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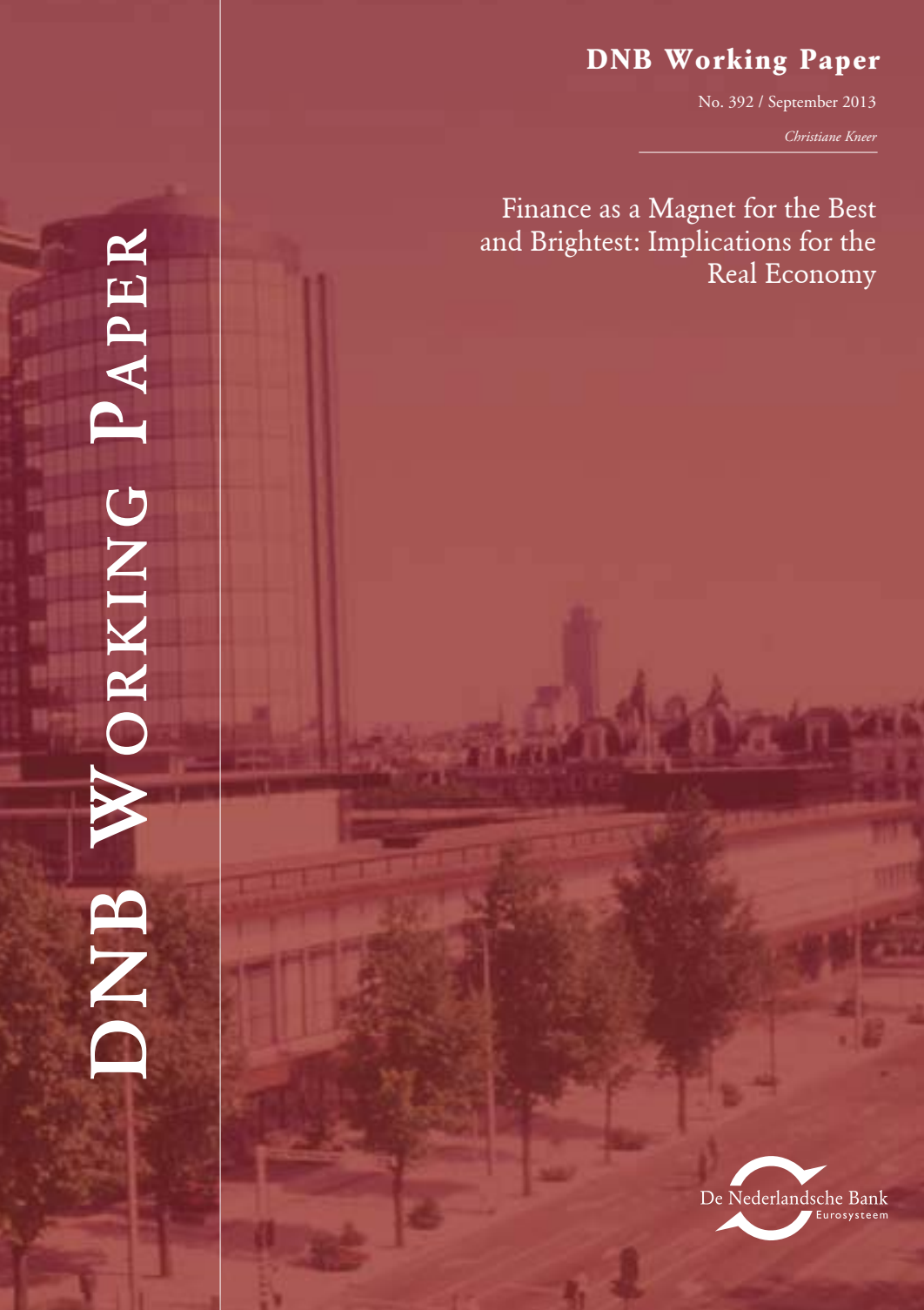

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Finance as a Magnet for the Best and Brightest: Implications for the Real Economy

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* Views expressed are those of the author and do not necessarily reflect official positions of De Nederlandsche Bank.

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Finance as a Magnet for the Best and Brightest: Implications for the Real Economy

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Abstract

This paper examines how the absorption of talent into the financial sector affects the real sectors in the economy. Based on a sample of 13 countries observed over the period 1980-2005, I show that financial liberalization is associated with skill-upgrading in the financial sector. I exploit variation in financial liberalization across countries and time, and differences in the needs for skilled labour across manufacturing industries to identify the effect of the absorption of talent into finance on real sector outcomes. My evidence suggests that employment of skilled individuals grows disproportionally slower in skill-intensive relative to less skill-intensive industries following financial reform. I also show that financial liberalization decreases labour productivity, total factor productivity and value added growth disproportionally in industries which rely strongly on skilled labour. This is consistent with the idea that financial liberalization hurts non-financial sectors via a brain-drain effect. Among the different dimensions of financial liberalization, especially policies fostering the development of security markets account for this finding.

1. Introduction

Government bailouts in the wake of the financial crisis sparked public outrage over the extraordinary compensation packages received by financial sector employees. In many advanced countries, compensation in the financial sector has been rising since the 1980s and peaked around the crisis time. This development has been accompanied by an upward trend in the skill-intensity of the financial sector. Although the evolution of the salaries and the skill-intensity of the financial sector have attracted the attention of academics, regulators and politicians, the implications of the absorption of skilled individuals into the financial sector for the real economy have not been assessed so far. Improving our understanding of how the attraction of talent by the financial industry affects real sectors is vital in light of both, the scale and speed of the ascendancy of finance and the finding by recent studies that rents have emerged in the financial industry. The latter suggests that too much talent might flow into the financial sector relative to the social optimum. This could lead to inefficiently low levels of productivity and growth in real sectors.

This paper examines how the flow of talent into the financial sector affects productivity and growth of manufacturing sectors. To identify the effect of a diversion of skilled labour into finance I exploit variation in the timing and extent of financial liberalization across 13 mostly European countries over the period from 1980 to 2005. Philippon and Reshef show that financial liberalization is a key determinant of the skill-intensity of the financial sector in the U.S. (Philippon and Reshef, forthcoming) and other countries (Philippon and Reshef, 2013). This result also holds for my sample and might be due to the fact that financial liberalization allows skilled labour to engage in more creative and complex activities, and to operate on a larger scale. To identify the absorption of skilled labour as the channel through which financial liberalization affects the real economy, I test for a differential effect of financial reform across manufacturing sectors with different dependencies on skilled labour. A diversion of talent into finance should disproportionally affect those real sectors which are very R&D-or skill-intensive.

The theoretical prediction of a heterogeneous response across real sectors with different skill-intensities is derived from a model by Murphy, Shleifer and Vishny (1991). The authors model a situation where two sectors compete for talent. In their setup, individuals with high ability organize production whereas individuals with lower ability become workers. Both sectors exhibit increasing returns to ability and talented individuals choose the sector where attractive compensation contracts, large markets, and weak diminishing returns to scale

allow them to earn the highest returns on their skills. An interesting feature of the model is that individuals with similar ability cluster in the same sector. This leads to inefficiencies in any scenario where the ability of individuals working in a sector drives productivity and hence growth in that sector. An increase in the relative attractiveness of one of the sectors, for instance due to changes in regulations, induces the most able individuals to switch to this sector. As a result, productivity and income in the other sector declines.

To understand how this model can be applied to my setup, assume that there is a financial sector, a high-skill sector and a low-skill sector. An increase in the relative attractiveness of finance affects only the productivity and the skill-level of the high-skill sector if the financial sector initially attracts the group of individuals with a level of ability just below that of the high-skill sector. A change in financial regulation may then induce individuals to switch between the financial and the high-skill sector while individuals in low-skilled sectors remain in their sector. Due to a decrease in the ability of individuals working in the high-skill sector, the performance of this sector deteriorates.

Detailed data on the skill-structure of sectors from the KLEMS EU database allow me to test for changes in the skill-intensity of different sectors in response to financial reform. My analysis first confirms that financial deregulation is a robust determinant of the skill-intensity of the financial sector for my cross-section of countries. My evidence suggests that the mirror image of this increase in the skill-intensity in the financial sector is a disproportional reduction in employment growth of skilled individuals in R&D-intensive real sectors relative to less skill-intensive sectors following financial reform. This diversion of talent into the financial sector has severe ramifications for the performance of manufacturing sectors: My results indicate that financial deregulation disproportionally reduces productivity in R&D-intensive sectors. This in turn translates into a disproportional reduction in value added growth in those sectors. I find that an increase in my financial liberalization index by an amount equal to what has on average been witnessed in my 13 countries between 1980 and 2005 leads to a fall in the value added growth of an R&D-intensive industry (75^{th} percentile of the R&D-intensity distribution) relative to a less R&D-intensive industry (25^{th} percentile of the R&D-intensity distribution) by 2.6 percentage points. Thus, my evidence is consistent with the idea that financial liberalization hurts non-financial sectors via a brain-drain effect. My results indicate that among the different reforms to liberalize the financial sector, especially policies encouraging the development of security markets are responsible for this finding.

Previous research has shown that financial liberalization leads to more liquid stock

markets (Levine and Zervos, 1998), reductions in the cost of capital (Charis and Henry, 2002), a relaxation of capital constraints (Lins, Strickland and Zenner (2003), Gelos and Werner (2002), Gupta and Yuan (2009), and Laeven (2003)) and improvements in the efficiency of capital allocation (Galindo et al. (2007) and Abiad et al. (2008)). R&D-intensive industries tend to rely more on external funds and are therefore relatively more affected by changes in credit market conditions following financial reform. Hence, it is essential to separate effects operating through changes in capital markets from a brain-drain effect by including a control term for the former. In line with existing evidence, I find that financial liberalization improves productivity and growth relatively more in industries which rely a lot on external funds. Improvements in credit market conditions following financial reform could be due to a rise in the skill-level in financial institutions. More skilled employees might be better at allocating funds to productive projects or monitor firms better. Thus, my control term might to some extent capture the gains for real sectors from a diversion of talent into finance. My results indicate however that for the vast majority of manufacturing industries, the negative brain-drain effect of financial liberalization dominates the positive effect which operates through improvements in credit markets. This suggests that the net effect of the attraction of talent by the financial sector is negative for manufacturing sectors.

One potential concern with my methodology is that the decision to liberalize might be endogenous. It is for instance conceivable that policymakers deregulate the financial sector in response to a disappointing growth performance of some of the real sectors. Such concerns are mitigated by the fact that my sample consists mostly of EU countries and countries which joined the EU during the sample period. In these countries, many reforms to financial sector regulation were implemented in response to EU directives and legislation, or in fulfillment of the accession criteria. The timing and extent of financial sector reforms is therefore not directly linked to national economic developments. To rule out that financial reform was a response to the decline of R&D-intensive industries, I also check whether the degree of financial liberalization was associated with changes in the relative performance of high and low-R&D industries prior to the introduction of financial sector reforms. The absence of a significant relationship between financial reform and prior industry performance confirms that the European context is suitable for assessing whether the diversion of talent into finance affects real sector outcomes. Another advantage of focusing on European countries is that, owing to language barriers, labour mobility is relatively low. This limits the extent to which migration of skilled labour between countries could distort my analysis.

Assessing the consequences of a diversion of skilled labour into the financial sector

and away from real sectors is particularly relevant in light of the on-going debate over a potential wedge between private and social returns to financial activities. A large theoretical and empirical literature has established that the financial sector provides many valuable and essential services to the real economy (see Levine (2005) for a summary). As intermediaries between users and providers of funds, financial institutions play a key role in driving economic growth by allocating capital to its highest value use. However, in the aftermath of the crisis the social value of some financial sector activities has been questioned and financiers have been accused of rent-seeking. Krugman (2009) argues for example that "everything we know suggests that the rapid growth in finance since 1980 has largely been a matter of rent-seeking, rather than true productivity". The possibility that the financial sector engages in rent-seeking rather than delivering economic value has also been emphasized by Lord Turner, until recently Chairman of the Financial Service Authority (Turner, 2010). Similarly, Paul Woolley states that "Rent extraction has become one of the defining features of finance and goes a long way to explaining the sector's extraordinary growth in recent years, as well as its fragility and potential for crisis." (Woolley, 2010).

It has been argued that compensation of financial sector employees has been based on transitory short-term profits which were not adjusted for risks. Bonuses were thus derived from temporary value created which evaporated later on. Haldane, Brennan and Madouros (2010) conclude that "Risk illusion, rather than a productivity miracle, appears to have driven high returns to finance. " They argue that excess returns had been generated based on leverage, larger trading books, and the sale of tail risk insurance on complex, opaque and risky products. The Financial Services Authority (2009) highlights that much of the structuring and trading activity involved in the complex credit securitization was not necessary to achieve efficient credit intermediation but was designed to extract rents based on the opacity of margins and asymmetric information between the users and the producers of financial services. Crotty (2010) notes that economies of scale and scope constitute barriers to entry in some segments of the financial service industry such as investment banking, and that this market power contributes to excessive compensation. Chen and Ritter (2000) present for instance evidence that collusion led to underwriting fees above competitive levels.

A number of empirical studies document that there are compensation premiums to working in finance and provide evidence suggesting that these premiums are rents rather than returns to skills. Philippon and Reshef (forthcoming) find that in the decade prior to the financial crisis, rents accounted for 30% to 50% of the wage differential between the financial sector and non-financial sectors in the U.S.. Using data from Harvard and Radcliffe College

graduates and controlling for a large amount of individual characteristics, Goldin and Katz (2008) show that graduates working in finance enjoy an earnings premium of 195% over other occupations. Comparing cohorts from 1970 and 1990, they also document that the share of those working in financial services increased dramatically. Oyer (2008) studies career paths of Stanford MBA students and shows that investment bankers are "made by circumstance" rather than being "born to work in Wall Street". He estimates wage differences between entry-level investment bankers and MBAs who enter consultancy of around 64%. The wage difference between investment bankers in their first year and graduates who become entrepreneurs exceeds 170%. These differences increase when wages are compared for years longer after graduation. Oyer argues that these differentials do not simply reflect a skill premium. Célérier (2011) shows that the premium for French engineers to working in finance was 7% in the 1980s and 30% in the 2000s. In line with these findings, the representation of individuals working in finance in the top brackets of the income distribution has increased in the UK (Bell and van Reenen, 2013), the US (Kaplan and Rauh, 2010) and France (Godechot, 2011).

If rents are collected in the financial sector then this implies that too much talent flows into finance relative to the social optimum. This in turn results in an inefficient allocation of skilled labour between the financial and the real sectors, thus hampering productivity and growth. The debate about the ascendancy of finance and changes to the skill- and compensation patterns in this sector has mostly ignored such consequences for real sectors. Recent studies documenting that financial sectors can grow excessively large mention the misallocation of labour across sectors as a potential contributing factor but do not explore this channel empirically (Arcand, Berkes and Panizza (2011); Cecchetti and Kharroubi, (2012)). To my knowledge, the vast literature on the growth effects of financial liberalization and the channels through which financial reforms affects the real economy has not focused on allocation of labour between sectors either (see Kose et al. (2007) and Henry (2007) for an overview of this literature). This paper is a first attempt to fill this gap.

The remainder of the paper is structured as follows. The next section discusses the estimation methodology. Section 3 introduces the dataset. The results are presented in section 4. Section 5 shows robustness tests and section 6 concludes.

2. Empirical Strategy

Due to endogeneity concerns it is not possible to identify the effect of a diversion of talent into finance by regressing the number of skilled people in finance on productivity and growth in real sectors. A negative relationship between these variables would also be consistent with causality running from real sector performance to skill-structures in finance. In particular, it is conceivable that a decline in productivity and hence wages in real sectors induce skilled labour to switch to jobs in finance. Skilled individuals in the financial sector and productivity in real sectors could also be jointly determined by factors that are difficult to control for. Technological change is an example of this. To circumvent these problems I exploit variation in financial liberalization across countries and years to determine how skilled labour in the financial sector affects productivity and growth in the real sectors of the economy. Following the methodological approach of Rajan and Zingales (1998), I also exploit heterogeneity across industries in terms of their needs for skilled labour. Sectors which rely heavily on skilled labour should be relatively more affected by a drag of skilled labour into the financial services industry.

For my empirical strategy financial liberalization needs to induce a flow of skilled labour into finance. I provide evidence of a positive relationship between financial liberalization and the skill-intensity of finance in section 4. This is in line with the findings of Philippon and Reshef for the U.S. (Philippon and Reshef, forthcoming) and other countries (Philippon and Reshef, 2013). Financial liberalization could increase the demand for skilled labour in the financial sector and raise the attractiveness of a career in finance for a number of reasons. Firstly, financial liberalization relaxes rules and restrictions on financial activities. For instance the removal of credit and interest rate controls or the relaxation of capital account restrictions gives financial sector employees more discretion and makes their work more creative and challenging. Furthermore, financial liberalization implies that the financial sector can engage in new and more complex activities and develop new products. Especially policies encouraging the development of security markets might be important in this respect. Finally, it is possible that the privatization of banks, the removal of barriers to entry into the financial sector and the reduction of capital account restrictions intensifies competition in the financial sector. Tighter competition might induce financial institutions to exploit economies of scale and scope, to use more efficient input combinations, to adopt new technologies, and to increase their product quality and range. If these changes associated with fiercer competition are complementary to skilled labour, deregulation should lead to skill upgrading by financial

institutions. The removal of geographical barriers in financial markets might also make finance more attractive to talent because it allows talented individuals to spread their ability advantage over a larger scale.

To determine whether financial liberalization and the associated absorption of talent into the financial industry hurts productivity and growth in non-financial sectors by depriving these sectors of the brightest minds, I estimate:

$$Y_{ict} = \alpha\ size_{ict} + \beta\ R\&D\text{-}intensity_i * liberalization_{ct} + \gamma\ external\ finance\ dependence_i * liberalization_{ct} + \rho_{ct} + \sigma_{it} + \varepsilon_{ict} \quad (1)$$

where c indexes my 13 countries, t indexes the years from 1980 to 2005 and i indexes 13 manufacturing industries. Y is a measure of employment of skilled persons or a measure of productivity in manufacturing industries from the set of indicators introduced in subsection 4.2. To evaluate the overall effect of the diversion of talent into finance I also estimate the effect on the growth rate of value added per hour worked and real value added growth. The variable *size* controls for the possibility that industries of different sizes experience different employment and productivity dynamics. I use the employment share of an industry in a country and year as a size indicator. In the regressions with employment of skilled persons as the dependent variable *size* is replaced by an industry's value added share in order to avoid a mechanic relationship between the dependent variable and the size measure. ρ_{ct} are vectors of state-year indicator variables which capture country and time-varying effects on productivity and employment of skilled persons. Similarly, σ_{it} are industry-year indicator variable which account for industry-specific time-varying effects. This set of fixed effects controls for instance for country-specific business cycles and industry-specific technological progress over time. Standard errors are clustered at the country and industry level.

The main variable of interest is the interaction term between the R&D-intensity of an industry and the financial liberalization index (*liberalization).* The index takes a wide range of reforms into account and increases in financial liberalization. The β-coefficient captures the differential effect of financial liberalization across industries with different R&D-intensities. A negative β-coefficient indicates that R&D-intensive industries which depend strongly on skilled labour suffer disproportionally from the attraction of talent into the financial sector.

The interaction term between the external financial dependence of an industry and the financial liberalization index controls for the possibility that financial liberalization might lead to changes in the quantity and cost of credit, and the efficiency of credit allocation. This

in turn could have a heterogeneous effect on productivity and growth structures across different industries.[1] The effect of industries which depend more on external funds should be relatively more affected by changes in credit conditions following deregulation. Since industries that rely more on external funds also tend to be more R&D-intensive it is essential to separate effects operating through changes in credit markets from a brain-drain effect. If financial deregulation is associated with a relaxation of credit constraints and a more efficient allocation of capital then especially productivity and growth in industries which are dependent on external funds should improve. This would be reflected in a positive γ-coefficient. Note that changes in credit conditions might partially be attributable to more skilled labour working in financial occupations. Thus, the interaction between external dependence and financial liberalization also encompasses a potentially positive effect of the attraction of talent into the financial sector working through an improvement of financial services.

3. Data

Financial liberalization. I use the index provided by Abiad, Detragiache and Tressel (2008) to gauge the degree of financial liberalization in a country and year. The financial liberalization index ranges from zero to one, where a value of one indicates maximum deregulation of the financial sector. The index takes into account seven different aspects of financial reform: credit controls, interest rate controls, barriers to entry into the financial sector, state ownership of banks, securities market policies, banking regulation and supervision, and capital account restrictions. In each year, a country is given a score between zero and three for each of the seven categories, with zero corresponding to the highest degree of financial repression and three indicating full liberalization. The liberalization scores for each category are then added and converted into single, normalized indicator between zero and one. I use this aggregate financial liberalization index in my analysis unless explicitly stated otherwise.

The credit controls component gauges the extent to which credit is directed, and high reserve requirements and ceilings on credit by banks are imposed. The component on interest rate controls accounts for restrictions on the determination of deposit and lending rates. Restrictions on the entry or activities of new or foreign financial institutions are captured by

[1] Predictions regarding the effect of the control term on employment of skilled persons are less clear. One potential channel is that a relaxation of financing constraints following financial reform allows industries which rely heavily on external funds to invest in new capital. To the extent that capital is complementary to skilled labour this might lead to skill-upgrading.

the entry barrier component. The state ownership component measures the share of bank assets controlled by state-owned banks. The banking regulation and supervision component is the only measure where more government intervention in form of the adoption of the Basel capital standards, greater independence and legal power of the supervisory authority, and larger coverage and increased effectiveness of supervision is coded as a reform. The capital account component increases in capital account openness. The security market component captures the extent to which government policies are used to encourage the development of security markets and security markets are open to foreign investors. Although interesting for the purposes of this study, restrictions on activities of banks such as the separation of investment banking and commercial banking are not taken into account in the construction of the financial liberalization index. Details about the criteria on which the components of the index are based are provided in table 1A in the appendix.

Table 1 shows average financial liberalization scores over the period 1980-2005, and the indices for the years 1980 and 2005 for each of the 13 countries in my sample. On average, the financial sector in Austria was most regulated and the financial sector in the Netherlands most deregulated over the period. All countries progressively deregulated their financial sectors over time. However, five countries experienced a temporary tightening of regulation in the 1980s and the mid-1990s. For the two transition economies, Hungary and the Czech Republic, the financial liberalization index is only available as from 1991. In 1991 the financial sectors in both countries were still more regulated than those in the other countries in 1980. The transition countries have experienced the greatest changes to financial regulation over the sample period. Conversely, Germany and the Netherlands which had relatively light regulations in the 1980s have reformed least over time. Overall, there is a lot of variation in financial regluations across countries and years which can be exploited to identify the effects of the absorption of talent into the financial sector.

Industry characteristics. The effect of financial liberalization should depend on the relative R&D-intensity and external finance dependence of real sectors. External finance dependence and R&D-intensities of real sectors were calculated based on US firm-level data from Compustat. These industry characteristics are supposed to capture an industry's intrinsic or technological need for external funding and R&D activity. Since Compustat firms are large and well-established and since they have access to security markets, they are likely to be relatively unconstrained in their use of external funds and skilled employees. Thus, their use of these factors should approximate demand. I calculate these industry characteristics using

data for the 1980s. It has been argued that in the 1980s, the financial system in the US was already sufficiently well developed to serve the financial needs of the real sectors (e.g. Krugman, 2009). Furthermore, the US financial sector in the 1980s was relatively small compared to later decades, suggesting that the competition for human resources from the financial sector was relatively limited at the time. Thus, data from the 1980s provide a good approximation of industries' demand for external funds and skilled employees.

Following Rajan and Zingales (1998), I assume that sectoral technological differences for the U.S. persist across countries. I exclude the U.S. from my sample in order to avoid potential endogeneity problems associated with the fact that my industry characteristics were calculated on the basis of US data. My analysis encompasses all manufacturing industries. These 13 industries are categorized according to the European Nace revision 1 classification.[2]

As in Rajan and Zingales (1998), external finance is defined as the amount of desired investment that cannot be financed through internal cash flows. My measure of dependence on external finance is thus the industry-level median of the ratio of capital expenditures minus cash flows from operations divided by capital expenditures. The numerator and denominator for each firm are summed overall years before dividing. Cash flow is calculated using Compustat item 110, if available, and otherwise the sum of Compustat items 123, 125, 126, 106, 213, and 217, plus the change in working capital (the sum of Compustat items 302, 303, and 304). Capital expenditure is calculated as the sum of Compustat items 128 (capital expenditure) and 129 (net acquisitions). I use the industry-level median of the ratio of research and development expenses to total assets as a measure of an industry's R&D-intensity.

Table 2 shows external financial dependence and R&D-intensities for the 13 industries. According to my R&D-intensity measure electrical and optical equipment is the most R&D-intensive manufacturing industry. The wood industry is least engaged in R&D activities. The textiles, leather and footwear industry is least dependent on external funds and the chemical industry most dependent on external funds. My two industry characteristics are highly correlated (ρ=0.79). I therefore present results both with and without the control for effects working through changes in credit market conditions.

Productivity and employment. This paper uses different productivity and employment indicators at the country-year-industry level from the EU KLEMS Growth and Productivity

[2] Compustat firms were assigned to Nace codes using the correspondence tables provided by the European Commission. The level of aggregation at the industry level was determined by the availability of data for the dependent variables from the KLEMS database.

Accounts as dependent variables. The KLEMS database covers the EU member states and a small number of non-EU countries. My analysis is based on 11 European countries and two non-European countries for which the financial liberalization index is also available.[3] My panel is unbalanced with the productivity series of some countries only beginning in the late 1980s or early to mid-1990s.[4] Given that changes to some of the components of the liberalization index such as the reforms to security market regulation were confined to the 1980s in most countries I choose 1980 as the starting date for the sample. My sample ends in 2005, the last year for which the financial liberalization index is available.

The KLEMS database contains various productivity indicators which are generated from growth accounting. Value added growth is broken down into the contributions of hours worked, changes in labour composition, ICT capital services, non-ICT capital services and total factor productivity (see Mahony and Timmer (2009) for more details). I use the contribution of total factor productivity to value added growth and the contribution of labour productivity to value added growth, which is defined as value added growth minus the contribution of hours worked, as dependent variables. Furthermore, I use the contribution of the knowledge economy to value added growth which is the sum of the growth contributions from investment in ICT capital, labour composition in terms of gender and skill, and total factor productivity. I also examine the effect of the absorption of highly skilled labour into finance on the growth rate of gross value added per hour worked and the growth rate of real value added.

The KLEMS database also offers a number of employment indicators disaggregated by the skill-level of persons working in an industry. I use the share of hours worked by high skilled persons in an industry (*skill-intensity*) and the total number of hours worked by skilled individuals in an industry (*skilled hours)* as dependent variables. Since education levels have risen over time and skill-levels in the economy improved more generally, I also consider the ratio of the skill-intensity of a sector relative to the entire economy (*relative skill-intensity*) and the number of "skilled hours" in a sector relative to the total economy (*relative skilled hours*). High skilled persons are defined as persons with at least a bachelor degree or equivalent.

Table 3 displays summary statistics of the variables for the full sample, and for high and low R&D-intensity sectors separately. High R&D-intensity sectors are defined as sectors

[3] Italy, Spain and the UK were excluded from the sample because the definitions of skill-intensities of industries differ for these countries.
[4] For Ireland the productivity series starts in 1989, for Germany in 1992, for Sweden in 1994, and for Hungary and the Czech Republic in 1996.

with an R&D-intensity greater than or equal to the median R&D-intensity. Low R&D-intensity sectors are sectors with below median R&D-intensity. The means of all outcome variables are larger in the subsample of high R&D-intensity industries. The productivity and growth indicators of low R&D-intensity sectors are more dispersed. The opposite is true for the employment indicators.

4. Results

4.1. Financial Liberalization and the Skill-intensity of Finance

My identification strategy requires financial liberalization to induce a flow of skilled labour into finance. To explore this relationship, I regress the financial liberalization index on different indicators of employment of skilled individuals in finance. I include country fixed effects to account for systematic differences across the 13 countries. Standard errors are clustered at the country level.

The results shown in column (1) of table 4 suggest that the share of skilled individuals in the financial sector increases with financial reform. As the evidence in column (3) suggests, this is not merely due to low-skilled individuals leaving the sector: The number of hours worked by skilled individuals increases significantly with financial liberalization. The findings of a positive effect of financial liberalization on the skill-intensity and the skilled hours in finance relative to the economy in columns (2) and (4) indicate that the effect is not simply a reflection of a general rise in skill-levels over the past decades. The coefficients in the last two columns capture the effect of financial liberalization on compensation of individuals engaged in the financial industry. While deregulation is not associated with a pay rise in the industry, it increased financial sector pay relative to wages prevailing in the whole economy. The insignificant effect of liberalization on compensation in finance might partly be due to data shortcomings. The compensation data include wages, supplements and bonuses, but do not capture income from exercising stock options.

4.2. The Effect of the Absorption of Talent into Finance on Skill Structures in Real Sectors

This section presents results from estimating equation (1) with various indicators of employment in real sectors as dependent variables. These estimations allow verifying whether the rise in the skill-intensity of finance in response to financial liberalization affects the skill-structure of the labour force especially in those real sectors which directly compete for talent

with the financial sector. The results in table 5 suggest that the skill-intensity and the hours worked by skilled persons, both in absolute terms and relative to the total economy, grow relatively slower in R&D-intensive manufacturing sectors following financial reform.[5] This supports the idea that talent was diverted away from those sectors which compete for talent with the financial sector.

The coefficients on the interaction term of the financial liberalization index and external finance dependence are positive but not significant. This suggests that changes to funding conditions following financial deregulation did not have a heterogeneous impact on skill structures across industries with differing needs for external funds.

4.3. Productivity and Growth Effects of the Absorption of Talent into Finance

To test how the diversion of talent into finance and away from non-financial sectors affects real sector performance I estimate equation (1) using various productivity and value added growth indicators as dependent variables. The results are presented in table 6. The negative coefficients on the interaction term between the liberalization index and R&D-intensity in the first six specifications lend support to the hypothesis that the absorption of skilled labour by the financial sector comes at the cost of slower productivity growth in real sectors. Financial deregulation disproportionally reduces the contributions of labour productivity and total factor productivity in R&D-intensive sectors. The results in columns (5) and (6) show that financial deregulation is also associated with a disproportional decrease in the contribution of the knowledge economy to value added growth in R&D-intensive sectors. These negative effects on the sources of value added growth combine to a negative overall effect on the growth rate of value added per hour worked and total value added growth as the results in the last four columns of table 6 indicate.

Accounting for changes in capital markets by including an interaction term between external finance dependence and the liberalization index increases the size of the negative effect of talent absorption on my outcome variables. The positive coefficients on the control variable are significant except in the specification with the growth rate of value added per hour worked as the dependent variable. This finding is in line with existing evidence showing that financial liberalization leads to more liquid stock markets (Levine and Zervos, 1998), reductions in the cost of capital (Charis and Henry, 2002), a relaxation of capital constraints

[5] Note that the regressions in table 5 are specified in terms of growth rates. Using levels for the dependent variables yields insignificant coefficients on the main variables of interest.

(Lins, Strickland and Zenner (2003), Gelos and Werner (2002), Gupta and Yuan (2009), and Laeven (2003)) and improvements in the efficiency of capital allocation (Galindo et al. (2007) and Abiad et al. (2008)). These improvements which might partially be attributable to a more skilled labour force in finance seem to translate into productivity and growth gains especially for those sectors which rely strongly on external funds.

To interpret the coefficients in table 6 it is useful to compare the differential effect of financial liberalization on industries with high and low R&D-intensities. The differential effect in terms of the change in the outcome variable in percentage points and in terms of the share of the variation in the respective dependent variable that the effect explains is shown at the bottom of the table. I evaluate the differential effects for a change in the liberalization index of 0.53 which corresponds to both the mean change that the countries in my sample experienced between 1980 and 2005.[6] The point estimate on the main interaction term in column (10) indicates for instance that loosening financial regulation in such a way that my index increases by 0.53 reduces the difference in value added growth between a relatively R&D-intensive industry such as rubber and plastic (75^{th} percentile of the R&D-intensity distribution) and a less R&D-intensive industry such as food, beverages and tobacco (25^{th} percentile of the R&D-intensity distribution) by roughly 2.6 percentage points.[7] The coefficients in columns (2), (4), and (6) indicate that the growth rate of the respective dependent variable in rubber and plastic relative to food, beverages and tobacco falls by roughly 2 percentage points following deregulation. This corresponds to roughly 0.1 standard deviations of the respective outcome variable and suggests that the diversion of talent in response to the liberalization of finance has a sizable impact on the real economy.

My estimates highlight that there are bright and dark sides to financial liberalization. How real sectors are affected by financial sector reforms depends on their relative reliance on external funds and skilled labour. Industries which use little external funds but are very R&D-intensive suffer most from the liberalization process. Conversely, low-R&D industries which are very reliant on external funds enjoy the upside of the liberalization process. Comparing the size of the brain drain-effect and the effect of financial liberalization which operates via changes in capital markets for individual manufacturing industries, I find that the net effect on the outcome variables is only positive for the wood and the coke industry. These two industries rank lowest on R&D-intensity but rely strongly on external funds. Thus, even if the

[6] The mean change lies slight below the median change which is 0.56. For the Czech Republic and Hungary the change refers to the years 1990 and 2005.

[7] The differential effect is calculated as {(-3.65)*(0.0233-0.0101)*(0.18) - (-3.65)*(0.0233-0.0101)*0}*100.

positive effect on the interaction between external finance dependence and liberalization was fully attributable to skill-upgrading in the financial sector, the net effect of the absorption of talent into finance is negative for the vast majority of manufacturing industries.

My results also hold if Italy, Spain and the UK are added to the sample. These three countries were excluded from the main analysis because skill-intensities are defined differently for them. Furthermore, conclusions are similar if equation (1) is estimated with the lagged financial liberalization index instead of the contemporaneous one. It is reasonable to assume that adjustments of the labour market to financial reform do not all take place instantaneously. Given that incremental changes of the liberalization index over consecutive years are very frequent for my sample I do not explore the dynamics of this relationship further.

4.4. Decomposition of the Effect of Financial Liberalization

To test which specific reforms drive the diversion of talent into finance, I also estimate equation (1) with each of the seven components of the financial liberalization index instead of the combined index. Thus, each component is interacted with the R&D-intensity measure and the seven interaction terms are jointly included in the model. Since the components of the index are positively correlated with each other multicollinearity problems loom large and results from these estimations are no more than indicative. The significance of the results reported in table 7 is sensitive to the inclusion of control terms which might aggravate multicollinearity problems. The results for the specifications without the control terms suggest that the disproportional slowdown in productivity and value added growth in R&D-intensive industries is mainly driven by policies encouraging the development of security markets. For some of the other components the coefficients are consistently negative but never significant.[8]

The finding of a brain-drain effect associated with policies encouraging the development of security markets is in line with expectations. The growth of security markets entailed the creation of high wage/high skill jobs in asset management, trading, and broker-dealer activities which attracted talent to the financial industry. Especially traders have been among the top earners of the industry. It has been argued that performance-based bonuses gave traders an incentive to take on excessive risks and proposals for regulating their pay

[8] The standard errors for the interaction terms with the privatization component in table 7 are missing. Standard errors clustered by industry and country have been generated using the command provided by Mitchell Petersen which implements the estimation procedure described in Cameron, Gelbach and Miller (2011) . Since the command involves subtracting off the variance matrix clustered by industry-country, standard errors might be missing due to negative values.

were made in the aftermath of the crisis.

5. Robustness

The two most important challenges for identification in my setup are the potential endogeneity of the decision to liberalize the financial sector, and the possibility that other reforms were introduced concurrently with financial liberalization. I address each of these in turn. Furthermore, this section tests whether results differ across subsets of countries with differing risk-taking propensities for financial institutions.

5.1. Exogeneity

A concern with my estimation methodology is that financial liberalization might be endogenous in my setup. The decision of a country to liberalize its financial sector could be driven by the evolution of its industrial structure over time and by the emergence of growth opportunities for a particular set of industries. Financial reform could also be the result of lobbying efforts by different real sectors. Thus, my specification could suffer from reverse causality.

These concerns are mitigated by the fact that my sample consists mostly of EU countries where deregulation of the financial sector was driven by EU legislation. National developments did therefore not play a dominant role in shaping the deregulation process. This applies especially for the second half of the sample period. Legislation to create a Single Market in financial services included for instance the creation of a "single passport" which allowed credit institutions legally established in one member state to provide financial services in other member states without further authorization. The directive also sought to harmonize regulatory standards more generally. The principle of a single license and harmonized regulation was subsequently extended to other financial institutions. Another milestone for opening up national financial systems was the Directive on Liberalization of Capital Flows which abolished capital controls. A further step towards removing restrictions on cross-border activities of financial services, introducing a consistent regulatory environment and promoting the free flow of capital within the EU was the adoption of the Financial Services Action Plan (FSAP).[9] The FSAP was supposed to be implemented by 2005, but many measures were due to be introduced at earlier dates. While initiatives at the

[9]Measures laid out by the FSAP include the provision of an updated EU passport to security firms and the introduction of new trading venues (such as multilateral trading facilities) in order to foster the emergence of a single cross-border securities market. Another objective of the FSAP was the adoption of prudential rules such as new capital-adequacy rules for banks based on the Basel Accord.

EU-level drove the process of financial liberalization, the timing and implementation differed across countries, resulting in variation in the financial liberalization index. Further variation is introduced by the fact that some countries joined the EU during the sample period. Sweden entered the EU in 1995. Hungary and the Czech Republic joined in 2004 and deregulated gradually to meet the accession criteria.

This argument does not apply to Japan and Australia, the two non-EU countries in my sample. Furthermore, large or wealthy EU countries had more influence in shaping EU regulations, and might have used this political power to pursue national growth strategies. There is no obvious way of sorting EU countries according to their political power - not least because the power structure changed over time. Arguably, Germany stands out as a political leader throughout my sample period. I therefore re-estimate my productivity and growth regressions without Australia, Germany and Japan. The evidence presented in table 8 confirms that my results also hold for the subsample of countries where the liberalization process was more likely driven by exogenous forces.

A negative coefficient on the main interaction term is only reconcilable with causality running from real sector performance to financial reform if R&D-intensive industries were expected to perform worse than other industries in the years prior to reforms or if, possibly due to a loss in competitiveness, R&D-intensive industries had less influence in shaping the political process. To test whether reverse causality is a concern I examine the relationship between the degree of financial liberalization in a country and the relative strength of a country's high and low R&D industries in the year prior to a major change in a country's liberalization index. Industries with an R&D-intensity above the median in my sample are classified as high R&D industries and industries with an R&D-intensity below the median are classified as low R&D industries. I divide the average performance of high R&D industries by that of low R&D industries for each of my outcome variables in the year prior to a change in the financial index and correlate the ratios with the change in the financial index.[10] The absence of a significant correlation between any of the performance ratios and the change in financial reform suggests that financial reforms were not introduced to accommodate less R&D-intensive industries with large growth potential or strong bargaining power. Furthermore, there is no relationship between the R&D-intensity of an industry and any of my outcome variables from equation (1) prior to regulatory changes. If causality ran from

[10] A change in financial regulation for this purpose was defined as a change in the liberalization index by more than 2/21. Setting a threshold is necessary because incremental changes in the index within a country over time are very frequent.

industry performance or political strength to financial reform we should observe a negative relationship between these variables.

5.2. Controlling for Other Economic Reforms and for Financial Sector Size

This section addresses the concern that measures to liberalize the financial sector might have coincided with other structural reforms which also had a differential effect across real sectors. Especially in Hungary and the Czech Republic financial liberalization might have been part of a more general transition process from a centrally planned economy to a market economy. In order to ensure that my results are not driven by concurrent reforms I include different sets of reform indicators as controls: An index of overall "economic freedom" which captures the broad institutional and economic structure of a country, a set of indicators for labour market regulations, and a set of macroeconomic variables which reflect macro-reforms.

I use the index of economic freedom provided by the Fraser Institute. The Fraser index takes into account the size of the government, legal structures and the security of property rights, access to sound money (money supply growth, inflation and the volatility of inflation), freedom to trade internationally, and the regulation of credit, labour and business. [11] The advantage of the Fraser index over other indices of economic freedom is that it dates back to the 1970s. The Fraser index is only available on a yearly basis after the year 2000. Before that year, the index is available every 5 years and yearly observations for each country were obtained by interpolation.

Labour market reforms are likely to be particularly important in shaping the allocation of labour between sectors and in determining productivity. I therefore control for labour market regulations in a separate regression. I use three indicators of labour market regulation provided by the OECD: The strictness of employment regulation regarding individual dismissal, a dummy variable indicating the presence of a statutory minimum wage in a country, and a measure of the public expenditure on labour market programmes as a share of GDP.[12] Some of these reforms are more binding for low-skill workers and might therefore affect sectors with different skill-intensities differently.

Controlling for all potentially relevant regulations and establishing the exact timing and extent of the reforms for all the countries in my sample is not feasible. Rather than measuring reforms directly, I adopt an indirect approach and control for continuous macro

[11] See http://www.freetheworld.com/ for more details on the construction of the Fraser index.
[12] The latter includes the spending of the main national public employment service, costs for training, job rotation and sharing, the provision of employment services and start-up incentives, job creation and support of employment and rehabilitation.

variables which capture the effect of macro reforms. I thus include the level of inflation, trade openness as measured by the ratio of exports and imports to GDP and government consumption as a share of GDP in the regression.

The results from adding interaction terms between my industry characteristics and the control variables to the original value added growth regression are reported in columns (1) to (3) of table 9. For all sets of control variables, the original results hold and the magnitude of the coefficients of interest is very similar to the ones displayed in table 6. Results point in the same direction if the other dependent variables from table 6 are used.[13]

Finally, I assess whether the size of the financial sector drives my results. As a measure of financial size I use the ratio of private credit by deposit money banks to GDP and the value added share of the financial sector in total value added. The results are shown in columns (4) and (5) of table 9. While the coefficients on the interaction terms between the industry characteristics and financial sector size are not significant the original finding of a brain-drain effect continues to hold.

5.3. Government Support and Risk-Taking by Financial Institutions

The financial sector is a particularly attractive career choice for talent if rewards that can be earned in this sector are large. It is likely that government support of banks interacts with policies to liberalize the financial sector in determining the returns for talented individuals in finance. Government support may exacerbate morale hazard problems and lead banks to take on risks which boost the compensation of employees. We should therefore observe that the effect of the diversion of talent into the financial sector following financial reform is stronger in countries with extensive safety nets for financial institutions.

Most empirical studies on the link between government support and bank risk-taking come to the conclusion that public guarantees increase the risk-taking behaviour of banks. It has been shown that risk-taking by banks increases in the presence of explicit government guarantees such as deposit insurance schemes (e.g. Chernykh and Cole (2011), Ioannidou and Penas (2010), Hovakimian, Kane and Laeven (2003), Demirgüç-Kunt and Detragiache (2002)). There is also evidence suggesting that banks which are large or perceived as being too big to fail adopt riskier strategies (e.g. Boyd and Runkle (1993), Boyd and Gertler (1994), Schnabel (2004, 2009)). Gropp, Hakenes and Schnabel (2011) construct a measure of the extent of public guarantees for banks which encompasses both explicit and implicit

[13] These results are available on request.

government guarantees using rating information from Fitch/IBCA. The authors obtain "bailout-probabilities" of individual banks by gauging the difference between banks' *Individual Rating,* a rating which ignores the possibility of government support, and the *Issuer Rating,* a rating which takes into account external support. Based on these bailout probabilities the authors calculate the market share of insured banks for individual countries. Higher values of this share can be due to a large share of publicly owned banks or due to the existence of explicit or implicit government guarantees. For my sample of countries public ownership of banks and the share of insured banks are not correlated, suggesting that differences across countries are mainly driven by differences in government guarantees.

I split my sample into a subsample of countries with an above median market share of public insurance and a subsample of countries with a below median share. For both measures of the market share of public insurance the subsample of above median insurance consists of Australia, Finland, France, Germany, Sweden and the Netherlands. I run separate regressions for each of the two subsamples to test whether the absorption of skilled labour into finance varies depending on public support for banks. The results reported in table 10 show that the differential effect of financial liberalization on growth and productivity is only significant for the subset of countries where financial institutions enjoy a lot of government support (Panel A). For the subset of countries where government support is less prevalent, the effect is never significant (Panel B). The coefficients for the two subsamples are however not significantly different from each other.

6. Conclusion

This paper has examined whether the absorption of talent into the financial sector affects the performance of real sectors. To identify this effect I have exploited variations in liberalization patters across countries and time and heterogeneous responses of manufacturing sectors with different skill-intensities. I show that liberalization was associated with an increase in the skill-intensity of the financial sector. This diversion of talent into the financial sector is reflected in changes in the skill-structure of real sectors: I show that the skill-intensity of industries which are very R&D-intensive grows relatively slower following liberalization. My results suggest that this comes at the cost of productivity and growth in real sectors. I find that financial liberalization disproportionally reduces labour productivity, total factor productivity and value added growth in skill-or R&D-intensive industries.

This brain-drain effect is counterbalanced by effects working through changes in credit markets. I show that financial liberalization disproportionally increases productivity and growth in industries which rely heavily on external funds. The combined effect thus depends on an industry's relative reliance on external funds and skilled labour. My findings indicate that the combined effect of financial liberalization is only positive for two of the 13 manufacturing industries. Thus, even if the finding of disproportional improvements in the performance of industries which rely heavily on external funds was entirely due to skill-upgrading in financial institutions, the brain-drain effect associated with a diversion of talent dominates for the majority of manufacturing sectors. In order to draw conclusion about the welfare impact of the talent absorption into finance for individual countries it would however be necessary to take into account possible effects on the performance of non-manufacturing sectors and the financial sector itself.

My analysis draws attention to the fact that financial liberalization was associated with an attraction of talent into the financial sector which had severe ramifications for the most innovative real sectors in the economy. Combined with the finding of rents in finance by earlier research, my evidence suggests that the new profit or rent-seeking opportunities that arise from financial liberalization necessitate a revision of compensation arrangements to ensure an efficient allocation of talent between the financial and the real sectors of the economy.

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APPENDIX

Table 1 Financial liberalization index

This table shows the financial liberalization indices in 1980 and 2005, and the mean of the index over the period from 1980 to 2005 for each of the countries in my sample.

Country	Index 1980	Index 2005	Mean Index 1980-2005
Australia	0.095	1	0.751
Austria	0.369	0.929	0.627
Belgium	0.536	1	0.777
Czech Republic		0.917	0.705
Denmark	0.393	1	0.814
Finland	0.357	0.810	0.706
France	0.286	1	0.786
Germany	0.714	0.905	0.839
Hungary		0.964	0.749
Ireland	0.560	1	0.860
Japan	0.429	0.857	0.696
Netherlands	0.774	1	0.913
Sweden	0.381	0.952	0.825

Table 2 Industry characteristics: R&D-intensities and external finance dependence

The industry characteristics are calculated using Compustat data from 1980 to 1989. The R&D-intensity of an industry is defined as the median ratio of R&D-expenses over assets. The external finance dependence of an industry is defined as the median ratio of capital expenditures minus cash flows from operations divided by capital expenditures.

Nace-Code	Industry	R&D-Intensity	External Finance Dependence
20	Wood	0.006	0.173
23	Coke, refined petroleum & nuclear fuel	0.006	0.112
21t22	Pulp, paper, printing & publishing	0.008	0.004
15t16	Food, beverages & tobacco	0.010	-0.028
17t19	Textiles, leather & footwear	0.011	-0.193
27t28	Metals	0.012	0.059
26	Other non-metallic mineral products	0.013	0.061
36t37	Manufacturing, n.e.c.; recycling	0.019	0.057
29	Machinery, n.e.c.	0.022	-0.039
25	Rubber & plastic	0.023	0.210
34t35	Transport equipment	0.023	0.238
24	Chemicals & chemical products	0.058	0.563
30t33	Electrical & optical equipment	0.077	0.433

Table 3 Descriptive statistics

This table shows the means, the standard deviations (st.dev.) and number of observations (Obs.) for the dependent variables used in this study. The first three columns report these statistics for the full sample. The next three columns show the statistics for industries with below median R&D-intensity and the last three columns for industries with above median R&D-intensity. The different contributions to value added growth are in percentage points. The growth variables are in % p.a.. The estimations are based on these variables divided by 100.

	Full sample			Low R&D industries			High R&D industries		
	Mean	St.Dev.	Obs.	Mean	St.Dev.	Obs.	Mean	St.Dev.	Obs.
Productivity and growth									
Contribution of labour productivity to value added growth	3.229	13.469	3432	2.192	17.817	1584	4.117	7.951	1848
Contribution of TFP to value added growth	1.775	13.468	3432	0.942	17.903	1584	2.488	7.818	1848
Contribution of the knowledge economy to value added growth	2.460	13.406	3432	1.645	17.824	1584	3.158	7.777	1848
Growth of value added per hour worked	3.608	13.161	4017	2.828	17.236	1854	4.276	8.134	2163
Growth of value added	2.340	13.728	3432	0.916	17.882	1584	3.561	8.531	1848
Employment of skilled persons									
Share of hours worked by high skilled persons	8.342	6.399	3718	7.511	5.830	1716	9.054	6.769	2002
Relative share of hours worked by high skilled persons	0.615	0.294	3718	0.550	0.270	1716	0.672	0.302	2002
Hours worked by skilled persons (mn)	39.261	110.018	3718	33.523	93.134	1716	44.179	122.463	2002
Relative hours worked by skilled persons	0.009	0.007	3718	0.008	0.007	1716	0.010	0.008	2002

Table 4 Financial liberalization and the skill-intensity of finance

This table reports results from regressing the financial liberalization index (*Liberalization*) on the share of hours worked by skilled persons in the financial sector (*skill-intensity*), the share of hours worked by skilled persons in finance relative to the total economy (*relative skill-intensity*), the number of hours worked by skilled individuals in finance (*skilled hours*) and the number of hours worked by skilled individuals in finance relative to the total economy (*relative skilled hours*), the real hourly compensation in the financial industry (*hourly compensation*) and hourly compensation in the financial industry relative to the total economy (*relative hourly compensation).* Real hourly compensation was obtained by deflating compensation with the CPI from the OECD. The sample consists of 13 countries which are observed over the period 1980-2005. I include country fixed effects in the regressions. Standard errors in parenthesis are clustered by country. *, ** and *** indicate statistical significance at the 10, 5 and 1% level.

	(1) Skill-intensity	(2) Relative skill-intensity	(3) Skilled hours	(4) Relative skilled hours	(5) Hourly compensation	(6) Relative hourly compensation
Liberalization	0.263***	0.381**	0.216*	0.011*	0.223	0.396*
	(0.046)	(0.152)	(0.119)	(0.005)	(0.134)	(0.212)
Country FEs	yes	yes	yes	yes	yes	yes
Observations	286	286	286	286	311	311
R-squared	0.970	0.991	0.970	0.981	0.987	0.992

Table 5 Effect of the absorption of talent into finance on skill structures in real sectors

This table reports results from estimating equation (1) for 13 countries over the period 1980-2005. The dependent variables are the growth rates of the share of hours worked by skilled persons in an industry (*skill-intensity*), the share of hours worked by skilled persons in an industry relative to the total economy (*relative skill-intensity*), the number of hours worked by skilled individuals in an industry (*skilled hours*) and the number of hours worked by skilled individuals in an industry relative to the total economy (*relative skilled hours*). R&D-intensity and external finance dependence are industry characteristics which are interacted with the financial liberalization index for a country and year (*Liberalization*). *Industry size* is the value added share of an industry. I include industry-year fixed effects and country-year fixed effects. The standard errors in parenthesis are clustered by country and industry. *, ** and *** indicate statistical significance at the 10, 5 and 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Growth of skill-intensity		Growth of relative skill-intensity		Growth of skilled hours		Growth of relative skilled hours	
R&D-intensity*Liberalization	-0.429*	-0.450	-0.429*	-0.450	-1.123*	-2.133*	-1.123*	-2.133*
	(0.242)	(0.309)	(0.242)	(0.309)	(0.636)	(1.199)	(0.636)	(1.199)
Ext.fin.dependence*Liberalization		0.00277		0.00277		0.137		0.137
		(0.0333)		(0.0333)		(0.101)		(0.101)
Industry Size	0.0679	0.0675	0.0679	0.0675	0.389***	0.368**	0.389***	0.368**
(value added share)	(0.0517)	(0.0522)	(0.0517)	(0.0522)	(0.146)	(0.145)	(0.146)	(0.145)
Industry x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes
Country x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes
Observations	3,588	3,588	3,588	3,588	3,588	3,588	3,588	3,588
R-squared	0.621	0.621	0.473	0.473	0.521	0.521	0.416	0.417

Table 6 Effect of the absorption of talent into finance on labour productivity, TFP and value added growth in real sectors

This table reports results from estimating equation (1) for 13 countries over the period 1980-2005. The dependent variables are the contribution of labour productivity, TFP and the knowledge economy to value added growth, and the growth rates of value added per hour worked and value added. R&D-intensity and external finance dependence are industry characteristics which are interacted with the financial liberalization index for a country and year (*Liberalization).* *Industry size* is the employment share of an industry. I include industry-year fixed effects and country-year fixed effects. The standard errors in parenthesis are clustered by country and industry. *, ** and *** indicate statistical significance at the 10, 5 and 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Contribution of labour productivity to value added growth		Contribution of TFP to value added growth		Contribution of the knowledge economy to value added growth		Growth of value added per hour worked		Growth of value added	
R&D-intensity*Liberalization	-1.354*	-2.855**	-1.286***	-2.319***	-1.313**	-2.512***	-1.135**	-1.626***	-1.794	-3.650**
	(0.810)	(1.131)	(0.472)	(0.778)	(0.594)	(0.933)	(0.551)	(0.389)	(1.092)	(1.490)
Ext.fin.dependence*Liberalization		0.203*		0.140*		0.162**		0.0667		0.251*
		(0.119)		(0.0797)		(0.0808)		(0.0502)		(0.145)
Industry Size	0.546	0.481	0.371	0.327	0.340	0.289	0.416	0.398	0.815	0.735
(employment share)	(0.652)	(0.638)	(0.559)	(0.552)	(0.557)	(0.546)	(0.526)	(0.524)	(0.740)	(0.727)
Industry x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Differential Effect (change in percentage points)	-0.954	-2.012	-0.906	-1.634	-0.925	-1.770	-0.800	-1.146	-1.264	-2.573
Differential Effect (in terms of st.deviations)	-0.071	-0.149	-0.067	-0.121	-0.069	-0.132	-0.061	-0.087	-0.001	-0.002
Observations	3,432	3,432	3,432	3,432	3,432	3,432	4,017	4,017	3,432	3,432
R-squared	0.242	0.242	0.207	0.207	0.219	0.219	0.248	0.248	0.261	0.261

Table 7 Regressions using the components of the financial liberalization index

This table reports results from estimating equation (1) with each of the seven components of the financial liberalization index instead of the combined index for 13 countries over the period 1980-2005. The dependent variables are the contribution of labour productivity, TFP and the knowledge economy to value added growth, and the growth rates of value added per hour worked and value added. R&D-intensity and external finance dependence are industry characteristics which are interacted with each of the 7 components of the financial liberalization index for a country and year (*Finlib_comp1-7*). *Industry size* is the employment share of an industry. I include industry-year fixed effects and country-year fixed effects. The standard errors in parenthesis are clustered by country and industry. *, ** and *** indicate statistical significance at the 10, 5 and 1% level.

	(1)	(2)	(3)	(4)	(3)	(4)	(5)	(6)	(7)	(8)
	Contribution of labour productivity to value added growth		Contribution of TFP to value added growth		Contribution to the knowledge economy to value added growth		Growth of value added per hour worked		Growth of value added	
R&D-intensity*Finlib_comp1	-0.263	-0.466	-0.259	-0.459	-0.252	-0.461	-0.245	-0.410	-0.318	-0.511
(Creditcontrols)	(0.268)	(0.587)	(0.253)	(0.583)	(0.261)	(0.580)	(0.182)	(0.381)	(0.275)	(0.606)
R&D-intensity*Finlib_comp2	0.112	0.251	0.170	0.343	0.167	0.330	0.00594	0.0527	0.102	0.248
(Interest rate controls)	(0.198)	(0.309)	(0.164)	(0.273)	(0.152)	(0.266)	(0.166)	(0.265)	(0.188)	(0.297)
R&D-intensity*Finlib_comp3	-0.0895	0.0298	-0.0845	0.0507	-0.0935	0.0371	0.0730	0.267	-0.0488	-0.0560
(Entry barriers)	(0.255)	(0.545)	(0.264)	(0.587)	(0.263)	(0.575)	(0.203)	(0.371)	(0.243)	(0.517)
R&D-intensity*Finlib_comp4	-0.184	-0.295	-0.179	-0.273	-0.188	-0.289	-0.128	-0.137	-0.219	-0.386
(Banking supervision)	(0.188)	(0.362)	(0.180)	(0.381)	(0.177)	(0.360)	(0.183)	(0.382)	(0.187)	(0.317)
R&D-intensity*Finlib_comp5	0.105	-0.0356	0.0782	0.00715	0.0809	-0.00484	0.0866	0.0105	0.0705	-0.0598
(Privatization)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
R&D-intensity*Finlib_comp6	-0.136	-0.318	-0.133	-0.381	-0.134	-0.375	-0.112	-0.181	-0.135	-0.202
(Int. Capital flows)	(0.207)	(0.436)	(0.215)	(0.449)	(0.211)	(0.434)	(0.199)	(0.422)	(0.252)	(0.486)
R&D-intensity*Finlib_comp7	-0.244***	-0.482**	-0.239**	-0.428	-0.257**	-0.466	-0.197***	-0.109	-0.302***	-0.388
(security markets)	(0.0914)	(0.214)	(0.105)	(0.331)	(0.117)	(0.330)	(0.0751)	(0.110)	(0.0991)	(0.269)
Ext.fin.dependence*Finlib_comp1		0.0270		0.0266		0.0278		0.0221		0.0256
(Creditcontrols)		(0.0411)		(0.0415)		(0.0406)		(0.0260)		(0.0433)
Ext.fin.dependence*Finlib_comp2		-0.0186		-0.0232		-0.0218		-0.00618		-0.0195
(Interest rate controls)		(0.0272)		(0.0257)		(0.0249)		(0.0221)		(0.0265)
Ext.fin.dependence*Finlib_comp3		-0.0168		-0.0189		-0.0183		-0.0264		0.000249
(Entry barriers)		(0.0375)		(0.0417)		(0.0402)		(0.0220)		(0.0377)
Ext.fin.dependence*Finlib_comp4		0.0150		0.0128		0.0137		0.00137		0.0226
(Banking supervision)		(0.0309)		(0.0341)		(0.0322)		(0.0333)		(0.0241)
Ext.fin.dependence*Finlib_comp5		0.0193***		0.00989		0.0119*		0.0104		0.0179**
(Privatization)		(0.00408)		(0.0108)		(0.00699)				(0.00851)
Ext.fin.dependence*Finlib_comp6		0.0252		0.0342		0.0333		0.00972		0.00982
(Int. Capital flows)		(0.0371)		(0.0412)		(0.0400)		(0.0332)		(0.0362)
Ext.fin.dependence*Finlib_comp7		0.0318		0.0252		0.0279		-0.0118		0.0111
(security markets)		(0.0198)		(0.0306)		(0.0307)		(0.0120)		(0.0182)
Industry Size	0.476	0.367	0.307	0.206	0.275	0.168	0.396	0.346	0.745	0.629
(employment share)	(0.642)	(0.638)	(0.556)	(0.549)	(0.554)	(0.542)	(0.530)	(0.543)	(0.708)	(0.686)
Industry x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	3,432	3,432	3,432	3,432	3,432	3,432	4,017	4,017	3,432	3,432
R-squared	0.243	0.244	0.208	0.209	0.220	0.221	0.249	0.249	0.262	0.263

Table 8 Robustness: Excluding Australia, Japan and Germany from the sample

This table reports results from estimating equation (1) for the period 1980-2005. Australia, Japan and Germany are excluded from the sample. The dependent variables are the contribution of labour productivity, TFP and the knowledge economy to value added growth, and the growth rates of value added per hour worked and value added. R&D-intensity and external finance dependence are industry characteristics which are interacted with the financial liberalization index for a country and year (*Liberalization*). *Industry size* is the employment share of an industry. I include industry-year fixed effects and country-year fixed effects. The standard errors in parenthesis are clustered by country and industry. *, ** and *** indicate statistical significance at the 10, 5 and 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Contribution of labour productivity to value added growth		Contribution of TFP to value added growth		Contribution of the knowledge economy to value added growth		Growth of value added per hour worked		Growth of value added	
R&D-intensity*Liberalization	-0.788	-1.816*	-0.776***	-1.359***	-0.749**	-1.483***	-0.702*	-1.068***	-1.188	-2.510*
	(0.662)	(1.000)	(0.154)	(0.237)	(0.345)	(0.421)	(0.372)	(0.354)	(1.030)	(1.477)
Ext.fin.dependence*Liberalization		0.140		0.0795		0.100		0.0500		0.180
		(0.122)		(0.0617)		(0.0612)		(0.0548)		(0.157)
Industry Size	0.423	0.378	0.277	0.251	0.231	0.199	0.400	0.383	0.541	0.483
(employment share)	(0.630)	(0.616)	(0.523)	(0.517)	(0.527)	(0.516)	(0.518)	(0.516)	(0.709)	(0.694)
Industry x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	2,613	2,613	2,613	2,613	2,613	2,613	3,003	3,003	2,613	2,613
R-squared	0.282	0.282	0.240	0.240	0.256	0.257	0.287	0.287	0.300	0.301

Table 9 Robustness: Controlling for other reforms and for financial sector size.

This table reports results from estimating equation (1) for 13 countries over 1980-2005. The dependent variable is value added growth. R&D-intensity and external finance dependence are interacted with the financial liberalization index (*Liberalization*) and with an index of economic freedom, a set of labour market regulations, macroeconomic variables and the size of the financial sector as control variables. The indicator of economic freedom is the Fraser Index. The set of labour market regulations consists of the strictness of employment protection, the existence of a minimum wage, and the expenditure on labour market programmes as a share of GDP. Trade openness, inflation and government consumption as a share of GDP capture the effect of macro-reforms. The ratio of private credit by deposit money banks to GDP and the value added share of finance in total value added are measures of financial sector size. Industry size is the employment share of an industry. I include industry-year fixed effects and country-year fixed effects. The standard errors in parenthesis are clustered by country and industry. *, ** and *** indicate statistical significance at the 10, 5 and 1% level.

	(1) Growth of value added	(2) Growth of value added	(3) Growth of value added	(4) Growth of value added	(4) Growth of value added
R&D-intensity*Liberalization	-3.467**	-3.667***	-3.396**	-3.857**	-2.634*
	(1.681)	(1.363)	(1.718)	(1.628)	(1.556)
Ext.fin.dependence*Liberalization	0.263*	0.368**	0.240*	0.272	0.212
	(0.145)	(0.156)	(0.142)	(0.176)	(0.135)
R&D-intensity*Fraser Index	-0.112				
	(0.361)				
Ext.fin.dependence*Fraser Index	-0.00892				
	(0.0594)				
R&D-intensity*employment protection		0.322			
		(0.400)			
Ext.fin.dependence*employment protection		-0.0237			
		(0.0312)			
R&D-intensity*expenditure on programmes		0.325			
		(0.439)			
Ext.fin.dependence*expenditure on programmes		-0.0376			
		(0.0380)			
R&D-intensity*Minimum Wage		-0.0184			
		(0.337)			
Ext.fin.dependence*Minimum Wage		-0.0519*			
		(0.0302)			
R&D-intensity*trade openness			-0.000396		
			(0.00851)		
Ext.fin.dependence*trade openness			7.12e-05		
			(0.000648)		
R&D-intensity*government consumption			0.0114		
			(0.0648)		
Ext.fin.dependence*government consumption			-0.00112		
			(0.00478)		
R&D-intensity*inflation			0.0852		
			(0.0699)		
Ext.fin.dependence*inflation			-0.00337		
			(0.00813)		
R&D-intensity*credit to GDP				-0.00414	
				(0.00630)	
Ext.fin.dependence*credit to GDP				0.000277	
				(0.000478)	
R&D-intensity*value added share finance					-0.371
Ext.fin.dependence*value added share finance					0.0148
					(0.0116)
Industry Size	0.761	0.763	0.773	0.731	0.711
(employment share)	(0.750)	(0.736)	(0.804)	(0.760)	(0.720)
Industry x Year FEs	yes	yes	yes	yes	yes
Country x Year FEs	yes	yes	yes	yes	yes
Observations	3,432	2,912	3,432	3,328	3,432
R-squared	0.262	0.257	0.262	0.267	0.263

Table 10 Regressions for subsamples of countries classified by the extent of government guarantees for banks

This table reports results from estimating equation (1) for the period 1980-2005 for two subsamples of countries. The results for the subset of countries with extensive public support for banks are shown in panel A (AUS, FIN, FRA, GER, NLD, SWE). The results for countries with weaker public support are presented in panel B (AUT, BEL, CZE, DNK, HUN, IRL, JPN). The dependent variables are the contribution of labour productivity, TFP and the knowledge economy to value added growth, and the growth rates of value added per hour worked and value added. R&D-intensity and external finance dependence are industry characteristics which are interacted with the financial liberalization index for a country and year (*Liberalization*). *Industry size* is the employment share of an industry. I include industry-year fixed effects and country-year fixed effects. The standard errors in parenthesis are clustered by country and industry. *, ** and *** indicate statistical significance at the 10, 5 and 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Contribution of labour productivity to value added growth		Contribution of TFP to value added growth		Contribution of the knowledge economy to value added growth		Growth of value added per hour worked		Growth of value added	
Panel A: Strong public support										
R&D-intensity*Liberalization	-1.161*	-1.048	-0.547*	-0.0386	-0.660*	-0.350	-1.002	-0.717***	-1.991**	-2.844
	(0.674)	(2.230)	(0.313)	(1.774)	(0.333)	(1.726)		(0.215)	(0.981)	(2.498)
Ext.fin.dependence*Liberalization		-0.0154		-0.0693		-0.0423		-0.0387		0.116
		(0.203)		(0.194)		(0.181)		(0.0737)		(0.217)
Industry Size	0.299	0.305	0.147	0.174	0.188	0.204	0.313	0.317	0.718	0.673
(employment share)	(0.531)	(0.539)	(0.578)	(0.610)	(0.544)	(0.569)	(0.457)	(0.459)	(0.574)	(0.596)
Industry x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1,638	1,638	1,638	1,638	1,638	1,638	2,028	2,028	1,638	1,638
R-squared	0.309	0.309	0.279	0.279	0.293	0.293	0.298	0.298	0.320	0.320
Panel B: Weaker public support										
R&D-intensity*Liberalization	0.428	-1.178	-0.214	-1.086	-0.166	-1.203	0.0525	-0.245	0.0126	-1.808
	(1.410)	(2.287)	(1.112)	(2.096)	(1.261)	(2.304)	(0.851)	(0.552)	(1.839)	(2.819)
Ext.fin.dependence*Liberalization		0.218		0.118		0.141		0.0404		0.247
		(0.257)		(0.188)		(0.191)		(0.0768)		(0.284)
Industry Size	0.689	0.656	0.368	0.349	0.351	0.329	0.559	0.551	0.995	0.957
(employment share)	(0.690)	(0.675)	(0.540)	(0.537)	(0.542)	(0.536)	(0.701)	(0.694)	(0.727)	(0.714)
Industry x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country x Year FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1,794	1,794	1,794	1,794	1,794	1,794	1,989	1,989	1,794	1,794
R-squared	0.356	0.356	0.330	0.330	0.337	0.337	0.338	0.338	0.379	0.380

Table A1 Criteria for the construction of the components of the liberalization index

Component	Criteria
1. Reserve requirements and credit controls	-Are reserve requirements restrictive? (3 categories: reserve requirement <10%, 10-20% or >20%) -Are there minimum amounts of credit that must be channeled to certain sectors? -Are there any credits supplied to certain sectors at subsidized rates? -Are there ceilings on the expansions of bank credit?
2. Interest rate controls	-Are deposit and lending rates subject to a binding ceiling, fluctuating within a band or freely floating?
3. Barriers to entry	-To what extent does the government allow foreign banks to enter into a domestic market? -Does the government allow the entry of new domestic banks? -Are there restrictions on branching? -Does the government allow banks to engage in a wide range of activities?
4. State ownership in the banking sector	-Based on the extent of state ownership of banks.
5. Capital account restrictions	-Is there a special exchange rate regime for either capital or current account transactions or is the exchange rate system unified? -Are there restrictions on capital inflows or outflows?
6. Prudential regulation and supervision of the banking sector	-Has the country adopted a capital adequacy ratio based on the Basle standard? -Is the banking supervision agency independent from executives' influence? -Does a banking supervisory agency conduct effective supervisions through on-site and off-site examinations? -Does the country's supervisory agency cover all financial institutions without exception?
7. Security market policy	-Have measures been taken to develop security markets (auctioning of T-bills, establishment of security commission, tax exemptions, introduction of longer term government bonds, policies to develop a corporate bond or equity market or derivative markets etc.)? -Is the country's equity market open to foreign investors?

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