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**Working Paper**

## Financial intermediation cost, rents, and productivity: An international comparison

EHES Working Paper, No. 141

**Provided in Cooperation with:**

European Historical Economics Society (EHES)

*Suggested Citation:* Bazot, Guillaume (2018) : Financial intermediation cost, rents, and productivity: An international comparison, EHES Working Paper, No. 141, European Historical Economics Society (EHES), s.l.

This Version is available at:

<https://hdl.handle.net/10419/247071>

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EHES Working Paper | No. 141 | November 2018

Financial intermediation cost, rents, and productivity:  
An international comparison

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**Abstract**

Calculation of the unit cost of financial intermediation for 20 countries from 1970 to 2015 has produced the following results. (i) Most countries' unit costs decline and converge in the long run. (ii) Unit costs were much higher in the 1970s and 1980s, coinciding with high nominal rates, as confirmed by panel cointegration tests. (iii) Countries' unit cost aggregation suggests a slight decrease in international unit cost whatever the set of hypotheses used in the calculation. (iv) The break down of unit costs into labor costs, capital costs, and profits shows that most of the decrease stems from reduced input costs. Gross operating surplus and total compensation per output tend to decline while distributed profit per output rises, suggesting increasing intermediation rents per output. (v) The productivity of labor in finance compared to other sectors tends to increase in most countries. (vi) The evidence suggests that most productivity gains have been captured by the financial sector in Canada, the UK, and the US. Elsewhere, productivity gains have benefited the nonfinancial sector through unit cost reduction. (vii) Deregulation is either negatively or not correlated with unit cost. In other words, deregulation is not related to unit cost increases. Finally, the paper discusses the consequences of those results for current debates about finance relative wage changes and inequalities.

JEL Codes: E3, E4, F3, G2, N2

Keywords: Unit cost, deregulation, convergence

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# 1 Introduction

In their seminal book on the rise of the western world, North and Thomas (1973) posit financial development as a necessary condition for economic growth. An efficient money market, they say, reduces the cost of financial intermediation and allocates capital to its best use. On this view, financial efficiency and the related decrease in financial intermediation costs played a significant role in European development before the nineteenth century. Looking at financial intermediation development in the Low Countries in the sixteenth and seventeenth centuries, North and Thomas argue:

*The development of an efficient capital market in the Low Countries had tremendous implications for the functioning of commerce and industry. The capital market consisted of a host of intermediaries bringing together borrowers and lenders. The intermediaries, armed with the new financial devices, became so efficient that the rate of interest was drastically reduced, from 20-30 percent in 1500 to 9-12 percent in 1550 and to 3 percent or even less during the seventeenth century. Thus the cost of capital fell substantially relative to the prices of the other factors of production. No sector of the economy of the Netherlands was immune from the influence of this dramatic change in relative factor prices.*<sup>1</sup>

If one accepts that the United Provinces was the first nation to escape from the Malthusian poverty trap (Fouquet and Broadberry, 2015), the reduction of financial costs was certainly a facilitating factor. This historical experience is consistent with theoretical models of the consequences of financial efficiency and productivity for growth. As pointed out by Demirgüç-Kunt et al. (2004) and Levine (2005), the access cost to capital and capital allocation efficiency are two fundamental components of economic growth. Low efficiency and productivity in finance supposedly drive up financial intermediation costs, which reduce enterprises' investments and innovation, and impede economic development (Aghion et al., 2005). Nevertheless, despite such a pivotal effect, few studies and measurements of financial intermediation cost have been made so far. One reason for this is the difficulty in calculating financial costs given the multifaceted and changing nature of financial activities. The unit cost of financial intermediation must provide the same information whatever the set of financial variations across countries and over time. In addition, the calculation has to account for financial intermediaries' ability to cross-subsidize their services, which makes prices uninformative of the real cost of financial services and prevents one specific income from being linked to one specific service. Although the interest-rate spread is essential to understanding financial costs, financial intermediation activities do not systematically and unequivocally depend on it. For example, wealth and asset management costs are based on fees as are most market-based activities and financial advice services. For that reason, measuring financial costs involves more than the simple use of interest rates, from a global perspective of financial services (Philippon, 2015).

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1. North D. C. and R. P. Thomas (1973), *The Rise of the Western World: A New Economic History*, p. 143

The first objective of the paper is to fill this gap by calculating unit cost series for 20 countries. We draw on the pioneering papers by Philippon (2015) and Bazot (2018), which calculate the unit cost of financial intermediation for the US and Europe. Although Bazot (2018) calculates unit costs for seven countries, that panel is too small to analyze unit cost determinants. This new data set enables us to compare countries' unit costs and to describe some of their features from a global perspective. It also provides fresh insight into current economic debates such as financial intermediaries' economic rents (Barkai, 2017; Autor et al. 2018), the connection between financial development and inequalities (Rajan, 2010; Kumhof et al., 2015), or finance relative wage variations (Philippon and Reshef, 2012, 2013; Boustanifar et al., 2018).

The second objective is to question the link between unit cost values, capital control, and deregulation—that is, financial market liberalization and capital market development. The 2007–2009 crisis and the development of the originate-to-distribute model of financial intermediation raised important questions with regard to the surge in financial intermediaries' income (French, 2007; Philippon and Reshef, 2012 and 2013; Philippon, 2015; Greenwood and Scharfstein, 2013; Bazot 2018). Deregulation seems to go along with lax screening (Keys et al. 2012), poor monitoring (Wang and Xia, 2014), and risk taking (Acharya, 2009; Acharya et al. 2013; Biais et al., 2015; Bolton et al., 2016), suggesting that financial intermediaries could take advantage of information asymmetries to raise their rents as a result of market liberalization (Gennaioli et al., 2014, 2015). Although Philippon (2015) and Bazot (2018) discuss the evolution of unit cost series, their panel cannot be used to test for the specific role played by deregulation. In addition, despite evidence linking finance relative wage increases and deregulation (Philippon and Reshef, 2012, 2013; Boustanifar et al., 2017), the specific mechanisms at work remain globally unknown—finance relative wage changes could stem from new opportunities provided by deregulation (Gennaioli et al., 2013, 2014, 2015; Bolton et al., 2016), labor productivity gains, or financial income distribution favoring skilled workers (Guadalupe, 2007).<sup>2</sup> Our new data set helps to look at those hypotheses and provides new insight into the connection between finance related-wages and financial productivity.

In this respect, this paper produces six principal results. First, unit costs have decreased globally over the past 45 years in most countries. However, large financial countries like the UK and the US do not display such a downward trend. Second, a global measure based on countries' unit cost aggregation shows that the international unit cost moves from 2% to 1.4%-1.7%—depending on the set of hypotheses used in the calculation.<sup>3</sup> Third, the decomposition of unit cost per input shows that the ratios of compensation to financial output and gross operating surplus to financial output decrease significantly in the long run.

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2. The finance relative wage is the average wage in finance divided by the average wage in the non-farm non-financial sector.

3. In particular, Stauffer (2003) and Fournier and Marionnet (2009) show that financial sector value added does not include capital income. Those incomes tend to be economically large after the mid 1990s due to the joint development of credit intermediation and the securities industry. Bazot (2018) proposes a “correction” of financial income to account for this omission.

On the other hand, the ratio of banks' distributed profits to banks' intermediated assets and liabilities tends to rise. In other words, most of the decrease in unit costs stems from reduced input costs, suggesting higher economic rents and markups. Fourth, unit costs tend to converge from the 1970s to 2000s. This is confirmed by econometric analyses explaining the 10-year variation in unit cost by its initial value. In addition, the standard deviation in unit costs in 1970 is more than twice the standard deviation in 2000. On the other hand, unit cost dispersion across countries remains stable from 2000 onward. Fifth, most unit cost series display higher values from the mid 1970s to the early 1990s. This coincides with high nominal rates of interest as discussed in Bazot (2018). Insofar as the change in nominal rates was partly due to the exogenous surge in oil prices, the decreasing unit cost trend might be due to artificial circumstances. In fact, the unit cost series appears mostly stagnant as we expurgate it from variations in nominal rates. Although this result holds under the assumption of full exogeneity in nominal rate variation, it shows that a significant part of the decrease in unit cost might not be due to structural change. Sixth, financial deregulation is not associated with increasing unit cost value, although Philippon and Reshef (2012, 2013) and Boustanifar et al. (2017) show that deregulation coincides with finance relative wage increases. On the contrary, the correlation between deregulation and unit cost is either positive or not significantly different from zero.

Those results have several consequences for current economic and political debates. First, the decomposition of unit cost per input coincides with labor productivity gains in most countries. This point is confirmed by the calculation of finance relative labor productivity which tends to increase in most cases.<sup>4</sup> Despite such productivity gains, Canada, the UK, and the US display stagnant unit costs, increasing distributed profits, and rising relative wages for skilled workers (Boustanifar et al., 2018). This shows that productivity gains in those countries have been captured by shareholders and skilled workers without any benefit for the non-financial sector. Second, those results question the link between inequalities, debt-to-income ratio, and financial crises, as suggested in Rajan (2010) and Kumhof et al. (2015). In these models, the credit supply must rise with households' inequalities due to top earners' preferences for wealth and bottom earners' willingness to maintain their consumption. Those models assume that the increasing volume of credit does not come from financial productivity gains—that is, from a decrease in unit cost. The data does not support this hypothesis for most countries. Thus, credit development over the past three decades could be explained by financial industry productivity gains—as supported by unit cost and labor productivity figures.

Given that the decrease in unit cost is intricately linked to higher labor productivity and lower production costs, the data show that the decrease in financial intermediation cost coincides with soaring outstanding financial assets and liabilities. This may have positive and

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4. Finance relative labor productivity compares labor productivity in finance to labor productivity in the whole economy. It is measured by the ratio of financial output to total hours worked in finance divided by the ratio of GDP to total hours worked in the whole economy.

negative consequences for welfare. If financial development is linked to inclusive growth, liberalization and deregulation should benefit the rest of society. On the other hand, we know from Schularick and Taylor (2012), Meissner and Bordo (2012), and Jordá et al. (2016a, 2016b) that a boom in financial development raises the probability of a financial crisis occurring. We also have evidence that too much finance may be growth-decreasing in the long run as it reaches the 100% GDP threshold (Arcand et al., 2016). For those reasons, paradoxically, those results suggest that financial deregulation and liberalization might have been welfare-decreasing due to their positive effect on financial intermediation productivity. In other words, negative externalities—such as banks issuing too much debt—could have led to costly financial instability (Stein, 2012) and greater inequality (Piketty, 2013; Cournéde et al., 2015).

The rest of the paper proceeds as follows. Section 2 presents the data. Section 3 displays some stylized facts about financial income and financial unit costs. Section 4 looks at potential correlation between unit cost and financial deregulation. Section 5 discusses the results. Section 6 concludes.

## 2 A new database on financial intermediation unit cost

Financial unit cost calculation is based on the methodology of Philippon (2015) and Bazot (2018). This section presents the hypotheses used to obtain national series and discloses the new data set.

### 2.1 Measuring the unit cost of finance

The purpose of finance is fourfold: intermediation—that is, matching supply and demand for capital and liquidity—, the safekeeping of assets, the provision of effective payment systems, and the ability to share risk (Davis et al., 2016). Intermediaries are compensated for providing those services, with the result that financial intermediaries’ income measures the cost of producing financial services at the national level. Because it is hard to attribute one specific income to one specific service, the unit cost calculation must take a global view of intermediation. A convenient way to circumvent the issue is to use the ratio of total financial income to the total production of financial services—that is, financial output. Such a method cannot inform us about the cost of producing each single financial service but measures the cost of producing (and maintaining) a basket of financial services worth one monetary unit.

Financial value added (FVA) is a convenient way to measure financial income. However, Stauffer (2003) and Fournier and Marionnet (2009) show that national accounts ignore capital income, the amount of which may dramatically affect the level of intermediaries’ income after the 1980s due to the joint development of credit intermediation and the securities industry (Greenwood and Scharfstein, 2013). Banking income data help to come up with a “correction” for financial income (Bazot, 2018). Two calculations are proposed, then: (i) a

plain financial income measure, based on plain FVA, and (ii) a corrected financial income measure, which adds banks' capital income to FVA. In both cases, the financial intermediation trade balance is used to adjust the measure for the provision of non-domestic services.

Financial output has to account for all intermediated financial services. Philippon (2015) and Bazot (2018) show that financial output is linked to the amount of outstanding financial assets and liabilities—credit (loans and bonds), market capitalization, broad money, and public debt. Some assets or liabilities might be more intermediated than others and the relative intermediation intensity may change over time. Hence, we need to weigh each item for each year to account for this effect. Thus we proceed in two steps: we first account for the relative intermediation intensity of assets, then we adjust the series for intermediation quality change.

The relative intensity of each item is set as follows. First, we normalize the intermediation intensity of loans to 1. Second, because intermediaries manage financial wealth with stocks, bonds, and loans (securitized or not) as a counterpart on the asset side, we act as if each asset class was as intensive to intermediate as credit (Philippon, 2015; Bazot, 2018). Because this choice is disputable, we test for its potential effect on the shape of the unit cost series in a robustness check section. Third, we propose to measure the relative intensity of intermediation and liquidity services through the use of the spread in interest rates. In fact, the spread between lending or deposit rates with the reference rate measures the cost charged by intermediaries to provide intermediation or liquidity services. The lending spread corresponds to the cost of obtaining intermediated credit relative to the riskless asset, which does not demand intermediation. Because an investor yields the reference rates if she puts funds on the market, the deposit spread is the opportunity cost relative to liquidity provision. As long as interest rate controls are removed, the ratio of average values appears close to 1 in all countries after the 1980s, suggesting similar intermediation intensity.<sup>5</sup>

As long as financial intermediaries innovate to extend their services to riskier clients, a quality adjustment is needed. Philippon (2015) uses a theoretical model to adjust the US financial output from low cash firms and poor households' access to credit. This method cannot be used apart from in the US case due to data availability issues. However, Philippon's result can be extrapolated to produce countries' quality adjustment as the adjustment ratio is closely correlated to the amount of outstanding credit in the economy.<sup>6</sup> Therefore, the coefficient of a regression explaining the adjustment ratio by the ratio of credit to GDP in the US can be used to adjust other national series. This results in the assumption that the quality of financial services is a linear and positive function of credit development while the access to finance of low cash firms and poor households is bound to credit development, as emphasized in Levine (2005).

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5. Let  $s_d = r - r_d$  and  $s_r = r_l - r$ , with  $r_d$  the deposit rate,  $r_l$  the lending rate, and  $r$  the reference rate (3 month government bond rate), the relative intensity of the liquidity and the intermediation service is measured by:  $\frac{s_d}{s_l}$ .

6.  $R^2 = 0.8$



In this respect, the unit cost is calculated for each year based on the following formula:

$$UC_{plain} = \frac{FVA - \text{financial trade balance}}{\Omega(\text{credit} + \text{market capitalization} + \text{broad money} + 0.1\text{public debt})} \quad (1)$$

$$UC_{corrected} = \frac{(FVA + \text{banks capital income}) \left(1 - \frac{\text{financial trade balance}}{FVA}\right)}{\Omega(\text{credit} + \text{market capitalization} + \text{broad money} + 0.1\text{public debt})} \quad (2)$$

With  $\Omega \geq 1$  the quality adjustment coefficient— $\Omega = 1$  being the extreme case of no quality adjustment. Following Phillipon (2015) and Bazot (2018), the public debt has been assigned a lower intermediation weight.<sup>7</sup> In addition, because of the unavailability of banks' capital income trade balance, the corrected unit cost is adjusted for the trade balance based on the ratio of the financial trade balance to FVA. In other words, we assume that capital income is subject to the same trade balance ratio as the other incomes.<sup>8</sup>

## 2.2 The data

Along with Philippon (2015) and Bazot (2018)'s data for the US, Germany, France, Italy, the Netherlands, Spain, and the UK, the new data set adds unit cost series for 13 additional countries.<sup>9</sup> Because the interpretation of unit cost is mostly based on its long term evolution, the set of countries has been chosen based on FVA and financial output data availability before 1990; this excludes most of the eastern European and developing countries. In addition, Ireland, Switzerland, and Luxembourg have not been included due to financial trade balance availability issues.

FVA data is based on national accounts, EU-KLEMS (van Ark and Jäger, 2017) and OECD-STAN; credit data is from the BIS credit database; market capitalization and broad money are from the World Bank database and FRED database; public debt is from the World Bank database and Reinhart and Rogoff (2010); financial value added trade balance is from the World Bank database; banking income is from OECD financial statement of banks. More details are available in the data appendix of the paper.

## 3 Financial income and unit cost: some stylized facts

### 3.1 Financial income series

Financial income is measured in two different ways depending on whether banks' capital income is added to FVA or not. Plain financial income is available for 20 countries while

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7. As a matter of fact public debt is safe and mostly used as a buffer. Few resources are thus devoted to managing it.

8. This assumption has almost no effect on the results, given that the trade balance is small for most countries except the UK.

9. Australia, Austria, Belgium, Canada, China, Denmark, Finland, Japan, New Zealand, Norway, Portugal, South Korea, and Sweden.

corrected financial income is available for 15 countries. In addition, banks' financial statements are not homogenous across countries, which means that different standards may be used to measure banking income. In particular, because they do not distinguish between the domestic and foreign business of national and international banks, data for Austria and the Netherlands are not exploitable.

Figure 1 displays the ratio of plain and corrected financial income to GDP per country.<sup>10</sup> Three main facts stand out. First, plain financial income to GDP increases in Anglo-Saxon countries, the Netherlands, China, Korea, and—though lately—Denmark. On the other hand, this ratio remains stable in all other countries except Italy, for which it decreases. Second, among countries for which plain financial income is globally stable, the trend of national series peaks in the late 1980s or early 1990s. This coincides with maximum values of real interest rates, suggesting that the spread of lending and deposit rates increases when interest rates are high. It is also worth noting that the financial trade balance barely affects those results. Although corrected values for before 1980 are not available, comparing corrected and plain financial income values does not dramatically change those conclusions. As a matter of fact, corrected financial income tends to increase in all countries except, Belgium, Finland, and Norway where it stagnates, and Japan where it decreases.

In order to produce the evolution of plain and corrected financial income from a global perspective, we built an international series based on the sum of countries' financial incomes. This method allows us to aggregate countries' financial income value in a single synthetic figure for each year. Figure 2 shows that both series increase in the long run. However, the difference between corrected and plain financial income widens from 1980 onward. The difference between plain and corrected values is close to 0.5% of GDP in 1980 and reaches almost 2% of GDP in 2006, suggesting that capital income accounts for 1/12 of financial income by 1980 but more than 1/4 by 2006. In addition, while the plain synthetic series is very stable after 1990, the corrected series increases steadily until 2007. Because capital income is mostly due to market-based activities (capital gains, income on securities, derivatives selling), the securities industry became larger for banks after the 1980s.

### 3.2 Unit cost series

Table 1 provides basic statistics on plain and corrected unit cost average value and variation per country.<sup>11</sup> Two facts can be underlined. First, from 1970 to 2014 the plain unit cost decreases in all countries, except for the UK where it increases slightly. Second, this fact holds good as we look at corrected unit costs, although the period is shorter.

In order to dig into the details, Figure 3 plots the plain and corrected unit cost for each country whether or not the series is adjusted for quality. Four principal facts stand out. First, the unit cost trend is either decreasing or close to zero for all countries. Second, except

10. See also Philippon and Reshef (2013) for a similar plot for 12 OECD countries from 1970 to 2007.

11. Financial output figures per country are reported in the online appendix for the sake of space and simplicity (see figure A1).

for New Zealand, Anglo-Saxon countries are the only ones to experience plain unit cost stagnation over the past 35 years. All other countries display a decreasing trend. This result holds good when we correct for capital income. Indeed, using the conservative hypothesis that the ratio of corrected to plain unit cost is fixed from the 1970s to the mid 1980s, the unit cost series is globally stagnating for three countries only: Canada, the UK, and the US.<sup>12</sup> However, it is worth noting that Germany joins the group of stagnating countries when the data extend to the 1960s (Bazot, 2018). In other words, data availability might mitigate our conclusion since other countries might be in the same situation as Germany. Third, the decline in unit cost appears larger when countries' unit cost is high during the 1970s, so that a convergence process seems to be at work. Fourth, the unit cost goes up in the 1970s, peaks in the mid 1980s, and declines sharply thereafter in most cases. This coincides with movement in nominal interest rates.

The last two points have significant consequences for the debate on the effect of market liberalization on financial productivity. Thus, we propose to discuss the related theoretical arguments and to test the validity of those observations based on econometric analyses.

### 3.2.1 Unit cost convergence

According to market principles, prices tend to converge as local barriers come down and rules homogenize. So, market liberalization and international openness is theoretically supposed to produce unit cost convergence between countries. This must hold in finance depending on capital mobility and regulatory barriers. Four forces are at work, in this regard. First, the rise in international finance affects domestic markets due to fiercer competition (Krozsner and Strahan, 1999; Claessens and Laeven, 2004; Demirgüç-Kunt et al., 2004). Efficient practices and regulations are adopted to attract capital and promote financial activities. Second, because of capital restrictions, interest rates and fees tend to climb along with capital scarcity. By the same token, depositors and investors cannot demand high remuneration since capital control diminishes the set of investment opportunities. This ultimately increases fees and interest margins and raises the cost of financial intermediation accordingly. As soon as capital barriers come down, investment opportunities go up and the capital flows wherever it brings the best return—that is, where capital is scarce. For those reasons, financial liberalization is supposed to foster productivity in countries with high unit cost values. Third, as argued by Stulz (1999), because the risks are shared among more investors with different risk strategies and hence different risk profiles, the risk and liquidity premium falls for borrowers in countries with access to global markets. Fourth, the homogenization of regulatory rules helps enterprises to adopt innovative financial practices which ultimately raise productivity and bring unit costs down. The lower the initial productivity, the greater the decline in unit cost.

However, the strength of these mechanisms depends on market effectiveness and imperfection. In particular, information asymmetry and non-regulatory-based barriers to entry

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12. As shown in Table 1 there is no available data to correct unit cost series for Australia.

prevent market participants from adjusting their decisions to market forces. This proves to be particularly salient in finance since private information management, risk taking, and trust are fundamental aspects of intermediation (Gennaioli et al., 2014 and 2015; Biais et al., 2015; Bolton et al., 2016). According to local market specificity and intermediaries' information rents, the price of financial services might not be affected by financial openness and deregulation. If financial inefficiency stems from information asymmetry, liberalization and deregulation could even raise unit cost values in the less efficient countries, depending on intermediaries' ability to benefit from moral hazard and market power as the demand for intermediation rises. In addition, the emergence of competitive conditions (decreased market power and concentration) could raise interest margins due to the potential increase in interest rates risk, credit risk, and operating costs (Maudos and Guevara, 2004).

On the other hand, market imperfections could be offset for two reasons. First, information is not always private, meaning that numerous financial operations are not affected by information rents. Second, the development of information and communication technologies decreases information costs and thereby reduces the effect of distance on lending (Petersen and Rajan, 2002). If distance remains a great impediment to market competition, information technologies tend to mitigate its effect.

What is the current evidence about financial intermediation price convergence and capital market integration? Interest rate data suggest that financial liberalization and deregulation coincide with financial price convergence from the mid 1970s to the early 1990s (Mussa and Goldstein, 1993; Obstfeld and Taylor, 2003; Volosovych, 2011).<sup>13</sup> However, interest rate convergence is not a sufficient condition for financial intermediation market integration due to the cross-subsidization of financial activities. Indeed, interest margins may decrease along with globalization as financial intermediaries tend to promote non-interest income at the expense of interest spread. This occurs when banks use attractive interest rates to increase their competitiveness but raise their fees on other related services. In other words, the law of one price does not necessarily hold. By contrast, because the unit cost rolls all financial services into one single measure, it is well suited to test for financial price convergence in the long run.

Although 20 observations are not enough to strongly infer a statistical effect, figure 4 shows how good the convergence effect is. In fact, the unit cost in 1973 explains 66% of the 1973–2003 unit cost variation variance. In order to generalize those results we test for convergence from the following model:

$$\Delta uc_{i,t} = \alpha + \beta uc_{i,t-10} + \epsilon_{i,t} \quad (3)$$

with  $\Delta uc_{i,t}$  the unit cost variation from  $t - 10$  to  $t$ . Table 2 shows the OLS result whether or not time and country fixed effects are included in the regressions. In all cases  $\beta_1$  appears negative and statistically significant at less than 0.1% confidence. The estimated coefficient is quite large: a one cent higher unit cost coincides with a 0.3 cent decline after

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13. See also Davis (1965) for an historical perspective based on net returns of reserve city banks in the US.

10 years. In addition, the strength of the estimation is so good that control variables—such as nominal rates, the globalization level, and the deregulation index—hardly affect the value and significance of the estimated coefficient (see table A1 in the online appendix). Another way to account for unit cost convergence is to look at changes in unit cost variance over the long run. Figure 5 shows that unit cost standard deviation is approximately divided by a factor of two over the period. In addition, the series shows that most of the convergence process occurs from the early 1970s to the early 2000s, so that unit cost convergence coincides with financial liberalization and deregulation. Figure A2 shows that the deregulation index variance fits particularly well with the unit cost variance. In fact, like the unit cost variance, the deregulation index variance appears particularly flat from the mid 1990s to the late 2000s.

Those results coincide with the convergence principles since financially efficient and productive countries did not experience large unit cost decreases during the deregulation and globalization process. Hence, the unit cost in the UK and Canada remains quite stable while the unit cost in France, the Netherlands, Austria, Portugal, and Italy decreases significantly. On the other hand, with regard to its relatively high unit cost in the 1970s, the US appears as an outlier—the unit cost did not decrease sufficiently.

### 3.2.2 Nominal rates effect

A key component of the unit cost of finance is the interest margin produced by intermediation. Thus, nominal rates and unit costs are intricately linked by the asymmetric evolution of interest expenses and interest incomes following nominal rate changes (Flannery, 1982; Neumark and Sharpe, 1992; Craig and Dinger, 2011). First, deposit rates are often more rigid than lending rates due to regulation (*e.g.* regulation Q). Second, sight deposits are not remunerated (Lucas, 2000). Third, banks tend to borrow short and to lend long, so that interest income rises in the long run as the nominal rates trend goes up. Fourth, demand, saving, and retail time deposit balances are imperfectly responsive to changes in market rates due to transaction or information costs (Flannery and James, 1984; Gennaioli et al., 2014). Nevertheless, this effect tends to vanish as banks hedge against market rate fluctuation (Flannery, 1981).

Because the variation in unit costs is theoretically bound to changes in nominal rates, we see how both variables are linked in the long run. Based on the large number of panels and years available from the data, it is possible to provide a robust investigation of the issue. Figure 6 shows that the long-term relationship between unit cost and nominal rates is globally good in most countries. In particular, plain unit costs are higher when the nominal rates trend is high in the 1970s and 1980s. In order to confirm this long-term relationship we use panel cointegration tests based on Westerlund’s (2003) methodology.<sup>14</sup> The panel cointegration test is particularly suitable here since: (i) the use of multiple panels increases the statistical power of the test; (ii) the cointegration test was made to capture the long-term connection

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14. The unit root test confirms that both unit cost and nominal rates series are integrated of order 1.

between variables. Table 3 shows that cointegration prevails at panel level.<sup>15</sup> In addition, despite the small number of observations per country, the test confirms the presence of panel cointegration at 1% confidence with corrected unit costs. The results hold good whether or not unit cost is adjusted for quality.

This has two consequences for the analysis of the financial system. First, the presence of cointegration informs us as to the shape of the unit cost series. If it is accepted that the surge in nominal rates during the 1970s and 1980s did not depend on financial industry activities—as confirmed by the link between the oil price surge, inflation, and nominal rates change—the rise and fall of unit cost values during this episode was not due to structural factors. Insofar as we are concerned with financial efficiency and changes in productivity, independently of the macroeconomic situation, it could be informative to act as if the turmoil had not occurred. Thus, we propose a counter-factual unit cost measure which “purges” unit cost series of movement in nominal rates. To do so we use the residual of a regression explaining the unit cost by nominal rates of interest. Figure 7 plots the related series whether adjustment is made for quality or not. We see that plain and corrected unit costs tend to stagnate in most countries after the 1970s. In other words, there is no evidence of unit cost variation in the long run whenever a control is made for nominal rate changes. However, this result depends on the hypothesis that the reduction in nominal rates from the 1980s to the early 1990s was strictly related to economic circumstances. Evidence about unit cost convergence and capital market integration tends to invalidate this assumption and suggests that changes in nominal rates also depend on capital controls and financial liberalization.

Second, unit cost depends closely on interest rate movements. In other words, the development of new market-based activities and the joint development of credit intermediation and the securities industry did not remove the link between interest rates and unit cost. However, this conclusion is mitigated by the widening gap between plain and corrected unit costs as more income has come from trading and securitization activities since the early 1990s.

### 3.3 International unit cost measure

Because each country is specific, national series do not provide general conclusions as to the global cost of financial intermediation in the long run. This is why we merge national series to produce an international unit cost series. We sum financial income, financial output, and trade balance, and use equations (1) and (2) to obtain the international unit cost measure. This method allows us to keep the financial services trade balance in the calculation. The remaining trade balance is thus due to financial operations with the rest of the world—which is not included in the measure.

Figure 8 shows that the international unit cost tends to decrease. This result is sensitive to the hypotheses used in the calculation, though. The corrected unit cost series appears only slightly decreasing if the series is not adjusted for quality. In addition, the decreasing

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15. It is worth noting that Pedroni’s panel cointegration tests lead to the same conclusion.



shape of unit cost is not necessarily due to rising efficiency and productivity, as suggested by the decrease in nominal rates in the 1990s. Accounting for this effect, figure 9 plots the international unit cost as the series are cleared of the effect of nominal rates. The unit cost displays a remarkably flat shape, whatever the set of hypotheses used in the calculation. In other words, the international unit cost tends to decrease over the period but most of the variation can be explained by the reduction in nominal rates during the 1980s and 1990s. This confirms that the international unit cost trend depends closely on nominal rate movement—which depends mostly on macroeconomic factors, either from commodity price surges, monetary policy rules, or capital market integration.

### 3.4 Unit cost decomposition

In order to dig into the causes of the unit cost trend we decompose national unit costs from their constituent parts—that is, labor and capital costs. Figure 10 plots total compensation and gross operating surplus (GOS) relative to financial output. We see that the unit compensation cost decreases sharply in most countries. The unit GOS cost tends to decrease in similar proportions. The evolution of the unit GOS cost is particularly contrasted, though. When capital income is accounted for, the unit GOS cost remains quite stable after the early 1990s in most countries. In other words, almost all of the decrease in the corrected unit cost can be attributed to reduced labor costs—despite the increase in finance relative wages documented in Philippon and Reshef (2012, 2013) and Boustanifar et al. (2017).

The unit GOS cost can be decomposed to compare the unit distributed profit—which represents what the company pays to financial intermediaries’ capital holders to obtain one unit of financial service—with the other components of the GOS. Unfortunately consolidated data are not available, except for banks. Nevertheless, given that banks account for the largest part of financial intermediation costs in most countries, these data remain highly informative. Figure 11 plots banks’ distributed profit against banking output—that is, banking assets plus banking deposits plus interbank loans minus interbank deposits.<sup>16</sup> Because banks’ balance sheet items are not the same in all countries due to specific institutional and geographic coverage, we plotted the ratio of distributed profit to financial output on the same graph. Both series show a positive trend in the long run although most of the increase occurs in the second half of the 1990s.<sup>17</sup> In other words, distributed profit increases more than financial output despite the boom in intermediated assets in the 1990s and 2000s.<sup>18</sup> It is also worth

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16. Banking output is based on OECD banks’ financial statements providing banks’ consolidated balance sheets and income statement at country level. The calculation is the following: *banking output* = *loans* + *securities* + *interbank loans* + *deposits* – *interbank deposits* + *other assets* + *other liabilities*.

17. The shape of both series appears very similar, suggesting that banking output and financial output are very similar. This reveals two things. First, financial output does not overlook banking assets and liabilities and coincides with changes in banks’ balance sheets. Second, national differences about institutional and geographical coverage of banking activities do not affect the main results of the paper.

18. For example, for \$1 of intermediated assets and liabilities, banks in the US distributed \$0.2 to their shareholders in 1990 but \$0.35 in 2007, that is a 57% increase.

noting that the ratio of profit after tax to intermediated assets increases in similar proportions over the period (figure A3). In most cases, distributed profit is the only item that increases more than financial output over the period.

Those results have several consequences with regard to the literature on the fall of labor share (Elsby et al., 2013; Karabarbounis and Neiman, 2014) and increasing rents (Barkai, 2017; Autor et al., 2018). As argued in Barkai (2017), the cost of capital can be calculated as  $c_K = RK$  with  $R$  the ex-ante required rate of return on capital and  $K$  the amount of capital. Thus  $\frac{c_K + c_L + \pi}{Y} = 1$  with  $c_L$  the cost of labor,  $\pi$  the profit, and  $Y$  the value added. VA can thus be decomposed into labor share, capital share, and profit share. Because of the decline in compensation and GOS to output documented above, we know that the input costs tend to decrease. At the same time the share of distributed profit grows 300% from 1987 to 2007 in the average country (figure A4). Only raising markups can explain both the decline in input costs and the increase in profit shares (Barkai, 2017), suggesting that economic rents have increased significantly in the financial sector since the late 1980s.<sup>19</sup> This result coincides with the “superstar” explanation for the decline in labor share (Autor et al., 2018) where a small number of large and highly productive enterprises extract monopoly rents from their past innovations. In other words, globalization or technological changes benefit the most productive firms so that the financial sector becomes increasingly dominated by “superstar” firms with high profits and a low share of labor and capital in firms’ value-added and sales.

### 3.5 Robustness check

A key assumption about the unit cost measure is that financial services do not differ in terms of intermediation intensity. This hypothesis is based on the idea that wealth management does not differ whether stocks, loans, mortgages, or bonds are used as an asset counterpart. In addition, the service of liquidity provision is assumed to be as intensive as the intermediation service.

What if the intermediation intensity is not properly measured? Would we obtain the same unit cost trend? An easy way to test for this is to compare domestic financial income with each class of assets and liabilities included in the financial output calculation. We thus test for the significance of a trend for three ratios:  $\frac{Income}{Credit}$ ,  $\frac{Income}{Market Capitalization}$ , and  $\frac{Income}{Broad Money}$ . The results are displayed in table A2 in the appendix. The ratios display a negative trend in most cases whether we use plain or corrected income values. We see five different cases: (i) all three ratios are negative, (ii) two ratios are negative while the last ratio is insignificantly different from zero, (iii) one ratio is negative while two ratios are insignificant with a positive sign, (iv) two ratios are of significant opposite signs, (v) one ratio is significantly positive while the other ratios are insignificant with opposite signs. Cases (i) and (ii) account for 26 out of 35 cases ( $\approx 74\%$ ), suggesting that unit costs are significantly decreasing whatever the

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19. Distributed profit is also part of capital costs, so, the rise in distributed profit could be explained by increased capital costs. This is not supported by recent studies showing that the required rate of return on capital is stable at around 8% (Karabarbounis and Neiman, 2014; Barkai, 2017).



hypotheses used to measure intermediation intensity; (v) accounts for only one case (the US when using plain financial VA), which coincides with previous results. Cases (iii) and (iv) correspond to ambiguous cases displayed in figure 3, that is, Canada, Spain, and the UK; the only surprising result is New Zealand, although figure 3 shows that a negative unit cost trend is the most plausible conclusion. Thus, the trend of the unit costs series appears unaffected by the hypotheses used to measure financial output.

## 4 The effect of deregulation

While unit cost convergence supports the idea of a negative effect of deregulation on financial costs, the link between nominal rates and unit costs shows that most of the unit cost decrease may have come from macroeconomic (non structural) forces—suggesting no deregulation effect. The former point matches previous micro level studies showing that free entry and capital market liberalization reduce interest margins and fees (Krozsner and Strahan, 1999; Claessens and Laeven, 2004; Demirgüç-Kunt et al., 2004; Guiso et al., 2006). The latter coincides with macro level inquiries suggesting that finance relative wage growth could be related to an increase in economic rents (Philippon and Reshef, 2012 and 2013; Boustanifar et al., 2017), despite the intensification of competition and financial market development.

This section proposes to test the link between unit cost and deregulation in two steps. First, it looks at the sign and significance of the correlation between unit cost and deregulation. Second, it tests the correlation between changes in deregulation and unit cost variation. Deregulation is measured from the index developed by Abiad et al. (2007), which assesses deregulation from seven criteria: credit control, interest rate control, bank privatization, international capital market openness, entry barriers, stock market development, and bank supervision. All those criteria (sub-indexes) are merged into one single figure to produce the deregulation index. However, the deregulation index is prone to imperfection. In particular, the weight of each deregulation item is normalized to one and so fails to account for the consequences of a change with regard to countries' financial specificities.

Because the aim of the analysis is to measure the effect of deregulation apart from the circumstantial variation of domestic unit cost values, control variables are added to capture the macroeconomic situation and international activities. Nominal rates and inflation rates are used to measure the effect displayed in section 3.2.2. Although both variables are linked to financial deregulation, they depend heavily on macroeconomic factors such as oil-price surges or monetary policy, the effect of which is hardly structural. Real GDP growth accounts for the effect of the business cycle on demand for financial services. The exchange rate controls for uncovered interest rate parity and the effect of unexpected variation in exchange rates on the cost of capital.<sup>20</sup> Net foreign assets to GDP and the liberalization index control for the development of international activities and the influence of market openness on the access

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20. The US dollar is used as the reference currency.

cost to capital. The share of banking credit is also added to measure potential differences between bank-based and market-based financial systems in terms of intermediation intensity. The correlation Matrix is available in Table A3 in the online appendix. The analysis is based on the following model:

$$uc_{c,t} = \gamma.deregulation_{c,t-3} + \beta'.x_{c,t-3} + \lambda_c + \lambda_t + \epsilon_{c,t} \quad (4)$$

Where  $uc$  is either the plain or corrected unit cost. Because quality adjustment is questionable, the regressions may or may not account for quality.  $x$  is the set of control variables. All explanatory variables are used with a lag of three years to address simultaneity issues.  $\lambda_c$  and  $\lambda_t$  are panel and time fixed effects. Even though clusters are needed to account for cross correlation among panels, they may overestimate standard errors as the number of panels is too low (Angrist and Pischke, 2008). Therefore, we use Driscoll and Kraay standard errors to solve this issue (Hoechle, 2009).

Table 4 shows that deregulation is negatively correlated to unit cost in its plain, corrected, adjusted, or unadjusted forms. Significance is good as long as Driscoll and Kraay standard errors are used. On the other hand, cluster standard errors display mixed results, particularly when the corrected unit cost is the response variable. This result contrasts with the effect of nominal rates of interest which are systematically significant at the 1% confidence level, whether clusters are used or not in calculating standard errors. The negative correlation between regulation and unit cost is thus rather fragile, although the coefficient of interest remains relatively stable whether control variables are included in the model or not.

Despite negative and significant results, it is hard to disentangle direct and indirect effects from more artificial ones. The example of interest rates is enlightening here. Variation in nominal rates during the 1980s may have been due to both exogenous forces (oil price surge) and financial deregulation. If financial deregulation helps reduce nominal rates, the effect of deregulation is not properly estimated when nominal rates are included in the model—interest rates would be a “bad control” (Angrist and Pischke, 2008).<sup>21</sup> On the other hand, removing this variable generates confounding variable bias insofar as high nominal rates may encourage national governments to reform their financial systems. In other words, the estimated effect of deregulation might not be properly measured whether nominal rates are used in the model or not. Nevertheless, this issue appears quite minor. Looking at coefficient values whether controls are included in the model or not, table 4 shows that  $\hat{\gamma}$  holds between  $-0.55$  and  $-0.75$ , suggesting that the “bad control” effect is small.

In spite of the low “bad control” effect, we cannot rule out omitted variable issues from unobservable variable bias. Oster’s (2017) criteria extrapolate the unobservable variable bias based on coefficient values, significances, and  $R^2$  variation before and after the addition of observable controls.<sup>22</sup> Using this method and assuming that the relative degree of selection

21. Because globalization depends on financial (de)regulation, it is potentially a “bad control” too.

22. The calculation of unobservable variable bias is the following: let  $\hat{R}^2$  and  $\hat{\gamma}$  be the respective  $R^2$  and  $\hat{\gamma}$  from univariate regression; let  $\tilde{R}^2$  and  $\tilde{\gamma}$  be the respective  $R^2$  and  $\hat{\gamma}$  when control variables are included; let

on observed and unobserved variables is equal to 1, we see that  $\gamma$  would remain negative even though  $R^2 = 1 - \hat{\gamma} = -0.00499$  as the response variable is the plain quality adjusted unit cost.<sup>23</sup> However,  $R^2 = 1$  is highly unlikely due to, say, measurement issues. Therefore setting  $R^{2max} = 0.9$ —that is, assuming that 10% of the unit cost variance comes from measurement issues—Oster’s criteria predict  $\hat{\gamma} = -0.0063$ . Therefore, the negative relationship between deregulation and unit cost seems not to stem from omitted unobservable variable bias. This does not mean that the endogeneity issue has been removed.

The first model measured the long term correlation between unit cost and deregulation. But, how does the unit cost reacts to a shock on deregulation in the short run? The second statistical model ties in with this question:

$$\Delta uc_{c,t+3} = \gamma \cdot \Delta deregulation_{c,t} + \beta' \cdot \Delta x_{c,t} + \lambda_t + \epsilon_{c,t} \quad (5)$$

This model compares the change in deregulation from  $t - 3$  to  $t$  ( $\Delta deregulation_{c,t} = deregulation_{c,t} - deregulation_{c,t-3}$ ) to the change in unit cost from  $t$  to  $t + 3$  ( $\Delta uc_{c,t+3} = uc_{t+3} - uc_t$ ). Table 5 shows no significant effect of deregulation on unit cost. So, deregulation does not seem to affect unit cost in the short run. However, the lack of any significant effect may have resulted from causality bias as a government tends to deregulate when financial costs are increasing. Because governments react to households and enterprises’ dissatisfaction, reforms may occur when unit cost variation is positive. Thus, the potential negative effect of deregulation might be offset by reversed causality. In addition, omitted variable bias persists. For example, countries under the semi-fixed exchange regime of the European Monetary System may have been led to favor financial reforms to avoid macroeconomic interventions in the 1980s (Eichengreen, 2008). By the same token, the Euro convergence criteria following the Maastricht treaty led member countries to follow strict monetary rules, leaving governments with little microeconomic leeway during the 1990s. Thus, it is hard to distinguish between micro financial reforms and macro policy effect.

Instrumental variable techniques can address those issues. According to Abiad and Mody (2005) and Boustanifar et al. (2017), the level of deregulation is a good instrument for changing deregulation. Insofar as deregulation increases throughout the period, a low (respectively high) level of deregulation is more likely to be related to a large (low) change in deregulation. In addition there is no theoretical reason for the level of deregulation to affect the short term unit cost variation.

Table 6 shows that deregulation is negatively and significantly correlated to unit cost.<sup>24</sup>

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$\delta$  be the explanatory weight of unobservables compared to observable variables; let  $R^{2max}$  be the highest  $R^2$  value as all variables are taken into account;  $bias = \delta[\tilde{\gamma} - \hat{\gamma}] \frac{\bar{R}^2 - \hat{R}^2}{R^{2max} - \hat{R}^2}$  and the related unbiased coefficient is  $\hat{\gamma} = \tilde{\gamma} - bias$ .

23. We use simple  $R^2$  based on OLS regressions instead of within  $R^2$ .

24. Note that standard errors appear to be systematically lower when clusters are included in the regressions. Because this is at odds with econometric theory, this means that the number of clusters is too small for the standard errors to be properly estimated. Therefore, Table 6 does not report standard errors with clusters.

A 10% increase in the deregulation index leads unit cost to decrease by 0.1 to 0.16 cents, depending on the unit cost measure. Regressions (1) to (4) use the three-year lag value of deregulation as an instrument while regressions (5) to (8) use the three-year lag value of two sub-components of the deregulation index: entry barriers and the access to international capital.<sup>25</sup> Regressions (5) to (8) are thus used to test the robustness of the instrumentation, as both sub-components should be even more independent of unit cost variation. In addition, those regressions can be used to run the Hansen J-test whereby we see that the instruments are not endogenous. It is finally worth noting that instruments are not weak according to Stock and Yogo criteria.<sup>26</sup>

The set of correlations produced in this section shows that deregulation either reduces financial unit cost or has no effect on it. The conclusion remains the same whether such correlations are looked at from a long-term or a short-term perspective. In other words, there is no evidence that deregulation raises unit cost values. This contrasts with the theoretical explanation linking deregulation with increasing rents per unit of financial service (Gennaioli et al., 2014 and 2015; Biais et al., 2015; Bolton et al., 2016) or lowering productivity (Maudos and Guevara, 2004). On the other hand, this result coincides with the unit cost convergence effect previously identified.

## 5 Discussions

### 5.1 Finance relative wages, productivity, and welfare

A key point in the debate about financial deregulation concerns the evolution of finance relative wages. Higher compensation in finance after the 1980s, as documented by Philippon and Reshef (2012 and 2013) and Boustanifar et al. (2017), poses two issues. First, is the increase in finance relative wages related to economic rents in finance? Second, is the rise in financial wages responsible for skilled labor misallocation (Murphy et al. 1991; Philippon, 2010)? The decomposition of unit cost series provides new arguments on this issue.

Two hypotheses explain high relative wages in finance: (i) labor productivity in finance increases more than in other sectors; (ii) the financial industry manages to get more economic rents than the other sectors and redistributes them to workers. Several facts help to question the impact of each potential effect. First, the decrease in unit cost coincides with an increase in labor productivity. In order to measure this effect we plot the ratio of financial output to GDP against the relative number of hours worked in finance compared to all sectors—which measures relative labor productivity. Figure 12 shows that finance relative labor productivity increases dramatically in most countries, although the trend is lower in market-based countries (Australia, Canada, the UK, and the US). Thus, financial output development

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25. Both sub-components have been used among others due to their link with financial liberalization and capital market integration, as discussed in section 3.2.1.

26. This point is also supported by high F-stat values.

is related to labor productivity gains, either due to the intensive use of skilled labor or to technological progress. Second, despite the rise in distributed profits, the share of financial VA devoted to labor appears globally stable in many countries (figure A5) while it decreases in the other sectors of the economy (Autor et al., 2018).<sup>27</sup> This suggests that productivity gains were partly redistributed to workers. Thus, the surge in financial intermediation productivity could explain at the same time the rise in finance relative wages—due to increasing finance relative labor productivity—and monopoly rent redistribution.

It is worth noting that the changes in unit cost, distributed profit, finance relative labor productivity, and finance relative wages can help determine some specificity with regard to the distribution of productivity gains. In this respect, the US, the UK, and Canada display stagnating unit cost, rising relative wages and labor productivity, and increasing distributed profits per output. In other words, productivity gains have not produced unit cost decreases and were captured entirely by the financial industry through higher wages and profits. Productivity gains have not been to the benefit of the non-financial sector there. By contrast, Italy shows stagnant relative productivity gains, rising distributed profits, and decreasing relative wages. Thus, the reduction in unit cost and the surge in profits are mostly due to the relative decline in wages. In all other cases, finance productivity gains tend to benefit both financial intermediaries' shareholders and stakeholders, except in Korea where they tend to benefit the non-financial sector exclusively.

Although productivity in finance may have increased compared to other sectors, labor allocation is not necessarily efficient from a social welfare perspective. Too much talent may enter the market as long as the marginal private returns from talent exceed its social returns (Murphy et al., 1991). High wages attract skilled workers and increase the development of financial activities, although financial activities may produce poor welfare results due to negative externalities. This may be the case here for two reasons: first, credit development raises the probability and the intensity of financial crises (Jordá et al., 2016); second, credit development is no longer positively correlated with economic growth above the 100% GDP threshold (Arcand et al., 2015) and may fuel income inequalities (Cournède et al., 2015). From a general equilibrium perspective, finance relative productivity might thus be welfare decreasing.

## 5.2 Inequality, financial costs, and financial crises

Following Rajan (2010), Kumhof et al. (2015) argue that household inequality could have been responsible for the economic crises both 1930s and after 2007. In a zero long-term growth economy, any increase in households inequality entails more leverage. Top earners save more due to their preferences for wealth accumulation while bottom earners borrow more to smooth their consumption. This results in a cumulative process whereby the greater credit

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27. The omission of capital income from the national accounts could explain this contrasted results. As a matter of fact, using banks' financial statement data, we see that the ratio of "staff costs" to total income decreases over the period in most countries.

supply increases bottom earners interest payments, raises top earners income, and increases bottom earners debt burden. At the end of the process, the surge in debt-to-income ratio raises the probability that bottom earners' will be unable pay back their loans and triggers the crisis.<sup>28</sup>

This model relies on stylized facts showing that inequality and bottom earners' leverage in the US went hand in hand before both crises. This also coincides with the increasing size of the US financial sector documented by Philippon (2015). However, the model assumes that credit development was not pulled by an increase in financial efficiency and productivity. Although this is not invalidated by the US unit cost data, this assumption no longer holds as we extend the analysis to other countries. The increasing level of inequality in European countries does not coincide with unit cost stagnation, so that credit development could be explained by an improvement in financial intermediation productivity. For instance, the Spanish plain unit cost in 1980 is twice the 2005 value due to both nominal rate decreases and productivity gains (figure 12). This led to the surge in credit supply which ultimately fed the property bubble. Thus, financial productivity gain could explain both the decrease in unit cost and the credit boom and bust (Schularick and Taylor, 2012; Meissner and Bordo, 2012). In this respect, the rise in financial output led the economy to an overload of credit which ultimately ended in a financial crisis (Jordà et al., 2016a, 2016b). Because financial development matches financial wealth very closely (Bazot, 2018), income inequality could be the consequence of, rather than the cause of, financial development (Piketty, 2013).

## 6 Conclusion

This paper has proposed to measure the unit cost of financial intermediation for a large panel of countries. The data set has helped to produce new facts. First, the unit cost decreases in most cases though its level and trend depends on countries' specificity. Scandinavian countries' unit cost appears lower while Anglo-Saxon "market based" countries' unit cost looks relatively flat. Second, national unit costs tend to converge along with capital market openness and liberalization. Third, unit costs and nominal rates are cointegrated, suggesting that nominal rates affect the trend of unit costs in the long run. Fourth, most of the decrease in unit costs is due to reduction in input costs while distributed profits per intermediated assets tend to increase over the period. Fifth, financial deregulation correlates negatively with unit cost value.

These results provide new insight into current debates about financial efficiency and productivity. First, the decline in unit costs in financially backward countries suggests that the cost of economic rents did not prevent the non-financial sector from benefiting from finance productivity gains. However, this effect depends on countries' specificities since financially developed countries did not display significant unit cost reductions. This is particularly the

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28. Crisis in the model is endogenous in the sense that top earners anticipate that bottom earners will default in their expected utility function.

case in so-called “market based” countries (Australia, Canada, the UK, and the US) for which unit costs have stagnated since the early 1980s despite the surge in credit provision. The rise in distributed profits and relative wages in those countries shows that most productivity gains have been captured by financial intermediaries. Second, according to finance relative labor productivity figures, the unit cost variation coincides with reduced labor costs and labor productivity gains. On the other hand, the rise in distributed profits per unit of financial service and the rise in excess wages for skilled workers documented in Philippon and Reshef (2012, 2013) and Boustanifar et al. (2017) suggests that labor productivity gains benefited both shareholders and skilled employees. Third, unlike Kumhof et al. (2015), the relative labor productivity calculation suggests that income inequalities might be the consequence—rather than the cause—of financial development.

It might be concluded that the unit cost reduction could help lower the production cost of non-financial sectors and thereby promote economic development, as suggested in the theoretical model with credit constraints (Aghion et al., 2005). However, with regard to the inverted U-shaped relationship between financial development and growth (Arcand et al., 2015), the unit cost reduction and the increase in finance labor productivity is not necessarily welfare improving. This is all the more true since the related credit development may lead to an overload of credit that could result in higher economic volatility (Stein, 2012; Schularick and Taylor, 2012; Meissner and Bordo, 2012; Beck et al., 2014; Jordà et al., 2016a, 2016b) and greater wealth and income inequality (Piketty, 2013; Cournède et al., 2015). Therefore, doubts remain as to the effect of unit cost decline on aggregate welfare, although it benefits the non-financial sector from a partial equilibrium perspective.

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**Table 1: Unit cost per country**

country	sample for plain unit cost	sample for corrected unit cost	Plain unit cost average value	Plain unit cost change	Corrected unit cost average value	Corrected unit cost change (1990-2007)
Australia	1970-2014		0,0301	-0,015		
Austria	1970-2014		0,0231	-0,02		
Belgium	1970-2014	1981-2009	0,0212	-0,012	0,0273	-0,016
Canada	1970-2013	1988-2009	0,0144	-0,007	0,0159	-0,002
China	1977-2014		0,0211	-0,012		
Denmark	1970-2014	1979-2009	0,0161	-0,009	0,0097	0
France	1970-2014	1988-2009	0,0166	-0,01	0,0234	-0,01
Finland	1970-2014	1979-2009	0,0115	-0,002	0,0172	-0,012
Germany	1970-2014	1979-2009	0,0184	-0,005	0,0213	-0,006
Italy	1970-2014	1984-2009	0,0257	-0,014	0,0342	-0,014
Japan	1973-2014	1989-2008	0,0105	-0,007	0,0064	0
Korea	1970-2014	1990-2009	0,0206	-0,01	0,0144	0,002
Netherlands	1970-2014		0,0186	-0,014		
New Zealand	1971-2014	1990-2009	0,0221	-0,018		
Norway	1970-2014	1980-2009	0,0132	-0,004	0,0138	-0,006
Portugal	1970-2014		0,0224	-0,021		
Sweden	1970-2014	1979-2009	0,014	-0,012	0,0132	-0,004
Spain	1970-2014	1979-2009	0,0158	-0,004	0,0275	-0,018
The UK	1970-2014	1980-2008	0,012	0,001	0,0153	-0,008
The US	1970-2014	1980-2007	0,0196	-0,002	0,024	-0,003

*Note:* Unit cost is adjusted for quality and financial income trade balance. Plain unit cost change is the difference between the last and the first sample year.

Table 2: Unit cost convergence

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	10 years variation plain adjusted unit cost	10 years variation plain unadjusted unit cost	10 years variation corrected adjusted unit cost	10 years variation corrected unadjusted unit cost	10 years variation plain adjusted unit cost	10 years variation plain unadjusted unit cost	10 years variation corrected adjusted unit cost	10 years variation corrected unadjusted unit cost
plain adjusted unit cost (10y lag)	-0.448*** (0.070)				-0.949*** (0.064)			
plain unadjusted unit cost (10y lag)		-0.446*** (0.071)				-0.912*** (0.060)		
corrected adjusted unit cost (10y lag)			-0.468*** (0.0841)				-1.372*** (0.144)	
corrected unadjusted unit cost (10y lag)				-0.492*** (0.0959)				-1.413*** (0.125)
Constant	0.0116*** (0.0018)	0.0105*** (0.0017)	0.0107*** (0.00280)	0.0130*** (0.00334)	0.0229*** (0.0018)	0.0204*** (0.0015)	0.0328*** (0.00366)	0.0374*** (0.00356)
Country fixed effect	no	no	no	no	yes	yes	yes	yes
Time fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Observations	78	78	24	24	78	78	24	24
R-squared	0.509	0.522	0.496	0.492	0.677	0.672	0.911	0.920
Number of panel	20	20	15	15	20	20	15	15

Cluster Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Note: Convergence regression is based on the following model:  $\Delta uc_{i,t} = \beta_0 + \beta_1 uc_{i,t-10} + \varepsilon_{i,t}$  with  $\Delta uc_{i,t}$  the unit cost variation from  $t - 10$  to  $t$ . The data run from 1973 to 2013 for plain unit cost estimations and from 1983 to 2003 for corrected unit cost estimations.

**Table 3: Panel cointegration test: unit cost and short term nominal rates**

<b>Panel A: plain quality adjusted unit cost</b>				
Statistic	Value	Z-value	P-value	Robust P-value
Gt	-2.210	-1.522	0.048	0.045
Ga	-7.734	-0.344	0.339	0.135
Pt	-7.426	-2.865	0.001	0.010
Pa	-7.126	-2.062	0.014	0.050

<b>Panel B: plain unadjusted unit cost</b>				
Statistic	Value	Z-value	P-value	Robust P-value
Gt	-2.168	-1.946	0.026	0.018
Ga	-8.025	-0.725	0.234	0.090
Pt	-10.042	-3.589	0.000	0.000
Pa	-7.289	-3.081	0.001	0.013

<b>Panel C: corrected quality adjusted unit cost</b>				
Statistic	Value	Z-value	P-value	Robust P-value
Gt	-2.193	-1.789	0.037	0.020
Ga	-8.886	-1.241	0.107	0.045
Pt	-7.366	-1.770	0.038	0.068
Pa	-7.064	-2.472	0.007	0.040

<b>Panel D: corrected unadjusted unit cost</b>				
Statistic	Value	Z-value	P-value	Robust P-value
Gt	-2.352	-2.477	0.007	0.008
Ga	-9.864	-1.936	0.026	0.015
Pt	-7.956	-2.363	0.009	0.020
Pa	-8.054	-3.336	0.000	0.008

*Note:* Westerlund test of no cointegration based on four cointegration tests from Westerlund (2007). The test is based on the following error correction model:  $\Delta z_{it} = \alpha_i + \rho_i(z_{it-1} - \beta_i' r_{it-1}) + \sum_s^{Pi} \delta_{is} \Delta z_{it-s} + \sum_s^{Pi} \mu_{is} \Delta r_{it-s} + \varepsilon_{it}$ . Although AIC criteria neither recommends lags nor leads, the model includes one lag. The test includes a Bartlett kernel window of width 3. Gt and Ga is the group mean test of cointegration rejection for all panel units (H0:  $\rho_i = 0$  for all i versus H1:  $\rho_i < 0$  for at least one i). Pt and Pa pool information over all cross sectional units (H0:  $\rho_i = 0$  for all i versus H1:  $\rho_i = \rho < 0$  for all i). Robust P-Value uses bootstraps estimation of standard errors from 1000 replications. The unit cost is adjusted for financial sector trade balance and financial services quality.



**Table 4A: Correlation between deregulation and plain unit cost**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Quality adjusted	Quality adjusted	Non adjusted	Non adjusted	Quality adjusted	Quality adjusted	Non adjusted	Non adjusted
Standard errors	Robust Cluster	Robust Cluster	Robust Cluster	Robust Cluster	Discroll and Kraay	Discroll and Kraay	Discroll and Kraay	Discroll and Kraay
deregulation index	-0.00622* (0.00351)	-0.00701** (0.00313)	-0.00525 (0.00376)	-0.00618* (0.00346)	-0.00622*** (0.00165)	-0.00707*** (0.00118)	-0.00525*** (0.00152)	-0.00624*** (0.00113)
nominal rates		0.0352*** (0.0108)		0.0370*** (0.0111)		0.0336*** (0.00533)		0.0352*** (0.00558)
inflation rate		-0.00507 (0.0108)		-0.00615 (0.0119)		-0.00586 (0.00821)		-0.00699 (0.00909)
net foreign asset to GDP		0.00159 (0.00154)		0.00117 (0.00144)		0.00164** (0.000729)		0.00122* (0.000687)
globalization index		-0.000919 (0.000591)		-0.000931 (0.000607)		-0.000890** (0.000322)		-0.000901** (0.000332)
bank share of credit		0.00773 (0.00558)		0.00804 (0.00575)		0.00773** (0.00301)		0.00804*** (0.00275)
real GDP growth		0.00463 (0.00820)		0.00624 (0.00776)		0.00220 (0.00581)		0.00350 (0.00567)
exchange rate (usd)		-5.39e-06 (4.55e-06)		-6.33e-06 (3.81e-06)		-5.43e-06** (2.40e-06)		-6.37e-06** (2.73e-06)
Constant	0.0182*** (0.00335)	0.0186*** (0.00594)	0.0197*** (0.00360)	0.0200*** (0.00646)	0.0180*** (0.00152)	0.0176*** (0.00231)	0.0194*** (0.00140)	0.0189*** (0.00210)
Time and panel fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Observations	731	698	731	698	731	698	731	698
R-squared	0.662	0.723	0.633	0.698				
Number of panel	20	20	20	20	20	20	20	20

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Note: Regression 1 to 4 use robust cluster standard errors ; regressions 5 to 8 use Driscoll and Kraay standard errors. The deregulation index is based on Abiad et al. (2009); Nominal rates and inflation rate are from FRED; net foreign asset is from Lane and Milesi-Ferretti (2012); the globalization index is the sum of capital import and capital export to GDP, data is from Lane and Milesi-Ferretti (2012). Unit cost is based on the ratio of financial income to financial output and accounts for financial sector trade balance. Quality adjustment of financial output is based on Philippon (2015).

**Table 4B: Correlation between deregulation and corrected unit cost**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Quality adjusted	Quality adjusted	Non adjusted	Non adjusted	Quality adjusted	Quality adjusted	Non adjusted	Non adjusted
Standard errors	Robust Cluster	Robust Cluster	Robust Cluster	Robust Cluster	Discroll and Kraay	Discroll and Kraay	Discroll and Kraay	Discroll and Kraay
deregulation index	-0.00692 (0.00531)	-0.00754 (0.00492)	-0.00543 (0.00557)	-0.00608 (0.00474)	-0.00692** (0.00289)	-0.00754*** (0.00222)	-0.00543* (0.00279)	-0.00608*** (0.00198)
nominal rates		0.0491*** (0.0111)		0.0526*** (0.0100)		0.0491*** (0.0135)		0.0526*** (0.0138)
inflation rate		-0.0175 (0.0144)		-0.0200 (0.0154)		-0.0175 (0.0128)		-0.0200 (0.0147)
net foreign asset to GDP		0.000971 (0.00307)		0.000780 (0.00288)		0.000971 (0.00164)		0.000780 (0.00145)
globalization index		-0.00313*** (0.00104)		-0.00337*** (0.00108)		-0.00313*** (0.000389)		-0.00337*** (0.000368)
bank share of credit		-0.00295 (0.00818)		-0.00420 (0.00802)		-0.00295 (0.00284)		-0.00420 (0.00273)
real GDP growth		-0.00138 (0.00846)		2.08e-05 (0.00801)		-0.00138 (0.00613)		2.08e-05 (0.00726)
exchange rate (usd)		4.36e-06* (2.29e-06)		3.99e-06* (2.21e-06)		4.36e-06 (3.38e-06)		3.99e-06 (3.43e-06)
Constant	0.0240*** (0.00189)	0.0256*** (0.00538)	0.0252*** (0.00193)	0.0277*** (0.00514)	0.0239*** (0.00125)	0.0256*** (0.00237)	0.0248*** (0.00121)	0.0277*** (0.00243)
Time and panel fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Observations	401	397	401	397	401	397	401	397
R-squared	0.510	0.657	0.464	0.626				
Number of panel	15	15	15	15	15	15	15	15

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Note: Regression 1 to 4 use robust cluster standard errors ; regressions 5 to 8 use Driscoll and Kraay standard errors. The deregulation index is based on Abiad et al. (2009); Nominal rates and inflation rate are from FRED; net foreign asset is from Lane and Milesi-Ferretti (2012); the globalization index is the sum of capital import and capital export to GDP, data is from Lane and Milesi-Ferretti (2012). Unit cost is based on the ratio of corrected financial income to financial output and accounts for financial sector trade balance. Quality adjustment of financial output is based on Philippon (2015).

**Table 5: Correlation between deregulation variation and plain unit cost variation**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	$\Delta$ plain adjusted unit cost	$\Delta$ plain adjusted unit cost	$\Delta$ plain unadjusted unit cost	$\Delta$ plain unadjusted unit cost	$\Delta$ corrected adjusted unit cost	$\Delta$ corrected adjusted unit cost	$\Delta$ corrected unadjusted unit cost	$\Delta$ corrected unadjusted unit cost
$\Delta$ deregulation index (3 years lag)	0.000971 (0.00189)	0.000236 (0.00210)	0.00109 (0.00202)	0.000277 (0.00222)	-0.00184 (0.00446)	-0.00391 (0.00420)	-0.00114 (0.00481)	-0.00386 (0.00458)
$\Delta$ nominal rates (3 years lag)		0.0120 (0.00706)		0.0140* (0.00758)		0.0177 (0.0116)		0.0189 (0.0130)
$\Delta$ inflation rate (3 years lag)		-0.00497 (0.00721)		-0.00719 (0.00814)		0.0101 (0.0143)		0.00732 (0.0160)
$\Delta$ net foreign asset to GDP (3 years lag)		0.000514 (0.000653)		0.000560 (0.000683)		-0.000854 (0.00147)		-0.000923 (0.00157)
$\Delta$ globalization index (3 years lag)		-0.000259 (0.000284)		-0.000242 (0.000308)		-0.00140 (0.000965)		-0.00139 (0.00112)
$\Delta$ bank share of credit (3 years lag)		0.00652 (0.00429)		0.00801* (0.00449)		-0.00305 (0.00530)		-0.00271 (0.00608)
$\Delta$ real GDP growth (3 years lag)		0.00309** (0.00123)		0.00285** (0.00122)		-0.000153 (0.00143)		-0.000878 (0.00150)
exchange rate growth (3 years lag)		-0.000718 (0.00394)		6.14e-05 (0.00386)		-0.00662 (0.00651)		-0.00444 (0.00681)
Constant	-0.00124 (0.000950)	-0.00309** (0.00123)	-0.000992 (0.000971)	-0.00280** (0.00127)	0.00296 (0.00215)	0.000211 (0.00261)	0.00337 (0.00235)	0.000825 (0.00293)
Time fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Observations	671	638	671	638	356	352	356	352
R-squared	0.137	0.206	0.149	0.217	0.166	0.223	0.172	0.221

Cluster robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Note: All variables are constructed based on three years variation ( $\Delta x = x_t - x_{t-3}$ ). The deregulation index is based on Abiad et al. (2009); Nominal rates and inflation rate are from FRED; net foreign asset is from Lane and Milesi-Ferretti (2012); the globalisation index is the sum of capital import and capital export to GDP, data is from Lane and Milesi-Ferretti (2012). Unit cost is based on the ratio of financial income to financial output and accounts for financial sector trade balance. Quality adjustment of financial output is based on Philippon (2015).

**Table 6: The effect of deregulation three years variation on unit cost three variation, instrumental variables**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Δ plain adjusted unit cost	Δ plain unadjusted unit cost	Δ corrected adjusted unit cost	Δ corrected unadjusted unit cost	Δ plain adjusted unit cost	Δ plain unadjusted unit cost	Δ corrected adjusted unit cost	Δ corrected unadjusted unit cost
Δ deregulation index (3 years lag)	-0.0143*** (0.00452)	-0.0150*** (0.00469)	-0.0136* (0.00747)	-0.0158* (0.00813)	-0.0101** (0.00490)	-0.0101** (0.00508)	-0.0108 (0.00928)	-0.0119 (0.0102)
Δ nominal rates (3 years lag)	0.0200*** (0.00563)	0.0224*** (0.00583)	0.0218** (0.00958)	0.0239** (0.0103)	0.0177*** (0.00534)	0.0197*** (0.00552)	0.0206** (0.0103)	0.0223** (0.0112)
Δ inflation rate (3 years lag)	-0.0104 (0.00680)	-0.0129* (0.00703)	0.00580 (0.0130)	0.00209 (0.0147)	-0.00882 (0.00674)	-0.0111 (0.00692)	0.00705 (0.0134)	0.00378 (0.0152)
Δ net foreign asset to GDP (3 years lag)	0.000970 (0.000788)	0.00104 (0.000843)	-0.000672 (0.000944)	-0.000700 (0.00102)	0.000838 (0.000795)	0.000887 (0.000843)	-0.000726 (0.000942)	-0.000772 (0.00102)
Δ globalization index (3 years lag)	-0.000321 (0.000249)	-0.000308 (0.000266)	-0.00139** (0.000561)	-0.00139** (0.000621)	-0.000303 (0.000245)	-0.000286 (0.000262)	-0.00140** (0.000554)	-0.00139** (0.000611)
Δ bank share of credit (3 years lag)	0.00386 (0.00415)	0.00520 (0.00428)	-0.00457 (0.00636)	-0.00458 (0.00708)	0.00463 (0.00398)	0.00611 (0.00409)	-0.00412 (0.00645)	-0.00398 (0.00721)
Δ real GDP growth (3 years lag)	0.00306*** (0.00119)	0.00282** (0.00118)	-0.000650 (0.00133)	-0.00149 (0.00149)	0.00307*** (0.00117)	0.00283** (0.00115)	-0.000504 (0.00136)	-0.00129 (0.00151)
exchange rate growth (3 years lag)	0.00124 (0.00339)	0.00213 (0.00356)	-0.00444 (0.00547)	-0.00176 (0.00609)	0.000676 (0.00327)	0.00146 (0.00341)	-0.00508 (0.00532)	-0.00263 (0.00589)
Constant	0.000507 (0.000443)	0.000502 (0.000481)	-0.000844 (0.000965)	-0.000789 (0.00112)	0.000522 (0.000436)	0.000520 (0.000473)	-0.000837 (0.000963)	-0.000779 (0.00111)
Time fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Observations	638	638	352	352	638	638	352	352
R-squared	0.084	0.096	0.196	0.187	0.144	0.162	0.209	0.206
First stage	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
deregulation index (3 years lag)	-0.166*** (0.0188)	-0.166*** (0.0188)	-0.170*** (0.0202)	-0.170*** (0.0202)				
international capital index (3 years lag)					-0.0288*** (0.00528)	-0.0288*** (0.00528)	-0.0335*** (0.00536)	-0.0335*** (0.00536)
entry barriers index (3 years lag)					-0.0151*** (0.00398)	-0.0151*** (0.00398)	-0.0161*** (0.00441)	-0.0161*** (0.00441)
Partial R squared of instruments	0.14	0.14	0.16	0.16	0.11	0.11	0.15	0.15
Kleibergen-Paap F-stat	77.57	77.57	52.78	52.78	22.08	22.08	16.22	16.22
Hansen J-test					0.68	0.89	0.82	0.62

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Figure 1: Financial income (%GDP)

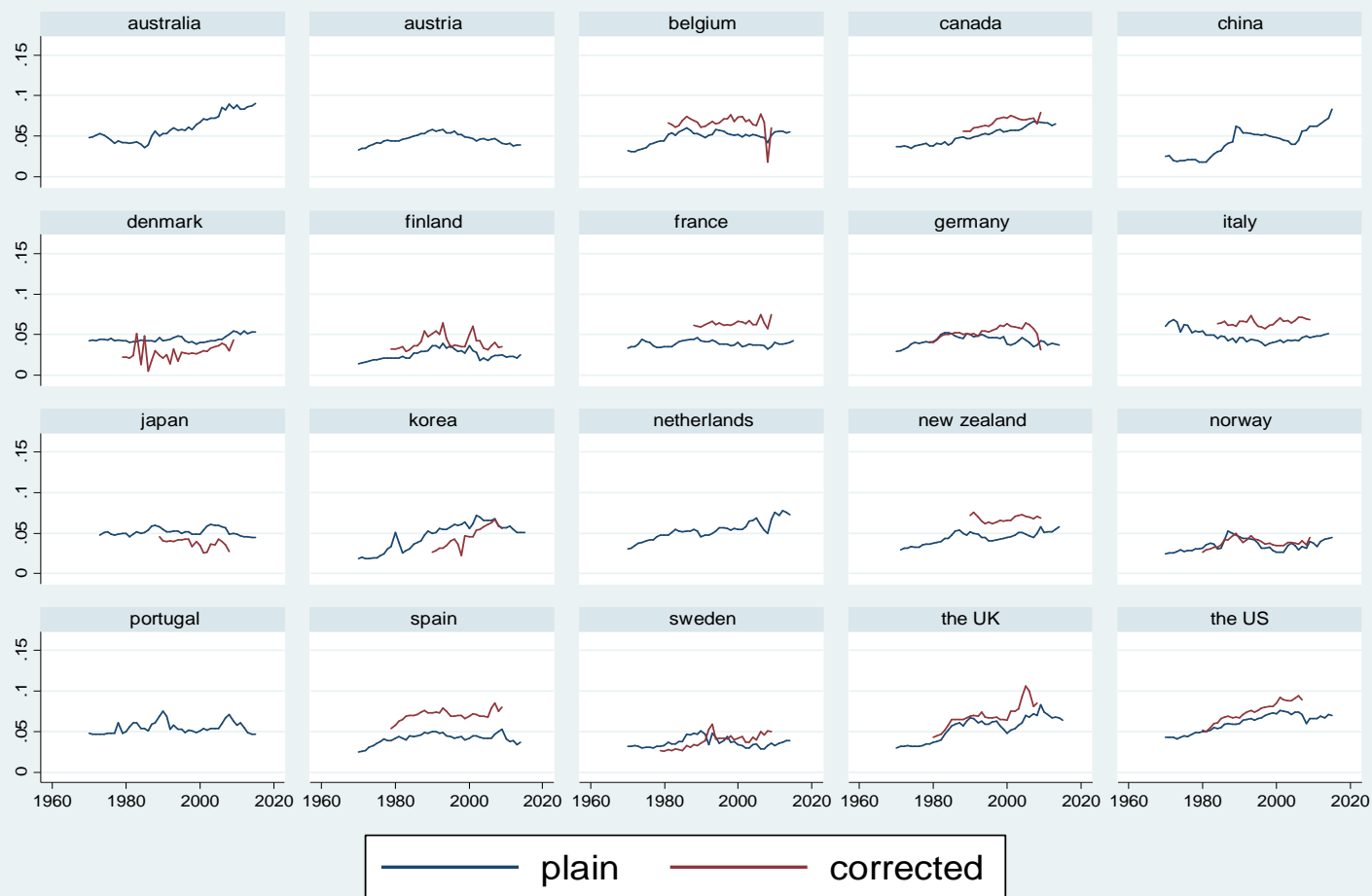
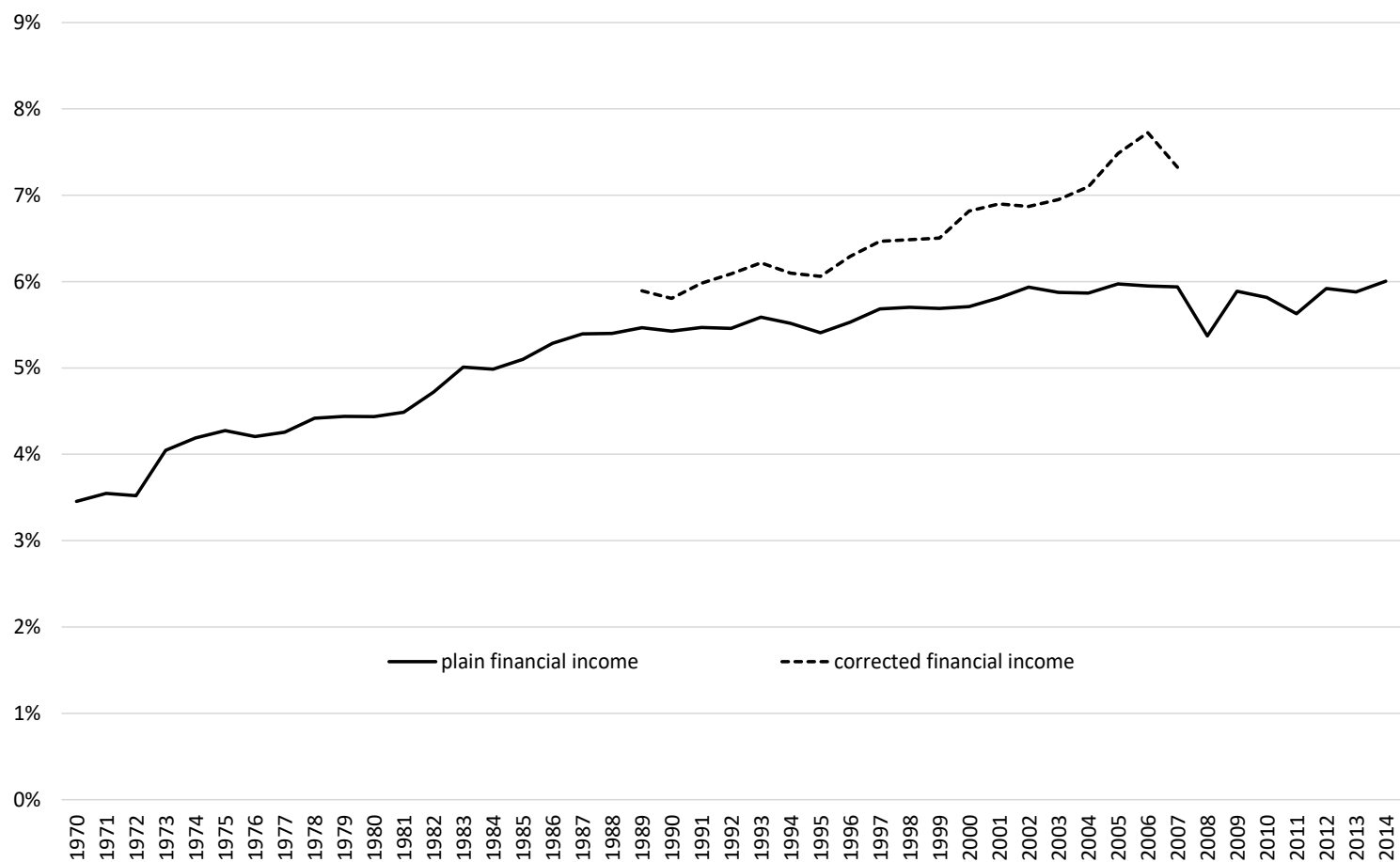
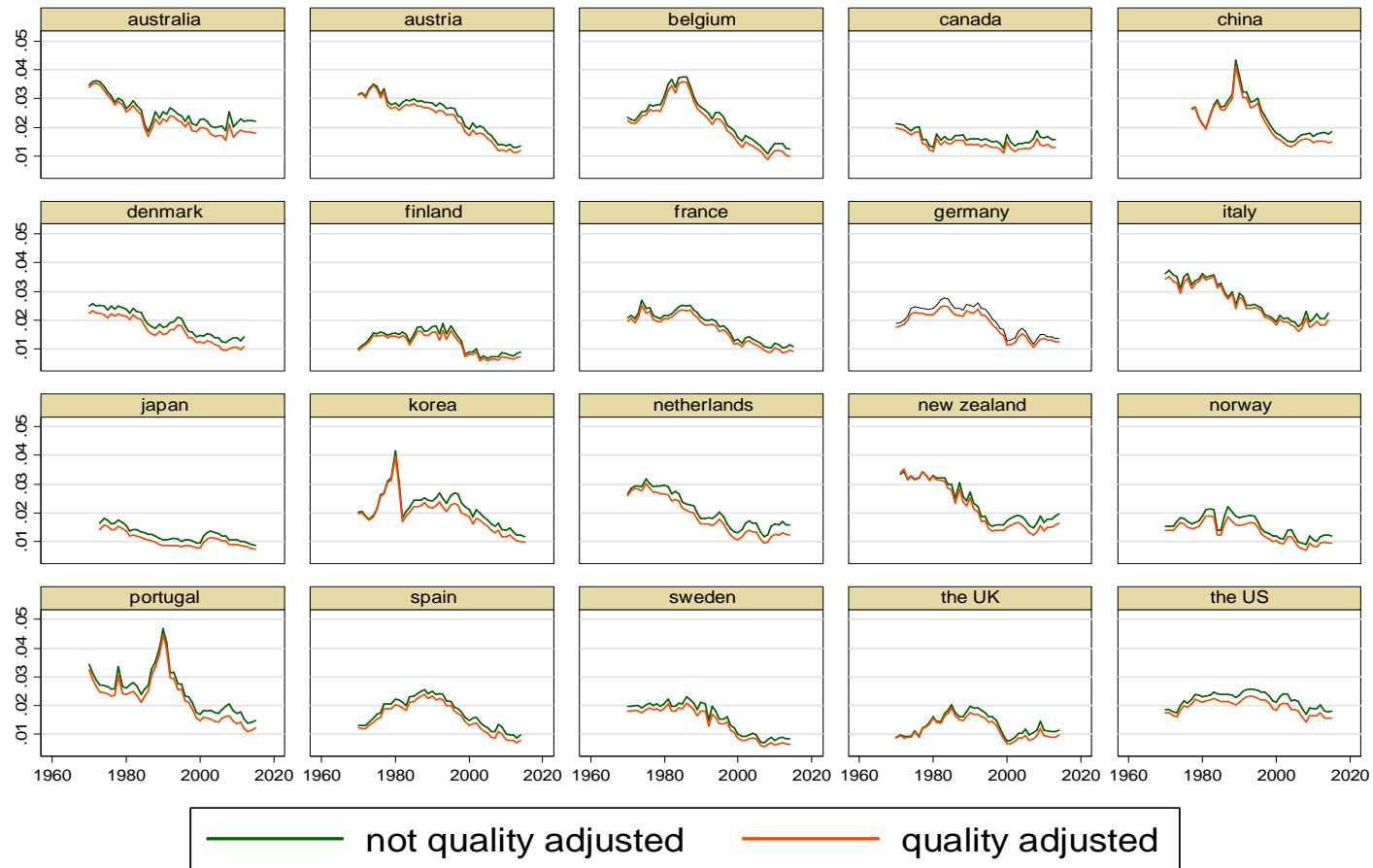


Figure 2: International financial income



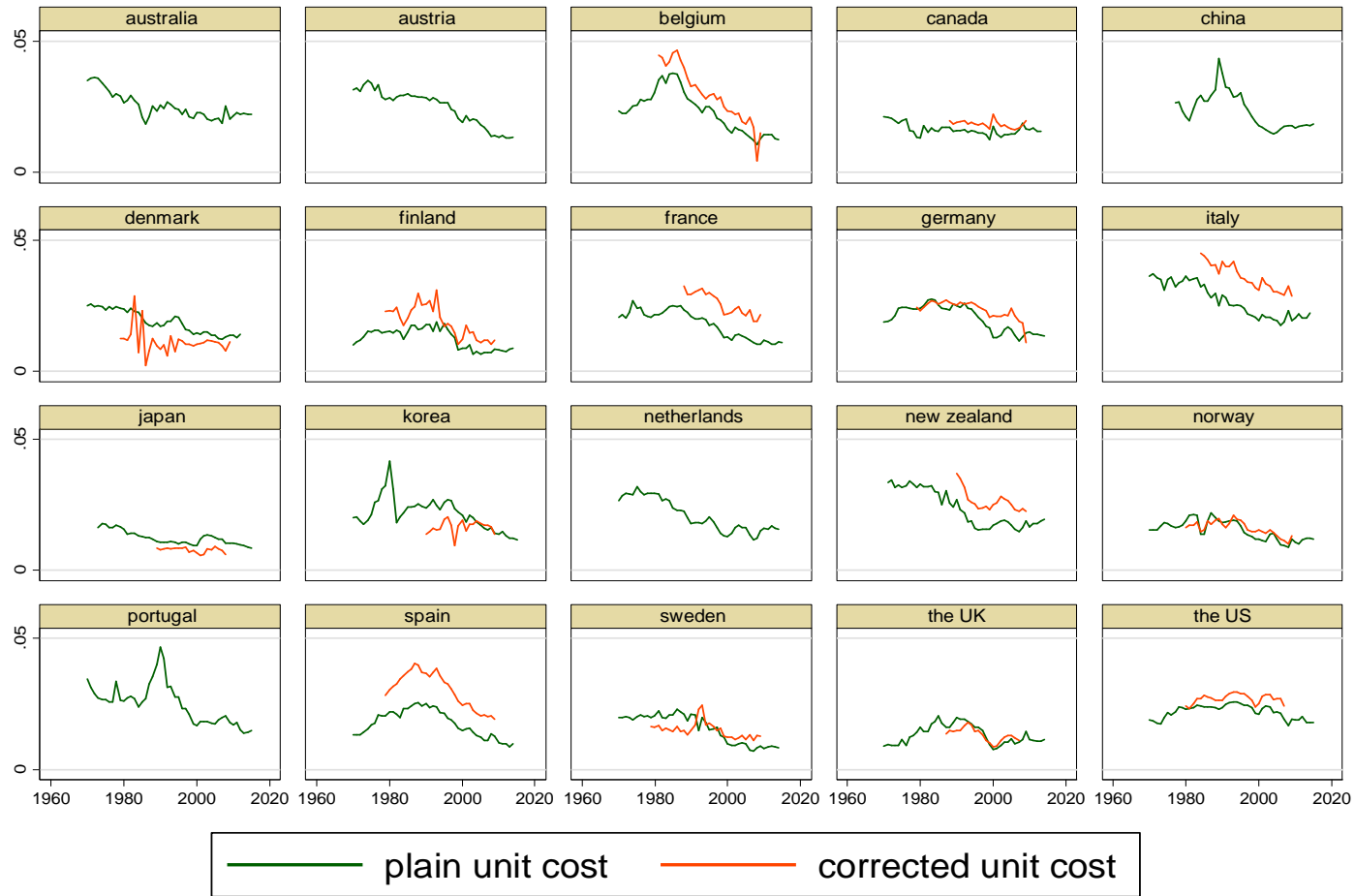
Note: International financial income is the sum of national income divided by the sum of national GDP. Corrected values add capital income and other interest income which are not included in value added calculation. Income are not adjusted for trade balance.

Figure 3a: plain unit cost with and without quality adjustment



Note: Quality adjustment based on the coefficient of a regression explaining the US quality adjustment calculated by Philippon (2015) and the US credit development. All series are adjusted for financial trade balance.

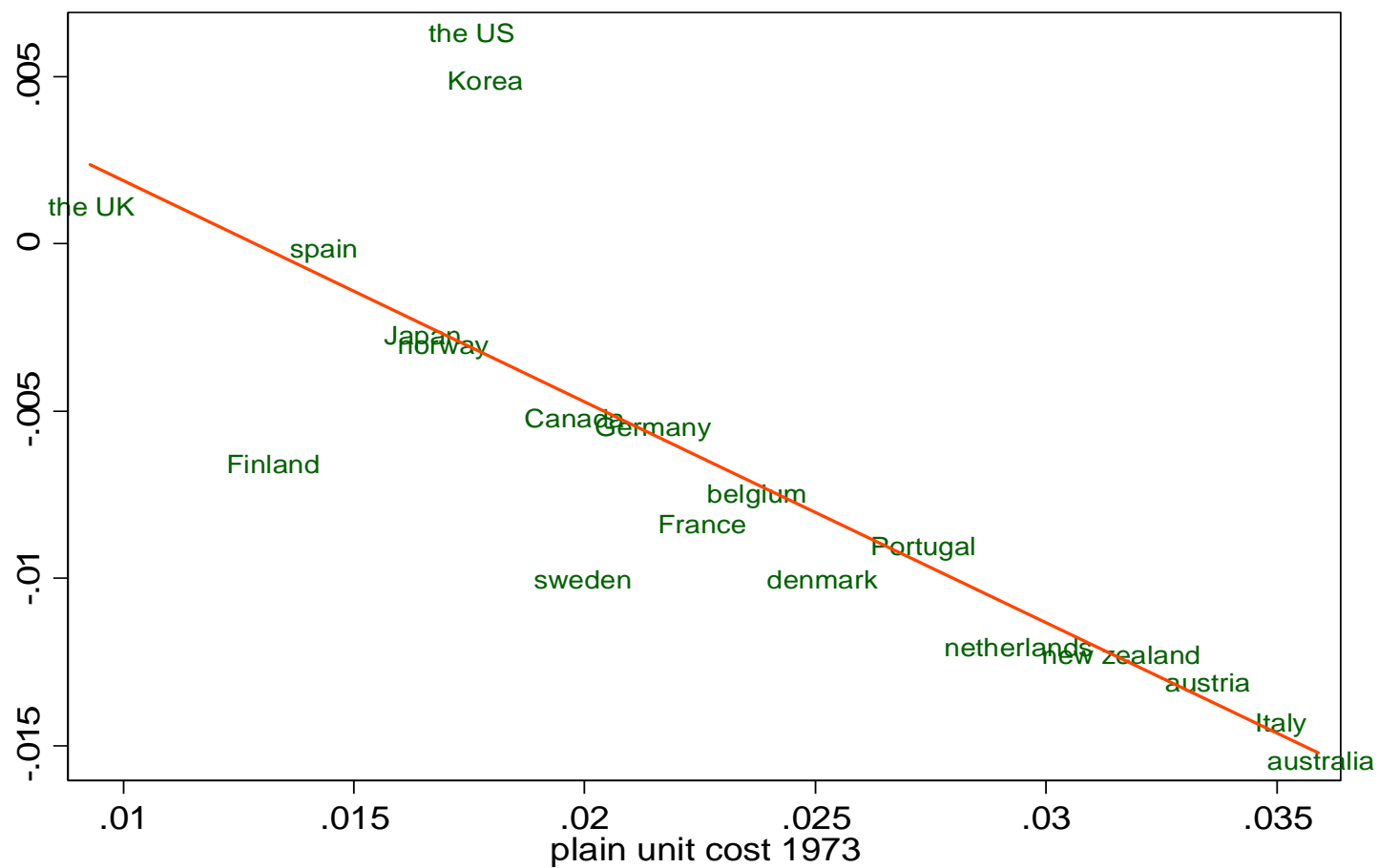
Figure 3b: plain and corrected unit cost without quality adjustment



Note: Corrected values add capital income to financial value added. All series are adjusted for trade balance.

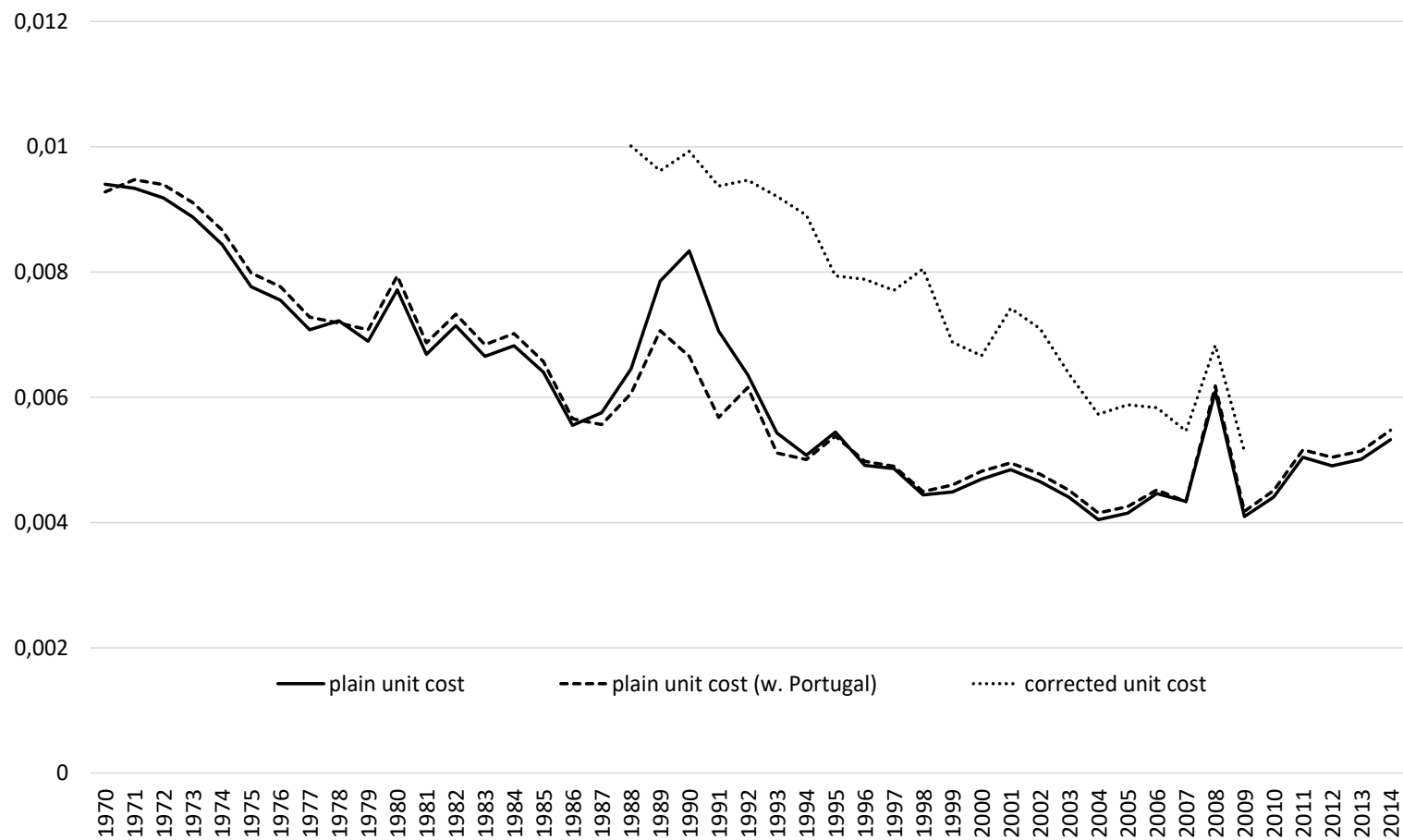


Figure 4: Plain unit cost convergence from 1973 to 2003



Note: Unit cost is not adjusted for quality.

Figure 5: unit cost convergence



Note: the convergence indicator is based on the standard deviation of unit cost. The corrected unit cost indicator of convergence does not start before 1988 as too few countries are included in the data before that date. This may increase or decrease the standard deviation artificially.

Figure 6: plain unit cost and short term interest rates

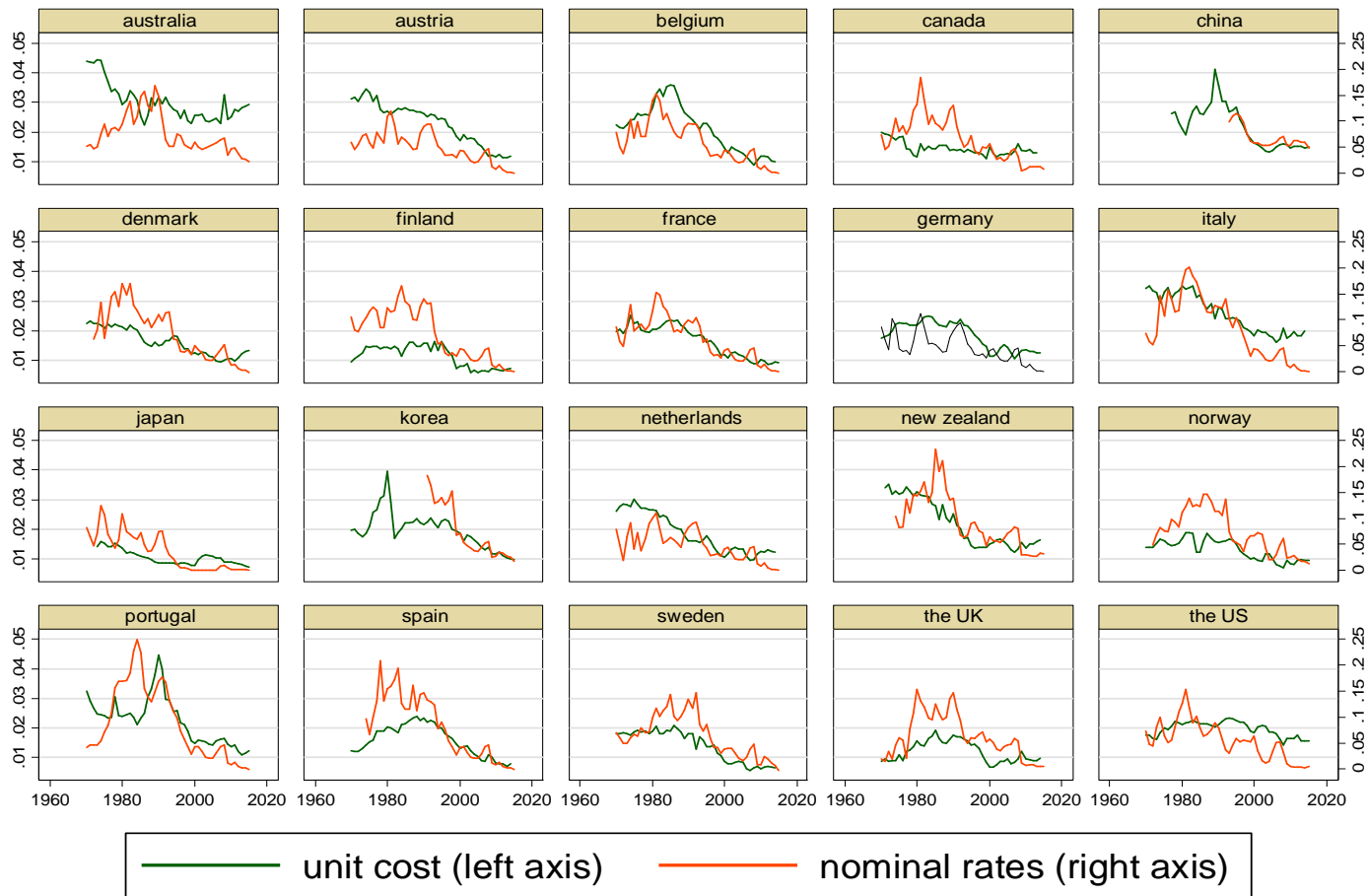
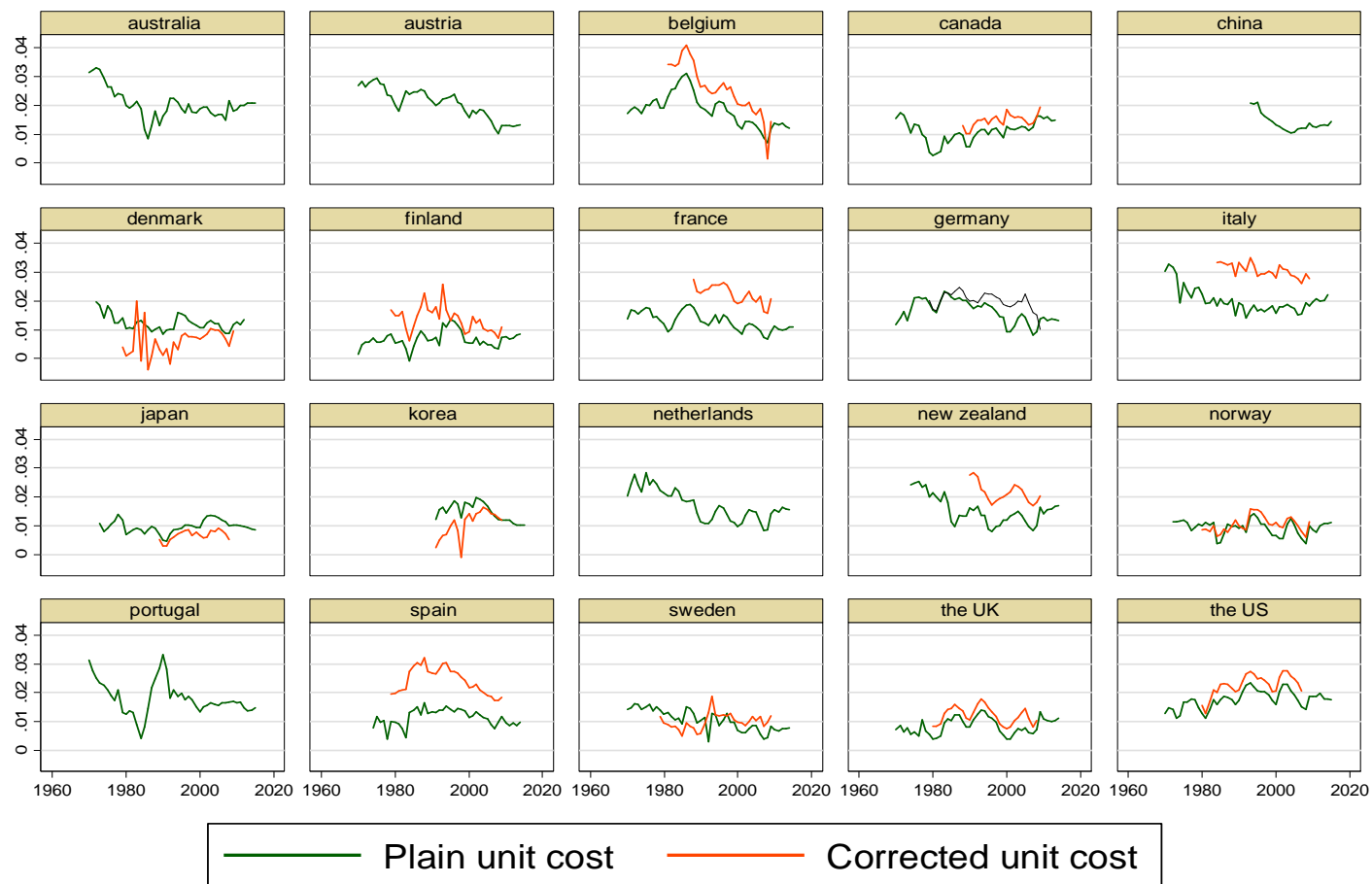
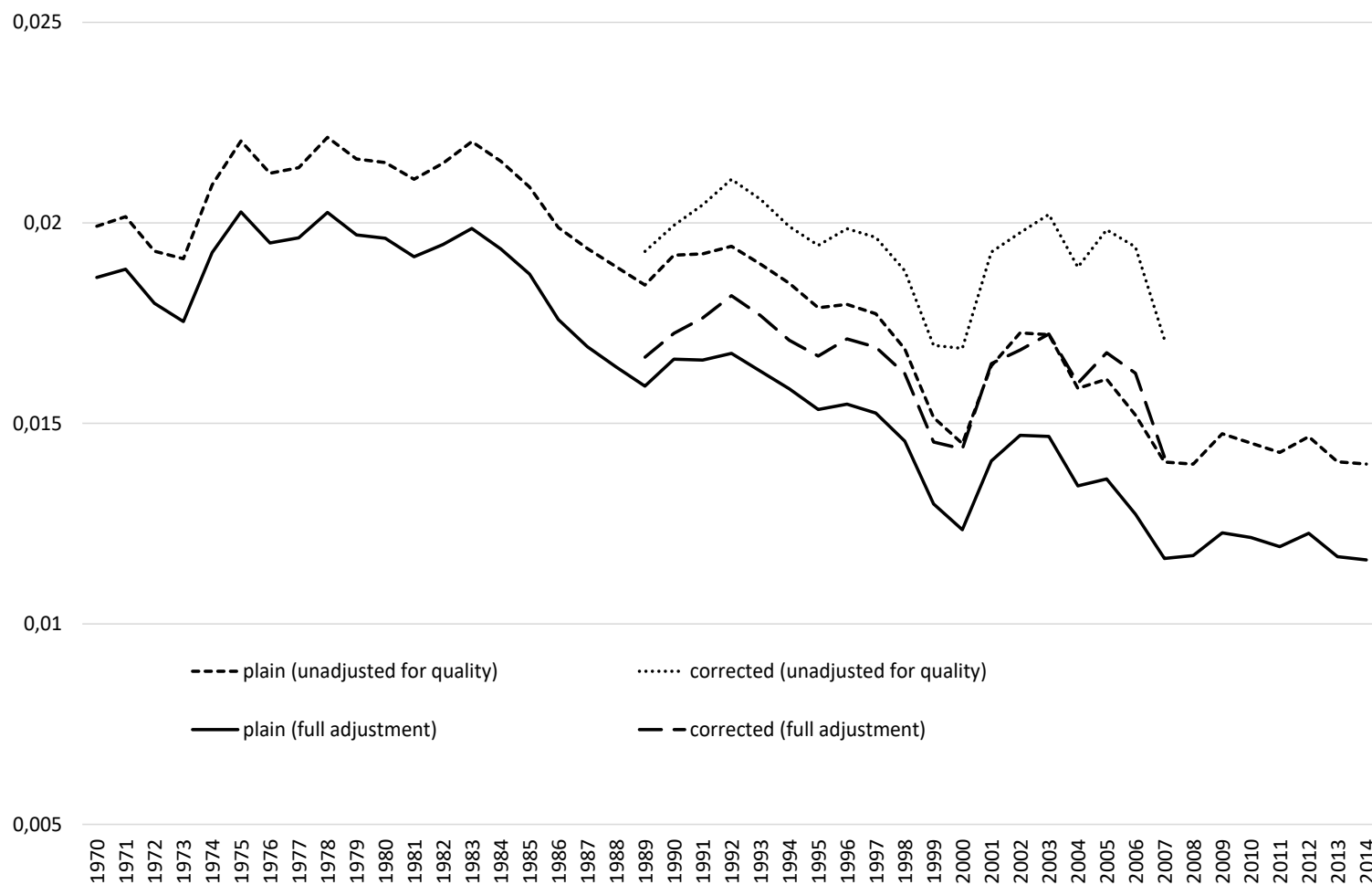


Figure 7: interest rates purged unit cost series



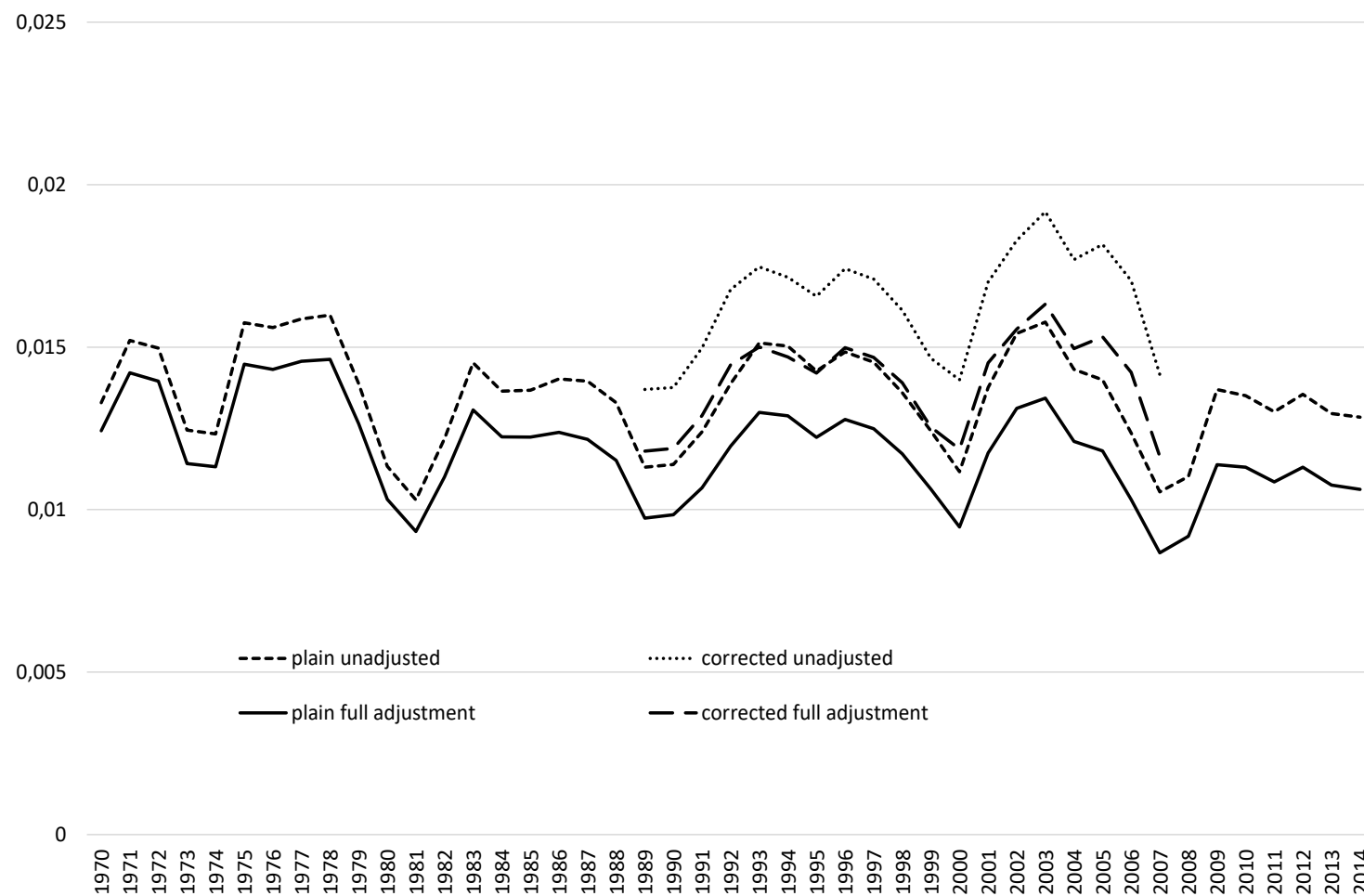
Note: interest rates purged series are measured from the residual of regression explaining unit cost by nominal rates of interest. Plain and corrected unit cost series are adjusted for quality and financial trade balance.

Figure 8: International unit cost measure



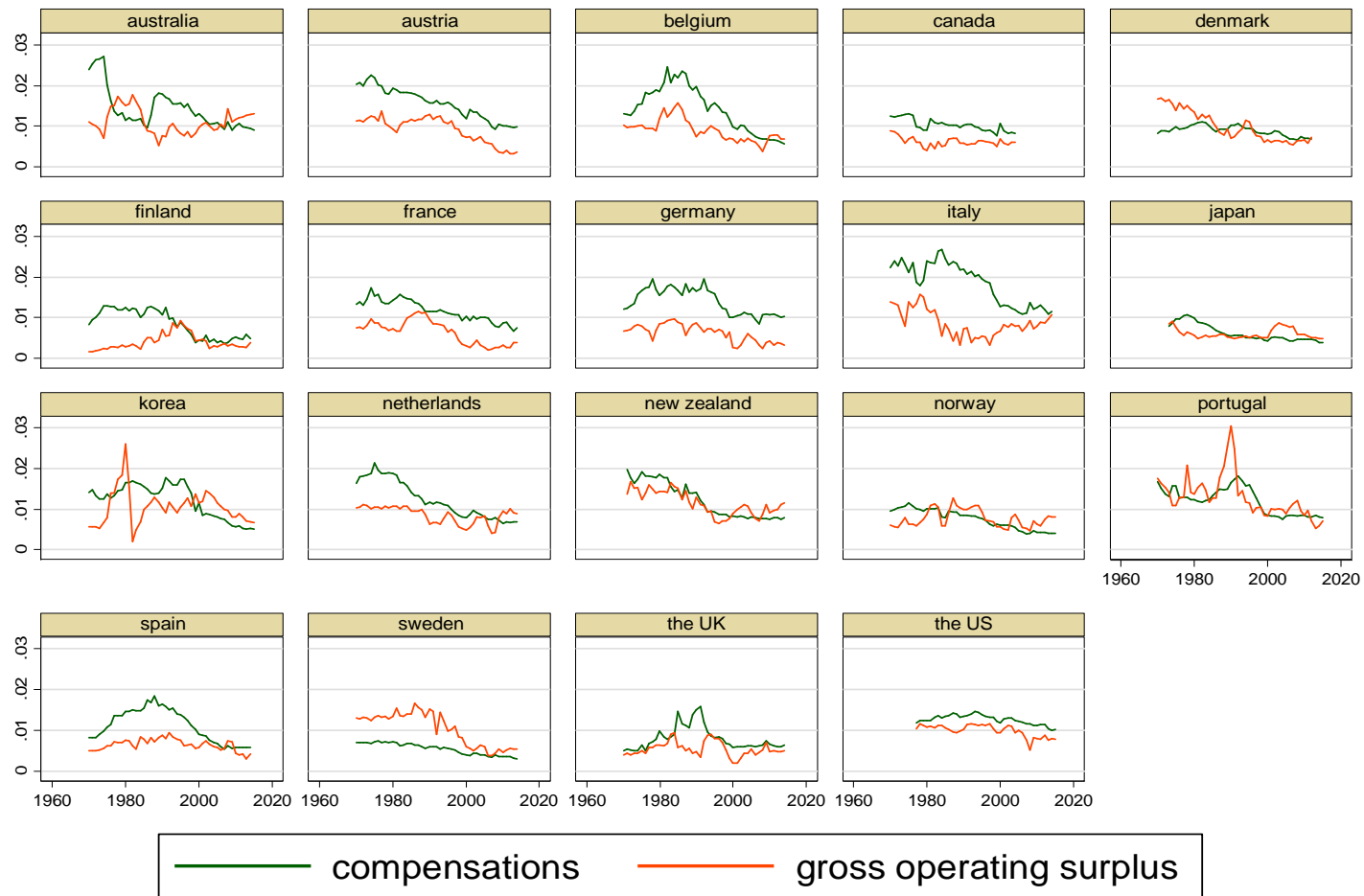
Note: The international unit cost is measured from the sum of countries financial income divided by the sum of financial output. Because banking income data for Japan start in 1989, the corrected unit cost estimation is not available before that date. The series are adjusted for trade balance based on the sum of countries trade balance.

Figure 9: interest rates “purged” international unit cost



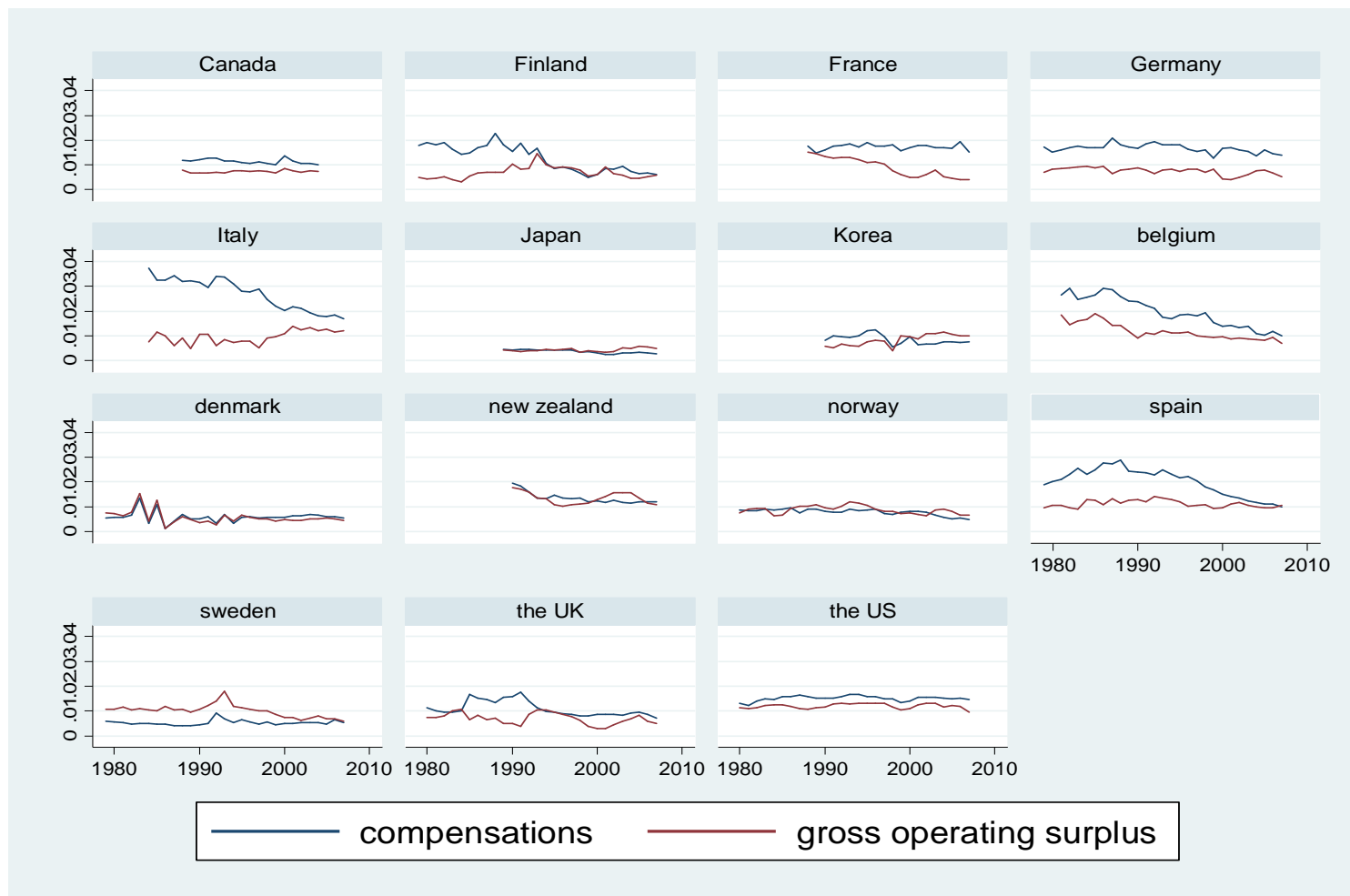
Note: The international unit cost is based on the following formula:  $uc = \frac{\sum_i (uc_i^{purged} \times Q_i)}{\sum_i Q_i}$ , with  $Q_i$  the financial output of country  $i$ . The series are adjusted for trade balance.

Figure 10a: plain compensations and gross operating surplus per unit of financial services



Note: Series are unadjusted for quality. Compensations and gross operating surpluses are adjusted for trade balance.

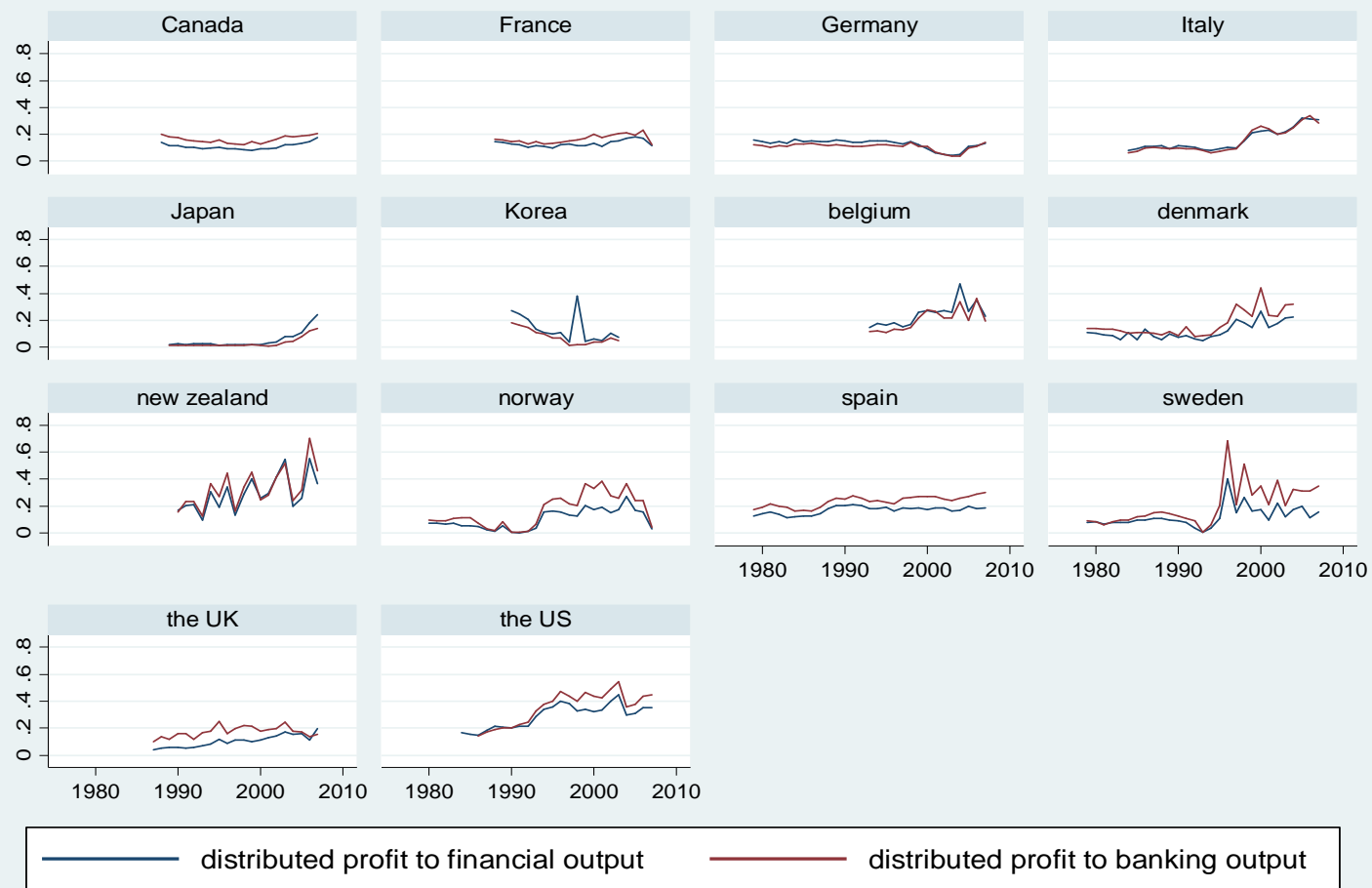
**Figure 10b: corrected compensations and gross operating surplus per unit of financial services**



Note: Corrected compensations in finance is obtained from:  $\text{corrected financial compensations} = \frac{\text{plain financial compensation}}{\text{plain financial VA}} \times \text{corrected financial income}$ .  
 Corrected gross operating surplus (GOS) is based on:  $\text{corrected GOS} = \text{corrected orrected financial income} - \text{corrected financial compensations}$ .



**Figure 11: Banks' distributed profit to output**



Note: Data is from OECD banking income statement. Financial output is the sum of intermediated assets and liabilities for the whole finance industry. Banking output is the sum of intermediated assets and liabilities for banks. Distributed profit data is adjusted for trade balance.

Figure 12: Finance relative labor productivity



Note: Relative labor productivity is based on the following formula:  $\frac{Q^{fin}/L^{fin}}{GDP/L^{tot}}$  with  $Q^{fin}$  the financial output,  $L^{fin}$  the number of hours worked by persons engaged in the financial sector, and  $L^{tot}$  the total number of hours worked by persons engaged in all sectors. Both series account for the share of financial trade balance to adjust financial output.

# Data Appendix per country

## General statement for main series

Unless otherwise stated, the sources used to build countries' unit cost of financial intermediation and finance relative productivity of labor are:

Credit data is from BIS database

Market capitalization is from FRED website

Broad money is from FRED or the World Bank database

Public debt is from the World Bank database and Reinhart and Rogoff (2010)

Financial trade balance (FTB) is based on World Bank database on import and export of financial services

Financial value added (FVA) is from EU-KLEMS (2009 and 2017 release) and OECD STAN database.

Banking income and distributed profit are from OECD financial statement of banks

Compensations and the total number of hours worked are from EU-KLEMS and OECD STAN database

Except for compensations and hours worked, data for Germany, France, Italy, Spain, the Netherlands, and the UK is from Bazot (2018). Data for the US is from Philippon (2015).

## Australia

FVA is based on EU-KLEMS from 1970 to 2007 then OECD STAN from 2008 to 2014. Given that EU-KLEMS data stop in 2007 while OECD STAN data start in 1989, the switch from EU-KLEMS to OECD has been chosen to keep data consistency. It is worth noting that OECD FVA is 20% higher from 1993 to 2000.

Market capitalization data is not available before 1979. Given market capitalization value after 1979, figures before 1979 have been set at 30% of GDP.

FTB data is available from 1989 to 2014. Given very low ratio of FTB to GDP in from 1989 to 1995, FTB is set to zero before 1989

## Austria

Market capitalization data is not available before 1975. Given market capitalization value after 1975, figures before 1975 have been set at 3% of GDP

Austrian data relate to domestic banks including their foreign branches and subsidiaries (on a consolidated basis) and to banks of foreign countries conducting banking business in Austria. Because it includes both foreign branches and branches of foreign banks activities, the Austrian data overestimate domestic banking income and is not usable in this study.

### Belgium

FVA is based on two different sources. Smits, Woltjer, and Ma (2009) from 1970 to 1980; EU-KLEMS database thereafter. This choice is due to rather extravagant values displayed in EU-KLEMS before 1975.

Market capitalization data is not available before 1975. Given market capitalization value after 1975, figures before 1975 are set at 10% of GDP.

FTB data is available from 2002 to 2014. Given very low ratio of FTB to GDP in from 2002 to 2004, FTB is set to zero before 2002

All other series are consistent with the data template.

### Canada

FVA data is from EU-KLEMS until 2004 and OECD STAN thereafter. Data for 2005 and 2006 are neither available from STAN nor EU-KLEMS, figures have been extrapolated from banking income figures based on the ratio of banking income to FVA in 2004.

Market capitalization data is not available before 1975. Given market capitalization value after 1975, figures before 1975 have been set at 30% of GDP.

FTB data is available from 1981 to 2014. Given very low ratio of FTB to GDP in from 1981 to 1985, FTB is set to zero before 1981

### China

Credit to GDP data is not available before 1977. Data from 1977 to 1984 is from the World Bank database. Banking income data is not available.

Market capitalization data is not available before 1992. Given market capitalization value after 1992, figures before 1992 have been set at 2% of GDP. Public debt is not available before 1982, figures are set at 5%.

FTB data is available from 1982 to 2014. Given very low ratio of FTB to GDP in from 1982 to 1987, FTB is set to zero before 1982

### Denmark

Market capitalization data is not available before 1975. Given market capitalization value after 1975, figures before 1975 have been set at 10% of GDP

## Finland

FVA is from EU-KLEMS.

Market capitalization data is not available before 1982. Given market capitalization value after 1982, figures before 1982 have been set at 10% of GDP.

FTB data is available from 1975 to 2014. Given very low ratio of FTB to GDP in from 1975 to 1980, FTB is set to zero before 1975

## France

Compared to Bazot (2018), the data add trade balance before 1992 and extend the series from 2008 to 2014 based on EU-KLEMS 2017 release.

FTB data is available from 1975 to 2014. Given very low ratio of FTB to GDP in from 1975 to 1980, FTB is set to zero before 1975.

## Germany

Compared to Bazot (2018), the data add trade balance before 1992 and extend the series from 2008 to 2014 based on EU-KLEMS 2017 release.

FTB data is available from 1975 to 2014. Given very low ratio of FTB to GDP in from 1976 to 1980, FTB is set to zero before 1976.

## Italy

Compared to Bazot (2018), the data add trade balance before 1992 and extend the series from 2008 to 2014 based on EU-KLEMS 2017 release.

FTB data is available from 1970 to 2014.

## Japan

FVA data is based on EU-KLEMS from 1973 to 1993 then OECD STAN from 1994 to 2014. In fact, EU-KLEMS data is not available after 2006 while OECD STAN data is missing before 1994. the switch from EU-KLEMS to OECD has been chosen to keep data consistency. Figures from EU-KLEMS and OECD STAN are very close during overlapping years.

FTB data is not available before 1995. Based on figures value after 1995, FTB before that date is set to 0.

Market capitalization data is not available before 1975, figures are set to 25% GDP

## Korea

FVA is from OECD STAN database.

Public debt data is missing from 1971 to 1975, figures have been extrapolated based on the difference between 1970 and 1976 figures. The same happens for 2011.

Market capitalization data is not available before 1979, figures are set to 6% GDP

FTB is not available before 1976 and set to zero before this year.

### The Netherlands

Compared to Bazot (2018), the data add trade balance before 1992 and extend the series from 2008 to 2014 based on EU-KLEMS 2017 release.

Market capitalization is from FRED from 1975 to 1986 and from Bazot (2018) for all other years.

FTB is available from 1967 to 2014.

### New Zealand

FVA is from OECD STAN. 1970 figure is missing.

Market capitalization data is missing before 1985 and set to 35% GDP before that year. Figures for 2010 and 2011 are missing and set to 30% GDP.

FTB is not available before 2000. Given very low value, FTB is set to zero before this year.

Broad Money is set to 90% GDP after 2010.

### Norway

FVA is from OECD STAN.

Market capitalization data is missing before 1980 and set to 5% GDP before that year.

FTB is not available before 1975 and has been set to 7.5% of financial income before this year.

### Portugal

FVA is from EU-KLEMS from 1970 to 1994 and OECD STAN from 1995 to 2014. Given that EU-KLEMS data stop in 2006 while OECD STAN data start in 1995, the switch from EU-KLEMS to OECD has been chosen to keep data consistency. It is worth noting that OECD STAN series are slightly higher than EU-KLEMS. The largest difference is equal to 8% by 2006.

Market capitalization is not available before 1988 and set to 12% of GDP before this year.

FTB data is missing before 1975 and set to zero before that year.

### Sweden

FVA is from EU-KLEMS.

Market capitalization data is missing before 1980 and set to 2.5% GDP before that year.

FTB data is available all over the period.

### Spain

Compared to Bazot (2018), the data add trade balance before 1992 and extend the FVA series from 2008 to 2014 based on EU-KLEMS 2017 release.

FTB is not available before 1975 and set to zero before this year.

### The UK

Compared to Bazot (2018), FVA is extended from 2008 to 2014 based on EU-KLEMS 2017 release. FTB before 2008 is from Bazot (2018) instead of World Bank database, FTB after 2007 is from the Pink Book publication.

### The US

Data is from Philippon (2015) and Bazot (2018)

On line appendix: Additional figures and  
tables



**Figure A1: financial output with and without quality adjustment**

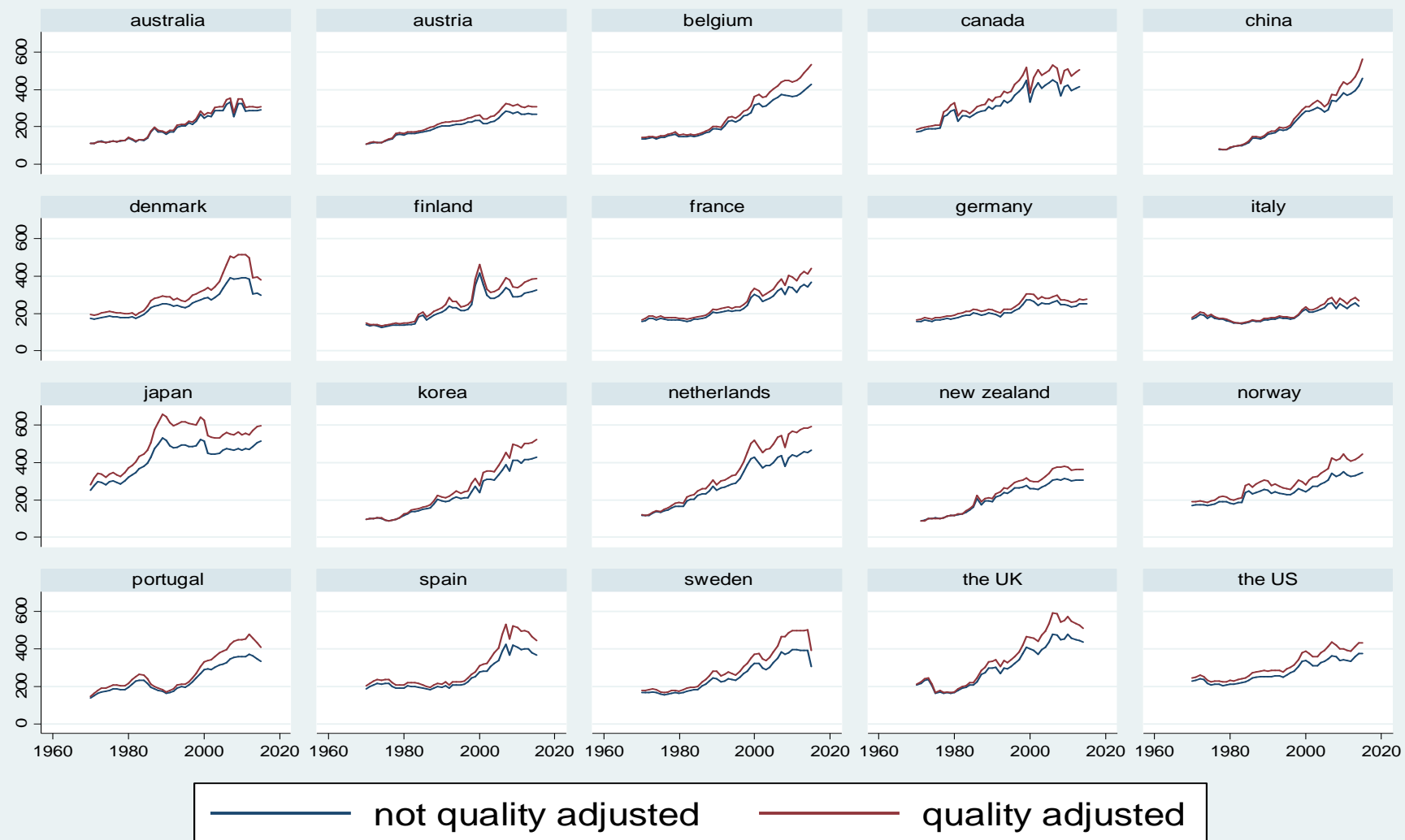
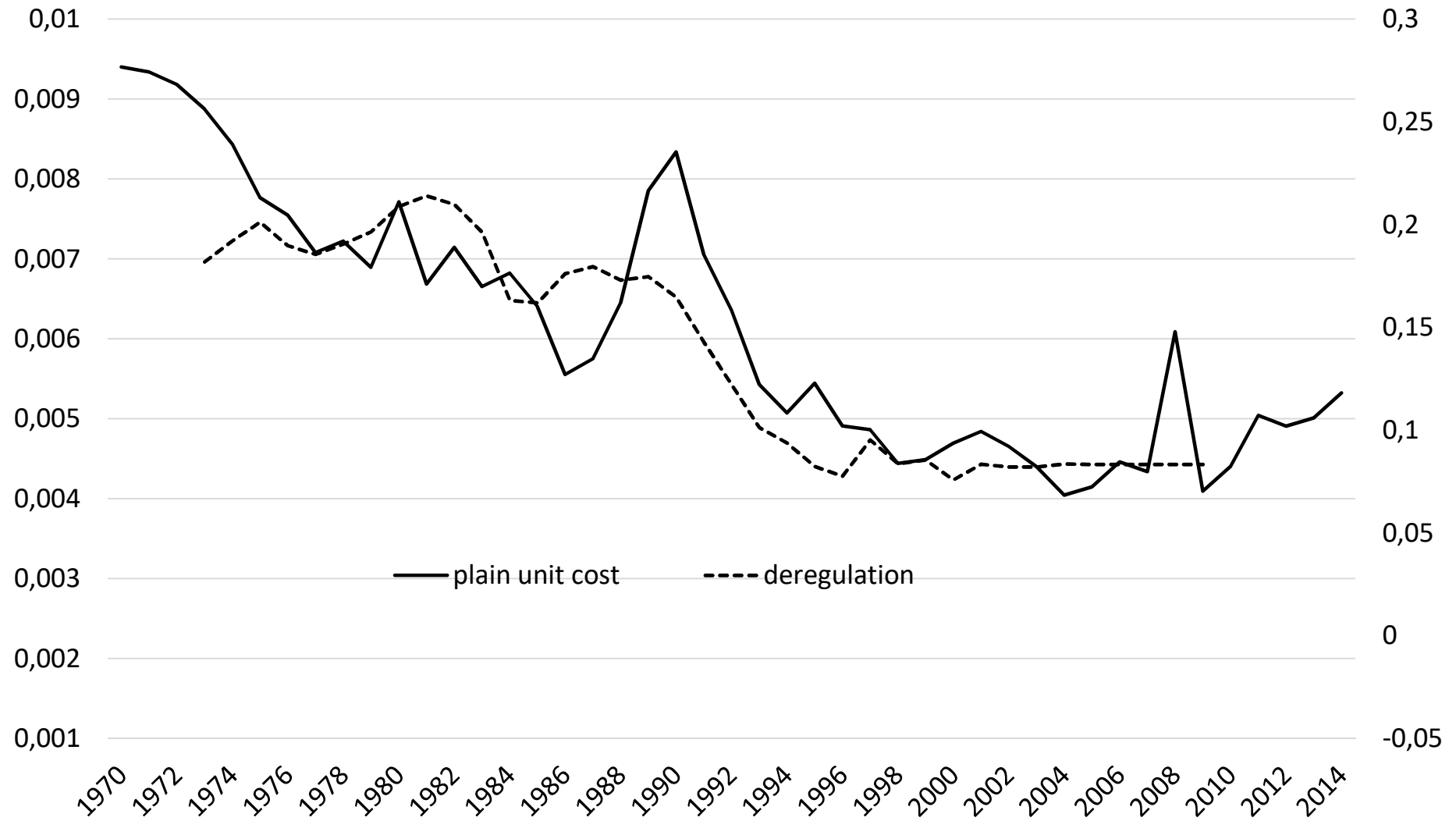


Figure A2: Deregulation index and unit cost standard deviation



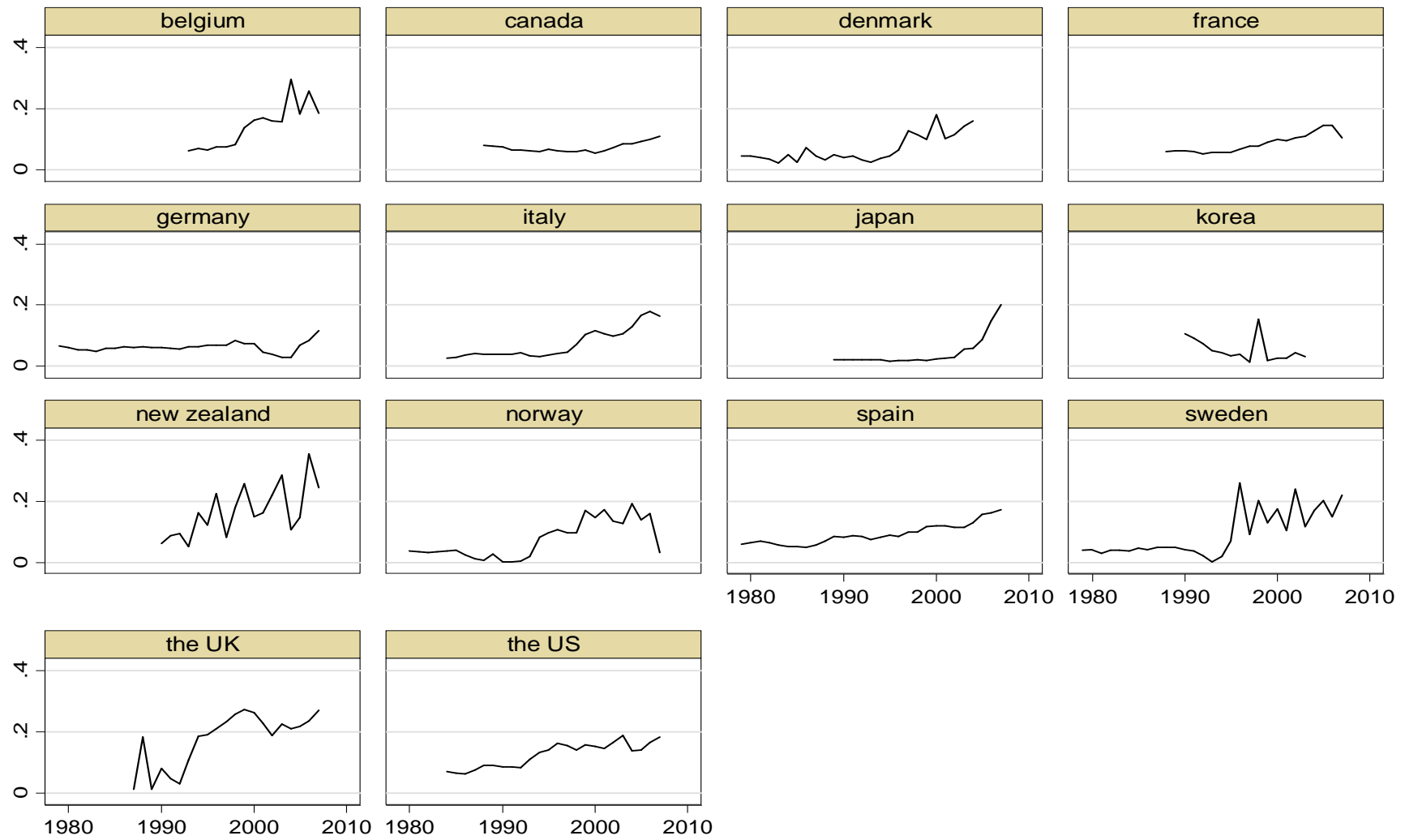
Note: The deregulation index data is from Abiad et al. (2007) and excludes China.

**Figure A3: Banking profits to banks intermediated assets and liabilities**

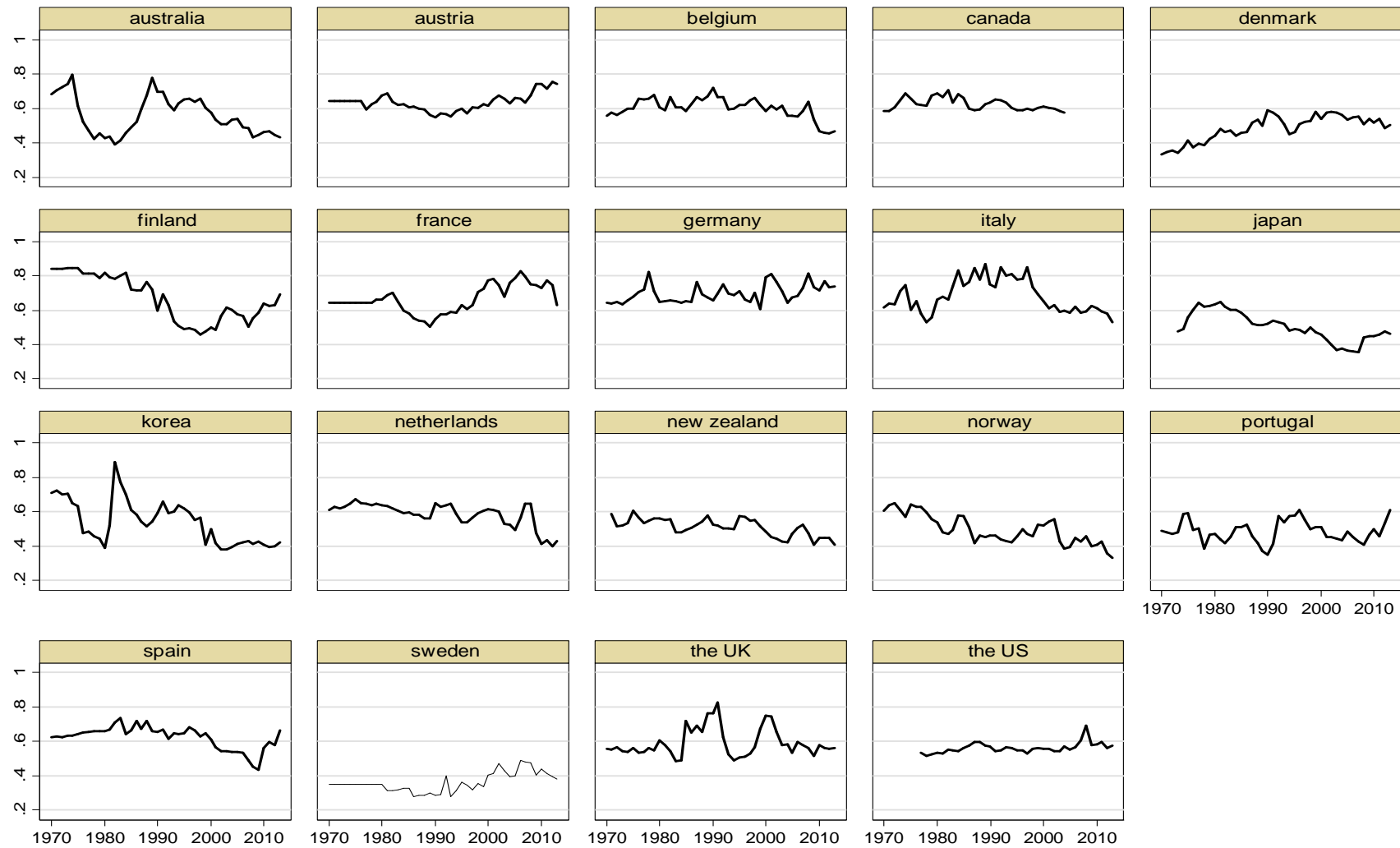


Note: Data based on locally weighted regression smoothing of band width equal to 0.5.

**Figure A4: Banks' distributed profits to income**



**Figure A5: Value added share of labor value**



**Table A1a: Unit cost convergence (10 years change in plain unadjusted unit cost)**

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	plain unadjusted unit cost							
unit cost 10 years lag	-0.326*** (0.0417)	-0.408*** (0.0520)	-0.428*** (0.0838)	-0.380*** (0.0725)	-0.521*** (0.0860)	-0.957*** (0.0639)	-1.148*** (0.109)	-1.101*** (0.0890)
nominal rates 10 years lag			0.00115 (0.0123)	0.0171 (0.0140)			0.0246 (0.0144)	0.0305 (0.0184)
globalization 10 years lag			-0.000242 (0.000382)	-0.000309 (0.000322)			-0.00124** (0.000564)	-0.00157* (0.000773)
deregulation 10 years lag			-0.00397 (0.00295)	0.00441 (0.00342)			-0.00726*** (0.00217)	-0.00573 (0.00470)
real GDP growth 10 years lag			0.0233 (0.0241)	0.0155 (0.0130)			0.0426** (0.0192)	0.0429* (0.0214)
time fixed effects	no	yes	no	yes	no	yes	no	yes
panel fixed effects	no	no	no	no	yes	yes	yes	yes
Constant	0.00470*** (0.000963)	0.0107*** (0.00185)	0.00883** (0.00371)	0.00622** (0.00302)	0.00889*** (0.00185)	0.0234*** (0.00180)	0.0260*** (0.00402)	0.0240*** (0.00363)
Observations	78	78	74	74	78	78	74	74
R-squared					0.230	0.677	0.731	0.741
Number of panel	20	20	20	20	20	20	20	20

Cluster robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table A1b: Unit cost convergence (10 years change in plain adjusted unit cost)**

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	plain adjusted unit cost							
unit cost 10 years lag	-0.327*** (0.0397)	-0.402*** (0.0491)	-0.425*** (0.0804)	-0.381*** (0.0693)	-0.502*** (0.0826)	-0.895*** (0.0728)	-1.084*** (0.116)	-1.045*** (0.0959)
nominal rates 10 years lag			0.000222 (0.0131)	0.0169 (0.0147)			0.0221 (0.0159)	0.0290 (0.0200)
globalization 10 years lag			-0.000268 (0.000367)	-0.000338 (0.000299)			-0.00112* (0.000567)	-0.00149* (0.000776)
deregulation 10 years lag			-0.00388 (0.00302)	0.00381 (0.00354)			-0.00693*** (0.00226)	-0.00648 (0.00472)
real GDP growth 10 years lag			0.0199 (0.0230)	0.0115 (0.0126)			0.0403** (0.0192)	0.0420* (0.0220)
time fixed effects	no	yes	no	yes	no	yes	no	yes
panel fixed effects	no	no	no	no	yes	yes	yes	yes
Constant	0.00448*** (0.000896)	0.0101*** (0.00167)	0.00873** (0.00351)	0.00636** (0.00297)	0.00824*** (0.00177)	0.0215*** (0.00190)	0.0242*** (0.00372)	0.0226*** (0.00339)
Observations	78	78	74	74	78	78	74	74
R-squared					0.241	0.660	0.721	0.729
Number of panel	20	20	20	20	20	20	20	20

Cluster robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Table A1c: Unit cost convergence (10 years change in corrected unadjusted unit cost)**

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	corrected unadjusted unit cost							
unit cost 10 years lag	-0.406*** (0.104)	-0.406*** (0.100)	-0.287** (0.112)	-0.297*** (0.108)	-1.437*** (0.430)	-1.382*** (0.168)	-1.300*** (0.205)	-1.309*** (0.167)
nominal rates 10 years lag			-0.0139 (0.0235)	-0.0125 (0.0234)			0.0679 (0.0497)	0.0896 (0.0639)
globalization 10 years lag			-0.000366 (0.000952)	-0.000562 (0.000929)			0.000947 (0.00313)	-0.00216 (0.00346)
deregulation 10 years lag			-0.00928 (0.00775)	-0.00171 (0.00804)			-0.0199* (0.00978)	-0.0239*** (0.00603)
real GDP growth 10 years lag			0.0829*** (0.0291)	0.0721*** (0.0245)			-0.0106 (0.0560)	0.00802 (0.0415)
time fixed effects	no	yes	no	yes	no	yes	no	yes
panel fixed effects	no	no	no	no	yes	yes	yes	yes
Constant	0.00775*** (0.00265)	0.0111*** (0.00337)	0.0124** (0.00567)	0.00958 (0.00624)	0.0348*** (0.0113)	0.0373*** (0.00490)	0.0392** (0.0156)	0.0416*** (0.0111)
Observations	27	27	27	27	27	27	27	27
R-squared					0.620	0.830	0.940	0.953
Number of panel	17	17	17	17	17	17	17	17

Cluster robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Table A1d: Unit cost convergence (10 years change in corrected unadjusted unit cost)**

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	corrected djusted unit cost							
unit cost 10 years lag	-0.392*** (0.0832)	-0.392*** (0.0839)	-0.291*** (0.0913)	-0.301*** (0.0876)	-1.249*** (0.350)	-1.199*** (0.125)	-1.148*** (0.161)	-1.153*** (0.145)
nominal rates 10 years lag			-0.0126 (0.0203)	-0.0111 (0.0198)			0.0585 (0.0372)	0.0706 (0.0524)
globalization 10 years lag			-0.000610 (0.000770)	-0.000782 (0.000740)			0.000959 (0.00239)	-0.000762 (0.00331)
deregulation 10 years lag			-0.00798 (0.00676)	-0.00125 (0.00690)			-0.0188** (0.00883)	-0.0210*** (0.00637)
real GDP growth 10 years lag			0.0665*** (0.0242)	0.0569*** (0.0200)			-0.0213 (0.0493)	-0.0109 (0.0456)
time fixed effects	no	yes	no	yes	no	yes	no	yes
panel fixed effects	no	no	no	no	yes	yes	yes	yes
Constant	0.00700*** (0.00217)	0.00997*** (0.00281)	0.0116** (0.00475)	0.00910* (0.00513)	0.0294*** (0.00916)	0.0317*** (0.00376)	0.0349*** (0.0114)	0.0362*** (0.00885)
Observations	27	27	27	27	27	27	27	27
R-squared					0.617	0.838	0.941	0.947
Number of panel	17	17	17	17	17	17	17	17

Cluster robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table A2: Robustness check**

	Plain financial income to credit		plain financial income to market capitalization		Plain financial income to broad money		Corrected financial income to credit		corrected financial income to market capitalization		corrected financial income to broad money	
	Coef	Std err	Coef	Std err	Coef	Std err	Coef	Std err	Coef	Std err	Coef	Std err
Australia	-3.64e-06	(2.72e-06)	-2.18e-05***	(3.04e-06)	-6.14e-06***	(5.45e-07)						
Austria	-1.12e-05***	(4.51e-07)	-0.000363***	(4.35e-05)	-5.02e-06***	(9.24e-07)						
Belgium	-6.44e-06***	(1.28e-06)	-9.02e-05***	(1.04e-05)	-1.43e-05***	(2.55e-06)	-1.97e-05***	(2.60e-06)	-0.000185***	(3.82e-05)	-4.34e-05***	(3.38e-06)
Canada	5.60e-07	(3.50e-07)	-1.29e-05***	(3.55e-06)	-3.77e-06***	(1.13e-06)	1.54e-06	(1.11e-06)	1.85e-06	(4.89e-06)	-1.52e-05***	(4.35e-06)
China	-1.47e-06	(1.29e-06)	-0.000504***	(7.93e-05)	-1.22e-05***	(1.48e-06)						
Denmark	-3.96e-06***	(1.89e-07)	-0.000121***	(9.02e-06)	-7.05e-06***	(8.36e-07)	-1.46e-06	(1.53e-06)	-7.59e-05***	(1.58e-05)	2.23e-06	(4.17e-06)
France	-7.46e-06***	(4.69e-07)	-2.64e-05***	(5.78e-06)	-8.04e-07*	(4.69e-07)	-9.41e-06***	(1.55e-06)	-8.38e-05***	(1.27e-05)	-8.21e-06***	(2.48e-06)
Finland	-1.66e-06***	(6.14e-07)	-5.15e-05***	(6.90e-06)	-2.38e-06	(1.47e-06)	-3.92e-06***	(1.33e-06)	-0.000135***	(2.42e-05)	-6.17e-06*	(3.39e-06)
Germany	-1.64e-07	(4.01e-07)	2.64e-06	(5.63e-06)	-5.00e-06***	(8.27e-07)	-9.84e-07	(1.37e-06)	-0.000108***	(9.32e-06)	-8.60e-06***	(2.90e-06)
Italy	-1.14e-05***	(9.43e-07)	-0.000495***	(6.30e-05)	-1.60e-06**	(6.63e-07)	-1.84e-05***	(1.07e-06)	-0.000178***	(4.45e-05)	1.73e-06	(1.98e-06)
Japan	-8.61e-07**	(3.65e-07)	-6.72e-05*	(3.37e-05)	-4.23e-06***	(3.49e-07)	8.76e-07	(1.17e-06)	-4.50e-06	(5.29e-06)	-3.33e-06***	(9.36e-07)
Korea, Rep.	-1.68e-06*	(8.41e-07)	-9.65e-05***	(1.28e-05)	-9.79e-06**	(3.90e-06)	9.74e-06***	(1.86e-06)	-2.01e-05	(2.23e-05)	-2.99e-05***	(5.01e-06)
Netherlands	-6.33e-06***	(3.24e-07)	-2.36e-05***	(4.89e-06)	-1.05e-05***	(2.02e-06)						
New Zealand	-1.70e-05***	(1.34e-06)	1.80e-05***	(3.35e-06)	-2.66e-05***	(2.39e-06)	-1.64e-05***	(1.96e-06)	2.94e-05	(4.08e-05)	-6.43e-06**	(2.86e-06)
Norway	-2.65e-06***	(3.47e-07)	-0.000159***	(1.39e-05)	-5.78e-07	(1.07e-06)	-2.44e-06***	(5.97e-07)	-0.000165***	(3.41e-05)	-1.03e-06	(1.59e-06)
Portugal	-5.66e-06***	(1.13e-06)	-8.48e-05***	(9.09e-06)	-9.81e-06***	(1.34e-06)						
Sweden	-5.08e-06***	(5.45e-07)	-0.000262***	(3.97e-05)	-3.26e-06*	(1.91e-06)	-1.50e-06**	(5.62e-07)	-6.37e-05***	(1.32e-05)	9.51e-06***	(3.37e-06)
Spain	-3.07e-06**	(1.20e-06)	-0.000184***	(3.07e-05)	4.91e-06***	(1.41e-06)	-9.51e-06***	(2.58e-06)	-0.000497***	(7.26e-05)	8.60e-06***	(2.85e-06)
United Kingdom	-3.78e-06***	(4.69e-07)	3.33e-06***	(6.23e-07)	-4.16e-07	(1.37e-06)	-5.90e-06***	(9.25e-07)	-6.92e-06**	(2.92e-06)	-1.21e-05**	(4.74e-06)
United States	-1.14e-07	(2.82e-07)	1.50e-06	(1.40e-06)	9.77e-06***	(8.26e-07)	1.82e-06	(1.12e-06)	-2.63e-05***	(4.04e-06)	2.62e-05***	(2.71e-06)

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Note: Result of regression per country explaining one of the ratio by a trend.

Dark blue: all three ratios are negative; light blue: two ratios are negative while the last ratio is insignificantly different to zero; gray: one ratio is negative while two ratios are insignificant with a positive sign; white: two ratios are of significant opposite signs; orange: one ratio is significantly positive while the other ratio of insignificant with opposite signs. Red character font corresponds to positive and significant coefficients.

**Table A3a: correlation matrix (variables in level)**

	Plain unit cost (3 years forward)	Deregulation index	Nominal rates	Inflation rate	NFA to GDP	Globalization index	Bank share of credit	Real GDP growth	Exchange rate
Plain unit cost (3years forward)	1.0000								
Deregulation index	-0.5224	1.0000							
Nominal rates	0.5333	-0.5159	1.0000						
Inflation rate	0.4858	-0.7193	0.6819	1.0000					
NFA to GDP	-0.0505	-0.0735	-0.1564	-0.0511	1.0000				
Globalization index	-0.4538	0.5620	-0.4660	-0.4221	0.0681	1.0000			
Bank share of credit	0.1646	-0.1400	0.0834	0.0508	-0.0382	-0.1370	1.0000		
Real GDP growth	0.0548	-0.1640	0.0151	-0.0517	0.0243	-0.1454	0.1219	1.0000	
Exchange rate	-0.0690	-0.0322	-0.0012	-0.0510	0.0490	-0.1265	0.1565	0.0982	1.0000

**Table A3b: correlation matrix (variables in variation)**

	Δ plain unit cost (3years forward)	Δ deregulation	Δ nominal rates	Δ inflation	Δ NFA to GDP	Δ globalization	Δ bank credit share	Δ real GDP growth	Δ exchange rate
Δ plain unit cost (3 years forward)	1.0000								
Δ deregulation	-0.0139	1.0000							
Δ nominal rates	0.2016	0.0152	1.0000						
Δ inflation	0.0126	-0.1379	0.5370	1.0000					
Δ NFA to GDP	0.0101	0.0194	-0.0868	-0.0788	1.0000				
Δ globalization	0.0243	-0.1900	0.0209	0.1236	-0.1592	1.0000			
Δ bank credit share	0.0604	-0.0099	-0.2843	-0.3572	0.0638	-0.0171	1.0000		
Δ real GDP growth	0.1048	0.0628	0.0855	-0.0017	-0.1251	0.0784	-0.0116	1.0000	
Δ exchange rate	0.0114	0.0489	0.0004	-0.0196	0.0602	-0.0664	0.0925	-0.1585	1.0000

Note: Plain unit cost is not adjusted for quality.  $\Delta x_t = x_t - x_{t-3}$ .

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