand of literature emphasizes that resource misallocation across heterogeneous firms could be an important determinant of aggregate productivity. Since firms in the same industry often exhibit very large productivity differences (Syverson, 2011; Foster *et al.*, 2008), the way resources are allocated among them can have substantial effect on aggregate productivity.

Theoretical studies in this literature try to establish the mechanism through which reallocation affects aggregate productivity. An influential study by Melitz (2003) used a dynamic industry model with heterogeneous firms to show how trade openness increases aggregate TFP by facilitating the exit of unproductive firms. Following the same line of reasoning, Hsieh and

Klenow (2009) build a monopolistic competition model in order to measure the effect of resource misallocation on aggregate TFP. They find that misallocation in China and India reduces aggregate TFP respectively by 30 and 60 percent relative to the level of the United States.

Alfaro *et al*. (2008) show that resource misallocation that distorts firms' ability to grow to their optimal size plays an important role in explaining cross-country income differences. Similarly, Restuccia and Rogerson (2008) find that policies that distort prices faced by individual producers can substantially reduce aggregate output and TFP in the range of 30 to 50 percent. Bartelsman *et al.* (2013) report large differences across countries in the relationship between firm productivity and size, which they interpret as indicative of differences in allocative efficiency. Using a model in which heterogeneous firms face idiosyncratic distortions, they show that allocative efficiency, measured with the covariance term between size and productivity, is positively associated with aggregate economic performance.

Most of these theoretical studies use generic types of price distortions to determine the effect of misallocation on aggregate productivity (Restuccia and Rogerson, 2013). The price distortions are implicitly imputed from observed differences in marginal products of labor and capital. In order to affect the process of reallocation across producers, these distortions would have to be idiosyncratic – i.e. firms in the same market face different distorted prices instead of one equilibrium price (Restuccia and Rogerson, 2008; Alfaro *et al.*, 2008). However, the distortions are often taken to be exogenous, so that little is known as to how they arise and why they vary across firms.

Other studies follow the more direct alternative of quantifying the effect of a specific institutional or policy mechanism on misallocation. A number of studies use growth models to calibrate the effect of specific policy distortions on misallocation. Buera *et al.* (2011), Buera and Shin (2013), and Erosa and Cabrillana (2008) show that financial frictions adversely affect aggregate TFP. Barseghyan (2008) and Barseghyan and DiCecio (2011) analyze how entry costs increase misallocation, thereby inducing TFP differences across countries. Lagos (2006) studies the effect of labor market frictions on aggregate TFP.

1.3   Gaps and Research Goals

The existing literature on resource misallocation and aggregate productivity has a number of gaps that warrant further investigation. This thesis seeks to contribute to the literature by addressing two important issues that remain yet unexplored.

Firstly, there is limited effort in measuring and comparing cross-country differences in misallocation at a large scale. Due to lack of firm-level data that is comparable across countries, most empirical studies focus on measuring misallocation for a relatively small set of countries. Moreover, there is limited effort to synthesize the insights from the literature on resource misallocation with those from the older literature on development accounting. The first goal of this thesis is to provide more comprehensive evidence on the role of misallocation across countries. Besides measuring misallocation for a large number of countries, it aims to link it with established measures of aggregate TFP in order to identify the contribution of misallocation to TFP differences.

Secondly, there is limited evidence on the origins of cross-country differences in misallocation. Particularly, little is known how distortions that induce misallocation are affected by institutional factors since they are generally treated as exogenous parameters in the literature (Syverson, 2011). Although a number of studies theoretically explore the mechanism through which specific institutional factors induce misallocation (Restuccia and Rogerson, 2013), empirical support for this is largely lacking.

The second goal of this thesis is thus to provide new evidence on the underlying market and institutional forces that induce misallocation. The thesis investigates the specific mechanisms through which institutional bottlenecks and market imperfections induce resource misallocation. It especially pays attention to establishing how institutional factors induce idiosyncratic distortions by affecting firms and industries differently.

To meet the stated goals, I exploit recent advances both in methodology and data availability to measure and explain misallocation across a large number of countries. Methodologically, the thesis makes use of recent models of monopolistic competition that account for firm heterogeneity and imperfect competition. In terms of data, the thesis uses two datasets with their own unique advantages. The first dataset is the World Bank's Enterprises Survey (WBES) dataset which covers tens of thousands of establishments in more than 90 countries for the years from 2002 to 2011. Our second data source is the Ethiopian Manufacturing Establishments Survey dataset, which is a census-based, panel dataset covering all manufacturing establishments in the country with more than 10 employees over a 15 year period (1996-2010). Both datasets

are collected through proper survey design procedures, and provide detailed, structured data on a number of variables needed for our analysis.

Before discussing the outline of this thesis, it will be helpful to delineate the scope of the research included in it. Most importantly, the studies included in this thesis are exclusively based on plant-level data from the manufacturing sector. Resource misallocation in our case hence refers to misallocation across heterogeneous producers within the manufacturing industry. Although it is not the subject of this thesis, a number of studies do address the issue of misallocation across sectors[1].

Moreover, even within the manufacturing industry the studies included in this thesis are exclusively based on the formal sector. This is partly because comparable data within well-defined industrial groups is necessary to measure misallocation, which is generally lacking for the informal sector. Moreover, the formal sector is more suited for our analysis since one major goal of the thesis is to identify how institutional factors affect misallocation. Informal, unregistered firms are less relevant for our analysis since they are less likely to be affected by formal institutions such as labor regulation.

A final qualification is that the thesis focuses only on misallocation along the intensive margin. As indicated earlier, previous theoretical and empirical studies have shown the importance of reallocation along the extensive margin due to firm selection in process of entry and exit (Hopenhayn and Rogerson,

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[1] Caselli (2005) separately estimates TFP for agricultural and non-agricultural sectors in order to identify potential differences across sectors. His results suggest that misallocation across sectors has a limited role in explaining TFP differences. Vollrath (2009) similarly compares misallocation between and within agricultural and non-agricultural sectors in a cross country setting.

1993; Bartelsman *et al.*, 2013). This thesis, however, is confined to analyzing reallocation among existing plants, due to both the nature of the data it uses and the need to limit its scope.

1.4 Thesis Outline

This thesis includes four original studies, three based on the WBES dataset and the last one based on a panel dataset of manufacturing plants from Ethiopia. While the first study focusses on documenting the contribution of misallocation for cross country TFP differences, each of the other three studies look specifically into one institutional mechanism that contributes to misallocation. Two of the studies investigate the role of financial development in capital allocation among firms using different approaches and datasets. A large literature explores the importance of financial development on productivity, growth and economic development at large (for a review of this literature see Levine, 2005). This thesis presents a more focused analysis by studying how financial development affects the allocation of capital among firms. One of the studies in this thesis looks into the impact of employment on the allocation of labor inputs among firms. Employment protection has received great attention in the comparative economics literature that investigates the importance of institutional arrangements for economic performance (Botero *et al.*, 2004). This thesis directly looks into the implications of employment protection on labor allocation among firms, thus addressing a mechanism that is hitherto unexplored. Combined, these studies will provide broad understanding on how institutional arrangements affect resource misallocation and aggregate productivity.

a) The Role of Misallocation in Accounting for Manufacturing Productivity Differences

The first study, presented in the second chapter, investigates the role of misallocation in accounting for manufacturing productivity differences across countries. The aim of this study is to investigate the extent to which the large cross-country TFP disparity documented in the development accounting literature (Caselli, 2005) can be explained by misallocation of resources across producers. The study calculates manufacturing TFP for 52 countries covered by the WBES and Penn World Table datasets, and decomposes it into misallocation and residual components.

Compared to past studies in the development accounting literature, this study has several novel features. First, it explicitly recognizes the presence of productivity heterogeneity, and seeks to identify the contribution of misallocation in aggregate TFP. Secondly, unlike previous studies that generally use economy-wide data for measuring TFP, the present study calculates TFP for a single sector, manufacturing, reducing measurement problems associated with sectoral composition.

For measuring misallocation, we use the monopolistic competition model of Hsieh and Klenow (2009) which exploits variations in marginal products of labor and capital to impute implicit price distortions that affect the allocation of resources. Using these results, we then decompose aggregate manufacturing TFP into 'misallocation' and residual components. The results show that misallocation substantially reduces manufacturing TFP. The average country in our dataset could raise its TFP by 62% if it were to improve the efficiency of factor allocation to the relatively more efficient level of the US economy.

However, the results also show that misallocation is only weakly correlated with productivity, implying that factors other than resource misallocation are important in explaining the productivity variation across countries.

b) Employment Protection and Misallocation of Resources across Plants: International Evidence

Although the results from the second chapter show that misallocation is not systematically related to observed TFP, they indicate large productivity losses from it (the average country losing 62% relative to US). Moreover, the results indicate large differences in the level of misallocation across countries, possibly reflecting differences in the policy environment that determines allocative efficiency.

The second study, presented in chapter three, turns to explaining the sources of misallocation. The goal of this study is to empirically test the effect of labor regulation on different measures of misallocation using country- and industry-level data. Stringent employment protection raises the financial and procedural burden of hiring and firing workers, potentially clamping down on the adjustment of employment in response to demand and technological shocks. A number of theoretical studies have documented the adverse effect of employment protection on aggregate productivity (Hopenhayn and Rogerson, 1993; Lagos, 2006). However, there is limited empirical evidence on the mechanisms through which employment protection affects misallocation.

In this study, I measure misallocation using the dispersion of marginal products, which is less controversial since it involves fewer assumptions than

the structured model used in the previous chapter. More specifically, misallocation is measured using the standard deviation and interquartile range of the marginal product of labor and total factor revenue productivity across plants within an industry. Larger levels of dispersion indicate misallocation since they imply unrealized TFP gains from reallocating resources from more productive to less productive firms.

The analysis is based on a version of the WBES dataset that covers close to 30,000 manufacturing plants in 91 countries. The results show that the cost of dismissing redundant workers is positively associated with misallocation. The effect of dismissal cost is especially larger in industries that have greater demand for adjusting labor. Industries that intrinsically have higher layoff rate, and in industries that have large positive or negative sales growth rates suffer more from employment protection.

c) The Effect of Political Connections on Credit Access: Does the Level of Financial Development Matter?

The third study of this thesis takes a closer look at the allocation of financial capital by investigating the effect of political connections on credit access. The focus on political connections is interesting because increasing evidence shows that they are important mechanisms of resource allocation in transition and developing countries (Li *et al.*, 2008; Khwaja and Mian, 2005). Moreover, analysis of how political connections affect credit access can be revealing for two reasons. First, political connections are firm-specific, and hence can offer an explanation as to why distortions could be idiosyncratic. As indicated earlier, the idiosyncratic nature of distortions is central to the misallocation literature, making it important to find explanations for it. Secondly, focusing

on the allocation of credit offers an alternative to imputing implied distortions from differences in marginal products. Whereas the previous two chapters assume a production function and profit maximizing behavior, directly using credit access involves no such assumptions.

In addition to testing if political connections affect credit access, this study also investigates if this effect declines with financial development. The analysis is based on a version of the WBES dataset that covers close to 20,000 plants in 68 developing and transition countries. The results show that the strength of political connections, measured by the amount of time the firm's senior managers spend with government officials, has a significant positive effect on credit access. Exploiting the cross-country dimension of the dataset, I then show that the effect of political connections is higher in countries where the banking sector is more concentrated and net interest margin is higher. Furthermore, the marginal effect of political connections is lower by half in countries that have credit information sharing mechanisms. These results suggest that a competitive banking sector improves efficiency of credit allocation by reducing politically motivated lending.

d) Investment in Developing Countries: Which Firms are Financially Constrained?

The use of international datasets in the first three studies enables us to examine the importance of institutional factors such as financial development and employment protection. However, because of the cross-section nature of the WBES dataset, we fail to consider the dynamics of resource allocation in a panel setting.

The last chapter focuses on the role of financial constraints on firm investment in the Ethiopian manufacturing sector. Ethiopia, one of the largest African economies with a manufacturing sector typical for the continent, provides an interesting case for studying how market imperfections affect the allocation of capital. The analysis is based on a census-based, plant-level dataset covering 15 years between 1996 and 2010.

The study investigates the effect of financial constraints on firm investment, focusing on how this effect varies by firm size, ownership type, number of plants and export status. The analysis involves comparing the effect of financial and fundamental factors on investment across different firm groups. When financial markets are efficient in allocating capital to the most productive firm, the marginal productivity of capital should be the sole important driver of investment (Hayashi, 1982). In the presence of financial constraints, however, financial factors such as cash flow become important determinants of investment (Fazzari *et al.*, 1988; Hubbard, 1998). A positive effect of financial factors on investment thus implies lack of external financial sources that make investment contingent upon the availability of internally generated cash flow.

In order to account for the dynamic relationship between investment, the marginal product of capital and cash flow, I estimate a panel VAR model using the three variables. I then calculate impulse responses that capture the direct and feedback effect of cash flow and the marginal product of capital on investment. The results show that cash flow shocks elicit relatively large investment response among small firms, and among single plant, non-exporting firms. In contrast, shocks of the marginal product of capital induce greater response among large firms, and among multi-unit or exporting firms.

These results show that investment among small, single unit, non-exporting firms is dependent on internal financing sources, indicating the presence of financial constraints. The financial market in Ethiopia thus appears to fail in its function of allocating capital to the most productive firms.

1.5 Concluding Remarks

This thesis presents four studies that try to quantify the effect of resource misallocation on aggregate productivity, and to explain it. The results show that there is substantial misallocation of resources, although this does not appear to be significantly larger in less developed countries. The results suggest that the efficiency with which resources are allocated among heterogeneous firms has an important effect on aggregate productivity. Thus improved economic performance is possible by removing obstacles for resource allocation even without technological progress.

The analysis on the institutional and market forces that drive misallocation gives important clues as to how this reallocation benefits can be captured. As the third chapter suggests, more flexible labor market regulation is an important step towards easing the process of labor reallocation. This appears particularly important for industries with greater demand for labor adjustment, either because they are expanding or because of structural reasons. Naturally, employment protection has non-economic benefits that in many circumstances could justify its existence, which could potentially compensate for its adverse effect on the reallocation of labor. Future research can give more insight on the tradeoff between the gains and losses from

employment protection, and particularly on the effects of job security on productivity at the micro level.

The fourth and fifth chapters point to the importance improving financial development for facilitating the allocation of capital. It has long been recognized that financial development can boost capital accumulation by lowering the cost of capital (Beck *et al.*, 2000; Aghion *et al.*, 2005). This thesis emphasizes the less-widely-studied reallocation benefit of financial development, also called the 'quality effect' in the literature (Abiad *et al.*, 2008). The fourth chapter shows that a competitive and efficient banking sector is less prone to distorting mechanisms of capital allocation such as political connections. Moreover, the results show that public availability of financial information leads to lower levels of politically motivated lending, thus reducing misallocation. The last chapter also highlights that improving the efficiency of financial markets is particularly important for the growth of small firms. Taken together, these studies indicate the importance of well-functioning factor and product markets for capturing the benefits of reallocation.

A number of themes in the measurement and analysis of misallocation offer interesting avenues for future research. One among them is a closer look into the implications of modelling assumptions on measuring the effects of misallocation on aggregate TFP. For example, the monopolistic competition model of Hsieh and Klenow (2009) that is used in our second chapter is based on a production technology with constant returns to scale. Whereas the assumption is useful for making the model tractable, it disregards the importance of scale differences, which have received greater attention, for example, in the trade literature (Melitz, 2003). Bartelsman *et al.* (2013) provide

an alternative modelling approach with fixed costs, which has a more realistic property of generating dispersions in marginal products even when there are no distortions. Future research can be useful in comparing the validity and implications of these and other assumptions.

As our results also show, the level of misallocation observed in the data is not close enough to justify the large TFP gap observed across countries. This raises the question of what other factors could explain TFP differences. Two recent studies by Jones (2011; 2013) emphasize complimentary and linkages that propagate the effect of misallocation, thus reducing TFP substantially. An interesting area of future research is the extent to which an industry's intensity of intermediate input use exposes it to greater misallocation due to the propagating effect of linkages and complementarities. If the distribution of industries in terms of their sensitivity to linkages and complementarities varies systematically across countries, this could also have implications on TFP differences across countries.

As indicated earlier, resource misallocation can happen within as well as across sectors. Future research can provide more systematic evidence on the relative importance of these two elements in total misallocation. Evidence on misallocation is particularly lacking for sectors other than manufacturing. Finally, a potentially fruitful area for identifying the sources of idiosyncratic distortions would be looking deeper into the decision making process of the firm. Factors that affect managerial practice such as culture and education can be valuable in illuminating how internal factors interact with external forces in affecting resource allocation (see Bloom and Van Reenen, 2010).