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Abstract

Economic theory predicts that consumption growth rates should be highly, if not perfectly, correlated across countries. Existing empirical evidence overwhelmingly rejects this prediction. In this paper we examine whether increased financial integration and labour market rigidities can help explain this apparent contradiction between theory and empirics. Using data for 19 OECD countries we show that although financial integration has a limited impact upon cross-country consumption correlations, labour market rigidities significantly increase consumption correlations. The results suggest that labour market rigidities improve the allocation of consumption risks either by shifting risk from employees to firms and shareholders or because it makes future income streams easier to use as collateral.

JEL Classification: E32, F15, E21

Keywords: Consumption correlation puzzle, financial integration, foreign direct investment, employment protection.

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1 Introduction

Openness to international capital markets should allow residents of different countries to pool various risks, by enabling them to trade (Arrow-Debreu) claims on international assets. Through such arrangements countries may trade idiosyncratic risk, which can have two impacts. Firstly, the presence of an international insurance arrangement suggests that domestic consumption shouldn't respond strongly to idiosyncratic shocks. Secondly, the trading of risk internationally suggests that consumption growth rates should be highly correlated across countries (see for example Lewis, 1999; Obstfeld and Rogoff, 2000).[1] Empirical evidence however strongly rejects international risk sharing, with cross-country correlations of consumption growth rates found to be rather low (see for example Backus, Kehoe, and Kydland, 1992). Such results lead Ambler, Cardia, and Zimmermann (2004) to argue that the high consumption correlations obtained in theoretical models are a major puzzle for international business cycle models and their most important shortcoming when compared to real world data. This puzzle has been termed the 'consumption correlation puzzle'.

Related to the consumption correlation puzzle is a second puzzle which has been termed, amongst other things, the 'quantity anomaly' (Backus, Kehoe, and Kydland, 1995). This anomaly relates to the empirical finding that output growth rates are typically found to be more correlated internationally than those of private consumption. This is a puzzle since we expect consumption growth rates to be highly correlated across countries. Moreover, if anything output should be negatively correlated, since capital should flow to regions with the highest returns (see for example Backus, Kydland, and Kehoe, 1994).

A number of solutions to one or both of the above puzzles have been proposed in the literature. Specific examples concentrating on the consumption correlation puzzle include Backus, Kehoe, and Kydland (1992) who allow for optimal capital investment and leisure choice in a Real Business Cycle model with productivity shocks. Their model suggests lower than perfect consumption correlations, but the predicted correlation is still higher than that found in the data. Lewis (1996) also develops a model that results in lower predicted international consumption correlations, in her case by introducing non-tradable goods. Kehoe and Perri (2002) develop a model with limited contract enforceability that leads to endogenously incomplete markets. Their model generates consumption correlations that are also substantially lower than in a complete markets model. Other proposed solutions include Stockman and Tesar (1995) who show that taste shocks in consumption potentially explain why international consumption correlations are low and Baxter and Crucini (1995) who argue that a complete markets model can generate low consumption correlations if shocks are persistent. This last solution has been emphasized by Becker and Hoffmann (2003) and Artis and Hoffmann (2004) who argue that persistent shocks are harder to insure and require more elaborate financial markets. Taken in isolation however none of these proposals would appear to give a complete explanation of the consumption correlation puzzle, though Lewis (1996) finds that when allowing for the presence of both non-traded goods and institutional restrictions on capital flows the consumption correlation puzzle disappears. A final explanation explored by Lewis (1999) and Obstfeld

[1] Indeed, adding additional assumptions such as those of iso-elastic utility and complete markets leads to the conclusion that consumption growth rates should be equal across countries (Lewis, 1999).

(1994) relates to the possibility that the gains from risk sharing are too small to encourage diversification, and that this may explain the low correlations of consumption growth rates.

In this paper, we analyze empirically the determinants of international consumption correlations across a sample of 19 OECD economies. The focus of the paper is on two potential sources of correlated consumption growth rates, namely, financial integration and labour market regulation. It is to be expected that more financially integrated economies hold more diversified asset portfolios and as a result may achieve more consumption insurance. Existing results provide some evidence suggesting that more financially integrated economies do indeed tend to have significantly higher consumption correlations, albeit using different methods and measures of financial integration to those employed in this paper. The second source of correlated consumption growth rates that we consider is labour market regulation, which to our knowledge has not been considered in the literature previously. The possibility that labour income is more difficult to insure than profits has lead to the suggestion that labour contracts may implicitly include insurance arrangements, with risk being shifted from labour income to profits (Azariadis, 1975). Highly regulated labour markets by allowing the enforcement of the insurance aspect of labour contracts and by shifting risk from wages to profits may lead to greater international risk sharing if profit income is easier to diversify on capital markets. In addition, stronger labour market regulations may make future expected income streams less volatile. As such, future income can be used as collateral, providing workers with access to credit markets. Consequently, agents are able to smooth shocks by adjusting their net asset position. The easier access to credit markets provides a further channel through which labour market regulation may influence the amount of risk sharing that can be achieved.

The current paper is related to that of Sørensen, Wu, Yosha, and Zhu (2005) who also consider the relationship between financial integration and international risk sharing, finding that both financial flows and the home bias in equity portfolios are correlated with the extent of international risk sharing. Rather than relying on regression-based tests of risk sharing however, the current paper focuses on the correlations of consumption growth rates directly. More closely related to the current paper is Imbs (2006) who analyzes the effect of financial integration on both consumption and output correlations. He finds that financial integration increases both consumption and output correlations, though the response of output correlations is substantially larger than that of consumption correlations. Using this result Imbs concludes that it is the impact of financial integration on output and not consumption correlations that is the key to the quantity anomaly. The current paper follows the approach of Imbs closely, though there are a number of important differences. Most importantly, we use data on Foreign Direct Investment (FDI) rather than portfolio investment as our measure of financial flows. Risk sharing may be accomplished through a diversity of financial instruments, including stock shares, FDI, insurance contracts and various derivative securities. Hence, the results presented in this paper can be considered a robustness test of Imbs' results using an alternative measure of financial integration. We also believe that FDI flows have a significant advantage over portfolio investment as a measure of financial flows in that FDI flows are more closely related to long-term development and are less susceptible to short-term speculative flows. A further important difference between the current paper and that of Imbs is the

consideration in the current paper of labour market regulations as a determinant of the extent of international risk sharing.

The main new result from our empirical analysis is that more rigid labour markets tend to increase the international correlation of consumption growth rates. Thus, despite possible negative impacts on macroeconomic performance (Nickell, 1997), stronger labour market protection appears to improve the international sharing of consumption risk. We are also able to show by splitting our index of labour market regulation in to sub-categories that much of the impact of regulation on international risk sharing comes through regulations on temporary employment. This result is in line with the conclusion that stronger labour market regulations encourage international risk sharing by making future income more predictable. Given that temporary workers are likely to have less access to credit due to their incomes being less secure, stronger regulations on temporary employment by either making the income of temporary workers more secure or by reducing the extent of temporary employment, would allow income to be used as collateral. While we find that labour market regulation increases the international correlation of consumption, we find little such evidence for financial integration. While such a result is in contrast to those of Sørensen, Wu, Yosha, and Zhu (2005), it is consistent with a number of results presented by Imbs (2006) who also often finds insignificant coefficients on his measure of financial flows. Also in line with Imbs (2006), we find that financial flows significantly increase business cycle correlations, thus confirming the conclusion of Imbs (2006) that it is the relationship between financial integration and output correlations that is the main reason for the quantity anomaly.

In Section 2 we discuss the theoretical motivation for and the empirical specification of our model. Section 3 discusses the data employed, while Section 4 presents and discusses our results. Section 5 concludes.

2 Determinants of International Consumption Risk Sharing

2.1 Theoretical Motivation

If agents have access to complete asset markets, a necessary condition for the efficient allocation of resources is that the marginal rates of substitution in consumption are equalized. (see for example Obstfeld and Rogoff, 1996, chapter 5). Under the additional assumption of iso-elastic utility, it follows that the growth rates of real per capita consumption should be perfectly correlated across countries (Lewis, 1999). As discussed in the previous section however, this has not been found to be the case empirically.

Despite the low correlations found in the literature it seems likely that countries that are better able to hold well diversified asset portfolios are more likely to achieve higher consumption insurance and share risk more efficiently. Consequently, countries with more intense financial linkages may be characterized by more highly correlated consumption allocations.

International financial linkages are likely to have additional impacts however, such as by encouraging the specialization of production through the reallocation of capital in a manner consistent with a country's comparative advantage. We would expect such spe-

cialization of production, which could result in greater exposure to industry- or country-specific shocks, to be accompanied by the use of financial markets to diversify consumption risk. In response to these arguments we analyze empirically whether consumption co-movements are indeed related to the degree financial integration.

Financial integration is likely to be only one of a larger number of factors influencing the extent of international risk sharing. A second influence that we consider to be relevant, and which has not been considered in this context previously, is the regulation of labour markets. There are two main justifications for considering the role of labour market institutions in affecting risk sharing. Firstly, it has been suggested that labour contracts may contain elements of an implicit insurance contract (see Azariadis, 1975), with at least part of the uncertain labour income stream of workers being shifted to third parties. Such insurance comes from employers who insure their employees against stochastic fluctuations in their incomes by guaranteeing relatively stable wages, that are to some degree at least independent of the business cycle. Risk is thereby transferred from wages to profits, and via the capital market, to the income of the firm's owners and creditors. Since risk associated with profit income is easier to diversify on domestic and international financial markets than labour income, both parties involved in such an implicit contract can be made better off. A role for labour market institutions arises in this setting due to the fact that implicit contracts are not enforceable, meaning that labour market institutions and mobility costs in particular help implicit contracts become self-enforcing. It is to be expected therefore that implicit contracts will be better enforced in countries with more highly regulated labour markets and high mobility costs, suggesting that high labour market regulation may increase the degree of international risk sharing.

A second reason for considering employment protection is that agents in countries with relatively highly regulated labour markets are likely to have income flows which are less volatile. For workers in such countries future income can be regarded as relatively predictable and can therefore be more easily used as collateral. As such, agents in countries characterized by high employment protection are likely to face less severe borrowing constraints and easier access to financial markets, other things being equal, that may allow for better consumption smoothing. Taken together, these two arguments suggest labour market regulation may be an important determinant of international risk sharing.

2.2 Empirical Setup

This section describes our methodology for examining whether countries that are more financially integrated and that have more regulated labour markets experience higher consumption correlations. The starting point for our analysis is an equation that relates bilateral correlations of consumption growth rates, ρ_{ij}^{C} to a set of explanatory variables,

$$\rho_{ij}^{C} = \alpha_0 + \alpha_1 \rho_{ij}^{Y} + \alpha_2 FDI_{ij} + \alpha_3 EPL_{ij} + \epsilon_{ij}^{C}, \tag{1}$$

where ρ_{ij}^{Y} denotes the correlation of GDP growth rates, FDI_{ij} denotes bilateral FDI flows between countries i and j and EPL_{ij} captures the average level of employment protection for countries i and j.[2] This equation follows closely that estimated by Imbs (2006), albeit

[2]The variables are defined and described fully in the next section.

with the addition of a measure of labour market regulation and an alternative measure of financial flows.

We include ρ_{ij}^{Y} in (1) in order to control for business cycle correlations. In the case of incomplete markets agents will only be able to diversify their income risk to a limited extent, and so consumption will track movements in income to an extent. Consumption growth rates will therefore be correlated if output fluctuations are correlated, even if there is no risk sharing at all.

To measure financial integration we use as a proxy bilateral FDI flows. Although this choice is influenced to an extent by data availability, there are a number of reasons to believe that FDI data are more appropriate to analyze consumption correlations than other financial flows, such as portfolio investment.[3]

FDI flows are determined to a large extent by long-term economic fundamentals such as an effective infrastructure, a skilled workforce, macroeconomic stability and political and legal predictability (see for example Wheeler and Mody, 1992), while portfolio investment often responds to short-run investment opportunities. The long-run nature of FDI means that it is less likely to be subject to idiosyncratic shocks than portfolio investment. Such shocks that can lead to abrupt reversals or sudden stops of short-run capital inflows can lower the productivity of existing capital stock, resulting in unexpected swings in relative prices and even lead to banking crisis or corporate bankruptcies, especially in small economies (Milesi-Ferrett and Razin, 1998). A further reason for considering FDI rather than portfolio investment concerns the importance of investment funds for portfolio investment that are to a large extent managed by multilateral financial institutions. It is not clear therefore to what extent such flows can be considered for bilateral risk sharing. For example, a significant share of portfolio investment by US investment funds in a particular region is likely to be from investors in third countries, and is thus not relevant for bilateral risk sharing.

The second variable of interest to us is a proxy for employment protection. As discussed above this variable is included since stronger labour market regulation may help enforce the insurance aspect of labour contracts shifting risk from wages to profits, and may make future income more secure, thus easing borrowing restrictions, both of which may increase consumption correlations. This part of our empirical analysis represents an extension of the current literature, which has paid little attention to this potential determinant of cross-country consumption and output correlations (the main exception being Fonseca, Patureau, and Sopraseuth, 2006). Indeed, it is only recently that the importance of labour market institutions has gained attention in empirical studies of the macro-economy (see for example Layard and Nickell, 1999), probably reflecting the recent availability of data on labour market institutions for OECD countries at least.

While estimating (1) as a single equation is the most straightforward approach, it seems problematic to do so since some of the right-hand side variables in (1) are likely to be endogenous. To develop an appropriate estimation strategy, we follow Imbs (2006) and formulate a system of equations in which the correlations of output growth, FDI, and trade flows and structure are treated as endogenous variables. The system is formulated

[3]Imbs (2006) uses the IMF's Coordinated Portfolio Investment Survey (CPIS) data, but notes that the use of survey-based data and the lack of data on Foreign Direct Investment could create biases.

by adding the following equations to (1),

$$\rho_{ij}^{Y} = \beta_0 + \beta_1 FDI_{ij} + \beta_2 T_{ij} + \beta_3 IIT_{ij} + \beta_4 EPL_{ij} + \epsilon_{ij}^{Y}, \tag{2}$$

$$FDI_{ij} = \gamma_0 + \gamma_1 T_{ij} + \gamma_2 IIT_{ij} + \epsilon_{ij}^{F}, \tag{3}$$

$$T_{ij} = \delta_0 + \delta_1 FDI_{ij} + \epsilon_{ij}^{T}, \tag{4}$$

$$IIT_{ij} = \theta_0 + \theta_1 FDI_{ij} + \theta_2 T_{ij} + \epsilon_{ij}^{IIT}, \tag{5}$$

where T_{ij} and IIT_{ij} denote bilateral trade intensity and bilateral intra-industry trade between countries i and j respectively.

Considering these equations in turn, we follow existing literature that suggests that business cycle correlations are determined by bilateral trade and financial flows (see for example Frankel and Rose, 1998; Imbs, 2006), by including FDI_{ij}, T_{ij} and IIT_{ij} as explanatory variables in (2). Theoretically the relationship between trade integration and output correlations is ambiguous and is likely to depend inter alia upon the nature of shocks and specialization patterns. A number of authors such as Kenen (1969) and Krugman (1993) have noted that as trade becomes more highly integrated, countries should specialize in the production of goods in which they have a comparative advantage, which can lead to lower output correlations. This will be the case if stronger trade linkages lead to an increase in intra-industry specialization across countries and when industry-specific shocks are important in driving business cycles. Imbs (2006), amongst others, however has found that the effect of trade on specialization is limited. An alternative view is that if trade is comprised largely of intra-industry trade then output may become more correlated across countries. This is likely to be the case in advanced countries, where intra-industry trade is commonly considered to account for a significant portion of trade. Empirical results suggest that stronger trade links have a positive impact on cross-country output correlations (see for example Frankel and Rose, 1998; Kose and Yi, 2001; Imbs, 2004, 2006). It is clear from this discussion that the structure as well as the level of trade is likely to be an important mechanism for the transmission of demand shocks between countries, with business cycles likely to converge if intra-industry trade is important in bilateral trade relations (Frankel and Rose, 1998).[4] As such we include variables capturing both the level of trade as well the extent of intra-industry trade in (2).

The role of financial integration in affecting business cycle correlations is less clear. On the one hand, tightly interlinked financial markets can be thought of as a transmission channel similar to intra-industry trade encouraging higher output correlations. On the other hand, financial integration allows production to become more specialized by decoupling it from consumption. Such specialization of production is likely to result in more exposure to industry- or country-specific shocks and may lead to a decrease in the degree of output correlations (see for example Kalemli-Ozcan, Sørenson, and Yosha, 2003; Krugman, 1993; Imbs, 2006).

As an additional variable we also include the variable indicating labour market regulation, EPL_{ij}, in (2). The rationale for this is that a high degree of employment protection may give rise to specialization, which as indicated above may influence business cycle

[4]This view is supported by Fidrmuc (2004), who finds a significant and positive relation between the correlation of business cycles and intra-industry trade in a cross-section of OECD countries.

correlations. With a high degree of employment protection workers can expect to remain employed in the same firm for a relatively long period of time, and as a result may be more willing to accumulate firm or industry specific human capital. In contrast, in economies with low employment protection, workers have an incentive to acquire general skills that can be easily transferred between firms or sectors. Thus, employment protection may foster specialization, which as discussed above may result in less synchronized business cycles.

The explanatory variables included in the FDI equation, (3), are the trade variables and the variable representing labour market regulations. A growing literature examines the inter-relationships between trade and FDI flows, and in particular whether trade and FDI are substitutes or complements. In the case of substitutes multinational firms replace exporting by setting up a subsidiary in a foreign country, trading off lower trade costs against higher fixed costs (Horstmann and Markusen, 1992). This case referred to as horizontal FDI leads to the situation whereby FDI replaces trade. In the case of trade and FDI being complements the production process is split into segments, with the different segments being produced in different countries each abundant in the resources necessary for the production of that segment (Helpman, 1984). Such vertical FDI will encourage trade since each plant must export its output as an intermediate good to other plants. The evidence in favour of substitutability or complementarity of FDI and trade is mixed, with evidence found for substitutability (Bayoumi and Lipworth, 1997), complementarity (Brainard, 1997) and both (Blonigen, 2001).

The role of labour market regulations in determining FDI flows has also been examined (see for example Kleiner and Ham, 2002). The empirical evidence suggests that stronger employment protection in OECD countries lowers FDI inflows largely by raising labour costs. However, the employment protection indices are insignificant in our analysis. Therefore we do not include the variable EPL in the equation for FDI.[5]

The final two equations are for the level of trade, (4), and trade structure, (5). In both of these equations we include FDI as an explanatory variable. This is again due to the two-way linkages between trade and FDI suggested by the literature. In addition, FDI may affect the structure of trade since FDI tends to be concentrated in certain sectors and may encourage specialization, particularly in the case of vertical FDI. The level of trade is included in (5) to account for the degree of openness and thus the potential for specialization. As for the FDI equation, labour market regulations are not included in these two equations, although we did include them in our sensitivity analysis, the results of which are not reported.[6]

The system represented by equations (1)-(5) is used to address the issues of whether more financially integrated countries and countries with higher labour market regulation engage in greater levels of risk sharing. Before discussing the data and the results from estimating this system, it is necessary to mention the detrending methods employed and other issues of robustness. For robustness purposes two detrending methods are considered. The first method is to simply consider seasonal differences, while the second method we consider is the band pass filter, as recommended by Artis (2003).

[5]The results when including the EPL are available upon request. In general, we find the coefficient on EPL to be negative but insignificant.

[6]The results are available upon request.

Also for reasons of robustness we consider several estimators of our system of equations. We begin by considering the standard OLS estimator. OLS is likely to be inappropriate however, since it does not reflect the possible endogeneity of the right hand side variables and the correlation of residuals across equations. We therefore estimate the whole system of equations by two and three stage least-squares. In these estimations, we instrument trade, intra-industry trade and FDI using gravity variables.[7]

Given that FDI flows are likely to be influenced by institutional factors we follow Imbs (2006) and instrument investment flows by the indicators on property and creditor rights, contract enforceability, the rule of law, juridical system, and corruption indices of La Porta, Lopez-de Silanes, Shleifer, and Vishny (1998). Finally, we also estimate the system using seemingly unrelated regression techniques which account for the correlation of residuals across the equations of the system. Our results suggest that the estimation results are robust to the application of different econometric methods.

3 Data Description

Our main focus of interest is on two variables, the cross-country correlation of consumption growth rates and the cross-country correlation of GDP growth rates, which are constructed using per capita data on quarterly real GDP and private consumption. These variables were constructed using data taken from the IMF's *International Financial Statistics*[8]. Data on nominal private consumption was deflated using the CPI index and expressed in per capita terms using total population, while real GDP was also expressed in per capita terms. All series are expressed in logs. This data was collected for 19 OECD countries over the period 1980-2004.[9]

Using this data two indicators of the similarity of consumption and income patterns across countries were constructed. Firstly, we follow existing literature and compute pairwise correlations of seasonally-differenced consumption and GDP per capita growth rates. Secondly, we follow the approach of Baxter and King (1999) and use the band pass filter to extract the business cycle component of the two series.[10] Before employing the band-pass filter our data was seasonally adjusted using the U.S. Census Bureau's X12 ARIMA procedure.

While we employ the band pass filter on the full sample of data, our empirical analysis considers only the most recent business cycles using data over the period 1991-2004. We concentrate on this period since it was characterized by a higher international mobility of capital than previous periods[11]. Moreover, data on labour market rigidities are only

[7]The gravity variables considered include population, distance, dummy variables for the EU and NAFTA, common language and geographic adjacency. Following Imbs (2006) we also use GDP per capita as an instrument, with countries with higher GDP per capita considered to be more specialized.

[8]The use of this data necessitated a correction for the jump associated with German reunification. In our empirical analysis however we concentrate on the period after German reunification only

[9]The countries included in our sample are Australia, Austria, Belgium, Canada, Denmark, Germany, Finland, France, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the UK and the USA. Our data set thus excludes Greece, Ireland, and Luxembourg for reasons of data availability.

[10]Artis (2003) supports the use of the band-pass filter over the Hodrick-Prescott filter.

[11]Obstfeld and Taylor (2004) for example argue that after the 1980s a degree of international capital

available from the late 1980s onwards.

In addition to data on consumption and GDP, we require information on trade flows and structure, FDI flows and labour market rigidities. Data on trade flows are taken from the IMF *Direction of Trade* Statistics, while our measures of intra-industry trade are computed using trade data from the UN World Trade Data Bank (see Fidrmuc, 2004). FDI data are taken from the ECB (see Artis, Fidrmuc, and Scharler, 2005), while the indicators of labour market rigidities are from the OECD (2004).

Using these data we follow existing literature when constructing the variables required for our empirical analysis. Trade integration is proxied by the bilateral trade intensity, as suggested by Frankel and Rose (1997, 1998), and defined as,

$$T_{ij}^{X} = \frac{X_{ij} + M_{ij}}{Y_i + Y_j},$$

where X_{ij} and M_{ij} denote the value of bilateral exports and imports between countries i and j. Y_i and Y_j denote the aggregate output of countries i and j.

To measure trade structure we use the popular Grubel-Lloyd index of bilateral intra-industry trade (Grubel and Lloyd, 1975) defined as,

$$IIT_{ij} = 1 - \frac{\sum_k |X_{ijk} - M_{ijk}|}{\sum_k |X_{ijk} + M_{ijk}|},$$

where X_{ijk} and M_{ijk} denote bilateral exports and imports by three-digit SITC commodity group k. A value of this index of zero indicates complete specialization in different products for each country (inter-industry trade), while an index value of 100 indicates exclusively intra-industry trade between countries.

Our measure of financial flows is analogous to that for trade intensity. We define the share of bilateral FDI flows (including both investment inflows and outflows) to total output of both countries as,

$$FDI_{ij} = \frac{FDI_{ij}^{I} + FDI_{ij}^{O}}{Y_i + Y_j},$$

where FDI_{ij}^{I} and FDI_{ij}^{O} denote inward and outward FDI flows between countries i and j.

Finally, we use indicators of employment protection legislation (EPL) taken from the OECD (2004) in order to measure the strength of labour market rigidities. The EPL indices are defined as a weighted average of 18 indicators of labour market regulations. The index consists of three components: Firstly, the index of protection of regular employment is based on standard indicators of flexibility of labour markets. This broad set of indicators includes information such as the period of notice before dismissal and severance pay, as well as qualitative information, including information on the difficulties firms face in dismissing workers. Secondly, the index of regulations on temporary forms of employment considers restrictions on fixed term contracts in the labour market, such as the maximum number or the duration of successive contracts, as well as the type of work eligible for temporary work. Finally, the index of legislation on collective dismissal covers specific

mobility emerged that had not been seen for over a century.

requirements related to collective dismissals, such as additional notification requirements and costs for the employer.

While the first two components of the overall index have equal weights, the final component has a weight of only 16 percent since it reflects only additional protection triggered by the collective nature of the dismissal. Employment protection is assessed only for selected periods, in particular the late 1980s, the late 1990s, and the early part of the current decade. Moreover, for the late 1980s the employment protection index was only produced for the first two components of the overall index, meaning that our empirical analysis is restricted to the period 1991-2004.

All employment protection indices are defined between 1 and 6.[12] Higher values of the index correspond to higher labour market rigidities. Similar to the indicator for financial flows, we take the average values of the EPL-indices as a bilateral indicator for countries i and j,

$$EPL_{ij} = \frac{EPL_i + EPL_j}{2}.$$

4 Results

The results from estimating our system of equations are presented in Tables 1-5. Tables 1 and 2 report the results for the consumption and output equation respectively, with panels A and B reporting the results using the series detrended by seasonal differencing and the band pass filter respectively. The final three tables report the results for the FDI, trade and intra-industry trade equations. All tables report OLS estimates along with the estimates from the two- and three-stage least squares and SUR regressions.

We begin by considering the results from the consumption equation in Table 1. First, our findings confirm that cross-country consumption correlations are largely dependent on business cycle co-movements. While the magnitude of the coefficient varies somewhat across estimators, the coefficient is generally large and highly significant. These results confirm previous results indicating the consumption correlation puzzle, with private consumption being largely conditioned by available domestic income.

Turning to our main variables of interest we find that the coefficient on bilateral FDI tends to be insignificant. Moreover, in the majority of cases the sign of the coefficient on bilateral FDI is against expectations. Hence, FDI flows do not seem to foster risk sharing between countries. Nevertheless, the results presented here using bilateral FDI flows are not out of line with a number of the results presented in Imbs (2006), who also often finds insignificant negative coefficients on his measure of financial flows. Imbs (2006) argues that the lack of significance on the financial integration variable doesn't necessarily indicate a lack of risk sharing. This would be the case if countries choose not to share risk with each other, but rather with the rest of the world.[13] Moreover, he also finds that when financial integration is proxied by an index that measures restrictions on international transactions, then financial integration significantly increases consumption correlations. Hence, it appears that although risks are shared via international financial markets, the precise channels are hard to identify.

[12] Though the extreme figures are not taken by any of the countries in our sample.

[13] Imbs (2005) adopts a specification that potentially alleviates this problem.

The results on our second major variable of interest, the employment protection index, indicate that institutional labour market arrangements seem to be an important factor in the allocation of consumption risk. The coefficient on EPL is found to be positive and highly significant especially for the specifications using the band pass filter. Thus, our results indicate that countries with higher degrees of employment protection are indeed characterized by more correlated consumption growth rates.

Considering now the coefficients on variables in the output equation, Table 2, we find, as with previous studies, a significantly positive relationship between our measure of financial flows and output correlations. Our results also indicate that trade structure has a positive and significant impact upon output correlations, suggesting that countries that engage in intra-industry trade (i.e. that have similar production structures) to a greater extent enjoy higher output correlations. This result is largely as expected and in line with the literature. [14]

While intra-industry trade appears to increase cross-country output correlations, the level of trade is found to have a negative, albeit usually insignificant, impact on output correlations. A negative coefficient on trade intensity is consistent with the view that trade integration leads countries to become specialized in different industries, increasing the importance of idiosyncratic shocks and reducing output correlations. This result is different to Imbs (2006) amongst others as well as our expectations, since we would expect intra- rather than inter-industry trade to be more prominent within the OECD. It has to be remembered however that we, unlike much of the previous literature, include a variable directly capturing the impact of intra-industry trade. The insignificance of trade intensity when accounting for intra-industry trade has been found by Fidrmuc (2004) employing a similar framework. The final coefficient of interest in this equation is that on EPL, which is found to be positive, but insignificant, suggesting that employment protection has little impact upon output correlations. This result is similar to that found by Fonseca, Patureau, and Sopraseuth (2006).

Turning to Table 3, which reports the results for the FDI equation, we find that bilateral FDI flows are positively and significantly related to total trade. Results presented in Table 4 indicate bi-directional causality with FDI also causing trade.[15] Taken together the results generally support the view that trade and FDI are complements in OECD countries.

The final two tables, Table 4 and Table 5, report the results for total trade and intra-industry trade respectively. While as mentioned above FDI flows are found to positively affect trade flows, we find no consistent relationship between FDI flows and intra-industry trade, with both positive and negative coefficients found. Finally, we find that the level of total trade has a large, positive and significant impact upon intra-industry trade. This result provides support for the views of Kenen (1969) and Krugman (1993) who argue

[14]Our measure of intra-industry trade is based on 300 bilaterally traded commodities, which is more detailed than the usual measures of industrial structure considered in the literature that tends to consider one digit industries. Note also that the sum of bilateral differences of industrial shares, which are used generally in the literature, increase with higher specialization, while intra-industry trade declines if specialization increases. Therefore, we expect a positive coefficient on intra-industry trade in the output equation, while other studies present a negative sign for industry specialization.

[15]For recent evidence of two-way linkages between FDI and trade see Aizenman and Noy (2006).

that as trade becomes more highly integrated, countries should specialize in production.[16]

To sum up, our results largely confirm the consumption correlation puzzle. Even after controlling for trade and financial integration, output correlations are still the single most important factor explaining consumption correlations. Taken together the results from Tables 1 and 2 also suggest that FDI is primarily a source of business cycle synchronization and not a channel for international risk sharing. This result is similar to Imbs (2006) who finds that the responsiveness of output correlations to financial flows is greater than that of consumption correlations. As such our results using an alternative indicator of financial flows, namely bilateral FDI flows, provide additional support for the conclusions of Imbs (2006). We may conclude from these results that greater financial integration synchronizes business cycles and therefore reduces the scope for risk sharing since the relative importance of idiosyncratic shocks is reduced. However, financial integration, as proxied by international investemnt flows, does not help countries to reach a more efficient allocation of the remaining consumption risk.

While FDI doesn't appear to impact upon consumption correlations, we find that employment protection has a significantly positive impact on consumption correlations. Moreover, and in contrast to FDI, the coefficient on EPL in the output equation is insignificant in most cases. In the few cases where it is significant, the point estimate is quantitatively smaller than in the consumption equation. Hence, we conclude that high employment protection is primarily a source of correlated consumption growth rates, while its impact on business cycle co-movements is rather weak.

It seems therefore that employment protection helps to improve the allocation of consumption risks, either by shifting risk from employees to firms and shareholders or because it makes future income streams easier to use as collateral. While our results are suggestive of the conclusion that stronger labour market regulation shifts risk from employees to firms and shareholders, our results also indicate that these do not diversify risk through FDI flows, since the coefficient on the FDI variable has no significant impact on consumption correlations. A potential explanation is that risks are shared internationally through other channels than FDI, which is consistent with the results reported in Imbs (2006).

The results presented above are supported by a number of robustness tests. In particular, we consider different sub-samples of countries. We follow Imbs (2006) by considering risk sharing between a core and periphery country, splitting our sample into a core of seven countries and a periphery comprising the remaining countries in our sample. We also consider as a second sub-sample EU members prior to 1995 since integration may be higher for these countries that have over time integrated their labour and financial markets. The results using these two sub-samples are similar to those for the full sample. The major difference in results is that we find evidence of a significant positive impact of financial integration on consumption correlations using the EU sample, a result more in line with expectations.[17]

As well as considering different sub-samples we also consider the different components of employment protection. As pointed out by the OECD (2004) the different components of employment protection may have different implications for countries. We therefore

[16]Imbs (2004) however, finds the effect of trade on specialization to be limited.

[17]These results are available on request. In further analysis we also exclude the two countries with the highest and lowest values of the employment protection index to examine whether our results are being driven by outliers. The results are again similar to those reported in the paper.

examine whether our results are being driven by specific aspects of employment protection legislation. A particularly interesting distinction is between differences in legislation on regular and temporary employment.

The protection of regular employment represents the most standard measure of firing costs by the firms. To reduce such costs, firms may consider increasing temporary employment, for which different regulations exist. The OECD (2004) notes for example that different legislation on temporary employment contributes significantly to the variation of employment protection legislation across countries. Moreover, temporary employment legislation has been the subject of significant changes during the 1990s, the period of focus of our study. Belgium, Denmark, Germany, Italy, Spain, Sweden, and the Netherlands all reduced restrictions on temporary contracts by at least half a point over this period. By contrast, a similar degree of liberalization with regard to regular employment was registered only by Spain over the same period.

We may expect differences in the impact on consumption correlations of temporary compared to regular employment legislation since temporary workers are likely to have a significantly lower credit rating with financial institutions. This may have implications for the accessibility of temporary workers to mortgages and other loans. As a result high shares of temporary workers may indicate the presence of financial impediments. A higher level of legislation on temporary employment however by providing more security for temporary workers may be expected to lead to higher consumption correlations across countries. Permanent employment contracts on the other hand already provide significant security on future income paths and legislation on permanent contracts may therefore be expected to have a smaller impact on cross-country consumption correlations.

Table 8 presents the results of the consumption equation for our system of equations.[18] The first three columns of this table report the results when including the index of protection on regular employment (Column 1), temporary employment (Column 2) and collective protection (Column 3) individually, thus avoiding multicollinearity.[19] The final column reports the results when all sub-indices are included simultaneously.

The coefficients on output correlations and FDI are in line with previous results, though the coefficient on FDI becomes insignificant in cases where employment protection variables are significant. The coefficients on the individual components of employment protection are interesting. In all cases, the coefficients are positive, though only in the case of temporary employment protection are the coefficients consistently significant and large. For the band pass filter formulation we find positive and significant results on all three forms of employment protection, with the coefficient being largest for temporary employment protection. When including all three components of employment protection simultaneously we again find that only the coefficient on temporary protection remains positive and significant using both detrending methods, though the coefficient on collective

[18]In the remaining equations of our system we continue to include the overall measure of employment protection, the coefficients of which are found to be similar to those presented in Section 3. Detailed results are available from the authors upon request.

[19]The individual components of the employment legislation are correlated to a greater or lesser extent. The correlation between protection of regular and temporary employment for our country sample is relatively high at a value of around 0.6, while regular employment protection and the regulations on collective dismissals are weakly correlated (0.1). This latter component is more correlated with the restrictions on temporary work (0.3) however.

protection is also positive and significant under the band pass formulation. This last result may reflect the positive correlation of this component with the regulations on temporary work contracts.

5 Conclusions

Theory predicts that consumption growth rates should be highly, if not perfectly, correlated across countries. In addition, theory argues that consumption growth rates should be more highly correlated than those of output. Both predictions have been rejected convincingly by the evidence.

While a number of potential explanations for such differences between the theory and empirics have been suggested, in this paper we concentrate on two, namely financial market integration and labour market rigidities. Financial integration by allowing individuals to hold well diversified portfolios is likely to encourage international risk sharing, increasing consumption correlations, while strong labour market regulations by increasing the certainty of future income and by enforcing implicit contracts should also increase the cross-country correlation of consumption.

We examine empirically these two hypotheses using data on 19 OECD countries over the period 1991-2004. Employing a system of equations we find evidence of the consumption correlation puzzle that has been found extensively elsewhere in the literature. Regarding our main hypotheses we find that our measure of financial integration, bilateral FDI flows, has if anything a small negative impact on cross-country consumption correlations, and is thus not found to be a factor affecting international risk sharing. Related to this result we find that financial integration does have a large, positive and significant impact on output correlations. Both of these results are in line with many of the results presented by Imbs (2006) who uses an alternative indicator of financial integration. Both sets of results suggest that the main reason for the quantity anomaly is the high correlation of output between financially integrated economies.

While financial integration is found to have a limited impact on international risk sharing, the impact of labour market regulations are found to be important. In particular, we find that stronger labour market regulations increase the cross-country correlations of consumption growth rates, a result robust to alternative country samples, different detrending methods and different estimators. Two explanations are proposed for such a result. Firstly, stronger labour market regulations can help in enforcing implicit contracts that shift risk from employees to owners of firms. Given that risks associated with profits may be easier to diversify on financial markets than labour income we may expect stronger labour market regulations to increase international risk sharing. This explanation is tempered somewhat however, since owners of firms and shareholders do not appear to share risk internationally through FDI since this variable is not found to be positively related to consumption correlations in the majority of cases. It would appear therefore that if risks associated with profits are being diversified internationally, this is being done using alternative financial instruments. A second explanation for the impact of labour market regulations is that strong labour market regulations by making future income more predictable allows increased risk sharing by allowing workers to use future income as collateral when borrowing. Additional results reported in the paper suggest

that much of the impact of labour market regulation on consumption correlations comes from regulations on temporary employment. This result provides support for this second explanation of our results in particular. Given that temporary workers are likely to have less access to credit due to their incomes being less secure, stronger regulations on temporary employment by making the income of temporary workers more secure or by reducing the extent of temporary employment would be expected to increase the importance of future income for collateral when borrowing.

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Table 1: System Estimates: Consumption Equation

A. Seasonal Differences								
	OLS		2 Stage OLS		SUR		3 Stage OLS	
Constant	-0.222	***	-0.230	***	-0.217	***	-0.226	***
	(0.065)		(0.067)		(0.063)		(0.065)	
ρ_{ij}^{Y}	0.789	***	0.857	***	0.780	***	0.939	***
	(0.063)		(0.106)		(0.062)		(0.102)	
FDI	0.000		-0.037		-0.008		-0.083	**
	(0.022)		(0.036)		(0.022)		(0.035)	
EPL	0.054	*	(0.060)	**	0.058	**	0.063	**
	(0.029)		(0.030)		(0.028)		(0.029)	
B. Band Pass Filter								
	OLS		2 Stage OLS		SUR		3 Stage OLS	
Constant	-0.347	***	-0.337	***	-0.217	***	-0.319	***
	(0.081)		(0.083)		(0.063)		(0.081)	
ρ_{ij}^{Y}	0.781	***	0.625	***	0.780	***	0.552	***
	(0.071)		(0.138)		(0.062)		(0.133)	
FDI	-0.024		-0.039		-0.008		-0.051	
	(0.029)		(0.049)		(0.022)		(0.048)	
EPL	0.107	***	(0.137)	***	0.058	**	0.148	***
	(0.039)		(0.042)		(0.028)		(0.041)	

Notes: Standard errors are in parentheses. FDI, Trade and Intra-Industry Trade are instrumented as explained in the text.

Table 2: System Estimates: Output Equation

A. Seasonal Differences								
	OLS		2 Stage OLS		SUR		3 Stage OLS	
Constant	0.040		0.001		0.039		-0.034	
	(0.080)		(0.093)		(0.079)		(0.090)	
FDI	0.091	***	0.163	***	0.091	***	0.237	***
	(0.026)		(0.034)		(0.025)		(0.033)	
Trade	-0.041		-0.094	*	-0.041		-0.163	***
	(0.031)		(0.051)		(0.030)		(0.049)	
IIT	0.635	***	0.724	***	0.638	***	0.788	***
	(0.130)		(0.197)		(0.128)		(0.190)	
EPL	0.021		0.014		0.021		0.012	
	(0.033)		(0.035)		(0.033)		(0.033)	
B. Band Pass Filter								
	OLS		2 Stage OLS		SUR		3 Stage OLS	
Constant	-0.241	***	-0.265	***	0.039		-0.327	***
	(0.087)		(0.099)		(0.079)		(0.096)	
FDI	0.104	***	0.168	***	0.091	***	0.232	***
	(0.028)		(0.036)		(0.025)		(0.035)	
Trade	-0.047		-0.079		-0.041		-0.157	***
	(0.033)		(0.055)		(0.030)		(0.052)	
IIT	0.900	***	0.939	***	0.638	***	1.092	***
	(0.140)		(0.211)		(0.128)		(0.201)	
EPL	0.128	***	0.119	***	0.021		0.121	***
	(0.036)		(0.037)		(0.033)		(0.036)	

Notes: Standard errors are in parentheses. FDI, Trade and Intra-Industry Trade are instrumented as explained in the text.

Table 3: System Estimates: FDI Equation

	OLS		2 Stage OLS		SUR		3 Stage OLS	
Constant	0.556	***	0.553	***	0.406	***	0.411	***
	(0.061)		(0.066)		(0.059)		(0.063)	
Trade	0.353	***	0.359	***	0.623	***	0.629	***
	(0.063)		(0.079)		(0.059)		(0.072)	

Notes: Standard errors are in parentheses. Trade and Intra-Industry Trade are instrumented as explained in the text.

Table 4: System Estimates: Trade Equation

	OLS		2 Stage OLS		SUR		3 Stage OLS	
Constant	0.269	***	0.183	**	0.050		-0.072	
	(0.073)		(0.086)		(0.070)		(0.081)	
FDI	0.381	***	0.537	***	0.671	***	0.861	***
	(0.068)		(0.092)		(0.064)		(0.083)	

Notes: Standard errors are in parentheses. FDI and Intra-Industry Trade are instrumented as explained in the text.

Table 5: System Estimates: Intra-Industry-Trade Equation

	OLS		2 Stage OLS		SUR		3 Stage OLS	
Constant	25.538	***	23.843	***	25.523	***	24.095	***
	(1.447)		(1.735)		(1.433)		(1.705)	
FDI	-0.816		-3.010		-0.831		-8.164	***
	(1.416)		(2.066)		(1.402)		(2.004)	
Trade	15.615	***	21.527	***	15.617	***	27.768	***
	(1.364)		(1.817)		(1.342)		(1.687)	

Notes: Standard errors are in parentheses. FDI and Trade are instrumented as explained in the text.

Table 6: System Estimates for Components of Employment Protection: Consumption Equation, 3 Stage OLS

A. Seasonal Differences								
	Regular empl.		Temporary empl.		Collective protection		All	
Constant	-0.181	***	-0.180	***	-0.151	**	-0.120	
	(0.066)		(0.047)		(0.076)		(0.084)	
ρ_{ij}^{Y}	1.187	***	0.806	***	1.271	***	0.810	***
	(0.115)		(0.095)		(0.137)		(0.108)	
FDI	-0.149	***	-0.050		-0.182	***	-0.018	
	(0.040)		(0.035)		(0.043)		(0.033)	
Regular	0.025				0.005		-0.038	
employment	(0.027)				(0.028)		(0.030)	
Temporary			0.060	***			0.078	***
empl.			(0.020)				(0.025)	
Collective					0.005		-0.013	
protection					(0.028)		(0.028)	
B. Band Pass Filter								
	Regular empl.		Temporary empl.		Collective protection		All	
Constant	-0.204	***	-0.195	***	-0.287	***	-0.420	***
	(0.074)		(0.058)		(0.099)		(0.117)	
ρ_{ij}^{Y}	0.853	***	0.609	***	0.755	***	0.390	***
	(0.133)		(0.125)		(0.158)		(0.140)	
FDI	-0.124	**	-0.047		-0.123	**	-0.014	
	(0.052)		(0.049)		(0.055)		(0.046)	
Regular	0.065	*					0.036	
employment	(0.034)						(0.040)	
Temporary			0.091	***			0.069	**
empl.			(0.028)				(0.034)	
Collective					0.083	**	0.081	**
protection					(0.038)		(0.038)	

Notes: Standard errors are in parentheses. FDI, Trade and Intra-Industry Trade are instrumented as explained in the text.