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THE DISTRIBUTION OF NATIONAL INCOME AND THE ROLE OF CAPITAL MARKET IMPERFECTIONS

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RÉSUMÉ

La part du travail dans le revenu national a connu des variations considérables en Europe continentale. La recherche empirique et théorique suggère que l'évolution du marché du travail et les imperfections de celui-ci peuvent en partie expliquer ce phénomène. Ce mémoire analyse de manière empirique et théorique le rôle des imperfections du marché du capital dans la détermination de la distribution du revenu national. Nous utilisons des méthodes de régression panel et de régression panel dynamique pour un pool incluant les principaux pays de l'OCDE. La régression tient compte des indicateurs du marché du capital, des facteurs provenant du marché du travail et des indicateurs macroéconomiques. Les résultats indiquent que l'intermédiation financière est négativement corrélée avec la part du travail, alors que l'inflation a des effets positifs. En outre, nous utilisons un modèle d'équilibre général simple pour retracer les effets des imperfections dans le marché financier sur les parts des facteurs. Les simulations du modèle soutiennent nos résultats empiriques.

Mots clés: imperfections du marché du capital, revenu national, la part du travail, inflation

ABSTRACT

Labor shares in national income have exhibited large variations in continental Europe in the last decades. Empirical and theoretical research suggests that the evolution of labor markets and labor market imperfections can in part explain this phenomenon. This thesis analyzes empirically and theoretically the role of capital market imperfections in the determination of the distribution of national income. We use panel and dynamic panel regression methods for a pool of major OECD countries. The regression analysis includes variables accounting for capital markets, labor markets and macroeconomic indicators. The results indicate that financial intermediation is negatively correlated with labor shares, while inflation has positive effects. We further use a simple general equilibrium model to trace the effects of imperfections in the financial market on factor shares. Simulations of the model support our empirical findings.

Keywords: capital market imperfections, national income, labor share, inflation

INTRODUCTION

Most economic models presume that the distribution of national income between labor and capital is constant over time and across countries. According to neoclassical theory, the breakdown of value added national income into capital and labor shares should be constant, leaving short term variations to economic fluctuations. This is the assumption underlying the Cobb-Douglas production function, for instance.

However, analyzing time series data on national accounts reveals a different picture. The distribution of value added national income experiences considerable variations over time and varies heavily across countries. Specifically, European labor shares follow a humped shaped pattern with shares peaking around 1980. This can be the result of changing factor prices (notably the interest rate and the wage rate), imperfections in labor and/or credit markets. The topic has attracted researchers' and politicians' interest in the context of European countries' most urgent common problem: substantially high unemployment rates that seem to persist. Currently low labor shares in Europe are certainly one of the determinants of high unemployment rates. The understanding of this key macroeconomic variable and its determinants is thus substantial. An extensive line of literature has examined the impact of labor market imperfections on the distribution of value added national income and agrees that different labor market conditions in European versus Anglo-Saxon countries can in fact account for large labor shares in Europe in the 1980s.

Although the importance of financial markets has been addressed extensively in the literature, there have been no attempts to relate capital market developments to factor shares. Financial markets affect the financing conditions of firms and might be an important determinant of the amount of capital that is employed. The idea is to analyze empirically and theoretically the link between financial intermediation and factor shares. A well developed and efficient capital market encourages investment, facilitates the start-up of new firms and results in an efficient allocation of resources. On the other hand, any capital market frictions as for instance search externalities, strict legislation or inefficient banking systems impede an optimal use of capital.

Financial imperfections in Europe in the 1980s may have contributed to low capital shares. Taking into consideration that firms are able to substitute capital for labor in the long run, the deregulation of the banking system and other improvements in the financial system in Europe such as technological innovation might have encouraged firms to employ more capital. Bertrand et al. (2005) for example analyze the effect of the deregulation of the French banking sector in the mid-1980s and report that the decrease of government intervention increased competition and "was associated with changes in firm behavior, such as a lowering of average wage...".

We thus extend the research to take into account capital markets and their imperfections as financial markets are of great importance for an economy. The present thesis examines whether credit market imperfections in addition to labor market rigidities can contribute to explain movements in factor shares. To analyze the importance of financial intermediaries in the determination of the distribution between labor and capital we concentrate on 15 OECD countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Italy, Japan, Germany, the Netherlands, Norway, Spain, the United Kingdom and the United States of America. The choice of countries is motivated by the aim to distinguish between Anglo-Saxon versus European countries, data availability limits the pool to fifteen countries.

The following methodology is applied: First, we adjust labor shares to account for self-employment income. Second, we use panel data techniques and dynamic panel estimation methods on a set of variables. As there is certainly no unique reason behind the movement in factor shares we include variables characterizing the performance of the capital market, factors determining the labor market and macroeconomic indicators. Our regression results suggest that financial intermediation has indeed a significant negative effect on labor shares. Second, we empirically confirm that high inflation rates in 1980, falling thereafter, had a positive effect on labor shares. Lastly, labor market indicators, increased globalization and alternative variables characterizing capital markets yield ambiguous results.

We further evaluate the quantitative properties of the general equilibrium model proposed by Wasmer and Weil (2004) with respect to factor shares. Enrepreneurs, workers and financiers interact in imperfect capital and labor markets, where imperfections are implemented via search and matching frictions. The model traces the repercussions of capital market imperfections on factor shares and qualitatively conforms with our empirical findings. Furthermore, simulations of the model enlighten the repercussions of the decrease in bargaining power of workers on labor shares. Last, variations of the level of bargaining power of financiers lead to important variations in the labor share.

The remainder of this thesis is organized as follows: Chapter 1 provides the relevant stylized facts on labor shares and capital markets. Chapter 2 reviews the literature devoted to this topic. Chapter 3 explains basic panel data theory and estimation methods. Chapter 4 presents data and outlays the method used to adjust labor shares to account for self-employment income. In chapter 5 we specify the empirical model and present econometric results of the regression of labor shares on a set of variables. Chapter 6 introduces the model and presents simulation results. A conclusion summarizes the thesis and outlines areas worthy of further research, analysis and investigation.

CHAPTER I

THE RELEVANT STYLIZED FACTS

This chapter presents the evolution of labor shares in European and Anglo-Saxon countries, respectively. Second, we highlight differences in the financial system across countries.

1.1 The Evolution of Labor Shares

Taking a look at data on national accounts reveals that labor shares experience considerable variations over time. Figure 1.1 shows that labor shares in continental European countries follow a humped shaped pattern. Labor shares substantially increased from the early 1970s up to 1980, the average European labor share increasing from about 50% (1970) to 55% (1979)[1]. This development is consistent with the rapid growth of wages during that period and with wages superior to the marginal product of labor. Subsequently, labor shares dropped down to reach their original level or even fall below original values by the end of the 1990s. This might be in part due to labor market adjustments and firms increasing their profit rates. The observed decrease in labor shares goes with falling real wages below the marginal product of labor and recovering profit rates. In the last two decades, labor shares have been relatively stable.

[1] Labor shares exclude self-employment and underestimate real labor shares. Cf. section 4.1

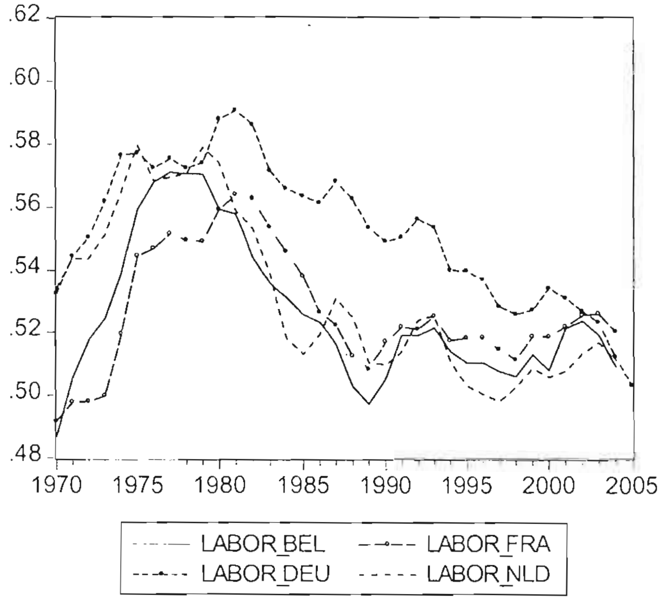

Figure 1.1 Labor Shares - Continental European Countries

On the other hand labor shares in Anglo-Saxon countries (cf. Figure 1.2) are relatively stable and seem to be consistent with standard macroeconomic theory of constant factor shares. There is a slightly negative tendency: In 1970, labor shares in Anglo-Saxon countries averaged out at 58% compared to about 55% today. Short term variations around this tendency might be attributed to cyclical fluctuations.

Australian labor shares are in between, with labor shares peaking about 1973 and abruptly falling afterwards, where the absolute level approaches Anglo-Saxon more than European levels. Finland and Norway also follow a humped shaped pattern. However, the patterns are less pronounced than in continental European countries. The only country completely falling out of the picture is Japan: labor shares peak from an extreme low in 1970 to a high in 1975, slowly falling afterwards. The complete picture is given in Figure A.1 in the appendix.

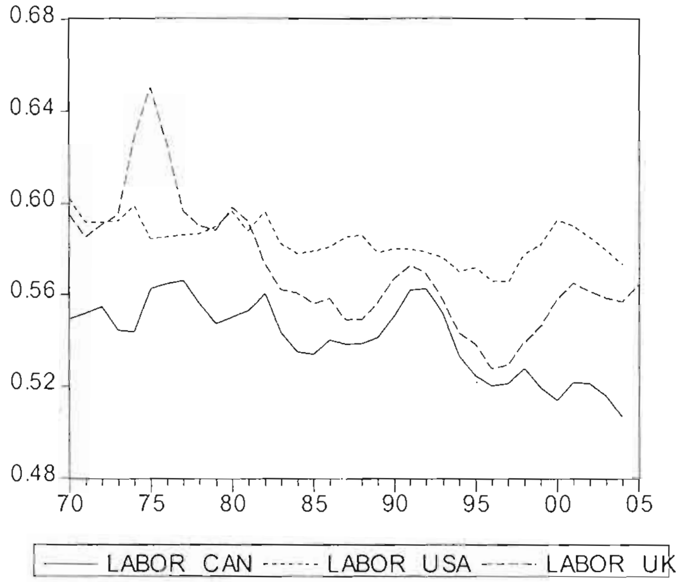

Figure 1.2 Labor Shares - Anglo-Saxon Countries. (Source: OECD National Accounts, Main Aggregates)

1.2 Capital Market Imperfections

Not only the banking sector but also the financial market constitute primary conditions for a sound economic environment. Where access to formal sources of finance is limited, new entrepreneurs might not be able to enter the market. Moreover, existing firms that face financing problems might not expand their activities or invest into new ones. By contrast, countries that facilitate access to credit tend to motivate new investment. Numerous studies confirm that financial intermediation positively affects economic growth.[2]

Taking a look at the performance of financial intermediation and credit market imperfections in the same set of countries, one remarks astonishing differences. One of the crucial determinants for start-ups or firms wanting to expend their activities is

[2] cf. for instance Levine (1997)

Table 1.1 Getting Credit

	Legal Rights Index	Credit Information Index	Public credit registry coverage	Private credit bureau coverage
Australia	9	5	0	100
Austria	5	6	1.2	45.4
Belgium	5	4	55.3	0
Canada	7	6	0	100
Denmark	7	4	0	7.7
France	3	2	1.8	0,00
Germany	8	6	0.6	88.2
Italy	3	6	6.1	59.9
Japan	6	6	0.0	61.2
Netherlands	8	5	0	68.9
Norway	6	4	0.0	100
Spain	5	6	42.1	6.5
Sweden	6	5	0	100
United Kingdom	10	6	0	76.2
United States	7	6	0	100
Cont. Europe, average	5.5	4.88	13.39	34.58
Northern Europe	6	4.5	0	100
Anglo-Saxon, average	8	6	0	92

Source: World Bank; Doing Business - comparing business regulation

the access to credit. The *International Finance Corporation* (the private sector arm of the *World Bank Group*) collects data on the economic determinants of *Doing Business*. According to the indices comprised in the data set *Getting Credit*, financial conditions in Europe are less developed than in Northern America. The legal rights index, which measures the degree to which laws facilitate banking, France only rates three whereas Canada and the United States both rate seven on a scale of one to ten. The same applies to the credit information index, which measures rules affecting the scope, access and quality of credit information: France has the lowest European standards (two) whereas information is relatively more accessible in the United States or Canada (six). The indicators are summarized in Table 1.2.

Financial conditions have been substantially changing within our horizon of interest. Not only the United States but also European countries have undergone deregulation of the banking system. These changing financial conditions are likely to have affected the financing activities and the economic performance of firms. Berg et al. (1992) for instance analyze productivity growth in Norway during the deregulation of the banking system (1980-89) and find that productivity fell prior to the period experiencing deregulation but grew rapidly when deregulation took place.

Changing financial conditions affect the rent splitting of firms. Black and Strahan (2001) for instance analyze the effects of the deregulation of the banking sector in the United States on the labor market and find that "rents were shared with labor when banking competition was limited by regulation" and that, due to higher competition "the average compensation [...] fell after states deregulated." On the theoretical side of the literature, Perotti and Spier (1993) find that firms have incentives to use high debt as a bargaining tool: relying on debt financing instead of equity financing, firms may convincingly threaten unions to lower wages in the light of the need to pay off their debts. Similarly, Wasmer and Weil (2003) argue that higher repayments of the firm to the financier decrease the wage. The higher the interest payments to the financier, the lower the total surplus that is split between workers and employers and the lower the remuneration of the worker.

We develop these arguments to see whether financial intermediation, as a logical consequence, is likely to affect labor shares. The importance of the latter for the overall performance of the economy suggests that the inclusion of credit markets into the analysis is a meaningful extension of current research.

CHAPTER II

LITERATURE REVIEW

This chapter outlines the wide literature that has addressed the question why European labor shares peaked in the 80s. Mostly, labor market institutions are claimed to be at the origin. We further take a look at the literature that analyzes financial markets.

The first to remark the dramatic movements in factor shares in value added national income was Oliver Blanchard (1997). He analyses factor shares, factor prices and relative shares and prices. He proposes arguments that can account for the observed developments, notably the interplay of adverse labor demand and labor supply shocks. Accordingly, the increase in European labor shares in the 1970s can be explained as a consequence of increasing wages with respect to the marginal productivity of labor (labor supply shock). Supply shocks, as for instance the oil price shocks and the slowdown in total factor productivity growth initiated European policy to strengthen the position of employees in order to protect their income.

In the 1980s however, firms started to adjust to increased labor costs by increasing capital shares, lowering wages, slowly recovering and stabilizing profits. The 1980s can thus be characterized by labor demand shocks, such as the decrease of the real wage offered by firms that lead to increased capital shares in Europe. Blanchard proposes three potential sources for the increase in capital shares: first, there might be adjustment lags to changes in factor prices: consequently, the increase in capital shares can be interpreted as a delayed reaction to high real wages. Second, firms' profits seem to have increased with respect to workers' remuneration, which might be a result of firms increasing mark-ups. Lastly, technological progress in favor of capital might have lead to increased capital shares.

Furthermore, Blanchard decomposes factor share movements into factor price and factor quantity movements. He shows that already in the 1970s, capital to labor ratios have been increasing. Decreasing profit rates during that period go with the increase in labor shares. Subsequently, profit rates recovered and capital to labor ratios continued to increase, resulting in increasing capital shares during the 1980s. As for Anglo-Saxon countries, Blanchard argues that these countries have been subject to weaker labor demand and supply shocks, i.e. a smaller increase of the real wage during the 1970s and weaker reactions from labor market institutions, leaving factor shares more or less stable over time.

Most of the research that follows Blanchard's text attempting to explain movements in factor shares concentrates on the evolution of labor markets and labor shares in national income. Caballero and Hammour (1997) for instance analyze capital to labor ratios in European countries. They argue that the creation of various labor protecting institutions in the early 1970s, i.e. the social security system, minimum wage regulations and centralized unions, contributed to increasing labor shares. The first oil price shock in 1973 further motivated the politics of job protection. According to their theory, the subsequent fall of labor shares is due to substitution of capital for labor. This argument is based on a theoretical framework that breaks the hypothesis of a constant elasticity of substitution between capital and labor equal to one. Instead, they provide convincing evidence of a level of elasticity inferior to one in the short run. A low elasticity of substitution implies that firms respond to an increase in a relative factor price with a less than proportional reduction of that factor. This entails that a relative price increase augments the part of this respective factor in national income. A low elasticity of substitution can thus explain that the wage push in the 1970s was accompanied by an increase in labor shares. The authors argue that, in the long run, the elasticity of substitution surpasses unity, implying greater flexibility. Firms only started to adjust to increased labor costs towards 1979: Labor input was reduced and firms employed more and more capital. The real wage adjusted backwards to reach a level close to or even below marginal productivity of labor and capital shares increased.

Bentolila and Saint-Paul (2003) extend the work in both empirical and theoretical terms. They show that movements in the labor share can be partially attributed to movements along the "share-capital schedule", i.e. the theoretical constant relationship between capital to output ratios and labor shares.[1] Examples of movements along this curve are changes in factor prices such as wage pushes and changes in the real rate of interest. On the other hand, factors such as mark-ups increase prices above marginal costs. Labor adjustment costs and changes in workers' bargaining power result in shifts of the share-capital schedule which consequently affects labor shares. Empirical results based on a panel of 14 OECD countries affirm the relationship between labor shares and the share-capital schedule. More importantly, labor adjustment costs and changes in workers' bargaining power are significant determinants of labor shares. They conclude that "discrepancies between the marginal product of labor and the real wage" can account for departures from the relationship between labor shares and the capital to output ratio and can thus explain rising labor shares in Europe.

Other research has focused on the development of social protection systems. Labor compensation in national accounts consists of wages and salaries. Supplements to wages and salaries such as contributions to social security, pensions are also included in labor compensation, those paid by employees and those paid by employers. The percentage of total social contributions has been varying considerably. Consider for instance increased contributions to unemployment insurance in continental Europe following the increase in unemployment rates. Consequently, they might play an important role in the

[1] This relationship is constant as long as there are no deviations such as mark-up pricing.

determination of labor shares. Poterba (1998) for instance points out that labor shares in the United States have been stable, while the part of wages and salaries has been continuously decreasing, implying increasing non-wage benefits such as contributions to health insurance and pension funds. In the same line of reasoning, taxation of firm profits are accounted for in capital shares and consequently influence the distribution between labor and capital. Timbeau (2000) for instance remarks that the part of taxation in value added national income (the sum of taxes on production and on corporate income) in France has been increasing 2.9 percentage points from 1981 to 2000.

Finally, some researchers doubt in the way parts of national revenue are measured. They propose alternative adjustments which seem to smooth and extenuate the observed evolutions as exposed by Blanchard. Askenazy (2003) for instance compares the distribution of value added national income in France and the United States and makes five adjustments to the data: first, he accounts for other forms of remuneration apart from wages and salaries, for instance the participation of employees in firms' surplus. Second, he adjusts labor shares to include an imputed self-employed income. Third, he takes into account the recent increase in part time work by using data on "full time equivalent"-employment.[2] Fourth, he remarks that "Financial Intermediation Indirectly Measured" (FISIM)[3] is "falsely" excluded from value added national income published by the OECD. Last, he accounts for the fact that the state is far more involved in economic activity in France compared to the United States by limiting the analysis to the private sector. Adjusting the computation of labor shares to these cited factors he comes to the conclusion that the composition of national income is not that different in France and the United States. His analysis is however limited to certain industries, excluding the public sector (i.e. education, health, state) and agriculture.

[2] The OECD refers to the number of all full- and part-time workers by "Total employment", while "Total employment - Full-time equivalent" is defined as total hours worked divided by average annual hours worked in full-time jobs.

[3] FISIM is an indirect measure of the value of financial intermediation services provided but for which financial institutions do not charge explicitly. Source: OECD glossary.

On the other hand, there is a considerable body of literature relating to the importance of financial markets in the context of economic development. The initiator of this concept was Goldsmith (1969). He was the first to establish a link between financial intermediaries and economic growth, and in fact demonstrated a high correlation. King and Levine (1993) provide convincing empirical proof of the positive effect of financial intermediation on economic development. Levine (1997) gives an excellent overview of the theoretical and empirical work that has been dedicated to this question and outlays the primary functions of financial intermediaries. He uses the database on indicators of financial market performance published by the World Bank, including measures of the activity, the composition and the efficiency of the banking sector and the stock market, for his empirical analysis. Regression results strongly support the idea that financial development fosters economic growth. He also addresses the question whether the distinction between "bank-based" and "market-based" economies can account for differences in economic progress. According to his assessment, this distinction does not play a major role. Finally, Levine analyses "third factors", i.e. the country's legal system, political institutions as potential reasons for different developments of the financial system.

On the theoretical sphere of the literature our research is directly linked to the work of Wasmer and Weil (2004). The authors build a general equilibrium model including frictions in both credit and labor markets. Entrepreneurs and financiers meet in the credit market and bargain over the financial contract. Then, entrepreneurs search for a worker and bargain over the wage contract. Both search procedures are subject to search and matching frictions. Credit market frictions not only affect the credit market but turn out to influence the labor market as well. The model is thus of great importance to our thesis as we extend it to demonstrate repercussions of credit market imperfections on factor shares.

Similarly, Perotti and Spier (1993) build a model which traces the interrelation between the capital structure of a firm and wage contracts. The authors develop the idea that firms might use the capital structure as an effective bargaining tool in the determination of the wage : firms exchange debt for equity when current profits are low, but prospects on future earnings are high, arguing that investment is necessary to pay future wages. Firms might then convincingly threaten that they will not invest in new projects unless the union agrees to reduce wages. The model enlightens that "debt-for-equity exchanges serve two purposes: wage concessions will be (i) more frequent and (ii) of greater magnitude." The paper is thus of interest to our analysis as it models the repercussions of financial structure on wages. It might serve as a basis to develop the link between financial structure and labor shares.

To sum up, most of the literature that addresses movements in factor income shares has focused upon labor markets. Labor market rigidities and real wage developments seem indeed to explain why labor shares have been increasing in Europe during the 1970s. While there seems to be a consensus on the reasons for increasing labor shares in continental Europe, attempts to explain the following decrease are less convincing. Blanchard for instance argues that increased mark-ups lead to increasing capital shares. However, increased competition due to thriving international trade is more likely to have forced firms to decrease mark-ups. Second, Blanchard gives no reason why biased technological change should have been different in Europe compared to the United States. The argument of an elasticity of substitution inferior to one in the short run and superior to one in the long run as observed by Caballero and Hammour is able to explain the increase and subsequent decrease in labor shares. However, it does not explain why labor shares in Europe fell below 1970 levels. Other researchers prefer to avoid the enigma by limiting their analysis to certain sectors of the economy.

CHAPTER III

METHODOLOGY

This chapter introduces the basics of panel data theory. We present the theoretical background of different estimation methods that we will use in the regression analysis, namely the pooled estimator, the random effects and the fixed effects estimator and dynamic panel estimators.

3.1 The Panel Data Model

To estimate the effect of financial intermediation and other variables on the labor share, we use panel data techniques. The reasons are twofold: First, only time series data on one country alone will result in poor estimates as the sample size is relatively small (data horizon of 36 years). Similarly, cross section estimation is clearly no sensible alternative with data being available for 15 cross sections, i.e. 15 countries only. Using panel data techniques has the advantage of providing a richer data source.

Second, panel data techniques allow to control for unobserved time-invariant heterogeneity in cross-sectional models. Even after controlling for a number of variables, we have to assume that labor shares in each country are determined by factors unknown or immeasurable. The advantage of panel data techniques is that the omitted variable problem can be eliminated by combining the time series and cross-sectional dimensions. In other words, it is possible to consistently estimate regression coefficients even though the explanatory variables might be correlated with unobserved, time constant variables specific to each cross section.

The model to be estimated can be represented as

$$Y_{it} = \mathbf{X}_{it}\beta + \varepsilon_{it}. \tag{3.1}$$

Y_{it} is the dependent variable for cross section unit i at time t where $i = 1, 2, ..., M$ and $t = 1, 2, ..., T$. X_{it} is a $1 \times K$ vector containing K observable variables that change across i and t and β is the $K \times 1$ vector of the coefficients to be estimated. ε_{it} is the *composite error.* ε_{it} can be split up into two parts: $\varepsilon_{it} = c_i + \eta_{it}$. The c_i are called *individual effects* which denote the variation that is specific to cross section i, i.e. there is variation across cross sections but not across time, with $E(c_i) = 0$. It is furthermore assumed that there is no correlation between the individual effects for two different cross sections, i.e. $E(c_i c_j) = 0$ for $i \neq j$, and that there is (for now) no cross section heteroskedasticity, i.e. $E(c_i c_i) = \sigma_c^2$. η_{it} represent the *idiosyncratic errors* that change across i and t. The error terms η_{it} are assumed to be uncorrelated with the $\mathbf{X}_{it}$ and $E(\eta_{it}) = 0$. Lastly, for now the idiosyncratic errors are assumed to have a time invariant unconditional variance, i.e. $E(\eta_{it}^2) = \sigma_\eta^2$, $t = 1, ..., T$ and to be serially uncorrelated, i.e. $E(\eta_{it}\eta_{is}) = 0$, $s \neq t$. The individual effects are uncorrelated with the idiosyncratic errors, i.e. $E(c_i \eta_{is}) = 0$.

One can view the data as a set of cross-section specific regressions so that we have M cross-sectional equations each with T observations stacked on top of one another. Let Y_i denote a vector of T observations for cross section i, i.e.

$$Y_i = \begin{bmatrix} Y_{i1} \\ Y_{i2} \\ .. \\ Y_{iT} \end{bmatrix}. \text{ Similarly, let } X_i = \begin{bmatrix} X_{i1}^1 & X_{i1}^2 & ... & X_{i1}^K \\ X_{i2}^1 & X_{i2}^2 & ... & X_{i2}^K \\ .. & .. & .. & .. \\ X_{iT}^1 & X_{iT}^2 & ... & X_{iT}^K \end{bmatrix} \text{ and } \varepsilon_i = \begin{bmatrix} \varepsilon_{i1} \\ \varepsilon_{i2} \\ .. \\ \varepsilon_{iT} \end{bmatrix}$$

be the $T \times K$ vector of explanatory variables and the $T \times 1$ vector of the disturbance term, respectively. Then the *stacked form* simply organizes data for all cross sections on top of each other:

$$Y = \begin{bmatrix} Y_1 \\ Y_2 \\ .. \\ Y_M \end{bmatrix}, \quad X = \begin{bmatrix} X_1 \\ X_2 \\ .. \\ X_M \end{bmatrix} \text{ and } \varepsilon = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ .. \\ \varepsilon_M \end{bmatrix}$$, where Y is of order $MT \times 1$. X of order $MT \times K$ and ε of order $MT \times 1$. The shortened version of the linear regression model can simply be expressed as $Y = \mathbf{X}\beta + \varepsilon$.

Panels can be balanced, i.e. the number of observation is the same for all cross sections ($T_i = T \ \forall \ i$), or unbalanced, i.e. $T_i \neq T \ \ \forall \ i$. If T_i is exogenous, the fact that the panel is unbalanced does not pose any problems on the estimation procedure. If T_i is endogenous, unbalanced estimation can cause problems. Our panel is unbalanced as not all variables are available from 1970 onwards for all countries. However, as we can assume that the reason for some data starting in 1976 only is not systematically related to labor shares, using the subsample has no serious econometric consequences.[1]

3.2 Estimation Methods

This section presents the most commonly applied estimation methods. Besides the *pooled estimator*, the *random effects* method is used whenever the individual effects are uncorrelated with the explanatory variables and the *fixed effects estimator* in the presence of correlation between the two. Last, the generalized method of moments is used to estimate *dynamic panel models.*

3.2.1 The Pooled Estimator

The pooled estimator is a first straightforward way to estimate panel data models. Because it rests upon strong assumptions which are unlikely to hold in our setting, it is of little interest to the present setting. However, it presents a convenient way to introduce the logic of panel estimators because it is simple and serves as a starting point.

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[1] cf. Wooldridge (2001), p. 552

Consequently, its assumptions can be relaxed one by one leading to more sophisticated estimators.

Assume that the composite error term ε is uncorrelated with the explanatory variable, that is

$$E(\mathbf{X}'_{it}\varepsilon_{it}) = 0. \tag{3.2}$$

When the *composite* error term can be assumed to be *i.i.d.* across time and cross sections, i.e.

$$\varepsilon_{it} \sim i.i.d.(0, \sigma^2), \tag{3.3}$$

estimation simply reduces to applying ordinary least squares (OLS) to the stacked data, i.e.

$$\widehat{\beta}_{POOL} = \left(\mathbf{X}'\mathbf{X}\right)^{-1}\left(\mathbf{X}'Y\right). \tag{3.4}$$

Because of 3.2 OLS will be unbiased. Moreover, 3.4 will result in efficient estimates.

However, assumption 3.3 is unlikely to hold in our setting as we are dealing with different countries over time. The composite error term ε_{it} is likely to be heterogenous because of different cross section terms c_i and the time dimension gives rise to questions about autocorrelation in the error term. To deal with these problems the literature proposed the random effects and the fixed effects estimation. The first treats c_i as a random variable and assumes that c_i is uncorrelated with the observed explanatory variables X_{it}. The latter allows for correlation of the unobserved effect with the error term where the cross specific effects c_i are coefficients to be estimated in the regression. In the following the two methods are explained.

3.2.2 The Random Effects Method

A first step to bring us closer to an appropriate estimator for the regression of labor shares on a set of variables is to relax assumption 3.3. The pooled estimator under assumption 3.3 basically ignores the panel structure of the data set. The decomposition of the error term $\varepsilon_{it} = c_i + \eta_{it}$ allows to be more specific about the structure of the variance covariance matrix of the error term. This is what the *random effects estimation* consists in: it applies a feasible generalized squares method that takes into account the particular structure of the error term ε_{it}. In the presence of errors that violate assumption 3.3 but under assumption 3.2 the random effects method is thus more efficient than the OLS pooled estimation method which ignores serial correlation in the composite error term.[2] What is more, the random effects method is of interest to the present study because it allows to deal with the presence heteroskedastic errors or serial correlation in the idiosyncratic error term.

The important assumption underlying the random effects in contrast to the fixed effects estimator is that the cross section specific effects c_i are uncorrelated with the explanatory variables (i.e. assumption 3.2 still holds). This method might be applied to panel data on household consumption for instance, where unknown household characteristics do not systematically vary with explanatory variables, e.g. income. The random effect method treats the cross section specific effects as random variables: the cross section effects c_i are simply seen as a part of the error term. The explanatory variable is assumed to be strictly exogenous, i.e.

$$E(\eta_{it}|X_i, c_i) = 0, \quad t = 1, 2, ..., T. \tag{3.5}$$

Under the specific assumptions about the idiosyncratic error terms (cf. page 16) one can calculate the elements of the variance-covariance matrix of the composite error term ε_{it} : $E(\varepsilon_{it}^2) = E\left[(c_i + \eta_{it})^2\right] = E(c_i^2) + 2E(c_i\eta_{it}) + E(\eta_{it}^2) = \sigma_c^2 + \sigma_\eta^2$ for all $s = t$ and $E(\varepsilon_{it}\varepsilon_{is}) = \sigma_c^2$ for all $s \neq t$. The $T \times T$ variance covariance matrix for cross

[2] cf. Johnston and DiNardo (1997), p. 391

section i takes thus the form $\Sigma = E(\varepsilon_i \varepsilon_i') = \begin{pmatrix} \sigma_c^2 + \sigma_\eta^2 & \sigma_c^2 & \ldots & \sigma_c^2 \\ \sigma_c^2 & \sigma_c^2 + \sigma_\eta^2 & & \ldots \\ \ldots & & \ldots & \sigma_c^2 \\ \sigma_c^2. & & & \sigma_c^2 + \sigma_\eta^2 \end{pmatrix}$. The $MT \times MT$ variance covariance matrix for the stacked form is thus

$$\Omega = I_M \otimes \Sigma = E(\varepsilon\varepsilon') = \begin{pmatrix} \Sigma & 0 & \ldots & 0 \\ 0 & \Sigma & & \ldots \\ \ldots & & \ldots & 0 \\ 0 & \ldots & 0 & \Sigma \end{pmatrix}.$$

Wooldridge (2002) shows how the elements σ_c^2 and σ_η^2 can be consistently estimated by $\widehat{\sigma}_c^2$ and $\widehat{\sigma}_\eta^2$. Assuming that the variance matrix of ε_{it} conditional on X_i is constant the estimated variance-covariance matrix $\widehat{\Sigma}$ can be used to apply feasible generalized least squares (FGLS):

$$\widehat{\beta}_{RE,FGLS} = \left(\sum_{i=1}^{M} \mathbf{X}_i{}'\widehat{\Sigma}^{-1}\mathbf{X}_i \right)^{-1} \left(\sum_{i=1}^{M} \mathbf{X}_i{}'\widehat{\Sigma}^{-1}\mathbf{X}_i \right) \tag{3.6}$$

The random effects FGLS estimator is consistent and efficient when the exogeneity assumption holds.

Two more extensions will be of use in our analysis: The random effects method (as well as the fixed effects method) allows to control for correlation patterns between the idiosyncratic residuals, i.e. $E(\eta_{it}^2) \neq \sigma_\eta^2$, $t = 1, ..., T$. We will consider the two most probable ones for our analysis: cross-section specific heteroskedasticity and period specific heteroskedasticity. In our application residuals are likely vary across cross section, i.e. across countries. *Cross-section specific heteroskedasticity* allows for a different residual variance for each cross section. It can be formally expressed as $E(\eta_{it}\eta_{it}|X_i, c_i) = \sigma_i^2$ and $E(\eta_{it}\eta_{js}|X_i, c_i) = 0$ for any s, t, j, i, $s \neq t$, $i \neq j$, or, using matrix formulation $E(\eta_i\eta_i|X_i, c_i) = \sigma_i^2 I_T$. The FGLS procedure first performs a preliminary estimation to obtain cross-section specific residual vectors and secondly uses these residuals to form estimates of the cross-specific variances. Feasible GLS then uses these estimates in a weighted least squares. Second, an alternative correlation pattern allows for *period specific heteroskedasticity* which assumes that the residuals vary with the time periods. This coefficient covariance method can be expressed as $E(\varepsilon_{it}\varepsilon_{jt}|X_i, c_i) = \sigma_t^2$ and $E(\varepsilon_{it}\varepsilon_{js}|X_i, c_i) = 0$ for any s, t, j, i, $s \neq t$. Feasible GLS procedure is similar to that for cross-section specific heteroskedasticity. Knowing that labor shares in Europe show a very similar pattern and that their economies were exposed to similar shocks, this assumption might be of interest. The empirical analysis will consider both coefficient covariance methods.

3.2.3 The Fixed Effects Method

The random effects method is still not satisfactory to our cross country analysis because the exogeneity assumption 3.2 seems too restrictive. The cross section terms c_i capture any country specific effects that are unknown or immeasurable to the econometrician. An example of these time constant variables in our application are characteristics of the labor market protection legislation which vary heavily across countries but are approximately time invariant. We have to be aware of the fact that the cross specific effects c_i are likely to be correlated with the explanatory variables, that is 3.2 does not hold because it demands that not only the idiosyncratic errors η_{it} but also the cross section specific errors c_i are uncorrelated with the explanatory variables, i.e. $E(X'_{it}\eta_{it}) = 0$ and $E(X'_{it}c_i) = 0$.

This is why we now turn to the fixed effect method: the key difference of fixed effects method with respect to the random effects method is that it does not restrict correlation between the unobserved effect and the error term, i.e. $E(\mathbf{X}'_{it}\varepsilon_{it}) \neq 0$. The c_i are thus allowed to be a function of $\mathbf{X}_i$.[3] This is one of the major advantages of the fixed effects estimator: It allows to consistently estimate regression coefficients even though the explanatory variables might be correlated with unobserved, time constant

[3] cf. Wooldridge (2002) p. 266

variable c_i. Contrary to simple time series or cross section analysis where the omission of a relevant variable results in biased estimates, the panel estimation techniques allow for reliable regression results. Whenever assumption 3.2 fails to hold, the random effects estimator will be biased and the fixed effects estimator should be used.[4] Graphically, the fixed effects estimator takes into account the "individuality" of each country by letting the intercept vary for each country but still assuming that the slope coefficients are constant across countries.

As in the random effects model, the explanatory variable is assumed to be strictly exogenous, i.e. assumption 3.5 still holds. The idea of the fixed effects method is to use the time dimension of the data to eliminate the time constant variable c_i. There are several methods to do so. The *fixed effect transformation* or *within transformation*[5] involves removing cross-section means from the dependent variable and exogenous regressors, and then performing the specified regression on the "demean". Algebraically, this can be seen as follows. Averaging data for each cross section over $t = 1, 2, ..., T$ gives the cross section equation

$$\overline{Y_i} = \overline{\mathbf{X}_i}\beta + c_i + \overline{\eta_i}, \tag{3.7}$$

where $\overline{Y_i} = \frac{1}{T}\sum_{t=1}^{T} Y_{it}$, $\overline{\mathbf{X}_i} = \frac{1}{T}\sum_{t=1}^{T} \mathbf{X}_{it}$ and $\overline{\eta_i} = \sum_{t=1}^{T} \eta_{it}$.[6]

Second, subtracting the cross section equation 3.7 from the original equation 3.1 gives

$$Y_{it} - \overline{Y_i} = (\mathbf{X}_{it} - \overline{\mathbf{X}_i})\beta + \eta_{it} - \overline{\eta_i}, \tag{3.8}$$

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[4] cf. Johnston and DiNaro, p. 396

[5] cf. Wooldridge (2002) p. 267

[6] Note that with a large number of cross sections one could simply use equation 3.7 to estimate β. This estimator is referred to the *between estimator*, which uses only variation between the cross section observations. However, this estimator does not make use of the time dimension of the data and is thus not efficient.

where the constant cross section term drops out. This time demeaned equation can now be estimated by pooled OLS: the fixed effect estimator is the OLS estimator from the regression of $Y_{it} - \overline{Y_i}$ on $\mathbf{X}_{it} - \overline{\mathbf{X}_i}$:

$$\widehat{\beta}_{FE,OLS} = \left(\sum_{i=1}^{M} \left[(\mathbf{X}_{it} - \overline{\mathbf{X}_i})(\mathbf{X}_{it} - \overline{\mathbf{X}_i}) \right] \right)^{-1} \left(\sum_{i=1}^{M} \left[(\mathbf{X}_{it} - \overline{\mathbf{X}_i})(Y_{it} - \overline{Y_i}) \right] \right) \tag{3.9}$$

The condition for OLS to be consistent is the strict exogeneity condition 3.5. This condition for equation 3.8 translates into $E\left[(\mathbf{X}_{it} - \overline{\mathbf{X}_i})'(\eta_{it} - \overline{\eta_i}) \right] = 0$. From assumption 3.5 we know that $\mathbf{X}_{it}$ is uncorrelated with η_{it} and thus $(\mathbf{X}_{it} - \overline{\mathbf{X}_i})$ will be uncorrelated with $(\eta_{it} - \overline{\eta_i})$ and OLS will be consistent. Moreover, one can show that under assumption 3.5 the fixed effect estimator is unbiased.[7] As long as the idiosyncratic error term is time invariant and homoscedastic, i.e. $E(\eta_i \eta_i | X_i, c_i) = \sigma_\eta^2 I_T$, the fixed estimator will be efficient. However, in practice and specifically in our analysis this assumption might be too restrictive as the errors might be serially correlated. The estimation procedure applied in these cases is feasible generalized least squares (FGLS). We therefore consider again the residual matrix. Let Σ be the variance-covariance matrix for the fixed effect transformation model 3.8, i.e. $\Sigma = E\left[(\eta_{it} - \overline{\eta_i})(\eta_{it} - \overline{\eta_i})' \right]$. The fixed effects procedure first considers simple fixed effects estimation to obtain cross-section specific residual vectors $\widehat{\eta_i - \overline{\eta_i}} = \left(Y_{it} - \overline{Y_i} \right) - (\mathbf{X}_{it} - \overline{\mathbf{X}_i})\widehat{\beta}$, $i = 1, 2, ..., M$. In the second step, these residuals are used to estimate the cross-specific variances. A consistent estimator of Σ is given by $\widehat{\Sigma} = \frac{1}{M} \sum_{i=1}^{M} \widehat{\eta_i - \overline{\eta_i}}\ \widehat{\eta_i - \overline{\eta_i}}'$. Feasible GLS can then be performed using the estimated matrix $\widehat{\Sigma}$:

$$\widehat{\beta}_{FE,FGLS} = \left(\sum_{i=1}^{M} \left[(\mathbf{X}_{it} - \overline{\mathbf{X}_i})'\widehat{\Sigma}^{-1}(\mathbf{X}_{it} - \overline{\mathbf{X}_i}) \right] \right)^{-1} \left(\sum_{i=1}^{M} \left[(\mathbf{X}_{it} - \overline{\mathbf{X}_i})'\widehat{\Sigma}^{-1}(Y_{it} - \overline{Y_i}) \right] \right). \tag{3.10}$$

Assuming full rank and 3.5, the estimator 3.10 will be consistent.

[7] see Wooldridge (2002) p. 268 for details

The Dummy Variable Regression

When 3.2 does not hold there is an alternative representation of the model 3.1 which involves the representation of country specific effects with the help of country dummy variables. The regression thus includes M dummy variables, say Dm_1, Dm_2, ..., Dm_M. These dummy variables for each cross section Dm_i take the value 1 for $m = i$ and 0 otherwise. That is, the dummy variable is 1 whenever the observation belongs to country i. The model can then be expressed as $Y_{it} = c_1 Dm_1 + c_2 Dm_2 + ... + c_M Dm_M + \mathbf{X}_{it}\beta + \eta_{it}$ or, more concisely

$$Y = \mathbf{X}\beta + Dc + \eta, \tag{3.11}$$

where $D = I_M \otimes i_T$, where i_T is an $T \times 1$ vector of ones and c is the vector of individual effects.

Again, to dispose of the fixed effects, data is transformed before applying least squares: differencing 3.11 across time gives $\Delta Y = \Delta\mathbf{X}\beta + \Delta\varepsilon$, where the dummy variables drop out because they are time invariant. Whereas assumption 3.2 does not hold for the original data, it holds for the transformed data: $\Delta\mathbf{X}$ is orthogonal to $\Delta\varepsilon$, i.e. $E(\Delta\mathbf{X}'\Delta\varepsilon) = 0$, so that OLS can be applied.[8] The dummy variable estimator can be shown to be identical to the fixed effect estimator. Therefore 3.11 is just another representation of the fixed effect equation which is why the fixed effect estimator is also called the least squares dummy variable estimator.

One should note that, although the dummy variable method allows obtaining estimates of the fixed effects c_i[9] there is no sensible interpretation: the method described above does not yield consistent estimates. Under the asymptotic theory that $M \longrightarrow \infty$ the number of fixed coefficients c_i tends to infinity as well. However, the primary interest lies in consistently estimating the coefficients in β, not the fixed effects.

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[8] cf. Johnston and DiNaro, p. 396

[9] see Wooldridge (2002) p. 273 for details

3.2.4 Dynamic Panel Models

The fixed effects estimator seems to reliably apply to our data. To test the robustness we also include dynamic panel data estimators as alternative estimation methods, namely the Arellano-Bover (1995) and the Arellano-Bond (1991) estimator. These estimators are of value to our analysis for several reasons. First, the proposed methods do not require the strict exogeneity of the explanatory variables (cf. assumption 3.5) so that we might include GDP growth into the explanatory variables which, because of endogeneity, can only be used as an instrument in the FE regression. Arellano and Honoré (2001) point out that the assumption of strict exogeneity is misleading in time series analysis where the distinction between predetermined and strictly exogenous variables is crucial. Second, the Arellano-Bover estimator allows to consistently estimate non-stationary data in levels as opposed to first difference. Last, Wooldridge (2001) argues that the "optimal procedure" is a generalized method of moments (GMM) procedure because it uses all available instruments and is thus efficient with respect to the FGLS estimator which, even when including instrumental variables (IV), only uses a constant dimension of IVs across t.

The general model can be expressed as

$$Y_{it} = \sum_{k=1}^{p} a_k Y_{i(t-k)} + \mathbf{X}_{it}\beta + c_i + \eta_{it} \tag{3.12}$$

where Y_{it} is the dependent variable, c_i is again the cross specific effect and η_{it} the residuals, $\mathbf{X}_{it}$ are the explanatory variables which may now contain lagged explanatory variables. The number of cross sections is again M, the number of time series is reduced by the number of maximal lags q, i.e. $t = q+1, ..., T$. The regression thus includes lagged dependent (and independent) variables. Because of the lagged dependent variables OLS will be inconsistent for small values of T. One of the leading estimation methods to address this problem is the Arellano-Bond linear estimator. This method combines a procedure to remove cross specific effects (i.e. differencing) with a GMM estimation including instrumental variables.

Equation 3.12 can be rewritten more compactly for each cross section as

$$Y_i = W_i\delta + c_i\tilde{\imath}_i + \eta_i, \tag{3.13}$$

where Y_i are the stacked $T-p$ values of Y_{it} for cross section i, $\tilde{\imath}_i$ is a $T-p$ vector of ones, δ is the vector of coefficients and W_i includes both lagged dependent variables and explanatory variables, i.e. $W_i = (Y_{it-1}, Y_{it-2}, ..., Y_{it-p}, \mathbf{X}_{it})$. The estimator proposed by Arellano and Honoré (1991) transforms data by differencing to eliminate cross specific effects: $Y_i^* = \begin{pmatrix} Y_{i(2+p)} - Y_{i(1+p)} \\ Y_{i(3+p)} - Y_{i(2+p)} \\ \cdots \\ Y_{i(T)} - Y_{i(T-1)} \end{pmatrix}$. Defining W_i^* and η_i^* similarly, the model reduces to $Y_i^* = W_i^*\delta + \eta_i^*$.

However, this model cannot be estimated by OLS because the transformed errors are correlated with the transformed dependent variable. The GMM estimator helps out in using a set of moment conditions $E(Z_i'Y_i) = 0$ where Z_i are the instrumental variables. The Arellano-Bond estimator exploit the fact that the transformed data is uncorrelated with lagged dependent variables, i.e. $E(\eta_{it} \mid Y_{i(t-1)}) = 0$.[10] Whereas Y_{it} is correlated with the composite error term, the level variable Y_{t-2} can then be used as an instrument for Y_{i1}^* because it is uncorrelated with $\eta_{i1}^* : E(Y_{i(t-2)}\eta_{it}^*) = 0$ or $E\left[Y_{i(t-2)}(Y_{it}^* - W_{it}^*\delta)\right] = 0$. The corresponding sample moments are then $\frac{1}{M}\sum_{i=1}^{M} Y_{i(t-2)}(Y_{it}^* - W_{it}^*\delta) = 0$ for $t = 3, ...T$.[11] Assuming that the $\mathbf{X}_{it}$ are strictly exogenous, the transformed data $\mathbf{X}_{it}^* = \mathbf{X}_{i(t+1+p)} - \mathbf{X}_{i(t+p)}$ serve as instruments for themselves.

Consider for instance the model 3.12 for one lag of the dependent variable, i.e.

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[10] cf. Arellano and Honoré (2001) p. 3242.

[11] cf Arellano and Bond (1991).

$p = 1$: $Y_{it} = a_1 Y_{i(t-1)} + \mathbf{X}_{it}\beta + c_i + \eta_{it}$, or, the transformed version $Y^*_{it} = a_1 Y^*_{i(t-1)} + \mathbf{X}^*_{it}\beta + \eta^*_{it}$, where the cross section terms drop out. The GMM estimator makes use of the increasing number of valid instruments for later observations. For the "first" equation $Y^*_{i3} = aY^*_{i2} + \eta^*_{i3}$ only the first observation Y_{i1} is a valid instrument, for the second equation $Y^*_{i4} = aY^*_{i3} + \eta^*_{i4}$, the first two observations Y_{i1} and Y_{i2} can be used as instruments, etc. The instrument matrix Z_i is thus

$$Z_i = \begin{pmatrix} Y_{i1} & 0 & 0 & \ldots & \ldots & \ldots & \ldots & 0 & X^*_{i3} \\ 0 & Y_{i1} & Y_{i2} & \ldots & & & & 0 & X^*_{i4} \\ \ldots & & & \ldots & & & & . & . \\ 0 & 0 & 0 & \ldots & Y_{i1} & Y_{i2} & \ldots & Y_{i(T-p+1)} & X^*_{iT} \end{pmatrix}.$$ [12]

Given the matrix of instrumental variables Z_i, the Arellano-Bond estimator of δ is given by

$$\widehat{\delta} = \left[\left(\sum_{i=1}^{M} W_i^{*\prime} Z_i\right) A \left(\sum_{i=1}^{M} Z_i^{\prime} W_i^*\right)\right]^{-1} \left(\sum_{i=1}^{M} W_i^{*\prime} Z_i\right) A \left(\sum_{i=1}^{M} Z_i^{\prime} Y_i^*\right). \tag{3.14}$$

Under homoscedastic errors, the optimal choice of A is $A = \left(\sum_{i=1}^{M} Z_i^{\prime} H Z_i\right)^{-1}$, where H is the covariance matrix of the differenced residuals η^*_{it}. This estimator is referred to by the one-step Arellano-Bond estimator. Consequently, estimated errors can be obtained from the one step estimator $\widehat{\delta}$ to form a robust estimator making use of an estimated variance-covariance matrix which is referred to as the two-step Arellano Bond estimator.

An alternative transformation of the data to first differencing involves the computation of orthogonal deviations (Arellano and Bover, 1995). Orthogonal deviations express each observation as the deviation from the average of future observations in the sample for the same cross section, and weight each deviation to standardize the vari-

[12] cf. Stata (2005)

ance.[13] In fact, the orthogonal deviations procedure is equivalent to first differencing to get rid of fixed effects, and then using GLS to eliminate first degree autocorrelation resulting from first differencing (Arellano and Honoré, 2001). We will not go into detail as the algebra is quite complex and intuition resembles basically the difference transformation estimation (see Greene, 2003, p. 310 for details).

There are however two major advantages of this transformation: First, autocorrelation between transformed errors will be absent if it is absent among the original errors. Second, orthogonal deviations allows to estimate the equation in levels, using variables in first differences as instruments as opposed to estimation in first difference using level instruments. The estimator 3.14, where the asterisk now represent transformed data using orthogonal differences, remains valid for nonstationary data as long as one assumes

$$Cov(Y_i^*, \eta_i) = 0, (t = 2, ..., T), \tag{3.15}$$

which requires "that the process started in the distant past".[14] Arellano and Bover (1995) point out that the assumption 3.15 adds levels moment equations of the form $E\left[(Y_{it} - aY_{i(t-1)})Y^*_{i(t-1)}\right] = 0$ for $t = 3, ..., T$ which remain valid even if Y is integrated of order one. This property is particularly interesting in our setting as labor shares are integrated of order one and the method allows estimating the autoregressive parameters a_k.

[13] Algebraically, data is transformed using the following formula: $\varepsilon^*_{it} = \left(\frac{T-t}{T-t+1}\right)^{1/2}\left[\varepsilon_{it} - \frac{1}{T-t}(\varepsilon_{i(t+1)} + ... + \varepsilon_{iT}\right]$, i.e. the transformation substracts the mean of the remaining future observations available in the sample. The first term weights the transformed errors to equalize their variance.

[14] cf Arellano and Honoré (2001) p. 3244.

CHAPTER IV

DATA AND DEFINITION OF VARIABLES

This chapter presents the data used in our regression analysis. First, we outline the calculation to adjust labor shares to account for self-employment. Second, we justify the choice of explanatory variables and state their sources. Our variables can be grouped into *i*) macroeconomic indicators *ii*) indicators characterizing the capital market and *iii*) factors determining the labor market. Lastly, we undertake some transformations of the data in the light of nonstationarity.

4.1 Labor Shares and the Adjustment for Self-Employment

Labor shares are calculated as total labor compensation over total value added in national income. Data on value added national income and its components is obtained from OECD National Account Data[1] or from national sources.[2] Labor compensation of employees does not only comprise wages and salaries of employees but also related costs such as contributions to social security, private pensions, health insurance, life insurance and similar schemes. Capital shares are the complement to labor shares in value added. They not only comprise corporate profits, i.e. dividends and undistributed profits, but also interests, proprietors' income and rental income of persons. Taxes on production are also accounted for in capital shares.

[1] e.g. that of the OECD STAN database for Industrial Analysis

[2] e.g. from the Bureau of Economic Analysis (BEA) for the United States.

The main data to calculate labor shares is drawn from national accounts. OECD Source provides the *Annual National Accounts Volume II - Detailed Tables - Main Aggregates Vol. 2005 release 01* which gives detailed national accounts data for most OECD countries. Data is available from 1970 onwards. It provides numerous approaches (income approach, output approach etc.). The approach used in this study is the *Gross Value Added at Basic Prices by Industry* approach (Table 6) and *Components of Value Added* (Table 7) which segments value added into capital and labor shares. We also use the *OECDSource STAN Structural Analysis* database to obtain more detailed data down to industry levels, in particular tables in *STAN Industry Vol. 2005 release 05.* This database provides a wide range of economic indicators that are compatible with the first database. In particular, this database combines national accounts data with data from other sources, such as national business surveys. It is of importance to the present study because it breaks down value added national income into main industrial sectors and sub industries. Finally, we use data on the composition of total employment (i.e. the number of salaried workers and of self-employed per industrial sector).

How to most adequately calculate labor shares is highly controversial. An intuitive way to calculate labor shares (LS) would be to divide labor compensation by total value added: $LS = \frac{Labor\ Compensation}{Total\ Value\ Added}$. However, this method ignores the fact that labor shares do not account for self-employment labor income. Self-employed workers are defined as "persons who are the sole owners, or joint owners, of the unincorporated enterprises in which they work ...". As information on self-employed income is not available, the OECD decided to completely exclude self-employed income from the calculation of labor compensation in order not to falsify the correct data on employee compensation. Self-employed income is thus accounted for in the share of capital categorized as "mixed income". Evidently, self-employed use labor and capital to produce output or provide a service. Calculating labor shares ignoring self-employment income underestimates the total contribution of labor to value added. Overall labor shares should be adjusted to include labor income of self-employed. This adjustment is important when one considers the large differences in self-employment across countries and over time (cf. Figure A.2

in the appendix).

The first step is thus to adjust labor shares to compensate for self employed income. Information on self-employed income is hard to obtain, estimates are limited to some countries and for recent years only. Even if self-employed income was known, this would not solve the question how their income should be split into labor and capital income. Literature on factor shares has proposed different methods to interpolate self-employed income. One straightforward and simple to use method is to allocate an income equal to mean labor compensation for employees. The "corrected" labor share is thus calculated as follows: $LS_{adjusted} = \frac{Labor\ Compensation}{Total\ Value\ Added} \cdot \left(1 + \frac{Number\ of\ Self-Employed}{Total\ Employment}\right)$. Labor shares are augmented proportionally to the number of self-employed in total employment.

However, this adjustment method is claimed not to take into account the dynamics of self employed income. Timbeau (2002) remarks that self-employed people enjoy larger incomes than employees. He therefore allocates an income equal to 120% of the mean income of employees. This seems to be an appropriate measure with respect to the current situation as most of the self-employed practice high income professions. In the 1970s though, as a large part of self-employed workers represented agricultural workers, the average income of self-employed was probably inferior to average income.[3] We therefore look at the dynamics of the composition of the working population not only over time but also across industries.

Figure 4.1 displays the proportion of self-employment per industry for the five most important industries in the United States. The OECD distinguishes between nine major industries. Self-employment seems to follow no major trend except for the agricultural sector. The high proportion of self-employment in the 1970s falls constantly from 57% down to only 38% today. This tendency is similar to that in other OECD countries. One way to bypass the problem of agricultural self-employment would be

[3] Cf. Carny (2006)

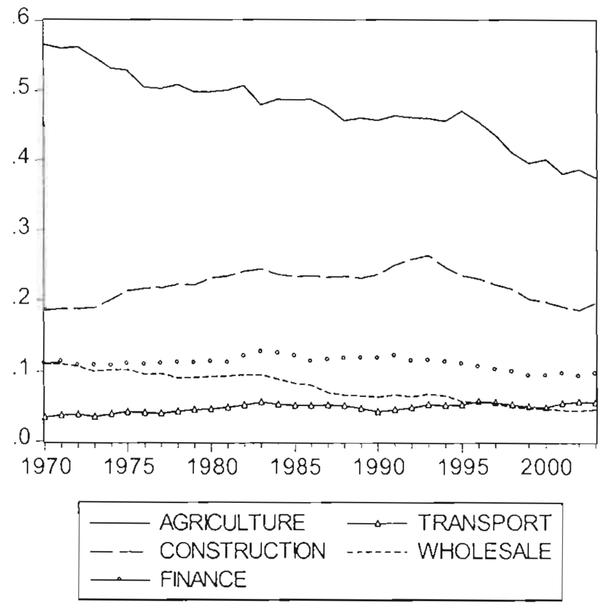

Figure 4.1 Self-Employment in Total Employment per Industry, USA. (Source: OECD, STAN database, Total Employment and Employees)

to simply work with non-agricultural value added data.[4] To provide a more complete picture of the economy we follow Askenazy (2003) in calculating labor shares for each industry separately, imputing a salary equal to the mean salary in the respective industry. The OECD publishes not only labor compensation and value added per industry, but also the number of total employment and the number of employees per industry, the difference representing self-employed and unpaid family workers.[5] We can thus apply the formula presented above for each industry separately. Resulting labor shares per industry are subsequently weighted according to the importance of the respective industry in value added and then aggregated:

$$LS^{*} = \sum_{i=1}^{n} \frac{Total\ Value\ Added_i}{Total\ Value\ Added} \left[\frac{Labor\ Compensation_i}{Total\ Value\ Added_i} \cdot \left(1 + \frac{Number\ of\ Self-Employed_i}{Total\ Employment_i} \right) \right],$$

[4] Cf. Askenazy (2003)

[5] Cf. OECD (2005)

where $i = 1, 2, ...n$ is the industry index.

Data availability reduces the pool of countries to fifteen major OECD countries which allows a representative comparison of Anglo-Saxon versus European countries. Our sample consists of Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), Denmark (DNK), Finland (FIN), France (FRA), Italy (ITA), Japan (JPN), Germany (DEU)[6], the Netherlands (NLD), Norway (NOR), Spain (ESP), the United Kingdom (UK) and the United States of America (USA). For most countries, data is available from 1970 onwards. When data on the number of self-employed persons within a single industry was not available for the beginning of the sample period, we interpolate shares backwards, assuming self-employment shares to be constant for all industries but agriculture where we assume a negative tendency consistent with other countries.[7] When data on labor compensation was missing, we assume that labor shares calculated per industry follow the same tendency as overall labor shares which are available for all 15 countries from 1970 onwards.

Figures 4.2 and 4.3 display the resulting labor shares for two sample countries, the United States and France. $LABOR\_FRA$ and $LABOR\_USA$ represent labor compensation divided by total value added, respectively. LS_FRA and LS_USA are calculated as described above. The figures show that adjustment for self-employment primarily only shifts the labor share curve upwards, tendencies seem to persist. However, it is in part true that adjustment for self-employment does extenuate the magnitude of labor share variations.[8] The magnitude of the maximal increase/decrease in labor shares reduces from 8.7 to 4.7 percentage points in Germany, from 7.2 to 7.0 in France and from 12.0 to 9.5 percentage points in Italy.

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[6] Data on Germany up to 1991 is on West Germany only.

[7] These adjustments only affect the calculation of labor shares for the Netherlands, Belgium and Spain for no more than two industries and for no more than five years.

[8] This is what Askenazy (2003) claimed.

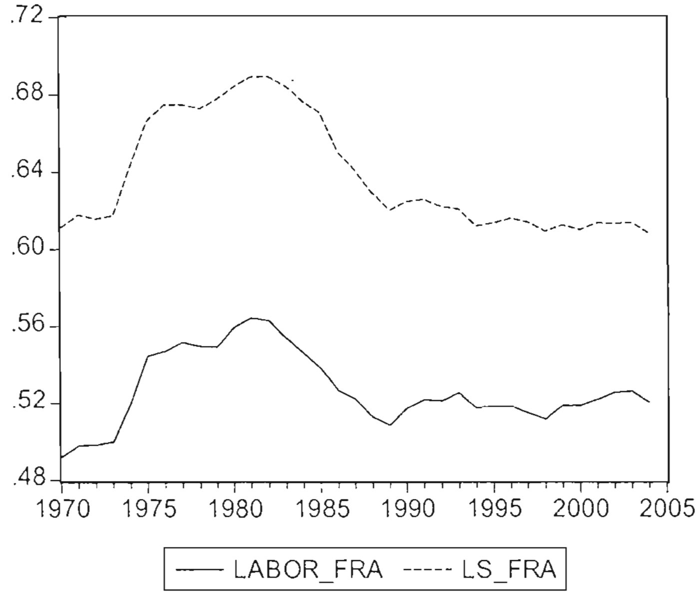

Figure 4.2 Labor Shares with and without Adjustment for Self-Employment, France

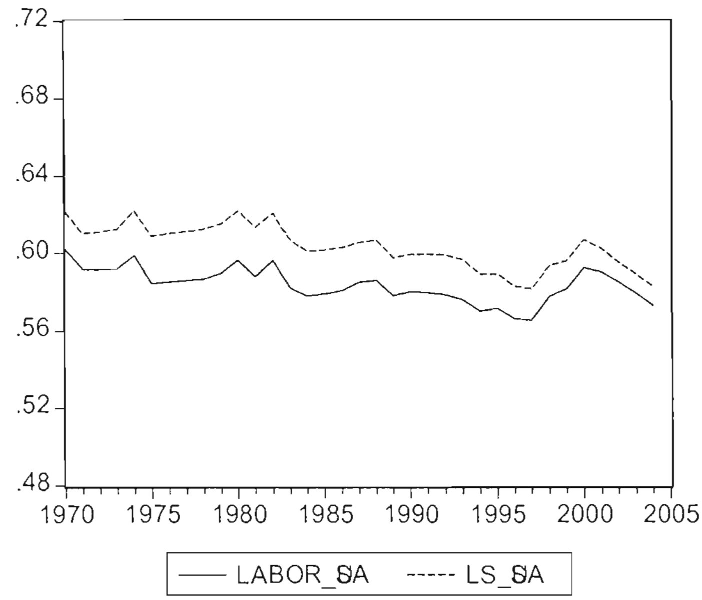

Figure 4.3 Labor Shares with and without Adjustment for Self-Employment, USA

Another important observation is the fact that correcting for self-employment has larger effects on European countries because self-employment is relatively more important on average. The increase in labor shares is more pronounced in European countries, which approaches the overall level of European labor shares to Anglo-Saxon levels which one might falsely presume to be higher than in Europe when analyzing Figures 1.2 and 1.1. The peak of average European labor shares in 1980 for instance increases from 55 % to 66 % due to the adjustment for self-employment.

4.2 Choice of Variables

We include three categories of variables: *i*) macroeconomic variables, i.e. GDP growth to account for cyclical fluctuations, inflation and trade to GDP as a measure of globalization *ii*) measures of the capital market, i.e. financial intermediation, private credit, claim on the private sector and stock turnover *iii*) measures that account for differences in labor markets, i.e. union density, labor market flows, strikes and lockouts, replacement rates and minimum wage to average wage. In the following section we outlay the motivation for the choice of variables.

4.2.1 Macroeconomic Variables

GDP growth (LOG(GDP))

We include GDP growth to account for cyclical fluctuations and differences in the overall macroeconomic performance for the countries analyzed. We should expect a negative correlation between labor shares and GDP growth: The real wage fluctuating much less over the cycle than the average productivity due to wage rigidities, additional income during economic booms will go to capital in form of greater profits. Contrary, profits will be low during economic downturns, contributing to low capital shares. The counterpart, labor shares, should thus be countercyclical.[9]

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[9] cf. Merz (1995) for empirical and theoretical evidence.

Inflation (INF)

Second, we include the inflation rate. The peaks in labor shares around 1980 are associated with high levels of inflation (cf. Figures 4.4 and 4.5). This supports the idea of a relationship between the two. As for European as well as Anglo-Saxon countries, inflation increased in most countries up to the early eighties. Starting in the 80s and continuing throughout the 90s, inflation decreased due to new objectives in monetary policy, focusing on the control of inflation rates instead of accommodating monetary policy aiming at output growth.

Disinflation in turn might have affected factor shares. Alcalá (2000) argues that disinflation favors capital through various channels. First, inflation causes fixed costs of price adjustments to increase. Second. mark-up pricing on the basis of historical costs lowers real mark-ups when inflation is high. High inflation rates during the 70s might have contributed to increasing labor shares in Europe, whereas the stabilized situation in the 80s thanks to disinflation has motivated a stronger use of capital. The argument might however run in the opposite direction: firms facing higher costs due to high real wages respond with increasing prices.

Whatever reason is the most pertinent, we consider movements in inflation rates too important to be ignored in regressions. Inflation is calculated for each country on the basis of the Consumer Price Index (CPI) obtained from the *OECD main economic indicators database* via $\pi_{t,i} = \frac{CPI_{i,t}-CPI_{t-1,i}}{CPI_{t,i}}$ where $CPI_{t,i}$ is the consumer price index of country i in period t.

Globalization (TRADE)

Thirdly, it is likely that globalization influences factor markets. The opening up of national to international markets, not only due to the European Union, resulted in higher international competition in product, capital and labor markets. Literature on

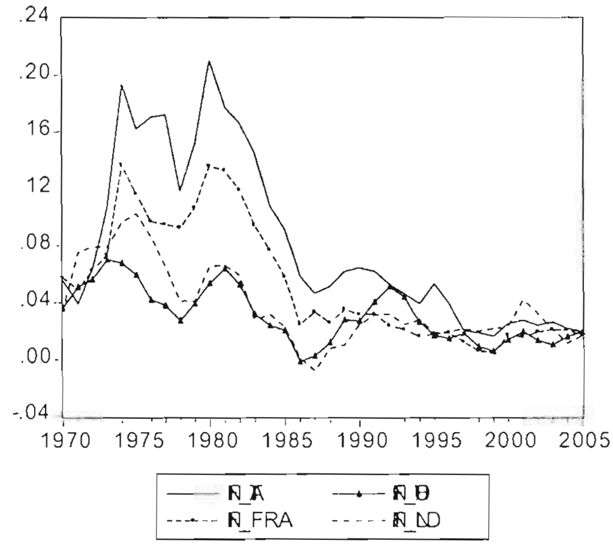

Figure 4.4 Inflation - Continental European Countries. (Source: OECD Main Economic Indicators, Consumer Price Index)

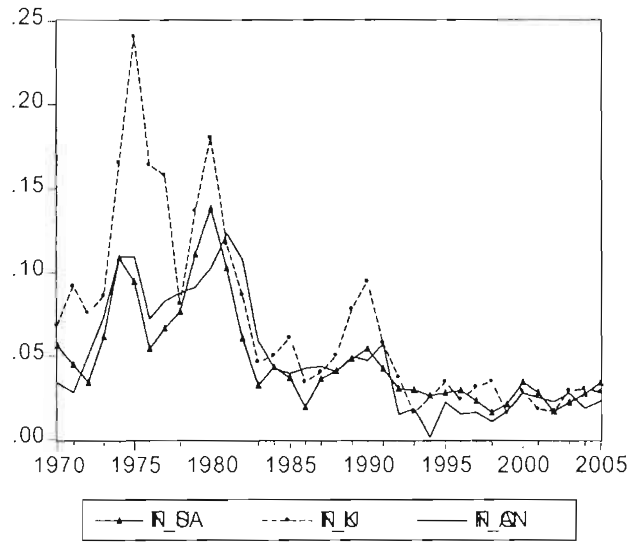

Figure 4.5 Inflation - Anglo-Saxon Countries

this topic argues that increased globalization increases the elasticity of labor demand.[10] What is more, globalization encourages factor substitution as firms have access to new markets. Greater investment possibilities might favor capital shares, contributing to explain constantly falling labor shares in Europe during the 80s and 90s.

Harrison (2002) argues rather convincingly that increased globalization weakens employee power, reducing the part of surplus that is allocated to employees in the bargaining process of employees and employers over wages. She uses "measures of trade openness, capital account restrictions, and capital flows" to assess the dimension of globalization and relates these measures to factor shares. She comes up with a weak but statistically significant negative impact of several globalization measures on labor shares. However, increased competition due to globalization is likely to reduce mark-ups, an argument running against increasing capital shares.

To find out whether globalization influences labor shares we include the variable *Trade-to-GDP*[11]. It is defined as the sum of exports and imports divided by GDP and therefore measures a country's openness or integration in the world economy. *Trade-to-GDP* has considerably increased in all of our sample countries. Nevertheless, there is no detectable distinction between European and Anglo-Saxon countries. Trade doubles to triples in all countries from 1970 up to today, the trend is smooth and does not seem to be related to factors such as the evolution of the European Union.

4.2.2 Capital Market Imperfections

Capital Market Imperfections can not be measured directly over time. To account for changing capital markets we include different measures that characterize the performance of the capital market.

Financial Intermediation (FI)

[10] cf. for instance Slaughter (2001)

[11] The indicator is published by OECD Statistics, Dataset: Macro trade indicators.

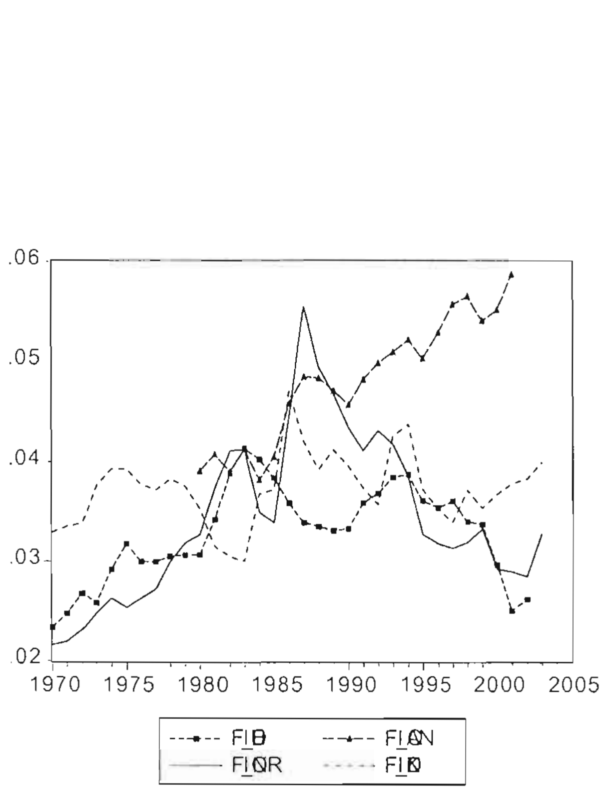

Figure 4.6 Part of Financial Intermediation in Value Added. (Source: OECD STAN database for Industrial Analysis, Vol. 05 and OECD Annual National Accounts -- Vol. 2, detailed aggregates, Gross Value Added by Industry)

A straightforward way of measuring the activity of financial intermediation is to calculate value added of this branch in national income. The *OECD STAN Industrial Database* releases value added per industry from 1970 onwards. Financial intermediation[12] comprises three different categories, the first, *Financial intermediation except insurance and pension funding* corresponding to depository institutions, i.e. banks other than the central bank.[13] Figure 4.6 displays the part of financial intermediation in value added for some sample countries.

We observe the following: financial intermediation value added increases for European countries from 1970 up to the mid-1980s. The increase is much stronger from

[12] Financial intermediaries are all "units which incur liabilities on their own account on financial markets by borrowing funds which they lend on different terms and conditions to other institutional units". (Source: OECD Glossary).

[13] The other two categories, *Insurance and pension funding, except compulsory social security* and *Activities related to financial intermediation* are of no interest to our analysis. In the following I will refer to this first category by simply *financial intermediation*.

1980 onwards which might be interpreted as a result of the deregulation of the banking sector. Thereafter, financial intermediation slowly decreases in European countries. As for Canada, financial intermediation in value added increases throughout the time horizon in focus. Unfortunately, data is incomplete for some countries for the beginning of the sample period. Regressions will take this fact into account by allowing for other complementary variables. The aim is to assess whether increased activity of the banking sector is associated with decreases in labor shares.

Private Credit (PC)

An additional measure of the intensity of banking activity is the amount of bank deposits. Beck (1999) et al. have constructed a *Database on Financial Development and Structure* covering a wide range of indicators of financial development and structure across countries and over time. Indicators are grouped into measures of the size, activity and efficiency of financial intermediaries and markets, respectively. The measure of the activity of the banking sector, *Private credit by deposit money banks to GDP*, is of value to our analysis. This measure isolates credit issued to the private sector (excluding the central bank) as opposed to credit issued to governments and public enterprises. It is thus a useful measure of bank activity in the sense of financial intermediation between lenders and investors. Data from 1970 onwards is available for nearly all fifteen countries.[14] Figure 4.7 displays the development of private credit for some countries. All countries see a clear increase in lending activity over the sample period. Credit seems to be greater in continental Europe compared to Anglo-Saxon countries.

Claim on the Private Sector (CLAIM)

The *International Monetary Fund* (IMF) provides data gathered in banking surveys and publishes it in the *International Financial Statistics database*. One of the interesting variables is the amount of claims of deposit money banks on the private sec-

[14] Data on Germany starts in 1992 only.

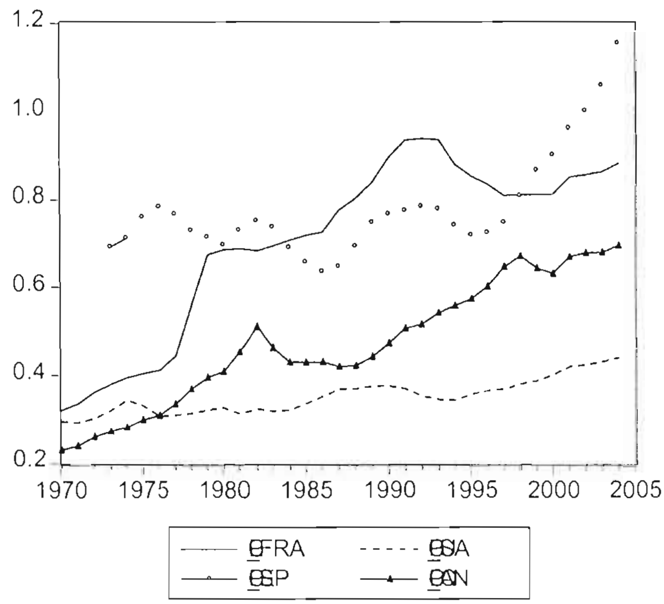

Figure 4.7 Private Credit. (Source: OECD Financial Structure Dataset, World Bank)

tor. Deposit money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits. We adjust data on claims on the private sector for currencies and divide by nominal GDP to give a comparable measures net of inflation.

Banking Profit (PROFIT) and Interest Revenue (INTEREST)

To take into account the profitability of the banking sector we recur at the *SourceOECD Bank Profitability Statistics database* which provides a wide rage of information on income statements, balance sheets and capital adequacy. The income statement analysis allows extracting relative measures: we use profits[15] as a percentage of balance sheet total and the net interest margin[16] to capture the profit margin. Dereg-

[15] Profits include retained and distributed profits

[16] The net interest margin is definded as interest income minus interest expense divided by total bank assets

ulation incurring greater competition are associated with lower profits. Demirgüç-Kunt and Huizinga (2000) for instance analyze financial systems across countries and conclude that "the greater the development of a country's banks, the tougher is the competition, the greater is the efficiency and the lower are the bank margins and profits."

Stock Turnover (STOCK)

Lastly, we account for the dynamics of the stock market as a complement to the banking sector. While stock markets are highly developed in Anglo-Saxon countries, European stock markets are relatively smaller.[17] Financial deregulation and an expanding stock market might motivate a modification of firms' financing activities, resulting in more equity and less debt financing. What is more, countries with better functioning markets may create a competitive environment that puts downward pressure on bank interest margins. Measures of the activity and efficiency of stock markets are included in the *Financial Structure Dataset* mentioned above. We follow Beck (1999) et al. in using their measure *stock market total value traded to GDP* to measure the activity or liquidity of the stock markets. It is defined as total shares traded on the stock market exchange divided by GDP.

Note that financial regulation should equally be an important factor in the determination of factor shares. However, exogenous measures of financial regulation are only available for some points in time, not on a yearly basis (cf. table 1.1 for instance). We thus have to restrict our analysis to potentially endogenous indicators such as bank profits and private credit.

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[17] cf. for instance the measure *Stock Market Total Value Traded to GDP* in the *Financial STructure Dataset*.

4.2.3 Labor Market Rigidities

Lastly, we take into account labor market indicators. We approximate employment protection legislation by a number of labor market characteristics such as labor market flows, unionization and minimum wage legislation.

Employment Protection Legislation

Employment protection legislation (EPL) indicators constructed by the OECD[18] suggest that labor is far more protected in European countries compared to Anglo-Saxon countries. The indicators are summarized in Table 4.2.3: Employment protection on regular employment in all four categories, that is difficulty of dismissal, notice and severance pay, overall strictness of protection against dismissals and regular procedural inconveniences, is significantly higher in European countries. The United States, the United Kingdom and Canada range among the least regulated countries. In 2003, taking difficulty of dismissal as an example, the United States and the United Kingdom are rated 1.25 and 0.5, respectively, on a scale from 0 to 4. On the other extreme, France and Germany rated 3 and 3.25, respectively. Employment protection on temporary employment shows even more dispersion in the strictness.[19] Furthermore, comparing EPL indicators in 1990 and 2003 suggests that European countries where legislation was particularly strict have slowly been adjusting to allow for greater flexibility. Albeit some convergence in the strictness of EPL between OECD countries, the classification of countries into strict and flexible EPL is similar in 1990 and 2003.

Employment protection is likely to protect labor shares in the short run, however, in the long run firms move away from costly and inflexible labor to a stronger use of capital. Caballero and Hammour (1997) for instance demonstrate a positive correlation between the change in the capital to labor ratio and an index of job protection. Likewise,

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[18]Cf. OECD Statistics, Dataset: Strictness of EPL.

[19]cf. OECD (2004), p. 71

Table 4.1 Employment Protection Legislation

	Dismissal		Notice		Strictness		Inconveniences	
	1990	2003	1990	2003	1990	2003	1990	2003
Australia	1.5	0.02	0.01	0.01	0.01	1.5	0.5	1.5
Austria	4.25	3.75	0.02	0.86	2.92	2.37	2.5	2.5
Belgium	1.75	1.75	2.286	2.43	1.68	1.73	0.01	0.01
Canada	0.02	0.02	0.95	0.95	1.32	1.32	0.01	0.01
Denmark	1.5	1.5	2.04	1.91	1.52	1.47	0.01	0.01
Finland	1.75	2.75	1.86	0.01	2.79	2.17	4.75	2.75
France	0.03	0.03	1.52	1.91	2.34	2.47	2.5	2.5
Germany	3.25	3.25	0.01	1.29	2.58	2.68	3.5	3.5
Italy	3.25	3.25	0.57	0.57	1.77	1.77	1.5	1.5
Japan	3.33	3.5	1.81	1.81	2.38	2.44	0.02	0.02
Netherlands	2.75	3.25	0.01	1.91	3.08	3.05	5.5	0.04
Norway	3.75	3.75	0.01	0.01	2.25	2.25	0.02	0.02
Spain	3.75	3.25	3.14	2.57	3.88	2.61	4.75	0.02
United Kingdom	0.75	1.25	1.10	1.10	0.95	1.12	0.01	0.01
United States	0.5	0.5	0.00	0.00	0.17	0.17	0.00	0.00
Cont. Europe, average	2.94	2.88	1.70	1.68	2.47	2.27	2.78	2.25
Northern Europe	2.75	3.25	1.43	0.01	2.52	2.20	3.38	2.38
Anglo-Saxon, average	1.08	1.25	0.68	0.68	0.81	0.87	0.67	0.67

Dismissal stands for difficulty of dismissal
Notice stands for notice and severence pay
Strictness stands for overall strictness of protection against dismissals
Inconveniences stands for regular procedural inconveniences
Source: OECD.Stat, Dataset: Strictness of EPL, regular employment

Gomez-Salvador et al. (2004) find that EPL significantly reduces job creation.

Unfortunately, it is difficult to include measures of employment protection into our regressions as indicators on hand are point in time estimates. Time series data is either not available for a representative set of countries or casts doubt on the reliability. Caballero and Hammour admit that their index[20] "is far from a sufficient index for the actual severity of [...] firing restrictions." The OECD EPL indicator is restricted to three points in time, notably in 1990, 1998 and 2003. Few researchers have tried to construct measures across time (cf. Lazear, 1990). However, they remain difficult to compare with the more general measure published by the OECD. A possible solution is to approximate EPL, or labor market flexibility in more general, by other labor market indicators that we will consider each in turn.

Labor market flows (FLOWS)

A first idea to approximate labor market flexibility is by labor market flows. Researchers agree that weak employment protection is associated with high job in- and outflows, indicating greater flexibility.[21] The general mobility rate[22] in Canada for instance was nearly twice as high as in Belgium (2001). Data on labor market flows is published in a database of the *International Labor Organization* (ILO), *Key Indicators of the Labor Market* for nine out of our 15 countries.

Unionization (UNION)

Second, stronger labor unions in European countries keep wages relatively higher and stickier. Union power as a measure of workers' bargaining power might explain

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[20] the index is based on the length of the mandatory severance payments and of the advanced notification period.

[21] cf. for instance Bertola, Boeri and Cazes (1999).

[22] General mobility rate is defined as the sum of inflow into and outflow from wage & salaried employment, see ILO Labor market indicators.

relatively large labor shares in continental Europe during the 1970s. However, unions have become less powerful in Europe, enabling firms to offer wages closer to marginal product of labor. Unions in Anglo-Saxon countries were weaker to start with, so that the real wage was close to marginal product of labor on average. *OECD Statistics* publishes the total number of employees and that of union members, the latter obtained from surveys. This data can be used to calculate the union membership ratio to approximate labor union power. As one might suggest, union membership is low in Anglo-Saxon countries (12% in the United States in 2002) and relatively high in European countries (74% in Denmark). Union density in Europe shows an increase in the 1970s reverting in 1980 and slowly decreasing up to today. This development might be of importance in the attempt to explain the increase and following decrease in labor shares.

Replacement Rates (RR)

Third, another indicator of the generosity of a social system is the amount of benefits paid to the unemployed. Replacement rates show the level of pensions as a percentage of previous individual earnings. The OECD publishes average replacement rates for the period of 1970 up to today. Clearly, replacement rates are higher in European countries than in Anglo-Saxon countries: In 2003, the average replacement rate in the Netherlands was 53% compared to only 14 % in the United States. Replacement rates do not show a common tendency, increasing irregularly for most countries.

Strikes and Lockouts (STRIKE)

Fourth, we follow Bentolila and Saint-Paul (1999) in using the number of strikes and lockouts normalized by the number of employees in that year to capture workers' bargaining power. Data is obtained from the ILO LABORSTA database. There are enormous differences in the number of strikes and lockouts. Among the highest rates are Finland (with an average of 0.44 strikes per employee), Australia (0.26), Denmark (0.18), France and Italy (0.13). Low strike countries are Austria (0.0012), the Netherlands (0.0044) and the United States (0.0011). Moreover, one can observe a negative tendency for almost all countries from 1973 onwards. An exception is Denmark, experiencing peaks in the late 90s.

Minimum wage to average wage (MINWAGE)

Lastly, we include the ratio of minimum wage to average wage (from the *OECD Database on Labour Force Statistics*). Minimum wages determine the cost of labor especially for jobs which are easily substitutable. Recent experience suggests that a well-designed minimum wage might foster higher employment by "guaranteeing that work pays better than remaining on social benefits"[23]. The ratio of the minimum wage to the average wage is highest in France (0.609 in 2003). On the other extreme ranges Spain (0.288 in 2003) followed by Japan and the United States (0.31 and 0.32, respectively).

The list of indicators of labor market rigidity is far richer; however, not all turn out to be of importance in regressions. Other indicators of labor market rigidity would be interesting as for instance collective bargaining measurements, unemployment benefit duration, etc. Unfortunately, data availability constraints limit the number of indicators that can be used in the regression. Total labor taxes for instance explain why labor is more expensive in European countries compared to Anglo-Saxon countries.[24] However, as labor taxes are accounted for in the labor share, we can be sure that the inclusion of this variable will bias our results.

Product Market Regulation (PMR)

Complementary to labor market regulation, one should expect product market regulation to play an important role in the determination of factor shares. The OECD

[23] cf. OECD (2006)

[24] Total tax wedge amounts to only 16% (2004) in the United States compared to 39% in France. (*SourceOECD Taxing Wages Statistics*)

Table 4.2 Product Market Regulation

	Product Market Regulation 1998	2003
Australia	1.3	0.9
Austria	1.8	1.4
Belgium	2.1	1.4
Canada	1.4	1.2
Denmark	1.5	1.1
Finland	2.1	1.3
France	2.5	1.7
Germany	1.9	1.4
Italy	2.8	1.9
Japan	1.9	1.3
Netherlands	1.8	1.4
Norway	1.8	1.5
Spain	2.3	1.6
United Kingdom	1.1	0.9
United States	1.3	1.0
Cont. Europe, average	2.1	1.5
Northern Europe	2.0	1.4
Anglo-Saxon, average	1.3	1.0

Source: OECD, Indicators of Product Market Regulation

(2001) finds that for instance anti-competitive product market regulations have significant negative effects on non-agricultural employment rates and that product market regulation that curbs competition has positive implications for wage premia. Table 4.2.3 shows the overall indicator for product market regulation calculated by the OECD. The indicator is an aggregate of different measures of product market regulation such as measures of state control, of barriers to entrepreneurship, of barriers to trade and to investment. The indicator gives a similar picture to that of the EPL indicator: first, we can observe a general decline in product market regulation from 1993 to 2003. Second, Anglo-Saxon countries seem to be less regulated that central European countries.

Unfortunately, the indicator and sub-indicators are available for two points in time only, so that we cannot include the indicator in our empirical regression. We should however keep in mind that product market regulations play certainly an important role in the determination of employment rates and wages that we cannot account for in the regression.

4.3 Data Transformation

The industry financial intermediation is a fraction of national income. Therefore, we need to exclude this industry from the calculation of labor shares when regressing the latter on financial intermediation to avoid collinearity. We will denote labor shares excluding the financial intermediation industry by $LSWOF$ as opposed to labor shares including all industries LS. This operation does not change the evolution of labor shares, it merely shifts the curves slightly downwards.

As a common phenomenon of time series data, most of our series are autocorrelated. A correlogram on for instance labor shares in Germany reveals that labor shares are highly autocorrelated which suggests that labor shares are integrated. Theoretically, there is no reason for labor shares to be integrated, the variable should always return to its equilibrium value. However, we cannot reject the test on the hypothesis that labor shares are integrated which we interpret as a small sample estimation problem. Our empirical specification thus has to take into account the fact that labor shares might be integrated. To verify this observation and to determine the order of integration we perform the *Augmented Dickey-Fuller (ADF) unit root test*. The test on $LSWOF\_DEU$ for example fails to reject the test in levels but rejects the test in first differences (cf. Tables B.1 and B.2 in the appendix). The series is thus integrated of order one. Repeating the test for all other countries reveals that the same is true for all sample labor shares.[25] The same applies to most of our explanatory variables: GDP for instance grows at an approximately constant rate, so we use the logarithm of GDP and differentiate to make the series stationary. Inflation contains a unit root, as well as financial intermediation. Summary statistics of all primary variables are provided in

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[25] One might interprete the turn in labor shares in 1980 as a structural break which potentially invalidates the ADF test. However, the alternative test proposed by Phillips and Perron (PP) (1988), which allows for one structural break, equally does not reject the unit root test in levels and rejects the test in first differences for all countries but the USA.

the appendix, cf. Tables B.3 - B.6.

However, the *Augmented Dickey-Fuller test* and its alternatives are often criticized for their low power, that is the probability of rejecting the null hypothesis (that the series is I(1)) when in fact the process is stationary is low when the coefficient is close to unity.[26] This is why we additionally perform panel unit root tests. Panel-based unit root tests have higher power than unit root tests based on individual time series because they make use of the larger cross-section sample. A summary of five tests on the series $LSWOF$ is displayed in Table 4.3. All the results indicate the presence of a unit root. The Levin, Lin & Chu, the Im, Pesaran and Shin W-stat test and both Fisher tests fail to reject the null of a unit root. Similarly, the Hadri test statistic, which tests the null of no unit root, strongly rejects the null hypothesis in favor of a unit root.

Tests on the other variables are not shown but confirm the presence of a unit root in the logarithm of GDP, private credit, claims on the private sector, stock turnover, trade and strikes per employees; and stationarity for financial intermediation, minimal wage to average wage and union membership. The tests on inflation are now in favor of stationary, where the tests include intercepts and trends. Nonstationary data can be differenced once to give stationary series. For the first specification, our dependent variable is thus first differenced labor shares instead of levels.[27]

The presence of both dependent and independent integrated variables brings up the question of cointegration. To check for the presence of cointegration between labor shares and GDP growth and/or inflation we simply regress labor shares on the latter and subject resulting error series to unit root tests. For most cases, the series indicate integration of order one which alludes to the absence of cointegration. However, our rather simplistic tests are likely to suffer from little sample bias so we cannot fully exclude the eventuality of cointegration.

[26] cf. Smith (2001)

[27] This is the transformation method that Smith (2001) proposes for nonstationary panel data in the case of no cointegration.

Table 4.3 Summary Panel Unit Root Tests on Labor Shares

Panel unit root test: Summary
Sample: 1970 2005
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic selection of lags based on AIC: 0 to 4
Andrews bandwidth selection using Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root				
Levin, Lin, Chu t*	1.90607	0.9717	15	490
Null: Unit root				
Im, Pesaran and Shin W-stat	3.76400	0.9999	15	490
ADF - Fisher Chi-square	8.27070	1.0000	15	490
PP - Fisher Chi-square	10.3657	0.9997	15	509
Null: No unit root				
Hadri Z-stat	11.5101	0.0000	15	524

** Probabilities for the Fisher test are computed using an asymptotic Chi-Squared distribution. All other tests assume asymptotic normality.

CHAPTER V

EMPIRICAL SPECIFICATIONS AND ECONOMETRIC RESULTS

This chapter presents estimation results. The panel regressions include a sensitivity analysis allowing for alternative estimation methods and additional variables. An interpretation completes this chapter.

5.1 Panel Regressions

Panel regression are performed on the total pool of 15 countries. To address the omitted variable problem we use the fixed effects estimator. The method used is Feasible GLS where the cross section covariances are estimated from a first-stage pooled OLS regression.[1] Cross section weighting accounts for cross-equation heteroskedasticity. To account for integration we follow Smith (2001) in differentiating series containing unit roots. He argues that, in case of no cointegration and integrated dependent variables the first difference model is appropriate. The base regression we run takes the following form:

$$D(LSWOF_{it}) = c_i + \beta_{GDP} D\left[LOG(GDP_{it})\right] + \beta_{Inf} INF_{it} + \beta_{FI} FI_{it} + \eta_{it}, \qquad (5.1)$$

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[1]We follow the preferred estimation method of Baltagi and Griffin (1997). Their analysis on 18 countries over 31 years on the gasoline demand suggests that pooled estimators are preferable to country specific regressions and two stage least squares procedures.

where the subindices denote countries ($i = 1, ..., 15$) and time ($t = 1970, ..., 2005$).[2]

$LSWOF_{it}$ denotes the labor share and $D()$ is the first difference operator,

c_i denotes the time invariant fixed effect for country i,

GDP_{it} is GDP and $LOG()$ is the logarithm operator,

INF_{it} the inflation rate,

FI_{it} the measure of financial intermediation and

η_{it} is the random disturbance.

The regression 5.1 might suffer from specification errors which we will address below but serves as a starting point. Regression results are presented in Table 5.1.[3] The estimated effect of financial intermediation is highly statistically significant and negative. This implies that higher capital market performance and a well developed financial system are associated with decreasing labor shares. An increase in financial intermediation of one percentage point has a negative impact of 0.336 on short run labor share changes. The other coefficients in the model appear plausibly estimated: GDP growth enters with a negative sign, the effect being weak but statistically significant at the one percent level. The negative sign is consistent with theoretical assumptions made in chapter 4 and theoretical and empirical evidence of Merz (1995). Inflation enters with a significant and positive coefficient, as expected. Stock turnover enters with a weak positive sign. This might be interpreted as an empirical affirmation of the theoretical argument presented by Perotti and Spier (1993): higher equity financing at the detriment of debt financing lowers the power of employers in the bargaining process with employees and thus might positively affect wages and labor shares. The effect is

[2] Pesaran and Smith (1995) note that, in the case of integrated variables, differencing removes some of the serial correlation that might arise due to the "inappropriate imposition of homogeneity on the slope coefficients".

[3] We include the variable $STOCK$ in the regression because its omission results in autocorrelated error terms and a low Durbin-Watson statistic.

Table 5.1 FE Regression Results: All countries

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009552	0.003634	2.628338	0.0093
D(LOG(GDP_?))	-0.086878	0.028284	-3.071605	0.0025
FI_?	-0.336358	0.077691	-4.329409	0.0000
INF_?	0.131528	0.022251	5.911011	0.0000
STOCK_?	0.003531	0.000821	4.300839	0.0000
Weighted Statistics				
R-squared	0.300688			
Adjusted R-squared	0.232277			
Durbin-Watson stat	1.955235			
Unweighted Statistics				
R-squared	0.293812			
Sum squared resid	0.017730			
Durbin-Watson stat	1.977183			

Dependent Variable: D(LSWOF_?)
Method: Pooled EGLS (Cross-section weights)
Effects Specification: Cross-section fixed (dummy variables)
Sample (adjusted): 1971 2003
Included observations: 33 after adjustments
Cross-sections included: 15
Total pool (unbalanced) observations: 332
Linear estimation after one-step weighting matrix
White cross-section standard errors and covariance

however weak but statistically significant.

The cross specific fixed effects are not reported, the presented parameter c represents the average of the c_i. The reported Durbin Watson Statistic is close to 2 so we should not worry about autocorrelation in the error term or misspecification. As it has been mentioned above, the assumption of fixed effects can be tested with the help of the Wu-Hausmann test. The test estimates both the random and the fixed estimates mode. Second, estimations of the fixed and random effect parameters c_i are obtained via $\widehat{c_i} = \overline{Y_i} - \overline{\mathbf{X}}_i\widehat{\beta}$. The Wu-Hausmann test then consists in testing the null hypothesis

Table 5.2 FE Regression Results using Log Transformation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.116468	0.037886	3.074138	0.0023
D(LOG(GDP_?))	0.694226	0.284935	2.43644	0.0154
FI_?	-1.442209	0.677855	-2.127606	0.0342
INF_?	2.34794	0.210376	11.16066	0.0000
Weighted Statistics				
R-squared	0.89347			
Adjusted R-squared	0.887552			
Durbin-Watson stat	0.496459			
Unweighted Statistics				
R-squared	0.891171			
Sum squared resid	2.480238			
Durbin-Watson stat	0.441977			

Dependent Variable: LOG(LSWOF_?/(1-LSWOF_?)
Method: Pooled EGLS (Cross-section weights)
Effects Specification: Cross-section fixed (dummy variables)

whether the random effects model is well specified, that is, whether the differences between the random effects and the fixed effects are small. The results of the test on our data provide strong evidence against the null hypothesis. We can thus conclude that the theoretical assumptions in chapter 3 were legitimate.

However, this regression contains a conceptual problem: Labor shares are a ratio comprised in the interval [0,1]. The above formulation regresses first difference labor shares on inflation and economic growth. This means that, in the stationary state, where the inflation rate and the growth rate are stable, the model predicts a certain level of first difference labor shares, and thus a labor share above 1 or below 0. This is why we transform labor shares to allow boundlessness. This can be done by a logistic transformation $logtrans\_LS = \log(\frac{LS}{1-LS})$ which results in values on the interval [-∞, ∞].

Table 5.2 shows results for the GLS regression where labor shares in first difference have been replaced by the log transformation. The correlation coefficient R^2 increases substantially, however, the Durbin Watson Statistic points to autocorrelation in the error term. The regression results replicate the respective signs of our explanatory variables from the first regression. However, significance levels decrease for the coefficient on financial intermediation and that of GDP.

An alternative estimation method that accounts for the likely presence of integration in the dependent variable is the specification in levels including lags of the latter. The second specification we run is

$$LSWOF_{it} = c_i + \sum_{l=1}^{2} a_l LSWOF_{i(t-l)} + \beta_{Inf} INF_{it} + \beta_{FI} FI_{it} + \sum_{l=0}^{2} \beta_{GDP\_l} GDP_{i(t-l)} + \eta_{it}. \quad (5.2)$$

This specification allows to get an idea of the first order autocorrelation of labor shares and to eliminate potential bias due to cointegration. We follow Bentolila and Saint-Paul (2003) in regressing actual labor shares rather than logarithms of labor shares. As a convenient side effect, the specification in levels of the panel estimator facilitates the interpretation of the estimated coefficients: the β depict the effect of a change in the explanatory variable on the level of labor shares instead of first differenced labor shares. Estimation results are presented in table B.7 in the appendix. The coefficients on inflation and financial intermediation are similarly signed, however, their magnitude cannot be compared to coefficients estimated above because the presence of lagged dependent variables changes fundamentally the interpretation of the coefficients. The lagged dependent variables embody the past values of the explanatory variables so that any "measured influence" of inflation or financial intermediation is "the effect of new information".[4] Labor shares are countercyclical which results in a coefficient of GDP growth on labor shares of -0.07 which is statistically significant. Financial intermediation yields a coefficient of about -0.1: an increase in financial intermediation in national income of one percentage point can explain the decrease in labor shares of 0.1 percentage points. Finally, inflation seems to positively affect labor shares: an increase of one percent in inflation increases labor shares by 0.13 percentage points. The coefficient on lagged labor shares of 0.95 suggests that labor shares are most likely integrated.

5.2 Sensitivity Analysis

In what follows, we check for the robustness of our results. We seek to improve the specification above by varying the estimation methods used. Second we vary the number of countries included. Last we widen the analysis in allowing for alternative variables of potential importance.

Table 5.3 investigates the sensitivity of the coefficients on the explanatory variables to a range of alternative specifications. We take the specifications in Table B.7 as a baseline. The coefficients from the baseline regression are reported in the top row of Table 5.3.[5] Each row of the table represents a different specification. In all cases the coefficient on financial intermediation is negative, implying that higher capital market performance is associated with low labor shares. The estimated effects of financial intermediation are mostly highly statistically significant. Similarly, the coefficient on inflation is robust to alternative specifications, the coefficient is highly statistically significant in all specifications. Inflation is associated with high labor shares.

First, we notice that GDP growth is endogenous and might thus bias our results. The *FE* estimator allows for endogenous fixed effects but requires the exogeneity of

[4] Greene (2003) p. 307

[5] We still include lagged GDP growth and two periods lagged labor shares in the regression but estimated coefficients are not shown to concentrate on the primary variables of interest.

Table 5.3 Sensitivity of Coefficients to Alternative Specifications

	Estimated coeffcients for the baseline explanatory variables			
Specification	LSWOF_(-1)	INF_	FI_	LOG(GDP_)
Baseline	0.949557 [0.047433] (0.0000)	0.130535 [0.019016] (0.0000)	-0.104689 [0.055431] (0.0599)	-0.070264 [0.022785] (0.0022)
GLS with IV	0.837812 [0.020197] (0.0000)	0.115182 [0.021284] (0.0000)	-0.721902 [0.118974] (0.0000)	-
Europe only	0.837453 [0.022068] (0.0000)	0.130172 [0.017243] (0.0000)	-0.753515 [0.132393] (0.0000)	-
Cont. Europe	0.784473 [0.064399] (0.0000)	0.188555 [0.073368] (0.0110)	-1.128763 [0.318374] (0.0005)	-
White Period	0.837812 [0.032089] (0.0000)	0.115182 [0.035354] (0.0013)	-0.721902 [0.178398] (0.0001)	-
Period FE	0.613904 [0.081472] (0.0000)	0.596901 [0.143637] (0.0000)	-1.085081 [0.813587] (0.1835)	-
GMM (orthogonal)	0.858917 [0.062902] (0.0000)	0.129788 [0.024563] (0.0000)	-0.392864 [0.163807] (0.0171)	-0.136509 [0.030950] (0.0000)
GMM (first difference)	0.305754 [0.057109] (0.0000)	0.155265 [0.035031] (0.0000)	-0.464373 [0.231730] (0.0460)	-0.228440 [0.027586] (0.0000)

Standard errors are given in square brackets [] and p-values in round brackets ()

explanatory variables. Wooldridge (2001) remarks that the fixed effects estimator is "inconsistent if an explanatory variable in some time period is correlated with η_{it}..." where "the size of the inconsistency might be small...". We thus recur at an instrumental estimator (IV) which instruments GDP growth and its lag. The second row of table 5.3 (cf. line *GLS with IV*) gives estimation results of the two-stage GLS estimation where instruments include GDP growth and GDP growth lagged, two periods lagged labor shares, lagged inflation and union power. The estimated coefficient on financial intermediation is now significant at the 1% level and jumps from -0.10 to -0.72, implying a much greater negative effect of financial intermediation on labor shares. The coefficient on inflation is slightly weakened. We conclude that instrumenting GDP growth seems to importantly improve our estimation results.

Second, we want to know whether labor shares in European countries are affected differently than the rest (cf. line *Europe only*). Removing Anglo-Saxon countries leads to an increase in the estimated coefficient of inflation on labor shares from 0.115 to 0.130. More importantly, it increases the coefficient on financial intermediation from -0.722 to -0.754. Dropping Nordic countries from the panel (cf. line *Cont. Europe*) further increases the estimated impact of financial intermediation on labor shares to -1.129. The inflation coefficient also increases significantly to 0.189. All coefficients are highly significant. We might conclude that the effects of financial intermediation are of greater importance in Europe than in Anglo-Saxon countries. This observation goes in line with the thought earlier discussed that decentralization of the financial sector in European countries during the 1980's brought about more pronounced changes whereas financial markets were relatively decentralized in Anglo-Saxon countries to start with.

The last four specifications alter the assumptions concerning the estimation procedure. First, we assume period specific heteroskedasticity instead of cross-section specific heteroskedasticity (cf. line *White period*). That is, the coefficient covariance method used is the White period estimator discussed in chapter 3 instead of the White cross-section estimator used in the base model. The method does not change the coefficients estimated but yields other standard errors, which however do not alter the fact that all three coefficients are highly significant.

Second, allowing for fixed time effects in addition to fixed cross section effects does not yield significant results (cf. line *Period FE*). The estimated coefficients on inflation and financial intermediation increase but the latter is no more significant. However, period fixed effects do not show any pattern nor are they statistically significant. Allowing for fixed time effects without any cross section effects does not yield significant results.

Third, we follow Bentolila and Saint-Paul (2003) in using the dynamic panel estimator (cf. line *GMM, orthogonal*) proposed by Arellano and Bover (1995). The Arellano and Bover estimator allows for endogeneity of the explanatory variables which allows us to include GDP growth in the variable list. The estimation method uses orthogonal deviations instead of differences for reasons discussed in chapter 3. The estimator is designed to include a growing number of lagged dependent variables as instruments. However, as our time series dimension is quite large this method would result in a grand number of instruments. Given that the small sample bias increases with the number of instruments, we prefer to restrict the number of lagged dependent variables to a maximum of five. Wooldridge (2001) states that "in practice, it may be better to use a couple of lags rather than lags back to $t = 1$."[6] The coefficient on lagged labor shares of 0.859 indicates high autocorrelation of labor shares. The coefficients on inflation and financial intermediation come close to coefficients previously estimated. We confirm the negative correlation of GDP growth and labor shares, the coefficient grows with respect to the baseline specification to -0.137. This implies that labor shares are countercyclical: an increase of 1% in GDP growth increases capital shares and thus decreases labor shares by about 0.137 percentage points. The coefficient is significant at the 1% level. The coefficient on financial intermediation drops to -.393 (with respect to the *GLS with IV* specification), whereas the coefficient on inflation is slightly stronger (0.130).

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[6]The GMM weighting method is again *cross section weights* which assumes the presence of cross-section heteroskedasticity. The coefficient covariance method is the *White period method* which is robust to arbitrarily serial correlation and time-varying variances in the disturbances.

Fourth, using instead the Arellano and Bond estimator (1991) (cf. line *GMM, first difference*) which transforms data by first differencing yields even stronger coefficients: the coefficient on financial intermediation grows from -0.393 to -0.464, the coefficient on inflation from 0.130 to 0.155. The coefficient on lagged labor shares is a lot weaker (0.310) which is however consistent with the finding of Blundell and Bond (1998) that, for high values of a_k, the first difference GMM estimator suffers "both a huge downward bias" and yields "very imprecise estimates [for a_k]."

Next, we test for specifications including alternative variables. Regression results are shown in Table 5.4. We start off with the last but one specification, GMM with orthogonal deviations, as the baseline regression because this estimation method seems to most appropriately capture the specific features of our analysis. The first column (cf. *Baseline*) presents results from the GMM specification. The inclusion of alternative variables does not change signs but only affects the magnitude and significance levels of the base line variables. In all instances, the coefficient on financial intermediation is statistically significant and negative, implying lower labor shares as financial intermediation is strong. The coefficient on inflation is statistically significant in all but one specification. Coefficients on GDP growth and lagged labor shares remain highly statistically significant as well.

First, we test for a number of labor market indicators discussed in chapter 4 (cf. column *Labor market*). Accounting for labor market dynamics results in enforcing the effects of the baseline variables: the coefficient on inflation increases from 0.129 to 0.162 and the coefficient on financial intermediation from -0.459 to -0.528. As for the new variables, all of these estimates are statistically significant. but effects are ambiguous. The greatest impact on labor shares is that of union density. Union density enters with a positive coefficient suggesting that higher employee power protects labor shares (in the short run). The estimated coefficient on labor market flows is positive, which contradicts the assumption that high labor market regulation (which is associated with low labor market flows) protects wages and therefore labor shares. Low labor market

Table 5.4 Panel Estimates Including Alternative Variables

Variable	Baseline	Labor market	Capital market	Summary
LSWOF_(-1)	0.864795	0.781190	0.787698	0.510482
	[0.062218]	[0.065411]	[0.059389]	[0.099963]
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
INF_	0.128612	0.161602	0.108306	0.248737
	[0.024264]	[0.026423]	[0.075226]	[0.074900]
	(0.0000)	(0.0000)	(0.1531)	(0.0011)
FI_	-0.459046	-0.527947	-0.132696	-0.184786
	[0.178037]	[0.192734]	[0.198860]	[0.241624]
	(0.0104)	(0.0066)	(0.0506)	(0.0445)
LOG(GDP_)	-0.134889	-0.101750	-0.224145	-0.225632
	[0.030789]	[0.034118]	[0.033454]	[0.058033]
	(0.0000)	(0.0031)	(0.0000)	(0.0002)
UNION_	-	0.036524	-	0.108047
		[0.015681]		[0.045924]
		(0.0206)		(0.0200)
FLOWS_	-	0.000573	-	-
		[0.000340]		
		(0.0952)		
TRADE_	-	-0.000506	-	-0.001210
		[0.000129]		[0.000271]
		(0.0001)		(0.0000)
STOCK_	-	-	0.002867	0.004016
			[0.000903]	[0.003622]
			(0.0020)	(0.2693)
PC_	-	-	-0.009699	-0.033308
			[0.006908]	[0.011620]
			(0.0635)	(0.0048)
INTEREST_	-	-	-0.001189	-0.001994
			[0.002442]	[0.003703]
			(0.7272)	(0.5910)
CLAIM_	-	-	0.011934	
			[0.003572]	
			(0.0012)	

Standard errors are given in square brackets [] and p-values in round brackets ()

flows, indicating difficulties in hiring and firing etc., might induce firms to shift away from labor to a more intensive use of capital. This logic is consistent with the findings of Caballero and Hammour (1998). They suggest that employers might respond to costly and inflexible labor by substituting capital for labor.

Unfortunately, other labor market indicators do not yield significant results. The inclusion of the number of strikes per employes results in a positive estimated coefficient suggesting that higher employee power protects labor shares. The coefficient is however not statistically significant and very weak. Bentolila and Saint-Paul (2003) argue that increasing bargaining power of employees creates a gap between the marginal revenue product of labor and the wage, thus positively influencing labor shares in the short run but leaving employment unchanged. Last, replacement rates (RR) do not yield any significant results.

Lastly, we can confirm the assumption that globalization reduces labor shares. The trade coefficient is statistically significant and negative. The result is qualitatively consistent with empirical findings by Harrison (2002): her regressions result in a negative impact of globalization measures on labor shares. Our estimated coefficient is slightly stronger compared to her estimated coefficient on trade-to-GDP, which might be due to the fact that her regression includes alternative measures of globalization.

The empirical results on labor market indicators are thus ambiguous. This might be due to differences in the short run and long run effects of labor protecting factors: in the short run, strong union power, high labor adjustment costs etc. might effectively protect employment and thus positively affect labor shares. However, the same factors might discourage firms to employ costly labor. In the long run, firms will substitute capital for labor where possible. What is more, we note that this version should be interpreted with care as data availability for labor flows reduces the pool to ten countries only. Excluding the variable $FLOWS$ from the regression does not change coefficients on the other variables much, but reduces the level of significance of some. The same argument applies for the inclusion of the relative measure of the minimum wage. Inclusion of this variable results in a weak positive coefficient which is consistent with the theoretical considerations in chapter 4. However, data availability further reduces the country panel to nine countries. As this variable is not statistically significant, we exclude it from the regression.

The second alternative specification tests for alternative measures of the capital market performance (cf. column *Capital market*). Accounting for alternative capital market dynamics results in weakening the effects of the baseline variables: the coefficient on inflation decreases from 0.129 to 0.108 and the coefficient on financial intermediation from -0.459 to -0.133. Stock turnover carries again a significant positive coefficient similar to the result presented of the first base specification (cf. Table 5.1). The amount of private credit divided by GDP as a measure of the level of debt of private firms carries the expected negative sign: Higher debt ratios weaken the power of employees in the bargaining process over wages and affect wages and thus labor shares negatively. Interest revenues as a percentage of balance sheet total do not systematically affect labor shares: the estimated coefficient indicates a negative effect, but the coefficient is not statistically significant and relatively small. Finally, claims on the private sector are only weakly linked to labor shares where the effect is counterintuitive. Other variables accounting for the performance of the banking sector do not yield significant results, either.[7]

The last specification (cf. column *Summary*) includes both labor market indicators and financial measures that have proven interesting before. The base variables, union power, trade and private credit are robust to variations of the variables included. Stock turnover and interest income do not turn out to be robust to the inclusion of alternative variables. This specification results in the strongest coefficient for inflation and a weaker coefficient on financial intermediation.

[7] We tested for the profit margin (defined in section 4.2.2), relative operating costs (operating costs devided by total assets), bank income (net interest and non-interest income divided by total assets). Data stems from the OECD Bank Profitability Database, Income Statement analysis.

5.3 Summary and Interpretation of Results

The most important results can be summarized as follows[8]:

i) Inflation is a positive and significant determinant of labor shares. It can be argued that inflation causes fixed costs of price adjustments to increase. Moreover, mark-up pricing on the basis of historical costs lowers real mark-ups when inflation is high. It is thus a negative determinant of profits. High inflation rates during the 70s might have negatively affected profits which are accounted for in capital shares. During the 90s, inflation decreased due to new objectives in monetary policy. Disinflation in turn favoured profits. thus causing labor shares to decrease. It is important to notice that the cause-effect relationship might run in the opposite direction: firms facing higher costs due to high real wages respond with increasing prices.

To get an idea of the quantitative importance of the positive coefficient of inflation, with an estimated coefficient of about 0.115 the decrease in the average inflation rate from about 12.3 % (1980) to an average of 1.5 % (1998) can account for a decrease in the average labor share of 1.242 percentage points. Moreover, as for the European specification, the estimated coefficient of 0.189 with a decrease in the average European inflation rate from about 10.2 % (1980) to an average of 1.3 % (1999) can account for a decrease in the average labor share of 1.678 percentage points. The qualitative results are consistent with previous findings (cf. Alcalá, 2000).

ii) Financial intermediation equally proves to be an important factor in the determination of labor shares. As expected, the increase of financial intermediation can in part explain shrinking wages and labor shares. The rise in financial intermediation during the 1980 might be interpreted as a result of the deregulation of the banking sector. Improved access of firms to debt financing might have strengthened the position of employers in the process of rent splitting. Perotti and Spier (1993) for instance argue

[8] The interpretation is based on the coefficients estimated in the *GLS with IV* specification because it seems to most appropirately capture the features of our analysis.

that the increased reliance on debt financing might be used as an effective bargaining tool in the determination of the wage: firms can argue that investment is necessary to pay future wages. Firms might then convincingly threaten that they will not invest in new projects unless the union agrees to reduce wages. There might thus be an important link between the financial structure on wages, which translates into a link between financial structure and labor shares.

A negative coefficient of 0.722 implies that the increase in average financial intermediation in value added from 2.30% (1970) to 4.40% (1993) can account for a decrease in average labor shares of 1.520 percentage points. Again, the effect on European countries is stronger: A negative coefficient of 1.129 implies that the increase in average European financial intermediation in value added from 2.34% (1970) to 4.24% (1992) can account for a decrease in average labor shares of 2.145 percentage points. The stronger effect for the European subgroup seems to support the idea that the effect of banking deregulation should be bigger, given that the banking sector was relatively deregulated in Anglo-Saxon countries to start with.

iii) Globalization is a negative and statistically significant determinant of labor shares. The opening up of national to international markets resulted in higher international competition in labor markets. Research on the potential effects of globalization on labor markets argues that increased globalization increases the elasticity of labor demand and thus weakens employee power. This should result in a smaller surplus that is allocated to employees in the bargaining process of employees and employers over wages and thus in smaller labor shares.

The estimated coefficient of -0.000506 implies that the increase of the trade-to-GDP ratio from an average of 33.3 (1980) to 62.3 (2004) can explain the decrease in average labor shares of 1.467 percentage points. The coefficient seems to be qualitatively robust to alternative specifications. Running the regression on European countries only results in a slightly weaker coefficient. The results are comparable with previous findings: Harrison (2002) calculates a weak but statistically significant negative impact of several globalization measures on labor shares.

iv) Labor market indicators have ambiguous effects on labor shares. The rigidity of labor markets should be expected to be a positive determinant of labor markets, as it has been argued in previous work. The coefficient on union density seems to support the idea that employee power protects wages and labor shares in the short run: the estimated positive coefficient of 0.108 implies that the decrease of union membership from an average of 44.4% (1978) to 31.3% (2001) can explain the decrease in labor shares of 1.001 percentage points.

Alternative measures of labor market characteristics yield however ambiguous results. Labor market flows, being associated with labor market flexibility, are positively related to labor shares. One possible argument is that high flexibility might encourage firms to employ more labor. The coefficient is however not robust which we attribute to the poor data availability reducing the panel to an unsatisfactory small sample.

Unfortunately a number of labor market indicators do not yield significant results at all, which might be explained by the lack of time series data that adequately describes the development of labor markets. We cannot conclude that indicators such as the minimum wage have no effect on labor shares. We rather argue that the nature of these indicators makes them unsuitable for panel regressions: the ratio of the minimum wage to the average wage for instance does not vary considerably over time and time series are available for nine countries only. Employment protection legislation similarly seems to be an important determinant of wages, and thus labor shares. However, constructed time series indicators vary little over time and do not yield significant results.

v) Finally, alternative measures of the financial sector partly confirm the results summarized in *ii*). Net interest income per GDP carries the expected sign (-0.001), where the effect is diminutive and not statistically significant. The measure of private credit equally implies negative effects on the labor share, the effect being quite weak as well (-0.010). The coefficient is however statistically significant and relatively robust to alternative specifications. Stock turnover is positively correlated with labor shares, where the effect is weak but statistically significant. The result is roughly consistent with theoretical work by Perotti and Spier (1993). The authors argue that high equity financing at the detriment of debt financing weakens the power of employers in the bargaining process over wages which might allow employees to keep wages, thus labor shares, high.

Coming back to our original question, we wanted to explain why we observe such differences in the development of labor shares after 1980, in particular why labor shares in Europe seem to constantly shrink but remain relatively constant in Anglo-Saxon countries. Our results indicate that financial intermediation can partly help to explain the puzzle. The share of financial intermediation in value added increased more significantly in European countries, which we associate with the deregulation of the banking sector in Europe. To the extent that the financial sector has been relatively deregulated to start with in Anglo-Saxon countries, it thus makes sense that the coefficient for financial intermediation is stronger for the European subsample (1.129 versus 0.722 for all countries).

Although inflation and trade are important determinants of labor shares, they do not help to explain the distinct development of labor shares across countries: both Anglo-Saxon and European countries have experienced a period of double-digit inflation and subsequent disinflation; both country groups face increasing competition due to globalization and rising trade-to-GDP ratios.

CHAPTER VI

THE MODEL

The empirical results found in the previous section can be backed up with a simple general equilibrium model. To abstract from short term movements and to concentrate on the equilibrium values of labor shares for different levels of credit market imperfections, we use the general equilibrium model with endogenous wages presented by Wasmer and Weil (2004). The model incorporates imperfections in both capital and labor markets which can be investigated about their impact on factor shares. We will not go into detail but give a short summary and concentrate on the application to this thesis. Please refer to Wasmer and Weil (2004) for more details on the model.

The economy consists of three agents: entrepreneurs, banks and workers. Entrepreneurs[1] and banks interact the capital market and entrepreneurs and workers in the labor market. Matching of workers and entrepreneurs in the labor market and of entrepreneurs and banks in the capital market, respectively, are modeled symmetrically: agents are matched with certain probabilities constituting search and matching frictions; matching takes time and is costly. Both credit and labor market imperfections turn out to affect the outcome of factor shares. In what follows, the matching process and the equilibrium values of factor prices are determined, respectively. Simulation and comparative statics are used to determine the impact of market imperfections on factor shares.

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[1]The terms "firm" and "entrepreneur" will be used interchangeably.

6.1 The Matching Process

The matching process in the labor market is constructed similarly to that in Pissaridies (1988). Firms find an unemployed worker (U) for their posted vacancy (V) at a matching probability $q(\theta)$. The probability depends negatively on the labor market tightness (from the point of view of entrepreneurs) $\theta = \frac{V}{U}$: the more entrepreneurs are posting vacancies, the tighter the labor market, the less probable is a match ($q'(\theta) < 0$), the longer it will take for the firm to find a worker on average.

The matching process in the credit market is symmetric to that in the labor market. Entrepreneurs (E) are looking for a financier (B) and are matched with a matching probability $p(\phi)$ where ϕ denotes the tightness of the capital market (from the point of view of entrepreneurs): $\phi = \frac{E}{B}$. Again, the probability depends negatively on the state of the credit market, i.e. $p'(\phi) < 0$. The more entrepreneurs are looking for a financier, the tighter the market, the less probable the match from the entrepreneur's point of view, the longer the entrepreneur will look for a banker on average.

Entrepreneurs start by searching a financier at a flow search cost c which is paid out of their pocket. Financiers dispense a flow search cost k looking for an entrepreneur. Once they found each other (with probability $p(\phi)$), they adopt a contract stipulating that the bank will finance the recruitment process of the firm and that the firm pays ρ to the bank in exchange, once it is producing output. ρ is determined in a bargaining process. The entrepreneur finally looks for a worker at a flow search cost γ which is financed by the bank. Once the entrepreneur found a worker (with probability $q(\theta)$), they determine the wage ω in a bargaining process, start producing an exogenously determined output y and pay the bank ρ for as long as the firm operates. Finally, firms are destroyed at an exogenous rate s.

6.2 Rent Splitting

Both the entrepreneur-bank relation as well as the entrepreneur-worker match result in a gain for each party. The total surplus of each relation is split according to the relative bargaining power of each agent in this process. Let α be the bargaining power of workers in the work contract and β be the bargaining power of banks in the financial contract.

Entrepreneurs and Banks

Entrepreneurs and banks benefit from exchanging capital. The splitting rule of total surplus is determined by Nash bargaining over the total surplus of their relationship and can be shown to result in[2]

$$\rho = \beta_\alpha (y - w) + (1 - \beta_\alpha)(r + s)\frac{\gamma}{q(\theta)}. \tag{6.1}$$

The equilibrium rental rate is a weighted average of the output of the firm net of wages $y - w$ and banks' opportunity cost, that is the cost of financing the recruiting process costing γ for on average of $\frac{1}{q(\theta)}$ periods. Weighting corresponds to the relative bargaining power of the two parties.

The effective bargaining power of banks $\beta_\alpha = \frac{\beta}{1-\alpha(1-\beta)}$ depends on the bargaining power of workers in the wage contract because bankers and entrepreneurs anticipate the wage contract when bargaining over the repayment rule.

Entrepreneurs and Workers

Similarly, both workers and entrepreneurs gain from the match and split their total surplus according to Nash bargaining. The resulting wage can be shown to be[3]

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[2] see Wasmer and Weil (2004) for more details.

[3] see Wasmer and Weil (2004) for more details.

$$\omega = \alpha_\theta (y - p) + (1 - \alpha_\theta) b \tag{6.2}$$

where b denotes unemployment benefits. The wage is thus a weighted average of output net of repayments to the bank $y - p$ and the workers outside option b. The effective bargaining power of workers $\alpha_\theta = \alpha \frac{r+s+\theta q(\theta)}{r+s+\alpha\theta q(\theta)}$ increases with bargaining power.

6.3 Equilibrium

In equilibrium, the tightness of the capital market can be shown to be

$$\phi^* = \frac{1 - \beta_\alpha}{\beta_\alpha} \frac{k}{c}. \tag{6.3}$$

To be able to track the effects of our key parameters on employment we follow Wasmer and Weil (2004) in normalizing the mass of workers to 1, so that u denotes both the number of unemployed and the unemployment rate. In equilibrium inflows into unemployment and outflows out of unemployment equalize:

$$s(1 - u) = \theta q(\theta) u. \tag{6.4}$$

Solving for the equilibrium unemployment rate yields $u^* = \frac{s}{\theta q(\theta)+s}$, or, for employment $(1 - u)^* = \frac{\theta q(\theta)}{\theta q(\theta)+s}$. The complete set of equations that describes the model is given in the appendix C.1.

6.3.1 The Share of Labor, Capital and Financial Intermediation

Labor shares

In this model the remuneration of labor is the number of workers times the wage rate ω. Total remuneration of labor is thus $(1 - u)\omega$. To be consistent with our data, labor shares should include not only net wages, but also supplements to wages, which amount to contributions to unemployment benefits in the model. Paid out unemployment benefits, i.e. ub, should equal contributions to unemployment benefits. Total remuneration of employees thus amounts to $(1-u)\omega + ub$.

To calculate labor shares, we divide remuneration of workers by output. Gross output amounts to y times the number of firms which is equal to the number of workers (each entrepreneur is matched with one worker): $(1-u)y$. Deducting search costs of entrepreneurs for workers γV and search costs of banks for entrepreneurs kB gives us a net output of $Y = (1-u)y - \gamma V - kB$.[4] The calculation of costs is given in the appendix C.2. The labor share is thus

$$LS = \frac{(1-u)\omega + ub}{(1-u)y - \gamma V - kB}. \tag{6.5}$$

Capital shares

The capital share in our data corresponds to the share of entrepreneurs' profits in total value added in the model. Profit per entrepreneur amounts to output net of factor costs $y - \rho - \omega$; profits of all entrepreneurs producing output to $(y - \rho - \omega)(1-u)$. Taking into account contributions to unemployment benefits, which are, in addition to net wages, paid by entrepreneurs, we have

$$CS = \frac{(y - \rho - \omega)(1-u) - ub}{(1-u)y - \gamma V - kB}. \tag{6.6}$$

Share of financial intermediation

The part of financial intermediation in output amounts to banks' income $\rho(1-u)$ net of search costs $\gamma V + kB$ divided by output:

$$BS = \frac{(1-u)\rho - \gamma V - kB}{(1-u)y - \gamma V - kB}. \tag{6.7}$$

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[4] We do not deduct search costs of entrepreneurs for bankers cE because the cost represents a nonmonetary effort of the entrepreneur.

6.4 Calibration and Simulation

6.4.1 Calibration

Our calibration of the model is close to that in Wasmer and Weil (2004) for the model with exogenous wages. The interest rate r is set to 0.05, output is normalized to 1. The separation rate s is 0.15 which corresponds to an average life time of firms of 6.67 periods. Instead of setting bargaining power α and β to 0.5, we set them to $\frac{1}{5}$ and $\frac{1}{6}$, respectively, because the model with endogenous wages implies that effective bargaining power, which matters for the outcome of wages and repayments, is strictly higher than α and β. We set costs c and k to 0.5 so that search costs turn out to represent a weak fraction of gross output. We follow Wasmer and Weil (2004) in parametrizing the matching functions $q(\theta) = q_0\theta^{-\eta}$ and $p(\phi) = p_0\phi^{-\varepsilon}$. The elasticities of the matching functions η and ε are kept at 0.5, respectively. We calibrate the level parameters p_0 and q_0 so that the outcomes of shares and the unemployment rate are realistic. We set unemployment benefits b to 0.1 so that they are in a realistic proportion to equilibrium wages.

Table 6.1 Calibration and Equilibrium Values

α=1/5	ε=0.5	Capital share	31.8951
β=1/6	η=0.5	Labour share	62.1007
c=0.5	s=0.15	Bank share	6.00422
k=0.5	r=0.05	Unemployment rate	5.56325
y=1	p_0=3	Wage rate	0.341805
b=0.1	q_0=1.5	Repayment rate	0.473727

Parameter values and equilibrium values are summarized in table 6.1. The bank share comes close to values of financial intermediation in value added we calculated in the empirical part of the thesis (section 4.2.2). The model produces capital and labor shares that realistically reflect shares in national output.

6.4.2 Comparative Statics

In the following we investigate how an increased probability of matching in the capital market and the variation of the bargaining power of banks and workers, respectively, affect labor and capital market outcomes.

6.4.2.1 Improved financial conditions $p(\phi)$

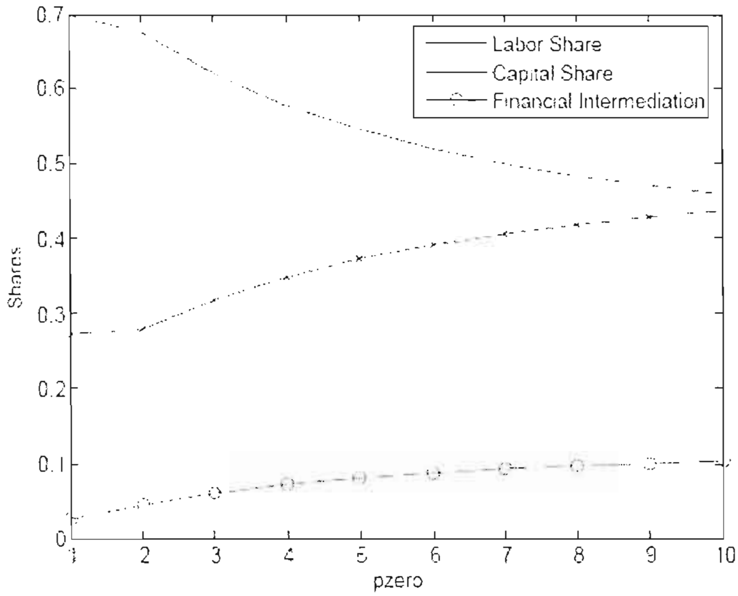
A more efficient capital market following financial liberalization for instance not only affects the capital market itself but also labor market variables like the wage and the labor share. An improved financial system can be modeled by an increase in the probability of matching $p(\phi)$ at any level of capital market liquidity ϕ.

The improved financial environment encourages both entrepreneurs and bankers to enter the market, so that the equilibrium credit market tightness ϕ^* stays put (cf. 6.3). However, the entry of entrepreneurs slackens the labor market, θ increases and the probability of finding a worker $q(\theta)$ with now more entrepreneurs in the market decreases. This means that the entrepreneurs will take more time on average to find a worker. Since it becomes more costly for banks to finance the recruiting stage, this boosts the repayment of entrepreneurs to banks ρ, ρ depends negatively on the matching probability $q(\theta)$ (cf. 6.1). The wage ω in turn depends on the previously determined repayment ρ : the higher the repayment of the entrepreneur to the bank, the smaller the total surplus that is split between workers and entrepreneurs and thus the wage.[5] The increase of θ can be shown to increase the effective bargaining power of workers, α_θ, which mitigates the decrease of wages. Last, the increase of θ boosts employment $(1-u)$ due to new entrepreneurs in the market.[6]

[5] Note that the rental rate ρ and the wage rate ω depend on each other which reinforces the initial effect of a decreased matching probability $q(\theta)$: the increase of ω further decreases ρ, which increases ω etc.

[6] This follows from the equilibrium condition 6.4.

Figure 6.1 Comparative Statics (p_0)



Labor shares

decrease due to improved financial conditions as the wage decreases (cf. 6.5). There are however some secondary factors: first, the increase of employment $(1 - u)$ slightly contributes to decreasing labor shares as output increases more importantly than workers' remuneration. Second, the entry of entrepreneurs and banks into the market increases search costs (γV and kB) which decreases output net of costs, mitigating the decrease of the labor share.

This result corresponds to our empirical findings on the effect of financial development on the labor share: a negative coefficient implies that financial intermediation has a negative impact on labor shares.

Capital shares

increase due to improved financial conditions. First, entrepreneurs' profits increase due to lower wages. This increase is mitigated due to higher repayments to the bank (cf. 6.6). Second, the enlargement of employment $(1-u)$ slightly increases capital shares. Third, the entry of banks and entrepreneurs and associated search costs kB and vacancy posting costs γV decrease output net of costs which still increases capital shares.

Financial intermediation

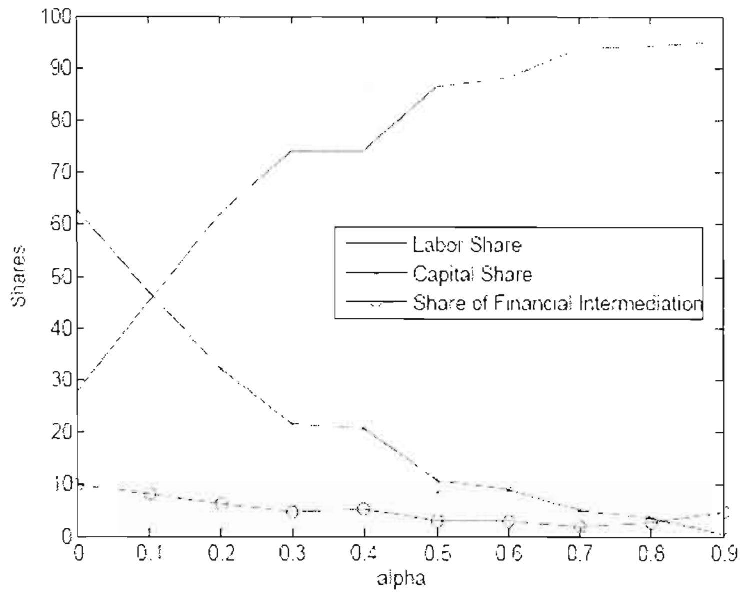
in value added should intuitively increase due to improved financial conditions: the upturn of repayments directly amplifies the part of banks in output (cf. 6.7). We observe however again some secondary effects: first, increased employment $(1-u)$ slightly adds to increasing the share of banks in total output. Second, increased search costs of banks kB and vacancy posting costs γV decrease net output which slightly decreases the part of banks in total output.

6.4.2.2 Higher bargaining power of workers (α)

To understand the logic of the repercussions of higher α, it is important to notice that there are two mechanisms by which α affects the outcome of wages and repayments. First, higher bargaining power of workers improves workers position in the determination of the wage contract and naturally increases wages directly, as effective bargaining power α_θ increases with bargaining power α (cf. 6.2). Second, endogenous wages are anticipated in the financial contract and thus also affect the relative effective bargaining power of banks and entrepreneurs: β_α depends positively on the bargaining power of workers. The higher the bargaining power of workers, the higher the bargaining power of financiers.

Better prospects on a high wage induce more workers to enter the market which slackens the labor market (θ decreases). Consequently, entrepreneurs will find it easier to find a worker, the probability $q(\theta)$ increases. A higher bargaining power of workers also increases the effective bargaining power of financiers. This attracts more financiers into the market inducing the credit market tightness slacken, equilibrium credit market tightness decreases (cf. 6.3) and the prospects for an entrepreneur to find a financier

Figure 6.2 Comparative Statics (α)



$p(\phi)$ increase. Financiers will have to finance the recruitment stage for a shorter period, so that entrepreneurs will repay less (ρ decreases with increasing $q(\theta)$). The increasing effective bargaining power β_α however counteracts the initial decrease of ρ. Increasing output net of repayments to the bank will, additionally to increased bargaining power, increase wages. We should note again that the slacker labor market will reduce effective bargaining power which mitigates the direct increase of ω due to α. Last, the inflow of unemployed pushes the employment rate $(1 - u)$ down.

Labor shares.

The improved situation of workers should, logically, increases labor shares. The increase of wages directly works on labor shares (cf. 6.5). Some secondary effects contribute to/mitigate the positive impact of increased bargaining power on labor shares. First, decreased employment reduces both output and total remuneration of workers, which turns out to further increase the labor share. The exit of entrepreneurs however reduces vacancy posting costs γV, slightly boosting output net of costs, thus reducing the labor share.

Some changes in the European labor market might support the idea that workers' bargaining power has decreased in the last decades. In particular, we can observe a decline of union participation, a number of pro-firm reforms on the labor market and higher competition on the labor market due to globalization. These factors translate into a weaker α in the model, thus potentially explaining the decrease of the labor share since 1980. The theoretical results coincide with empirical findings: the decrease in unionization has been found to be a robust determinant of shrinking labor shares (cf. page 45).

Capital shares.

Again, opposing forces determine the outcome of capital shares. Our simulation shows that the decrease of capital shares due to increased wages (cf. 6.6) overplays the increase due to lower repayments. Two minor factors contribute to reducing capital shares: first, decreased employment acts negatively on capital shares. Second, the outflow of entrepreneurs lowers vacancy posting costs γV which slightly increases output net of costs, reducing capital shares.

Financial intermediation.

The position of banks deteriorates with increasing bargaining power of workers as the decrease of the repayment rate directly decreases shares of financial intermediation (cf. 6.7). Increased effective bargaining power of banks however mitigates the latter effect. Some secondary effects add to the interplay of opposing forces: first, the exit of entrepreneurs and the associated decrease of vacancy posting costs γV slightly increases the share of banks. Second, the decrease in employment $(1 - u)$ turns out to slightly decrease the share of financial intermediation.

6.4.2.3 Higher bargaining power of banks (β)

Greater bargaining power of banks forces up concessions to the bank, leaving workers and entrepreneurs with less surplus to share. We should thus expect labor shares to fall.

In more detail, higher bargaining power attracts bankers into the market, equilibrium credit market tightness ϕ^* decreases (cf. 6.3). Bankers see their effective bargaining power β_α increased and force up repayments ρ of entrepreneurs (cf. 6.1). Entrepreneurs are in turn discouraged to enter the market because prospective profits are smaller due to higher repayments to the bank. The ratio of vacancies to unemployed θ scales down and it is easier to find a worker ($q(\theta)$ increases), making it less expensive for banks to finance the recruiting process, counteracting the upturn of ρ. Smaller output net of repayments to the bank will reduce the wage rate. We should again consider the effect of the slacker labor market on effective bargaining power of workers: in equilibrium, a decrease of labor market tightness decreases α_θ. This effect contributes to reducing the wage rate. Last, the employment rate is a positive function of labor market tightness θ: employment $(1-u)$ decreases slightly.

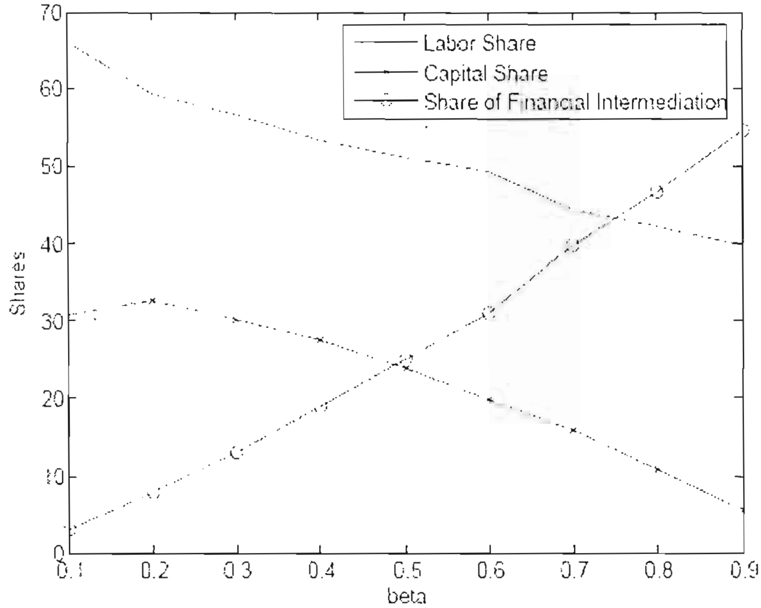
The impact on factor shares can now be derived:

Labor shares

decrease as the wage rate is the main influential factor. The exit of entrepreneurs and associated shrinking vacancy posting costs γV contribute to the decrease of labor shares. Two less important effects mitigate the decrease of labor shares: first, the entry of banks into the market slightly increases costs kB, thus decreasing net output and rising the labor share. Second, the decrease of employment exerts some upward pressure on labor shares.

The model thus replicates the intuition that greater bargaining power of banks should negatively affect the labor share.

Figure 6.3 Comparative Statics on Shares (β)



Capital shares

are again subject to opposing forces. Simulation results show that capital shares decrease with rising β as entrepreneurs loose bargaining power in the determination of the repayment rate. Higher repayments reduce the profit of entrepreneurs, thus pushing capital shares down. At the same time, reduced wages improve the financial situation of entrepreneurs, slightly counteracting the downwards trend of capital shares. Once again, the inflow of bankers into the market slightly rises the capital share whereas the inflow of entrepreneurs and associated higher vacancy posting costs γV decrease capital shares. Last, the downturn of employment additionally slightly reduces capital shares.

Financial intermediation

in value added is, intuitively, increasing in the bargaining power of bankers. The upturn of repayments have a direct positive impact on the share of banks in total output (cf. 6.7). The outflow of entrepreneurs decreases vacancy posting costs γV which pushes the share of banks further up. Two less important factors exert downward pressure on the share: first, the inflow of bankers in the market and second the downturn of employment.

CONCLUSION

One central question at the origin of this thesis was to verify whether financial market imperfections can contribute to explain movements in labor shares. We find both empirical and theoretical evidence that not only labor market characteristics but also the level of financial intermediation plays an important role in the determination of factor shares. As for the empirical analysis, we find that financial intermediation has a strong negative and significant effect on labor shares. Our panel data study on 15 major OECD countries finds evidence that the performance of the capital market affects the position of employers in the bargaining over rent splitting and therefore affects wages and labor shares. The deregulation of the banking sector and other improvements in capital markets such as technical innovation might thus be seen as factors contributing to shrinking labor shares in Europe. Furthermore, we find that inflation is a robust determinant of labor shares. Inflation is associated with low investment and thus shrinking capital shares. Employment protection legislation should further play an important role in the determination of factor shares. Due to a lack of intertemporal data, we proxy employment protection legislation by a number of labor market indicators. Labor market indicators yield ambiguous empirical results: One the one hand, inflexible labor markets characterized by high unionization for instance can account for high labor shares, on the other hand, there is evidence that inflexible labor market systems discourage the employment of labor and thus reduce labor shares. Some indicators such as replacement rates or the minimum wage yield non significant or ambiguous results. We argue that the poor results for this category of variables might be explained by the limited quality of these indicators: they do not cover all countries, nor are they available for the whole time horizon. Sample size is thus unsatisfactory small and poor estimation results do not surprise. Globalization seems to increase competition and force down wages, thus contributing to shrinking labor shares.

Empirical results might be extended into various directions: First, regressions might be broadened down to industry level to see whether capital market imperfections affect some industries more than others. Samuel Bentolila and Gilles Saint-Paul (2003) for instance regress industry-country labor shares on a number of country-industry specific variables and country specific variables. Adding the industry dimension augments the number of observations and yields insights into the dynamics of labor shares within industries and their determinants.

Empirical findings are backed up with a general equilibrium model including search and matching frictions in both capital and labor markets. Varying the degree of capital market imperfections in the form of the matching probability enlightens the dynamics by which credit market imperfections affect factor shares. What is more, the model reflects how a decrease in workers' bargaining power results in decreased labor shares. Last, variations of the level of bargaining power of banks can contribute to explaining movements in factor shares. The model can however not be used to corroborate the impact of inflation on labor shares. Further research should aim at including money and inflation in the model to give an appropriate mirror image of empirical results.

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APPENDIX A

FIGURES

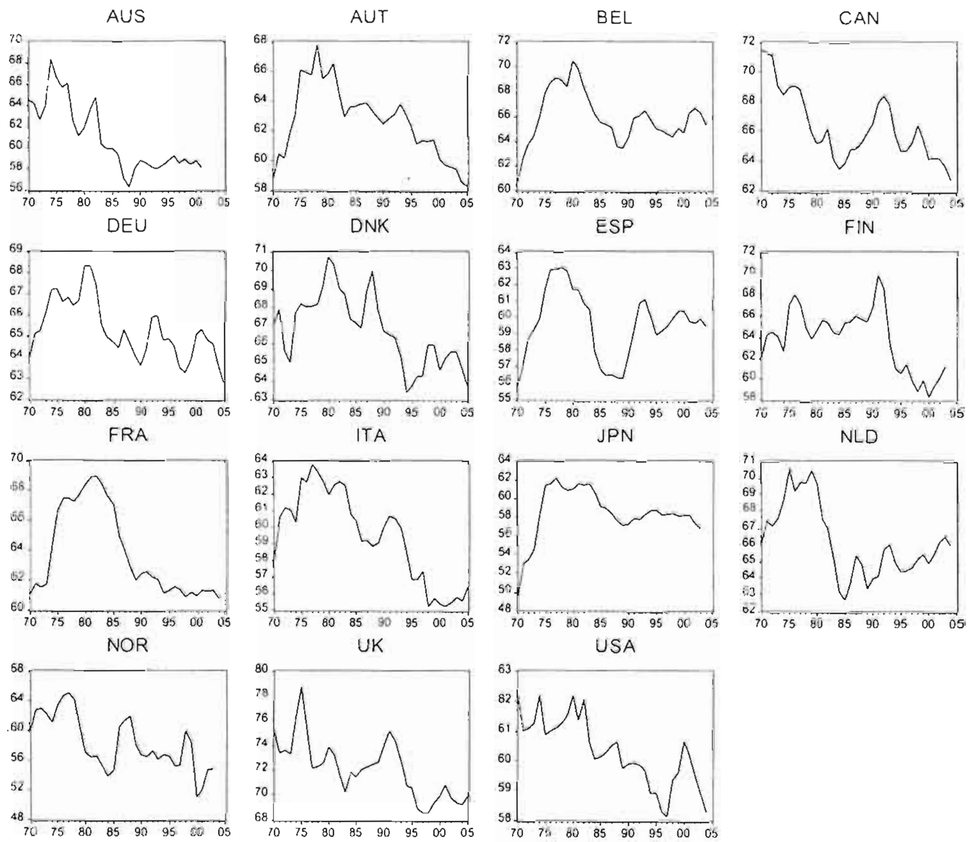

Figure A.1 Labor Shares - All Countries

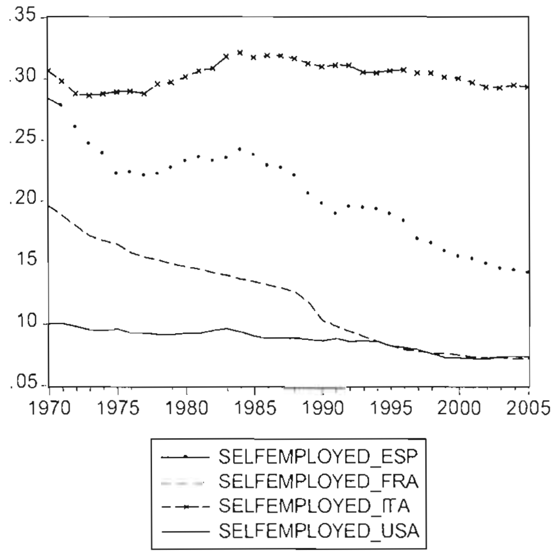

Figure A.2 Self-Employment in Total Employment. (Source: OECD data, Economic Outlook, No. 78)

APPENDIX B

TABLES

Table B.1 ADF Statistic on Labor Shares, Germany

Null Hypothesis: LSWOF_DEU has a unit root

		t-Statistic	Prob.*
ADF test statistic		0.744950	0.9915
Test critical values:	1% level	-3.632900	
	5% level	-2.948404	
	10% level	-2.612874	

*MacKinnon one-sided p-values.

Table B.2 ADF Statistic on First difference Labor Shares, Germany

Null Hypothesis: D(LSWOF_DEU) has a unit root

		t-Statistic	Prob.*
ADF test statistic		-4.770239	0.0005
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Table B.3 Summary Statistics: Labor Shares

	Data Horizon	Obs.	Mean	Maximum	Minimum	Std. Dev.	Stationarity
AUS	1970-2001	32	0.523903	0.616609	0.457310	0.049307	I(1) at 1%
AUT	1970-2005	36	0.554114	0.617246	0.489393	0.033360	I(1) at 1%
BEL	1970-2004	35	0.562955	0.620403	0.524144	0.030091	I(1) at 1%
CAN	1970-2004	35	0.578003	0.660687	0.505597	0.041825	I(1) at 1%
DNK	1970-2005	36	0.582115	0.624005	0.521531	0.028831	I(1) at 1%
DEU	1970-2005	36	0.590698	0.638135	0.538057	0.029543	I(1) at 1%
ESP	1970-2004	35	0.526667	0.568124	0.495484	0.021896	I(1) at 1%
FIN	1970-2003	34	0.576882	0.631491	0.506462	0.036368	I(1) at 1%
FRA	1970-2004	35	0.540154	0.599873	0.481421	0.042510	I(1) at 1%
JPN	1970-2005	36	0.525814	0.582783	0.469368	0.037199	I(1) at 1%
NOR	1970-2003	34	0.514199	0.562018	0.454529	0.026596	I(1) at 1%
UK	1970-2004	35	0.563618	0.627291	0.515000	0.036293	I(1) at 1%
ITA	1970-2003	34	0.525323	0.605006	0.432917	0.046625	I(1) at 1%
NLD	1970-2005	36	0.625170	0.725907	0.552595	0.047395	I(1) at 1%
USA	1970-2004	35	0.507925	0.562765	0.451471	0.036394	I(1) at 1%

Table B.4 Summary Statistics: Financial Intermediation

	Data horizon	Obs.	Mean	Maximum	Minimum	Std. Dev.	Stationarity
AUS	1989 - 2004	16	0.064788	0.075425	0.050869	0.007577	I(1) at 1%
AUT	1976 - 2003	28	0.038928	0.049021	0.031227	0.004749	I(1) at 1%
BEL	1995 - 2001	7	0.041570	0.045416	0.034455	0.003948	I(1) at 1%
CAN	1980 - 2001	22	0.048118	0.058705	0.038155	0.006250	I(1) at 1%
DNK	1970 - 2001	33	0.032773	0.041293	0.023366	0.004772	I(1) at 1%
DEU	1970 - 2003	34	0.037300	0.047037	0.029972	0.003630	I(1) at 5%
ESP	1995 - 2001	7	0.043043	0.046472	0.040669	0.002045	I(1) at 1%
FIN	1975 - 2004	30	0.029445	0.040285	0.022413	0.004274	I(1) at 1%
FRA	1978 - 2003	26	0.038094	0.045328	0.031189	0.004210	I(1) at 1%
JPN	1970 - 2002	33	0.032773	0.041293	0.023366	0.004772	I(1) at 1%
NOR	1996 - 2004	9	0.060045	0.066589	0.054870	0.004695	I(1) at 1%
UK	1970 - 2003	34	0.028297	0.040119	0.014199	0.006065	I(1) at 1%
ITA	1097 - 2003	34	0.034227	0.055540	0.021587	0.008268	I(1) at 1%
NLD	1992 - 2003	12	0.035216	0.043450	0.026991	0.005673	I(1) at 1%
USA	1987 - 2003	17	0.070097	0.080621	0.059525	0.007004	I(1) at 1%

Table B.5 Summary Statistics: Inflation

	Data horizon	Obs.	Mean	Maximum	Minimum	Std. Dev.	Stationarity
AUS	1970-2005	36	0.063031	0.154762	0.002144	0.041395	I(1) at 1%
AUT	1970-2005	36	0.037826	0.095368	0.005144	0.022687	I(1) at 1%
BEL	1970-2005	36	0.042955	0.129032	0.009424	0.031281	I(1) at 1%
CAN	1970-2005	36	0.048725	0.123377	0.001115	0.033610	I(1) at 1%
DNK	1970-2005	36	0.031406	0.070388	-0.001361	0.019538	I(1) at 1%
DEU	1970-2005	36	0.054480	0.154545	0.012150	0.038441	I(1) at 1%
ESP	1970-2005	36	0.085618	0.241135	0.018319	0.058724	I(1) at 1%
FIN	1970-2005	36	0.057039	0.178114	0.001871	0.047685	I(1) at 1%
FRA	1970-2005	36	0.053497	0.136986	0.005112	0.041960	I(1) at 1%
JPN	1970-2005	36	0.080956	0.210526	0.016684	0.059567	I(1) at 1%
NOR	1970-2005	36	0.034620	0.231845	-0.008953	0.048354	I(1) at 1%
UK	1970-2005	36	0.038389	0.102625	-0.007905	0.027639	I(1) at 1%
ITA	1970-2005	36	0.056529	0.136571	0.004655	0.036046	I(1) at 1%
NLD	1970-2005	36	0.070363	0.240741	0.015674	0.055196	I(1) at 1%
USA	1970-2005	36	0.047950	0.137767	0.016094	0.029879	I(1) at 1%

Table B.6 Summary Statistics: GDP Growth

	Data horizon	Obs.	Mean	Maximum	Minimum	Std. Dev.	Stationarity
AUS	1970-2005	36	5.581787	6.152333	5.055902	0.331722	I(1) at 1%
AUT	1970-2004	35	4.678910	5.564903	3.328627	0.668673	I(0)
BEL	1970-2004	35	4.878843	5.772686	3.575151	0.647751	I(1) at 1%
CAN	1970-2004	35	5.945870	6.910751	4.516339	0.710101	I(1) at 1%
DNK	1970-2004	35	6.945332	7.766375	5.681196	0.644839	I(1) at 1%
DEU	1970-2004	35	4.316740	5.150397	3.135494	0.607373	I(1) at 1%
ESP	1970-2004	35	5.937917	6.994667	4.532599	0.706754	I(1) at 1%
FIN	1970-2005	36	4.463250	4.926123	3.946057	0.272860	I(1) at 1%
FRA	1970-2004	35	6.615427	7.516216	5.278115	0.669217	I(1) at 1%
JPN	1970-2004	35	6.557098	7.384114	5.234312	0.660879	I(1) at 1%
NOR	1970-2005	36	8.127007	8.516019	7.498318	0.312531	I(1) at 1%
UK	1970-2004	35	5.295013	6.229694	3.994524	0.669703	I(1) at 1%
ITA	1970-2005	36	4.698306	5.219198	4.051333	0.344752	I(1) at 1%
NLD	1970-2004	35	6.552958	7.539559	5.305789	0.662683	I(1) at 1%
USA	1970-2004	35	8.331530	9.365565	6.932448	0.733064	I(1) at 1%

Table B.7 FE Regression results: Specification in Levels

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.173882	0.032319	5.380213	0.0000
LSWOF_(-1)	0.949557	0.047433	20.01900	0.0000
LSWOF_(-2)	-0.171491	0.045309	-3.784888	0.0002
LOG(GDP_)	-0.070264	0.022785	-3.083808	0.0022
LOG(GDP_(-1))	0.061382	0.021432	2.864096	0.0045
FI_	-0.104689	0.055431	-1.888624	0.0599
INF_	0.130535	0.019016	6.864551	0.0000

Weighted Statistics	
R-squared	0.984853
Adjusted R-squared	0.983840
Durbin-Watson stat	1.823996

Unweighted Statistics	
R-squared	0.984192
Sum squared resid	0.026985
Durbin-Watson stat	1.771723

Dependent Variable: LSWOF_?
Method: Pooled EGLS (Cross-section weights)
Effects Specification: Cross-section fixed (dummy variables)
Sample (adjusted): 1971 2003
Included observations: 33 after adjustments
Cross-sections included: 15
Total pool (unbalanced) observations: 332
Linear estimation after one-step weighting matrix
White cross-section standard errors and covariance

APPENDIX C

THE MODEL

C.1 System of Equations

The system in equilibrium is described by eight equations:

$$\phi^* = \frac{1-\beta_\alpha}{\beta_\alpha}\frac{k}{c} \tag{C.1}$$

$$s(1-u) = q_0\theta^{1-\eta}u \tag{C.2}$$

$$\alpha_\theta = \alpha\frac{r+s+\theta^{1-\eta}}{r+s+\alpha\theta^{1-\eta}} \tag{C.3}$$

$$\beta_\alpha = \frac{\beta}{1-\alpha(1-\beta)} \tag{C.4}$$

$$\omega = \alpha_\theta\,(y-p) + (1-\alpha_\theta)b \tag{C.5}$$

$$p = \beta_\alpha\,(y-w) + (1-\beta_\alpha)(r+s)\frac{\gamma}{q_0\theta^{-\eta}} \tag{C.6}$$

$$\frac{k}{\rho_0\phi^{1-\varepsilon}} = \frac{\beta_\alpha(1-\alpha_\theta)}{1-\alpha_\theta\beta_\alpha}\frac{q_0\theta^{-\eta}}{r+q_0\theta^{-\eta}}\left(\frac{y-b}{s+r}-\frac{\gamma}{q_0\theta^{-\eta}}\right) \tag{C.7}$$

$$\frac{c}{\rho_0\phi^{-\varepsilon}} = \frac{(1-\beta_\alpha)(1-\alpha_\theta)}{1-\alpha_\theta\beta_\alpha}\frac{q_0\theta^{-\eta}}{r+q_0\theta^{-\eta}}\left(\frac{y-b}{s+r}-\frac{\gamma}{q_0\theta^{-\eta}}\right) \tag{C.8}$$

The unknowns are ω, ρ, α_θ, β_α, γ, u, ϕ and θ.

C.2 Calculation of Costs

To calculate output net of costs, we calculate the number of vacancies and bankers. The number of vacancies can be obtained directly from the definition of labor market tightness $\theta = \frac{V}{U}$, thus $V = \theta U$. Vacancy posting costs amount to $\gamma V = \gamma\theta U$.

Second, we need to determine the stock of bankers B searching for an entrepreneur. We first determine the number of entrepreneurs in stage 0 that are searching for a financier, say E^0. In equilibrium the stock of entrepreneurs E^0 is constant so that inflows into the pool of E^0 is equal to outflows. The number of inflows is the number of firms that split up at a rate s, i.e. $s(1-u)$. The number of outflows is equal to the number of entrepreneurs that find a financier, i.e. $p(\phi)E^0$. We have

$$\begin{aligned} \frac{dE^0}{dt} &= -p(\phi)E^0 + s(1-u) \\ &= 0 \\ &\Rightarrow \quad E^0 = \frac{s(1-u)}{p(\phi)}. \end{aligned}$$

We can now determine the number of bankers via the definition of credit market tightness, $B = E^0/\phi$, which gives us

$$B = \frac{s(1-u)}{\phi p(\phi)}.$$